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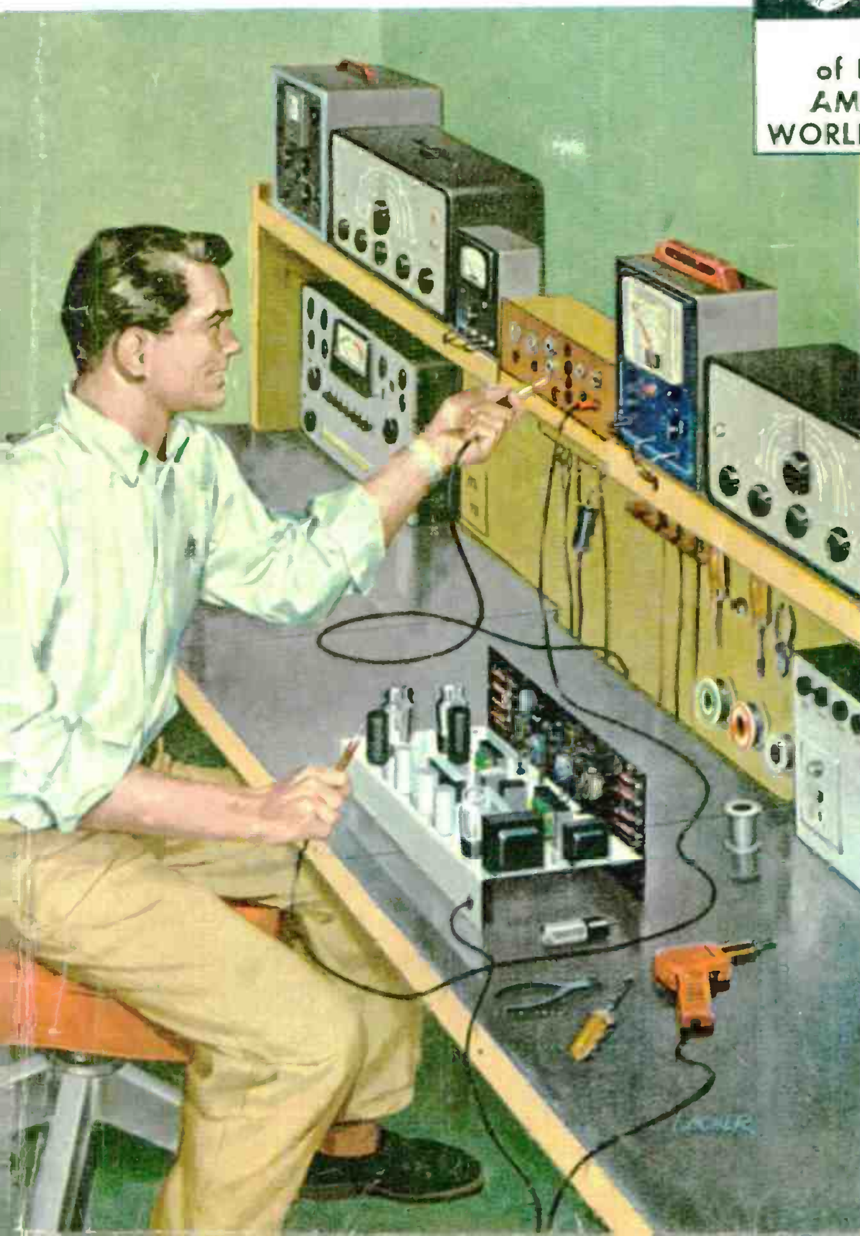

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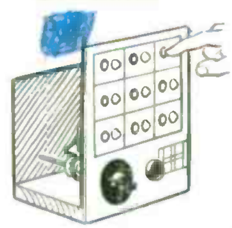

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You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for Television.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $22.95. The Signal Tracer alone is worth more than the price of the entire Kit.

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You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

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The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a Professional Radio Technician.

Included in the "Edu-Kit" course are sixteen Receiver, Transmitter, Code Oscillator, Signal Tracer, and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuity." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio & Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of troubles in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

FROM OUR MAIL BAG

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

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RADIO-TV Experimenter

VOLUME FIVE

CONTENTS

SPECIAL SUPPLEMENT

Cover by Dick Locher

Published and Copyrighted 1958 by
SCIENCE AND MECHANICS PUBLISHING COMPANY
450 East Ohio Street **Chicago 11, Illinois**

The Radio-TV Experimenter contains a selection of the most popular electronics projects and radio and TV maintenance articles that have appeared in *Science and Mechanics Magazine*, plus a number of projects and helpful articles on the same subject appearing for the first time.

Science and Mechanics Handbook Annual No. 1, 1958—No. 551

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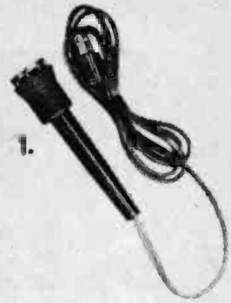
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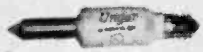

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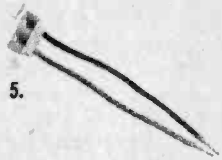
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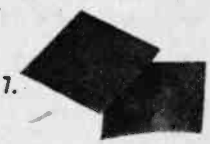
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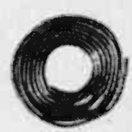
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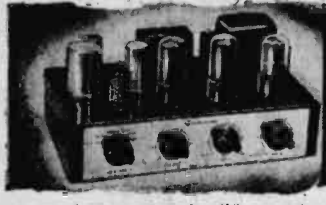

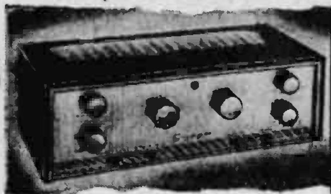

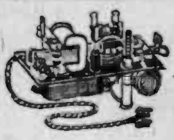

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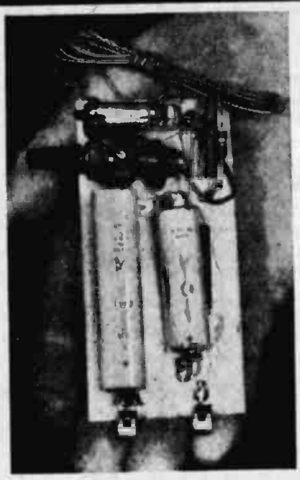

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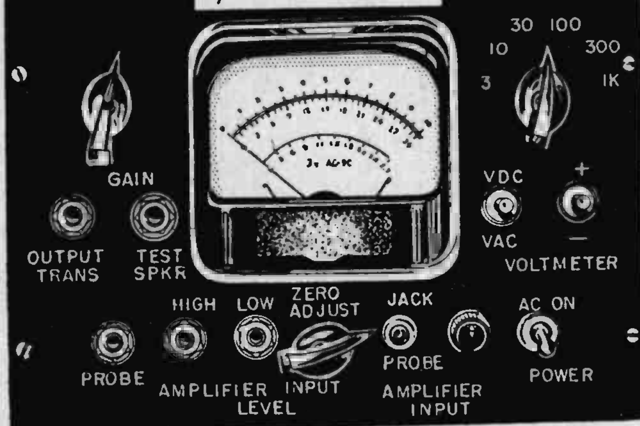
Troubleshooter and probe unit (speaker is mounted in top of cabinet). Drawing (left, below) gives front panel designations of switches and jack inputs.

Signal Tracing Troubleshooter

By W. F. GEPHART



ONE of the handiest tools for servicing work and design testing is the signal tracer, which permits a check of the signal at all points from the antenna (or input) to the output of radios (or amplifiers). Used in combination with a voltmeter and test speaker, virtually all trouble-shooting can be done not only easily but in a minimum of time. The unit shown in Fig. 1 combines the three needs for this type of trouble-shooting, allowing an audible check of the signal at any point in the circuit, a voltage measurement at any point, and a speaker test. It also functions as a utility amplifier, an extra vacuum-tube voltmeter, and a utility speaker.

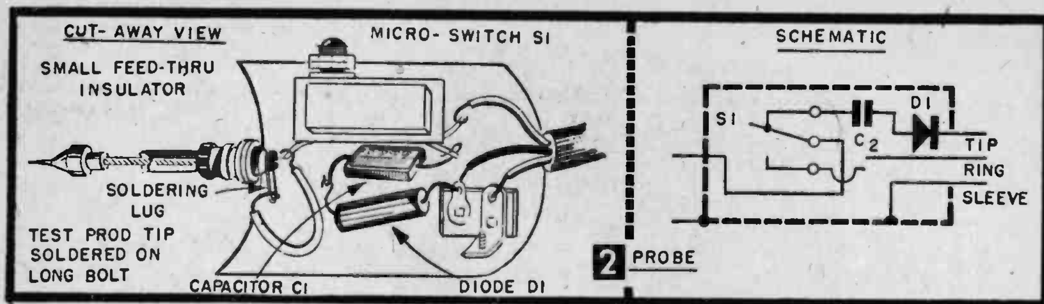
The VTVM, a simple bridge circuit using a dual triode (V1 in Figs. 4 and 5), has a high input impedance (12 megohms) and can be used in grid circuits without loading. A meter rectifier permits measurements of audio frequency or *ac* voltages, making AF voltage gain measurements possible during tracing, and a polarity switch permits measurement of both positive and negative *dc* voltages without reversing test leads.

The signal tracing section is a high-gain amplifier fed through a crystal detector, permitting the signal to be checked in either RF, IF or AF sections. The detector is mounted in the probe unit, minimizing loading in RF stages. The probe unit also contains a switch which transfers the probe tip from the amplifier to the voltmeter to permit voltage measurements at signal check points without changing leads, plugs, or reaching to the unit itself to throw a switch.

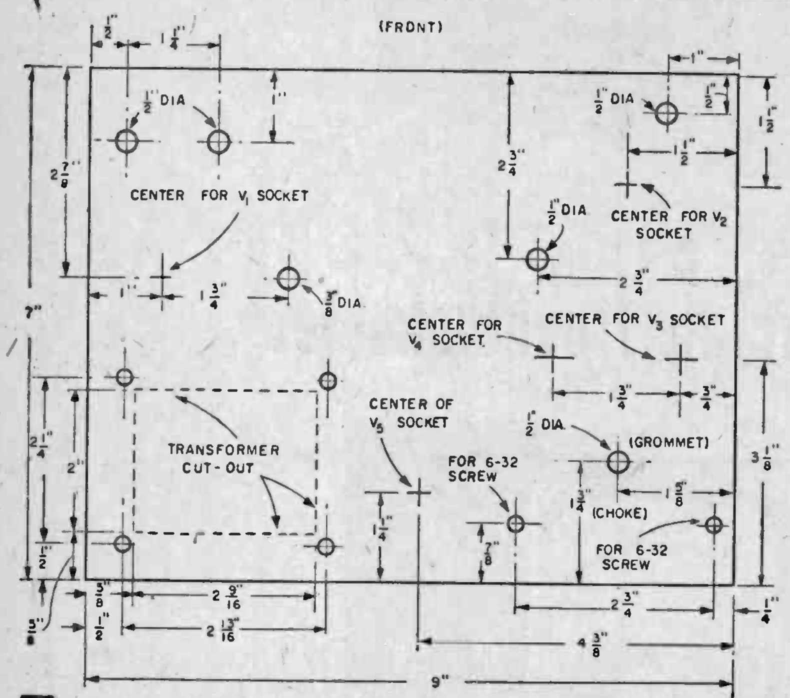
For utility service, inputs may be fed into the amplifier at either of two gain levels, and the output transformer secondary and built-in speaker voice coil are each available on jacks on the front panel, for testing other speakers, and for using the built-in speaker as a test speaker.

Both the VTVM and signal tracing amplifier are powered by a transformer-type power supply which isolates the unit from the power lines.

Figure 2 shows the probe unit details. The probe housing is a small chili powder can with a screw top. The probe tip is mounted on a small



2 PROBE



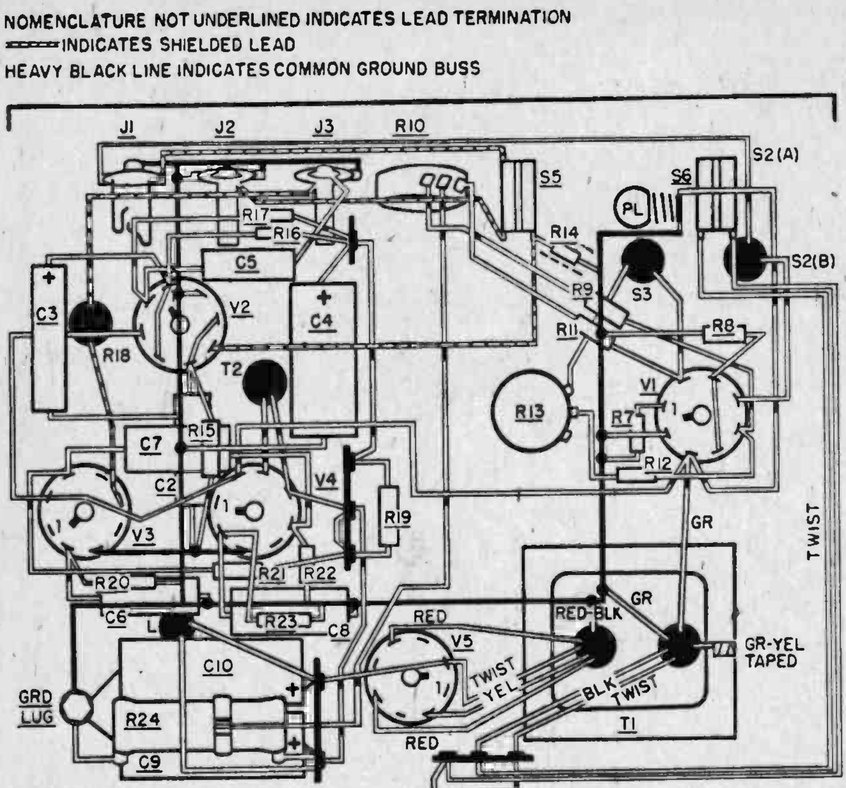
3 CHASSIS LAYOUT

MATERIALS LIST—SIGNAL TRACING TROUBLESHOOTER

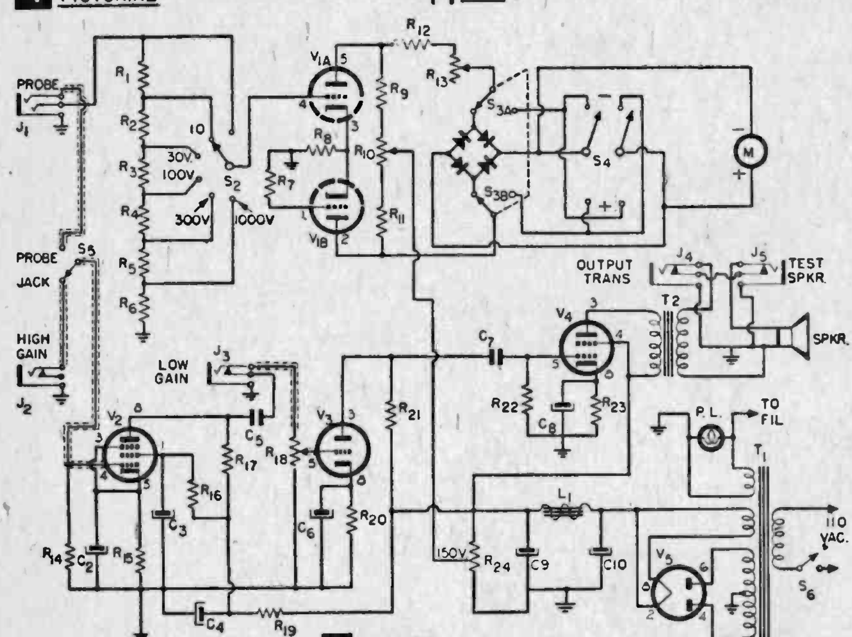
Desig.	Description
R1	9 meg., 1%
R2	2 meg., 1%
R3	700K, 1% (K-1000 ohms)
R4	200K, 1%
R5	70K, 1%
R6	30K, 1%
R7, R14, R16	2.2 meg., ½ watt
R8	2500 ohm, 1 watt
R9, R11	27K, 1 watt
R10	50K pot. ("Zero")
R12	22K, 1 watt
R13	25K pot. ("Calibrate")
R15	1500 ohm, 1 watt
R17, R22	470K, ½ watt
R18	1 meg. pot. ("Gain")
R19	5000 ohm, 1 watt
R20	12K, 1 watt
R21	270K, 1 watt
R23	360 ohm, 1 watt
R24	5K, 25 watt adj.
C1	.001 mf., 1000 v.
C2, C6, C8	25 mf., 25 v.
C3, C4, C9, C10	8 mf., 450 v.
C5, C7	.01 mf., 400 v.
S1	SPDT micro-switch (Acro MPB-312, Unimax MXJ-1, etc.)
S2	2 pole, 6 pos., rotary (Mallory 3226J)
S3, S4	DPDT toggle
S5	SPDT toggle
S6	SPST toggle
J1	3 cond., open ckt. jack (Mallory SCA-2B or JK-33A)
J2, J3, J4, J5	2 cond., closed ckt. jack
L	8 hy., 75 ma. choke
T1	500-0-500 v. @ 70 ma., 5 v. @ 2A., 6.3v. @ 2.5A. power trans. (Stancor PM-8403)
T2	5000 ohm to VC output trans.
V1	6SN7
V2	6SJ7
V3	6C5 or 6J5
V4	6V6
V5	5W4
MR	Bridge-type meter rectifier
M	0-1 ma. meter
PL	Pilot light assembly
Spkr	4" PM speaker (3.2 ohm VC)
D1	1N34 crystal diode
Miscellaneous	2x7x9" chassis; 7x8x10" hinged cover cabinet (ICA 3826); octal sockets; terminal strips; knobs; feed-through insulator; solder; wire; etc.

feed-through insulator and can be equipped with a needle point assembly from an old test prod. Since the can is so small (about 1½-in. in dia. and 3 in. long) there is a trick to assembling the unit. Drill a hole in the center of the bottom of the can for the feed-through insulator, a hole in the side of the can for the micro-switch, a hole in the center of the top of the can for the cord, and a mounting hole in the side of the can, opposite the hole for the micro-switch, and near the open end of the can. Solder a 6-in. length of wire to a soldering lug, and mount the feed-through insulator and lug (as shown in Fig. 2) in the bottom of the can with a long bolt, with the wire extending through the open end of the can.

Next, solder the diode leads to the single terminal strip and to the capacitor as shown, and solder the other capacitor lead to the proper terminal of the micro-switch. Then solder the three cord leads to the terminal strip and micro-switch as shown. Cut the wire from the feed-through insulator as short as possible, and solder it to the remaining micro-switch terminal. Push the micro-switch and terminal strip into the can, first



4 PICTORIAL



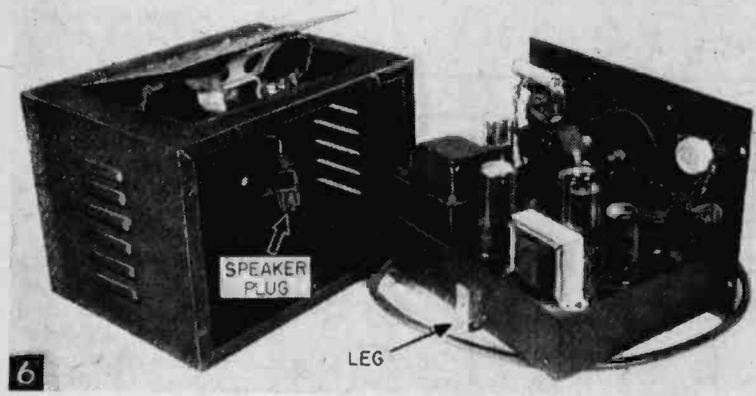
5 SCHEMATIC

positioning and tightening the micro-switch, and then fasten the terminal strip in place with a small bolt. Check to be sure that no bare sections of wire are shorting out, and thread the cord through the hole in the top of the can, screwing the top in place. The micro-switch should be wired as shown in Fig. 2 so that pressing the button transfers the probe tip to the voltmeter.

Figure 3 gives the chassis layout for the entire unit, Fig. 5 the schematic wiring diagram, and Figs. 4, 6 and 7 the pictorial wiring diagrams. To minimize hum in the amplifier, the power supply is placed as far from the amplifier input as possible, and certain grid leads should be shielded as shown. The voltmeter multiplying resistors (R1 through R6) should be of 1% tolerance, but the specifications on the other parts are not too critical.

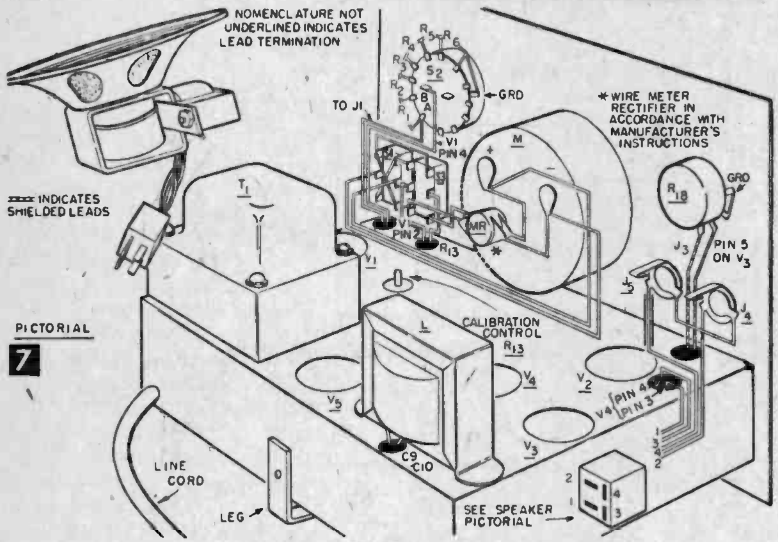
The chassis is secured to the front panel by the bottom row of jacks and switches, fastened up from the bottom of the panel enough to clear the lip of the cabinet, which then requires a small "leg" at the back of the chassis for support (see Figs. 6 and 7). The speaker is mounted in the top of the cabinet and is connected to the chassis by a four-conductor cord and plug arrangement, permitting easy removal of the chassis when removal is necessary.

To calibrate the voltmeter, turn the unit on, allow several minutes warmup time, and set the pointer of the meter to Zero, using R10. Put the



6

Troubleshooting unit out of cabinet showing "leg" on chassis and speaker connecting cord and plug.



PICTORIAL

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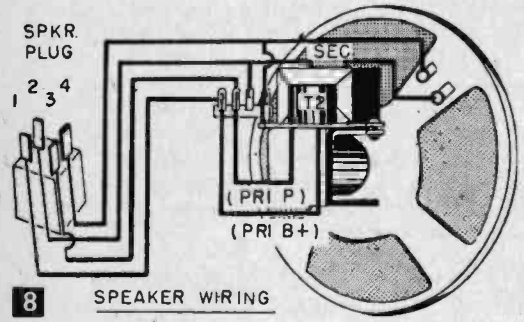


8 SPEAKER WIRING

probe cord in the "Probe" jack, set the Range Switch (S2) to "10" v., and connect 6 v. *dc* across the probe terminals. (It is most important that this test voltage be known to be accurate; an automobile battery source is suggested). With the voltage across the probe terminals, adjust the calibration control (R13) for the proper reading. Since the meter will probably be calibrated 0-10 or 0-100, a new scale should be made for the meter face and the "proper reading" mentioned above will be the percentage of the full scale reading (10v., as set by the Range Switch) equal to the test voltage. Thus, R13 should be adjusted to have the meter read .6 (on a 0-1 meter scale), 6.0 (on a 0-10 scale), or 60 (on a 0-100 scale).

One calibration will do for all *dc* and *ac* scales except the 0-3 v. *ac* scale. Due to the loading of the meter rectifier, a special scale, established by a series of checks with varying *ac* voltages between 0 and 3 v., will have to be made for this range.

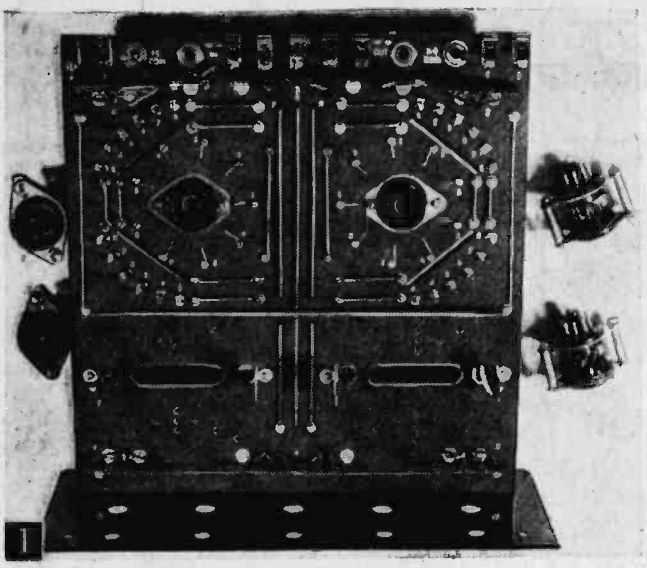
To use the unit as a Signal Tracer, set S5 on "Probe," plug the probe lead into the proper jack, and clip the ground lead of the probe to the ground of the unit being checked. Touch the point of the probe to the various check points, and adjust the Gain control (R18) for the desired signal level. To read voltage at any point, press the button on the probe, making sure that the Range Switch and the Polarity Switch (S4) are set properly.

To use the unit as a Test Amplifier, set S5 to "Jack," and feed the signal into the amplifier through the High Gain jack (J2) or Low Gain jack (J3), depending on the gain you require for your test.

To test a questionable speaker, feed a signal into the amplifier as you would to test amplification, and plug the questionable speaker into the "Output Transformer" jack (J4) on the front panel of the unit.

To use the built-in speaker as a Test Speaker, plug the desired output signal into the "Test Speaker" jack (J5). In this use (and in the questionable speaker test using the "Output Transformer" jack, J4), the output of the amplifier and the built-in speaker voice coil both have an impedance of 3.2 ohms.

To use the voltmeter separately, the probe can be used (with the button pressed), or a separate set of test leads can be made, terminating in a three-conductor plug (using Ring and Sleeve only), to be plugged into the "Probe" jack on the front panel.



Top view of designer's chassis ready for use. Tube socket adapters are on either side of chassis.

Designer's Experimental Chassis

IN experimental circuit design work, a chassis on which parts can be readily changed and substituted for one another, where any type tube can be used, and where a minimum of wiring is required, is a real boon to designers, saving them both time and temper. Without such a chassis, experimental results are often disappointing due to haywire test rigs. This experimenter's chassis will give "permanent construction" results while still retaining the advantages and simplicity of haywire rigs.

Test circuits for up to two tubes are provided on this chassis, plus a number of features that reduce wiring problems. By the use of socket adapters, any tube (up to nine-pin base) can be used, and there is space on the chassis for small transformers, relays, and other circuit components. All connections (except input, power and output) are soldered, yet components can be changed without disturbing other components connected to the same terminals.

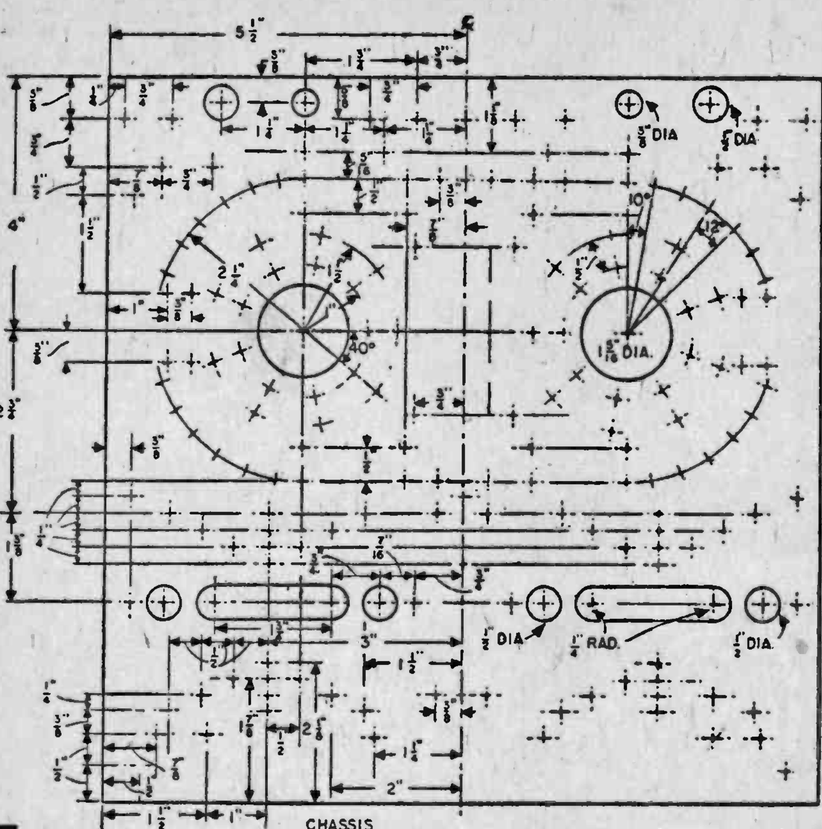
Input, power and output connections are at the back of the chassis; two filament inputs are provided, but if tubes with the same voltage are being used, a switch parallels the filament leads to the tubes so that only one power lead need be connected. Similarly, two plate voltage inputs are provided; these can be tapped on exposed bus wires at any point down the center of the chassis, but, if only a single plate voltage is used, a switch parallels these leads. The input and output connections are both clip and jack type, and each also appears on two two-terminal tie points (input shown as "W" and output as "Y" on Fig. 3). This makes input and output available both near the tubes and also near the transformer mounting space. Wiring for these units is shown in Figure 4.

A ground (B-minus) clip at the back of the chassis connects to an exposed bus wire that runs down the center of the chassis, across the center, across the front, and part way down each side, permitting connection to ground virtually anywhere on the chassis. Each tube socket has nine exposed sections of bus wire—one for each pin—for connections. In addition, six of the tube pins also have lug connections around the opposite side of the other tube, parallel-connected with the basic tube socket bus wires. This arrangement provides convenient connection from pins of one tube to those of the other without running a lead across the chassis. (The parallel connections are made permanently under the chassis.) Each tube pin is numbered with decal letters, both at the tube location and at the paralleling lugs on the other side of the chassis. Also located around each tube socket are seven pieces of isolated bus wire to serve as tie-points or multiplying connections.

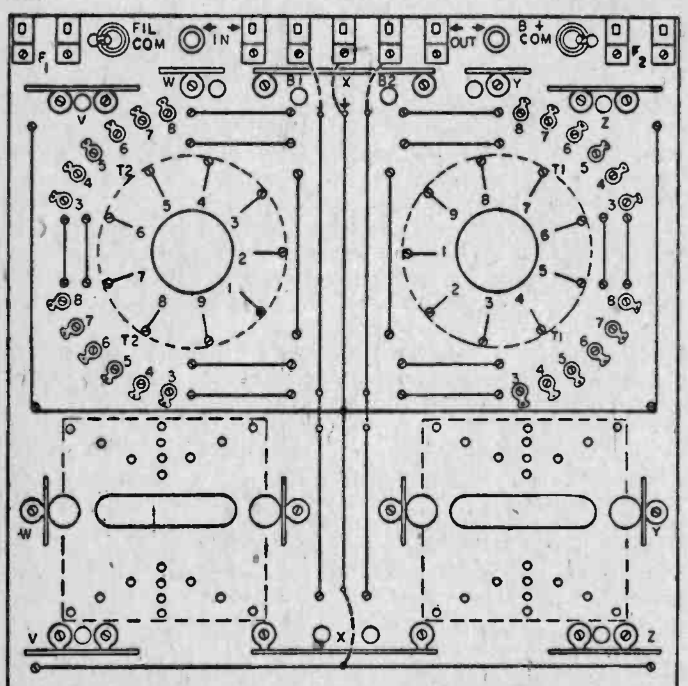
At the front of the chassis are two open spaces with a series of mounting holes for various-sized transformers and other, similar electronic parts. On the outer side of these spaces are the two-terminal tie points that parallel the input and output, and on the inner side are two other two-terminal tie points for miscellaneous transformer connections.

A steel panel with five 3/8-in. holes and five 1/2-in. holes for mounting potentiometers, switches, etc., serves as the front of the chassis. Just behind this panel are two five-terminal tie points (one on each side, "V" and "Z" in Fig. 3), and one six-terminal tie point ("X") in the center. These are for connections to panel-mounted components and are parallel-connected to similar tie points at the back of the chassis near the tube sockets. The bus wires are held in place by screws and are raised about 1/32-in. above the surface to permit leads from capacitors, resistors, and other circuit components to be slipped under them before "tacking" with solder.

Any tube can be used on the chassis by building tube socket adapters as shown in Figure 6.



2 CHASSIS LAYOUT



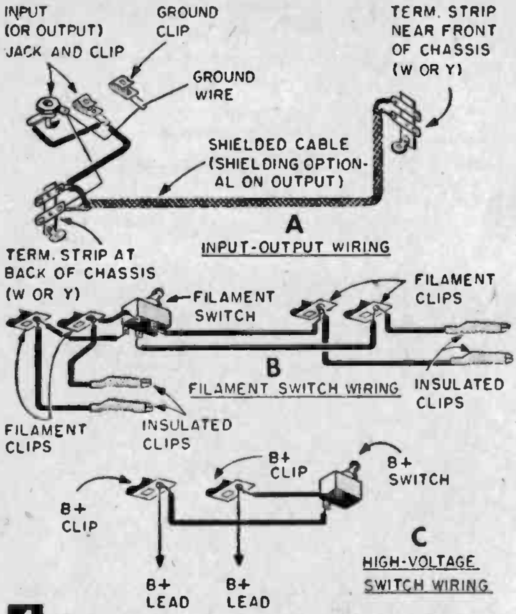
3 TIE-POINT LAYOUT ---- UNDER-CHASSIS WIRE CONNECTIONS ---- PLYWOOD CUT-OUT ⊘-NO. 4 WOOD SCREWS

In all cases, the bottom plug is a nine-contact octal, to match the sockets in the chassis; the upper socket matches the desired tube. Connections between the two are made in pin number order, so that, in many cases, there will be no connection to Pin #9 on the chassis. However, Pin #1 on the chassis will always be Pin #1 of any tube used, and so on.

The top of the chassis is ⅛-in. tempered hardboard mounted on ¼-in. plywood. The tempered surface of the hardboard is not easily damaged by solder, the plywood provides strength. To make the tube socket connections and to simplify transformer mounting, portions of the plywood (shown as light dotted lines in Figure 3) are cut out before assembly starts.

The simplest means of drilling all of the holes required is to make a full-size drawing of the center points from the dimensions shown in Fig. 2. Tape drawing to board and center-punch holes for drilling.

After the holes are drilled, temporarily screw-fasten the hardboard to the plywood (after fastening the 1¼-in. side and front pieces to the plywood, as shown in the photo, Fig. 5). Run the ground wire first, using bare #16 tinned copper wire. If regular bus wire is not available, straighten coiled wire by placing a length between two boards and rubbing the boards together so that the wire rolls between them. Since this wire is stiff, each above-board section should be made individually and connected under the



4

WIRING DIAGRAMS

chassis, rather than trying to make a series of bends.

Run the B-plus wire next, using the same type of wire, again making connections under the chassis. Next place the miscellaneous bus wires, each with a screw at both ends, using bare #18 tinned copper wire for this purpose. Where space is available, a washer at each screw, *under the wire*, helps hold the wire slightly above the chassis.

The tube socket bus wires are bare #18, soldered to the socket, run up through the hole by the socket, and then to a screw. The ½-in. length between the hole and the screw provides room for connections.

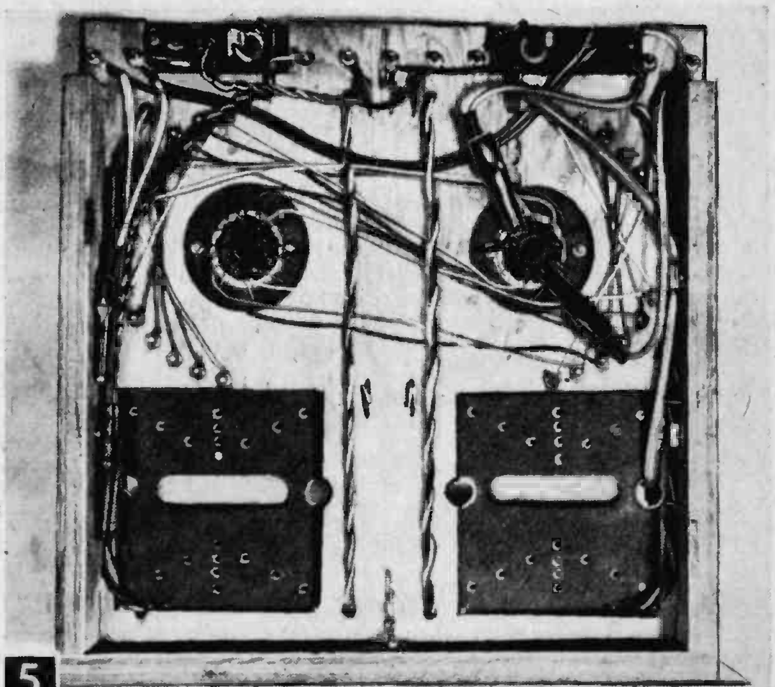
When all surface wiring is done, place the multiplying tube pin soldering lugs, using 4-36 machine screws and nuts. Then screw the various tie points to the top, and complete underchassis wiring.

Wire the tube pin multiplying screws first, by paralleling the appropriate numbered lugs on each side to each other, and then multiply-

MATERIALS LIST—DESIGNER'S CHASSIS

No. Req'd	Description
9	medium Fahnestock clips
1	SPST toggle switch
1	DPST toggle switch
2	open-circuit phone jacks
4	five-terminal tie strips
6	two-terminal tie strips
2	six-terminal tie strips
½ gross	⅜" #4 rh woodscrews
24	small soldering lugs
24	¾" 4-36 machine screws and nuts
2	nine contact octal socket with adapter plate (Amphenol 78RS9)
1	⅛ x 11 x 11" tempered hardboard
1	¼ x 11 x 11" plywood
2	½ x 1¼ x 10" pine (side pieces)
1	½ x 1¼ x 11" pine (front panel backing)
1	steel plate, approx. 5" x 12"
4	insulated alligator clips
	#18 bare tinned copper wire
	#16 bare tinned copper wire
	test lead wire
For each tube socket adapter assembly:	
1	nine-prong octal plug with adapter plate (Amphenol 86CP9)
2	1¼" x 6-32 machine screws and nuts
2	1¼" metal spacers
4	#6 flat washers
2	lock washers
1	tube socket*

* For four-pin to octal, standard sizes, use Amphenol Type RS. For seven-pin miniature, use Amphenol 78A7P with adapter plate, and for nine-pin miniature, use Amphenol 78A9P and adapter plate.


5

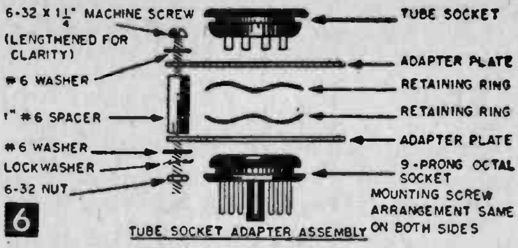
Bottom view of chassis showing permanent, underchassis tie-point connections. Note filament clips in place on right-hand tube socket.

ing one set of such connections to the properly-numbered pin of the tube socket on the other side of the chassis.

The final wiring to be done under the chassis is the input, output, filament switch and B-plus switch. The lead length of the under-chassis filament leads (made of test lead wire) should be long enough to permit the insulated clips to be clipped to any tube socket pin. Two small nails on the inside of each plywood side piece hold the leads in place when they are not being used. In Fig. 5, one set of leads is connected to tube pins, the others are clipped to the nails.

The steel panel is screwed to the front support piece. A bolt goes through the support and is connected to the ground lead, enabling the steel panel to act as a shield from body capacity.

In using the chassis for circuit design work, the proper tube adapters are plugged in and the filament leads connected to the proper pins under the chassis. Then transformers and other "mountable" components are bolted to the chassis, and panel items are fastened to the panel. Wiring is done by slipping component leads under a bus wire, in a lug, or in a terminal tie point, and tacking them in place with solder. In a few cases, short leads of jumper wire may be required, but the multiplying characteristics of the various tie points and tube socket lugs usually makes this unnecessary.—W. F. Gephart.



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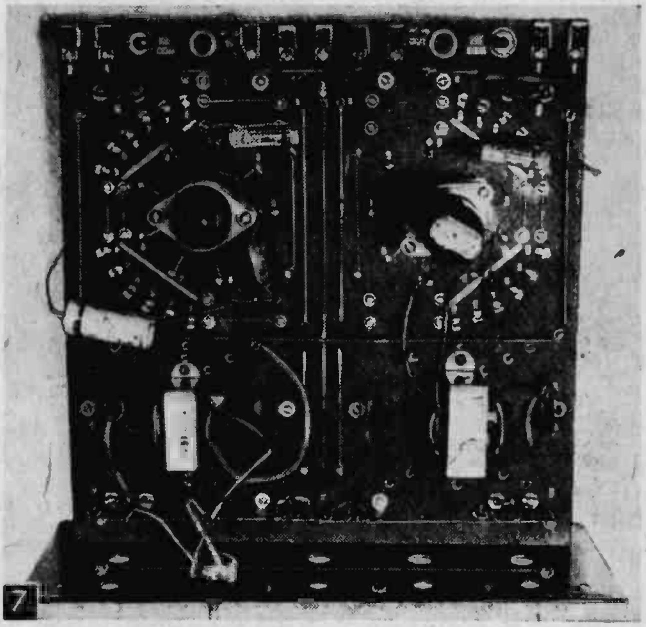
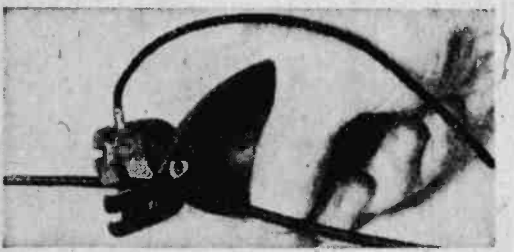


7

Designer's chassis in use, two-tube amplifier under test.

Insulated-Wire Tester

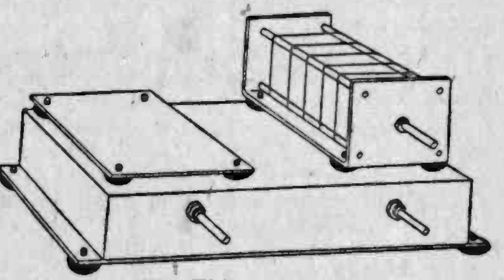
• Convert your Christmas tree lamp tester for insulated-wire testing. Solder an insulated wire lead directly to toothed electrode so temporary connections can be made to insulated wires in radio and electrical test work. Sharp teeth on the tester cut through the insulation and contact



the wire without damaging the insulation. Connect 2 of these testers to an ac voltmeter for electrical work, or, to a volt-ohm-milliammeter for radio service work and experimental work. Testers have fiber handles which make them safe for use on high voltages.—Arthur Trauffer.

Vacuum Cups as Cushions

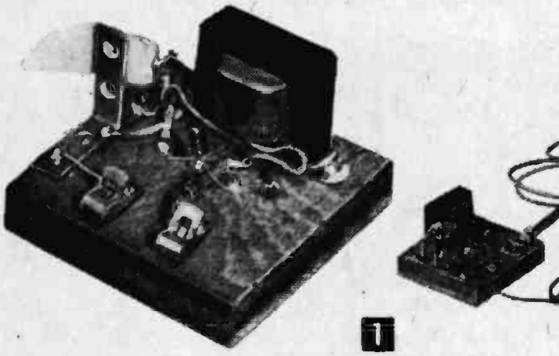
• Radio amateurs and experimenters find that vacuum cups with a machine-screw molded in and a thumb-nut attached, make good rubber cushions and shock absorbers on a receiver or transmitter chassis. Sketch shows a gang-condenser held and cushioned on chassis, a sub-as-



sembly panel cushioned and held to chassis, and chassis itself cushioned from operating table. In latter case, cups also keep chassis from sliding and scratching furniture. Cups are sold in most supply stores.—Arthur Trauffer.

Spit-Powered Oscillator

A Scotsman's Delight



1

A quick dip of the blotting paper, place it between the brackets, and you've set the set to buzzing, ready to key off for code practice.

By C. F. ROCKEY

AYE, LADDIE, if you've got a bit of the Scots in you—or even if you haven't—you'll ken this thrifty little oscillator. Its source of power is tap water—or spit—and it's just the thing for code practice, for circuit continuity testing, for capacitor checking, and for use as a signal source when adjusting hi-fi or public address amplifiers.

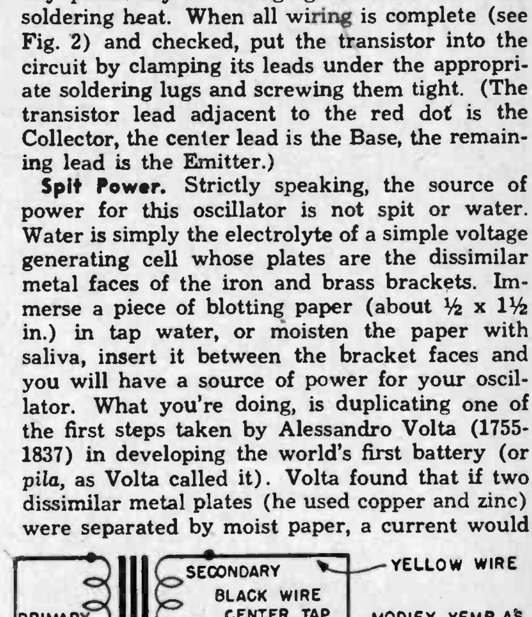
To build it, first saw, sand smooth and shellac a ¾-in. piece of soft pine or plywood to a 4 x 4 in. block. This is your oscillator's chassis. Next, physically modify the driver transformer by bending the bottom fastening lugs away from the core and removing the mounting frame, finding the dividing point between the "E" and the "I" sections of the core (see Fig. 3) and—carefully—prying up and removing the "I" section. Set the "I" section aside, re-insert the modified core in the transformer's frame and bend the fastening lugs in place.

We used a Thordarson 14-D-93 interstage audio coupling transformer (4:1) that we had on hand, but this type has been discontinued by the manufacturer. Its closest present Thordarson equivalent is the 20-A-16 interstage transformer. This—or any similar transformer made by any other manufacturer—will work just as well in the oscillator's ultra-simple circuit.

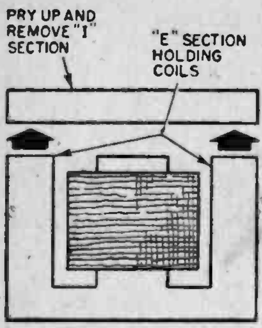
When transformer is modified, mount it and all other circuit components except the angle brackets on the wood-block chassis (see Fig. 4), with ½-in. #6 r.h. wood screws. Before mounting the two angle brackets, clean their facing surfaces carefully with sandpaper or steel wool. Mount them with faces about 1/16 in. apart.

Make all connections to the transistor connecting lugs before mounting the transistor to avoid any possibility of damaging the transistor with soldering heat. When all wiring is complete (see Fig. 2) and checked, put the transistor into the circuit by clamping its leads under the appropriate soldering lugs and screwing them tight. (The transistor lead adjacent to the red dot is the Collector, the center lead is the Base, the remaining lead is the Emitter.)

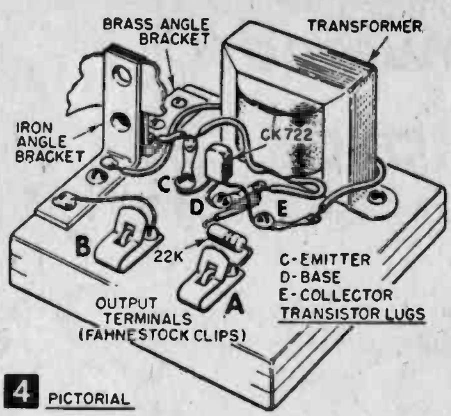
Spit Power. Strictly speaking, the source of power for this oscillator is not spit or water. Water is simply the electrolyte of a simple voltage generating cell whose plates are the dissimilar metal faces of the iron and brass brackets. Immerse a piece of blotting paper (about ½ x 1½ in.) in tap water, or moisten the paper with saliva, insert it between the bracket faces and you will have a source of power for your oscillator. What you're doing, is duplicating one of the first steps taken by Alessandro Volta (1755-1837) in developing the world's first battery (or *pila*, as Volta called it). Volta found that if two dissimilar metal plates (he used copper and zinc) were separated by moist paper, a current would



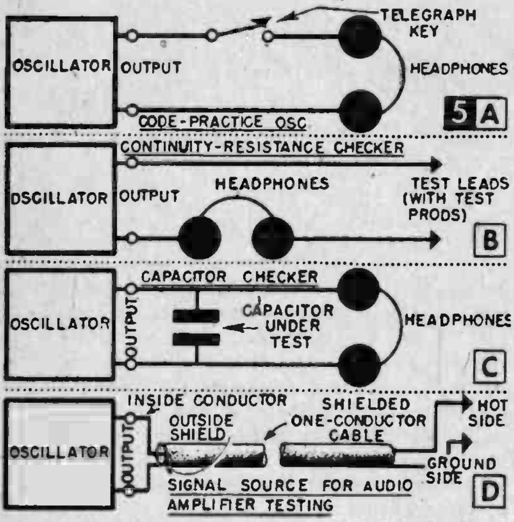
2 SCHEMATIC



3 MODIFICATION OF TRANSFORMER



4 PICTORIAL



MATERIALS LIST—SCOTSMAN'S DELIGHT

No. Req'd	Description
1 pc	3/4x4x4" pine or plywood
9	#6x1/2" r.h. wood screws
1	brass angle bracket, 1 1/2" arms
1	iron angle bracket, 1 1/2" arms
2	Fahnestock clips
1	CK722 Raytheon transistor
1	Thordarson 20-A-16 transformer (or Stancor A-53 or Triad A-31X)
1	22,000 ohm, 1/2 watt resistor
1 pr	2000-4000 ohm headphones (Trimm "Featherweight" standard or "Professional"—Allied cat. no's. 59J000, 59J020, or 59J021)
1 pc	blotting paper

flow between them when their outer surfaces were connected together.

Ordinary tap water usually contains enough impurities to act as an electrolyte; saliva, too. But if you don't get oscillation with either used as an electrolyte, do as Volta did, use a dilute salt solution, ½ teaspoonful of table salt in a small glass of water.

To test the unit for oscillation, connect a high-impedance (2000 to 4000 ohms) pair of earphones across the output terminals and listen for a clear, smooth tone of about 500-1500 c.p.s. If you don't hear such a tone, check the wiring and transistor connections for correctness and if these are as they should be insert a 1½*v*. dry cell temporarily across the brackets (plus side of cell to the brass bracket). This will give you a check on the transistor's condition. If it's good, oscillation will certainly occur. If not, substitute a new transistor in the circuit. (CK722's have proved unusually reliable in this simple circuit, but any other good PNP transistor may also be used.) Also, if you have used a transformer other than those specified in the Materials List, see if reversing its primary connections helps the tone.

With the unit operating, it can be used as a code-practice oscillator (see Fig. 5A); as a continuity-resistance checker to locate open circuits (Fig. 5B)—in circuits up to 10-megohms resistance if you use sensitive phones; as a capacitor checker (Fig. 5C); and as a signal source for audio amplifier testing (Fig. 5D). If too much hum is present for best audio amplifier testing, put the oscillator in a grounded coffee can and bring the shielded cable out through a hole in the can's top cover.

In capacitor testing, a good paper or mica capacitor in the capacity range of .001 mfd to .1 mfd will slightly weaken the signal and noticeably change its frequency. An open capacitor will have no effect on the signal, a shorted capacitor will kill it. (It is not recommended that you test electrolytic capacitors with the oscillator.)

Heavy Current Relay

• This little relay will handle as much as two amps. without trouble. Remove stationary contact of an electric bell or buzzer and turn it around. When current flows through coil, armature is pulled in and it makes contact with stationary member.—R.F.Y.

Better Soldering

• When using non-corrosive soldering paste flux for radio work, first warm the joint slightly with the soldering iron, then apply the paste with a piece of wire. The small amount of flux which melts on the joint is entirely adequate. Excessive flux spreads to adjacent insulation, causing leakage.

1

Photo-Electric Controls

Depending upon the circuit employed, motors, lights, alarms, etc. can be photo-electric controlled by as little as a lead pencil intercepting the beam of light.

WHETHER assembled merely for entertainment or put to serious use, the photo-electric control, or "Electric Eye," has an element of mystery about it for spectators. Yet the principles by which these controls operate are the very same principles applicable to simple triode tubes.

A triode has three elements: cathode, grid and plate. Electrons flow through the triode—as they flow in all tubes—from cathode to plate, since the cathode is at a negative potential with respect to the plate. The grid acts as a valve, situated between cathode and plate, controlling this electron flow. (In England, radio tubes are called valves.)

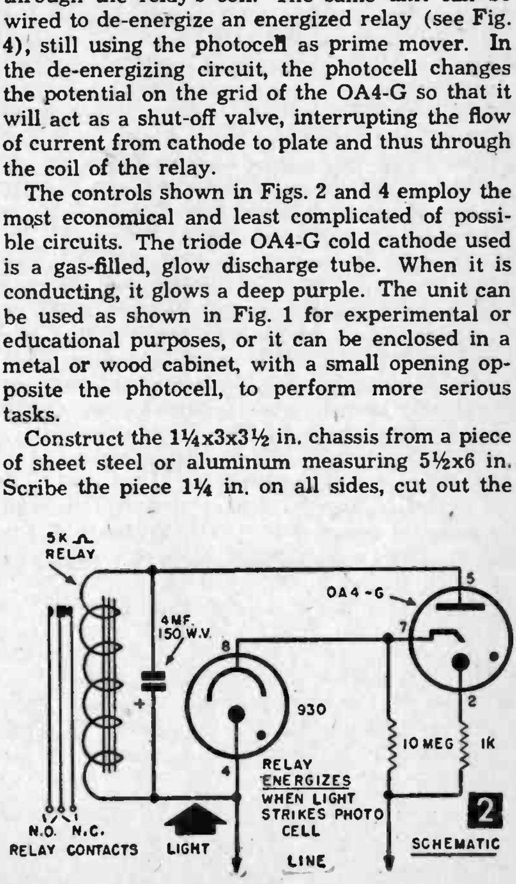
When the grid is connected to a voltage with the same sign (polarity) as the cathode, electron flow from cathode to plate is impeded since like charges repel and both the cathode and the grid (which is closer, physically, to the cathode than the plate) have like charges. The reverse holds true, of course, when the grid is connected to a potential with the sign opposite to that of the cathode; electron flow through the tube is increased. Thus, varying the sign (or the size) of the potential (charge) on the grid of a tube varies the electron flow (current) through it from cathode to plate.

In photo-electric control circuits, a photo-electric cell is used to vary the charge on the grid of a tube and a relay is connected into the plate circuit. When electron flow through the tube becomes sufficient to energize the relay's magnetic coil, it closes its switch contacts and thereby performs the desired work—operating motors, lights, etc. The photocell controls the grid; the grid, the plate; the plate, the relay.

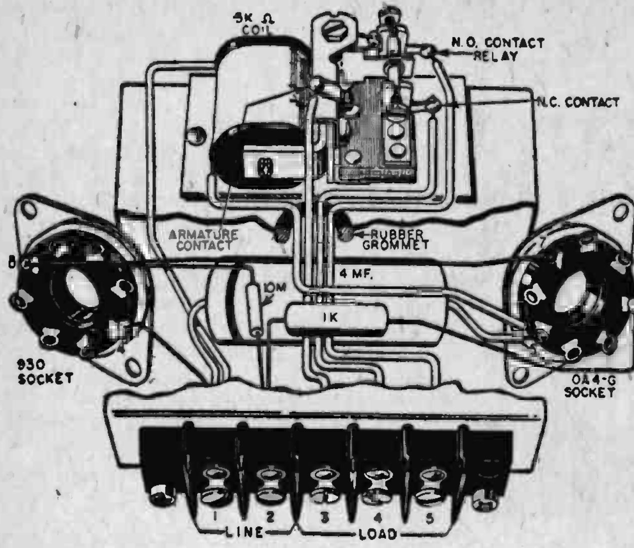
The 930 photocell employed in the unit shown in Fig. 1 is its prime mover, its master control. When light strikes the 930, the relay energizes because the potential on the grid of the OA4-G has been changed (see Fig. 2) to permit greater electron flow to the OA4-G's plate and, thus, through the relay's coil. The same unit can be wired to de-energize an energized relay (see Fig. 4), still using the photocell as prime mover. In the de-energizing circuit, the photocell changes the potential on the grid of the OA4-G so that it will act as a shut-off valve, interrupting the flow of current from cathode to plate and thus through the coil of the relay.

The controls shown in Figs. 2 and 4 employ the most economical and least complicated of possible circuits. The triode OA4-G cold cathode used is a gas-filled, glow discharge tube. When it is conducting, it glows a deep purple. The unit can be used as shown in Fig. 1 for experimental or educational purposes, or it can be enclosed in a metal or wood cabinet, with a small opening opposite the photocell, to perform more serious tasks.

Construct the 1¼x3x3½ in. chassis from a piece of sheet steel or aluminum measuring 5½x6 in. Scribe the piece 1¼ in. on all sides, cut out the



2 SCHEMATIC



3 PICTORIAL RELAY ENERGIZES WHEN LIGHT STRIKES PHOTO CELL

corners, and bend the panel to shape in a vise. Cut two 1 in. or 1⅛ in. holes on the top of the chassis for mounting the two octal tube sockets, and drill a ½ in. hole between the socket openings for a ½-in. rubber grommet. There is ample room on the chassis top, so location is not critical. The relay coil and contact leads are passed through the rubber grommet. Finally, two ⅛ in. holes—spaced as needed—are drilled on the top of the chassis for mounting a 5000 ohm, S.P.D.T. relay. Location of these holes will depend upon the make of relay employed.

To make the control completely flexible, power line input and relay switch contacts terminate on a Cinch-Jones barrier strip mounted on the front apron of the chassis. Provide the apron with a ¼ x 3 in. slot directly behind the upper row of terminal screws, remove these screws and solder the leads into the threaded bushings. Your electronic parts dealer may be able to supply a terminal strip with soldering lugs, but we prefer the arrangement shown in Fig. 1.

Depending upon whether you want to energize a relay, or de-energize it, wire as shown in Figs. 2 and 3 or 4 and 5. While many relays are small enough for such under-chassis mounting, top-chassis mounting is advised. This allows the experimenter to adjust the relay's contacts and armature tension, and also to see it in action. Note that only pins 4 and 8 of the 930 photocell and pins 2, 5 and 7 of the OA4-G are used. Other pins on their tube bases are dummies. Therefore, any blank lugs on their tube sockets may be used as solder tie-points for securing component leads. The electrolytic capacitor, for instance, may be secured to blank socket lugs to insure rigidity.

Make soldered connections to the photocell socket as clean as possible. Leakage across pins 4 and 8 can cause either circuit to operate erratically. In fact, touching these pins with the fingers will cause the circuit to operate. A dirty socket should be cleaned with denatured alcohol after soldered connections have been made.

Since each control uses identical components, no harm will be done if you later wish to rewire your original circuit. In fact, either circuit can do identical jobs because the relay is a S.P.D.T. type. However, the *right* circuit for a particular job is the circuit that keeps the relay de-energized except when the photocell is to be influenced by the presence or absence of light as called for by the job.

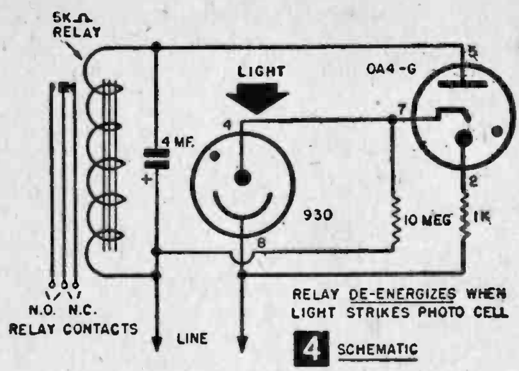
Figures 2 and 3 show the 930 photocell wired to produce a positive potential on the OA4-G's "grid" (starter anode) when the 930 is made conductive by, say, a fire, daybreak, or a beam of artificial light. This hook-up can be used to turn on yard lights, operate motor driven garage doors, etc. At all other times, the control *rides* on the power line and draws almost zero current. There is no heat or wear on the components, and years of troublefree service are assured.

Figures 4 and 5 show the 930 photocell wired to produce a negative potential on the OA4-G's starter. As long as a beam of light plays on the photocell's light sensitive cathode, the starter grid of the OA4-G has more negative voltage on it because of the photocell, than positive bias (fixed *d-c* potential) arriving via the 10 megohm resistor. The OA4-G tube, therefore, does not conduct. Breaking the beam focused on the 930, however, stops the flow of electrons through it, making the positive voltage through the 10 megohm resistor the master. The OA4-G instantly fires (conducts), the relay pulls in and, say, the burglar alarm sounds.

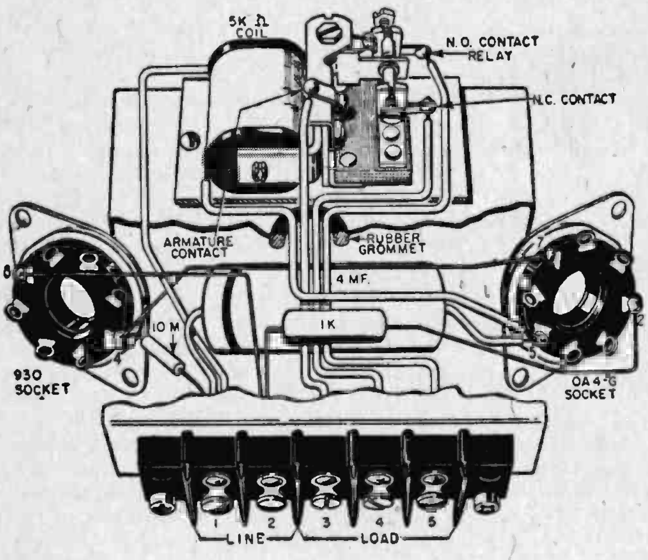
Only the experimenter who builds and experiments with these circuits will be able to appreciate their possibilities. The operation of either arrangement is virtually foolproof except for minor relay adjustments. The original control employed a Sigma Type 4-F relay with an 8K (8000) ohm coil. Sigma relays are slightly more expensive than other makes because they provide

MATERIALS LIST—PHOTO-ELECTRIC CONTROLS

No.	Description
1 pc	5½ x 6" light steel or aluminum
2	molded or wafer octal tube sockets
1	930 photocell
1	OA4-G cold cathode triode
1	Cinch-Jones barrier terminal strip #5-141
1	5K (5000) ohm relay (Potter-Brumfield LS-5 or LM-5, or equivalent)
1	1K (1000) ohm, 1 watt resistor
1	10M (10 megohm) ½ watt resistor



4 SCHEMATIC



5 PICTORIAL RELAY DE-ENERGIZES WHEN LIGHT STRIKES PHOTO CELL

precision adjustment of contacts and of armature tension. However, the inexpensive 5K relays made by Potter & Brumfield work quite well in the circuits, though it may be necessary to make minor spacing adjustments of contacts and to reduce the armature tension of the fixed coil spring, for optimum relay sensitivity.

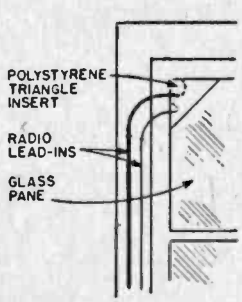
Potter & Brumfield relays are provided with silver contacts which will handle loads up to 5 amps. at 110 v. (550 watts). The Sigma relay contacts are rated at 2 amps. (220 watts). Where greater loads are involved, an auxiliary magnetic contactor or mercury plunger type relay must be used, and the photo-control relay contacts operate the coil of this power relay. A heavy motor or load is handled by the power relay's silver contacts or mercury solenoid displacement. Power relays are made in a variety of sizes and types, including "lock-in" relays which, when momentarily energized, lock and continue to sound alarms, etc. until manually released.

A typical use of the circuit shown in Figs. 2 and 3 might be to run a motor. A 110-125 *v.* source is connected to terminals #1 and #2 of the terminal strip and one wire of the motor is also connected to terminal #1. A jumper lead is connected across terminals #2 and #3 and the remaining motor wire is connected to terminal #5.

Light (a flashlight, for instance) activating the photocell causes the relay armature (terminal #3) to close the relay's normally open contact (terminal #5) and the motor runs. To reverse this action, move the motor lead on terminal #5 to terminal #4. Now the motor will continue to run until light strikes photocell. The combination of circuits and double throw relay contacts makes possible a great variety of electrical functions—starting one device and stopping another by employing both the normally open (NO) and normally closed (NC) relay contacts.—T. A. B.

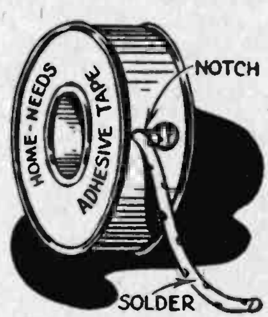
Plastic Lead-in Window Insert

• Most radio amateurs know that clear polystyrene window panes are available to replace glass panes so lead-in can be brought in without drilling glass, but fitting in a triangular corner saves the cost of a whole pane.

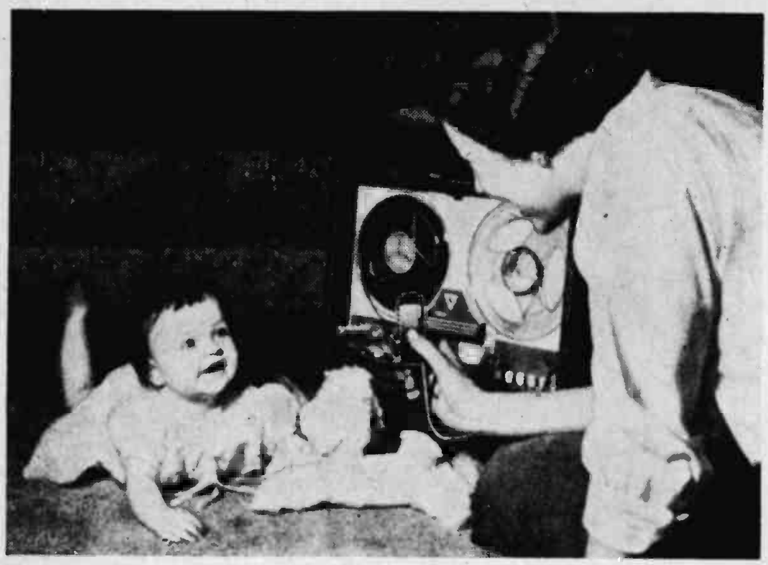


Remove the glass pane and cut off the corner, not more than 4 in. along either side. For about 20c you can get enough 3/32 in. polystyrene plastic sheet to fill in the corner. Drill through the plastic corner for lead-ins.—Arthur Trauffer.

Handy Reel For Solder



• Small household packages of solder that are not regularly supplied on a reel can be transferred onto a handy dispenser and holder by coiling them on a used adhesive tape reel as shown in the drawing. This does away with much of the direct contact with the solder and any escaped flux. Cut a hole at the side of the can for uncoiling the solder. A wedge-shaped notch at the side of the hole will lock the solder from receding back into the can.



That first "muh-muh" will be just as valuable to you in years to come as the "mi-mi-mi" of a world-famous mezzo-soprano—probably more valuable. But you can capture them both for posterity with a tape recorder. Recorder shown here is a Bell and Howell TDC Stereotone.

How to Get the *Right* Tape Recorder

By MILT GRASSELL and DON HUNTER

FIRST words of an infant-size Junior Miss, Elvis Presley, trial summations, hen-house tunes—even TV pictures—can be captured with a tape recorder, the *right* tape recorder. To get that right recorder you have to know, before stepping up to the counter: 1) what type of material you're going to want to tape; and 2) what equipment is equal to the task.

Tape recording has become one of the hot divisions in the home appliance field. One reason is that prices are down. True, some custom-made sets cost more than $20,000; and professional sets range from about $300 to $3600 in price. But for $75 to $300 or so you can get excellent home units. (And, after you've paid for the recorder, additional costs for tapes—tapes that can be erased and re-recorded more than 3,000 times—are minor.) A recorder that cost about $150 ten years ago, sells for around $90 today—and it's a better machine today than it was 10 years ago, simpler and more economical to operate.

The latest recorders are also more versatile than models were back in the 40's. Business firms, for instance, protect their property with tapes of stern, commanding voices calling for police and telling burglars the jig is up. And hen house custodians find that taped music not only pleases Pertelote, it coaxes greater egg production from her. So what qualities should you look for in order to get the right recorder for your purposes? Well, the best place to start your investigation is with the mechanical features of the various makes and models; then go on to check the electronic features.

MECHANICAL FEATURES

Motors. The number of motors is often directly responsible for the quality of the recording. A constant tape speed is required for high fidelity. When this speed varies—even slightly—*flutter* and *wow* show up. Flutter is an unsteadiness of sound, volume, and pitch, caused by rapid variations in the tape speed, usually noticeable in the higher frequency ranges. Wow is a wavering of sound similar to that produced by a disc record rotating at an uneven speed.

Flutter and wow are reduced by having separate motors (three are best) for (1) the capstan (it pulls tape at a constant linear speed), (2) the supply (feeding) reel, and (3) the take-up reel. Separate motors also minimize tape spill (tape that continues to unwind after the capstan has stopped) and tape breakage due to jerkiness.

Fast Forward and Fast Rewind. Sometimes you will need to get from one part of your tape to another. That's where the fast forward and fast rewind controls come in. It's a good idea to pick a machine with a forward and rewind ratio of 10 to 1 or greater.

The Selection Locator control quickly locates programs on your tape. (Also called index counters and program indicators). While this control is not essential on home machines, some recordists find it convenient.

TABLE A

Recording time for 7-inch (1200-foot) reel on full- and half-track tape recorders

	Full Track Machine	Half Track Machine
At 1⅞ ips	2 hrs	4 hrs (2 hrs in each direction)
At 3¾ ips	1 hr	2 hrs (1 hr in each direction)
At 7½ ips	½ hr	1 hr (½ hr in each direction)
At 15 ips	¼ hr	½ hr (¼ hr in each direction)

If you're shopping for a tape recorder and have $1500-plus, you can get Bell and Howell's Series 866 radio-phonograph-recorder combination shown at right. If you don't happen to have that much at the moment, units such as Webster Electric's Ekotape Model 240 (inset), are available for under $200.

Two of the least desired types of locators are (1) lines marked under the reels indicating elapsed time and (2) dial-type pointers indicating remaining time. Neither is very accurate.

An odometer-type counter gives a much more accurate tape location if it is synchronized with some point on the tape each time.

Maximum Reel Size partly determines the kind of material you can record. You can't cram a 14-in. reel on a recorder designed for a five-in. reel (except on some machines where adapters are available at extra cost). Be sure you get a recorder that will take large reels if you plan to make long recordings. For most home or amateur uses a seven-in. reel is the most convenient. Professional machines will take 10-inchers.

Tape Speed more than anything else determines how much it will cost you to use your recorder. The faster the tape is used, the more you will spend unless you re-use your tapes. Table A lists the recording time for a seven-inch (1200-ft. reel) of tape on a full- and half-track machine:

Tape speed is also important for fidelity. Table A shows that you get more playing time for your money by using slower tape speeds. But at slower speeds fidelity suffers.

Recorders operating at 3¾ *ips* (inches per second) are usually adequate to cover the principal frequencies of the human voice. Hi-fi *aficionados* will want to record at higher speeds (7½ *ips* and 15 *ips*) since recordings at these speeds will reproduce the tonal qualities of such instruments as violins, French horns, and pipe organs more faithfully.

Controls. There are two basic types of controls, mechanical and electrical. The elec-

TABLE B Recorder Features to Check With the Salesman

	This Is GOOD	This is BETTER
ELECTRONIC SPECIFICATIONS		
1. Frequency response	80-8,000 cps ± 3 db	70-10,000 cps ± 3 db
2. Tape speed equalization	At higher tape speed only	At higher and lower speeds.
3. Level indicator	Neon bulbs	Magic eye or V.U. meter
4. Inputs	Microphone and radio	Microphone and radio with mixing
5. Heads and amplifiers	Two heads and single amplifier	Three heads and separate amplifiers for record and playback
6. Speaker system	1 good 6" speaker plus ext. speaker jack	8 or 10" speaker, multiple speakers, plus ext. speaker jack
7. Tone controls	Treble only	Bass and treble
8. Extras		Provision to use as a P.A. system. Remote control provision. Built-in radio
MECHANICAL SPECIFICATIONS		
1. Wow and flutter	0.3% at 7½ ips	Less than 0.2%
2. Number of motors	One or two	Three, or synchronous capstan drive motor
3. Tape speeds	7½ ips, 3¾ ips	15, 7½ and 3¾ ips
4. Fast forward and reverse	Should have both	Should have both but fast
5. Positive motor action	Mechanical braking	Won't spill or break tape when switched fast
6. Foolproof controls	Record interlock	Record interlock
7. Weight for portables	Less than 30 lbs.	Less than 25 lbs.

This information was developed from the manufacturers' literature and trade sources. (SCIENCE AND MECHANICS does not undertake to guarantee accuracy.)

ELECTRONIC FEATURES(*)

Manufacturer and Model	Price	*Frequency Response at 7½ ips	*Tape Speed Equalization	*Recording Level Indicator	*Inputs	*Heads and Amplifier	*Speaker System
Knight 96RZ940 Allied Radio Corp. 100 N. Western Ave. Chicago 80, Ill.	$84.50	65-8,000 ±3 db	7½ only	Neon lamp	Mike Radio-phono	1 head 1 amplifier	5x7"
Pentron RWN The Pentron Corp. 777 S. Tripp Ave. Chicago 24, Ill.	$139.50	50-9,000	7½ only	Neon lamp	Mike Radio-phono	2 heads 1 amplifier	4x6"
Bell RT88 Bell Sound Systems Columbus 7, Ohio	$139.95	50-10,000	7½ and 3¾	Neon lamp	Mike Radio-phono	1 head 1 amplifier	6x9"
Mitchell 2525 Esco Electronics, Inc. 901 West Huron Chicago, Ill.	$139.95	65-10,000	7½ only	Neon lamp	Mike Radio-phono	1 head 1 amplifier	Two 4" speakers
Ampro 745 Ampro Corp. 2835 N. Western Ave. Chicago 18, Ill.	$159.50	60-11,000	7½ only	Magic eye	Mike Radio-phono	2 heads 1 amplifier	Two 5x7" woofers 3" tweeter
Masco 500 Mark Simpson Mfg. Co. 32-28 49th Street Long Island City 3, N.Y.	$168.50	50-12,000 ±3 db	7½ only	2 neon lamps	Mike Radio-phono	1 head 1 amplifier	5x7"
VM 710 VM Corp. Benton Harbor, Michigan	$189.00	40-14,000 ±5 db	7½ only	2 neon lamps	Mike Radio-phono	2 heads 1 amplifier	6x9" woofer 4" tweeter
Webster Electric W240 (Ekotape) Webster-Electric Co. Racine, Wisconsin	$189.50	50-7,000	7½ only	Neon lamp	Mike Radio-phono	1 head 1 amplifier	5"
Wilcox-Gay 651 Wilcox-Gay Corp. Charlotte, Michigan	$189.95	65-10,000 ±3 db	7½ only	2 neon lamps	Mike Radio-phono	1 head 1 amplifier	6x9" 4" 3" tweeter
RCA 7TR3 RCA Victor Div. Camden, New Jersey	$199.95	50-8,000	7½ only	2 neon lamps	Mike Radio-phono	1 head 1 amplifier	6½" two 3½"
Webcor 2711 Webster-Chicago Corp. 5610 Bloomingdale Ave. Chicago 39, Ill.	$199.95	50-10,000 ±3 db	7½ and 3¾	Magic eye	Mike Radio-phono	2 heads 1 amplifier	8"
Revere T700D Revere Camera Co. 230 East 21st St. Chicago 16, Ill.	$225.00	40-14,000 ±3 db	7½ and 3¾	2 neon lamps	Mike Radio-phono	1 head 1 amplifier	6x9"
Bell & Howell 300M 7100 McCormick Road Chicago 45, Ill.	$299.95	50-15,000 ±2 db	7½ only	2 neon lamps	Mike Radio-phono	2 heads 1 amplifier	Two 8" woofers Two electro-static tweeters
Dukane 11A200 DuKane Corp. St. Charles, Ill.	$395.00	50-10,000 ±1½ db	7½ and 3¾	Magic eye	2 mikes Radio-phono	2 heads 1 amplifier	6x9"
Ampex 601 with 620 Ampex Electric Corp. 934 Charter St. Redwood City, Calif.	$714.50	40-15,000 ±4 db	7½ only	V.U. meter	Mike: line	3 heads 2 amplifiers	8" speaker, acoustic enclosure

MECHANICAL FEATURES(**)

*Tone Controls	*Watts Output	**Wow and Flutter at 7½ ips	**Number of Motors	**Tape Speed in ips	**Fast Wind and Rewind	**Positive Tape Braking	**Foolproof Controls	**Carrying Weight	Other Features
Treble loss	——	0.5%	one	7½ 3¾	yes	yes (mechanical)	yes (keyboard)	24 lbs.	——
Treble loss	4 watts	0. 5% (flutter only)	one	7½ 3¾	yes	yes (mechanical)	yes (gearshift)	23 lbs.	P.A.
Treble loss	3½ watts	——	three	7½ 3¾	yes	yes (electrical)	yes (keyboard)	27 lbs.	P.A.
Treble loss	2 watts	0.3%	one	7½ 3¾	yes	yes (mechanical)	yes (rotary switch)	22½ lbs.	Tape storage space
Treble loss	5 watts	0.5%	one	7½ 3¾	yes	yes (mechanical)	yes (switch)	25 lbs.	Editing conveniences
Treble loss	5 watts	0.3%	one	7½ 3¾	yes	yes (mechanical)	yes (gear shift)	23 lbs.	P.A., Monitoring facility
Feedback Treble and bass boost	5 watts	0.5%	one	7½ 3¾	yes	yes (mechanical)	yes (keyboard)	30 lbs.	Tape timer, Auto shut-off, Patch cord, Pause control
Treble loss	2½ watts	0.3%	one	7½ 3¾	yes	yes (mechanical)	yes (rotary switches)	29 lbs.	P.A.
Treble loss	7 watts	0.35%	one	7½ 3¾	yes	yes (mechanical)	yes (keyboard)	35 lbs.	Tape index, Can mix mike and radio, P. A., Remote control
Treble loss plus music/vocal switch	2½ watts	0.3%	one	7½ 3¾	yes	yes (mechanical)	yes (push-button)	38 lbs.	Remote control, Odometer, Patch cord
Treble loss	8 watts (peak)	0.4%	two (4 coil)	7½ 3¾	yes	yes (mechanical)	yes (rotary switch)	45 lbs.	Auto reel reverse, P.A., Reel turn counter, Auto shut-off
Treble and bass	5½ watts	0.3%	one	7½ 3¾	yes	yes (mechanical)	yes (keyboard)	30 lbs.	P.A., Odometer, Remote control provision
Treble loss	10 watts	0.2%	three	7½ 3¾	yes	yes (electrical)	yes (push button)	42 lbs.	Drop-in tape threading, P. A., Odometer, Auto tape shut-off
Treble loss	7½ watts	0.3%	one	7½ 3¾	yes	yes (mechanical)	yes (push buttons and switch)	45 lbs.	P.A., Odometer, Tape splicer
Bass/treble on amplifier	10 watts	0.25%	one	7½ only, others on order	yes	yes (mechanical)	yes (two switches)	56 lbs. in two cases	P.A., Two channel mixer, Drop-in tapethreading

TABLE C

Check for These Tape Recorder Features When Shopping (listed in order of importance).

ELECTRONIC

1. **Frequency Response.** The highest and lowest sound frequencies that can be recorded and played back; also includes the db variation within this range.

2. **Equalization for Different Tape Speeds.** An adjustment which makes the recorder give its best performance at each tape speed.

3. **Level Indicator.** This may be one or two neon bulbs, a magic eye, or volume indicating meter.

4. **Inputs.** There should be at least two. One for microphone, one for radio. On better machines there are provisions that permit mixing the two and simultaneous recording of both.

5. **Separate Heads And Amplifiers.** Lower-priced machines use a single amplifier switching from record to playback. More expensive machines use separate amplifiers for each. This usually permits better equalization. Less expensive machines usually use the same head for recording and playback. More expensive machines use a separate head for each (each head can be designed for best performance).

6. **Speaker System.** All recorders should provide a jack to permit a use of an external high fidelity speaker. High fidelity (particularly bass) is difficult to obtain with a small tape recorder cabinet. One good speaker is enough, the larger the better. Multiple speakers—as used in tape recorders—usually do not aid fidelity; they may help disperse sound more uniformly.

7. **Tone Controls.** Required on playback only. Separate bass and treble controls are helpful. Better machine will have bass and treble boost as well as bass and treble droop.

MECHANICAL

1. **Wow And Flutter.** Listening for wow and flutter is a way of telling how good the motor and bearings are. If they're poorly made and aligned, recordings of sustained tones (voice, organ, or piano) will have an extraneous tremolo.

2. **Number Of Motors.** Two or three are preferable. One or two well-made motors give improved wow and flutter performance over three poorly-made motors.

3. **Tape Speeds Available.** A home machine should be able to play back and record at least 7½ ips and 3¾ ips. A professional machine should be able to run at 15 ips and 7½ ips at least. Most pre-recorded tapes on the market are recorded at 7½ ips, with some at 3¾ ips.

4. **Fast Forward And Fast Rewind.** These controls save considerable time when changing reels and locating sections within a reel.

5. **Positive Switching Operation.** When switching between forward and fast forward, forward and rewind, etc., no setting of the function switching should permit the tape to spill or to break.

6. **Ease of Switching.** Switching controls should be grouped in one section of the recorder. Push button or piano-key switching is most desirable. All recorders should have some type of interlock to permit recording only when an extra switch is thrown. This prevents most erasing of tapes accidentally.

7. **Weight And Portability.** Twenty to 30 lbs. is a good portable weight for the average home type recorder. If you want to do a great deal of interviewing, a smaller machine would be better. There is some sacrifice of fidelity in the very smallest machines under 10 lbs.

8. **Extras.** Inputs for public address systems, remote control switches, mikes, etc., are helpful.

trical types actuate a solenoid; the mechanical types work by pressure. Electrical controls are more expensive, but are easier to adjust. On a very light portable model, mechanical controls would be most practical since their components weigh less.

Piano-style keys, knobs, levers, and push-buttons operate the various makes. Some recording specialists prefer either the piano keys or push-buttons.

Controls to look for are record/playback; volume; fast forward/fast reverse; and record-level indicator. One necessary control is an interlock to prevent accidental erasure. On a well-designed recorder an interlock's actuating handle will be so distinctively designed that it cannot be mistaken for any other control.

Weight. Many of the portables used in homes, schools, and churches weigh from 15 to 30 lbs. and are no larger than a typewriter. If you're going to use it for field work, carrying it from place to place frequently, better buy one of the lightweights that weigh 25 lbs. or less.

Remember though, to some degree, there is a correlation between weight of the recorder and quality of recordings. Weight in the right places reduces distortion from waver and uneven speed.

Style and Finish. Keep in mind that while attractive furniture-style cabinets make recorders handsome additions to your furnishings, they up purchase price a good deal. With a luggage-type portable case you can tape and play back just as fine recordings as you can with a walnut-cabinet model.

ELECTRONIC FEATURES

Overall Frequency Response refers to the frequency of sound waves a recorder can record and play back. It is expressed in cycles-per-second (*cps*). You can only make good recordings within the overall frequency response limits of your machine.

The average adult male's voice has a 100-to-5,000 *cps* range. The human ear, roughly speaking, can hear sounds from 20 to 18,000 *cps*. Many persons, however, cannot hear this well.

Manufacturer's specifications give the *low and the high frequency* limits of their recorders. In general, low-priced recorders suitable for taping such material as music, bird calls, and sound effects have overall frequency response ranges of about 80 to 8,000 *cps*. Higher-priced machines for the same material will bracket 30 to 15,000 *cps*. For recording speech, a range of 150 to 4000 *cps* is adequate.

Frequency Response Deviation refers to a ratio

Carried in a shoulder-holster, this three-lb. Midgetape, manufactured by Mohawk Business Machines Corp., is used by law enforcement agencies, salesmen and many others. Amplifier Corporation of America has an 11¾ lb. recorder which is built into a brief case and is widely used by salesmen.

of loudness which is pegged in terms of the loudness of individual sound tones. A mathematical term known as a decibel (*db*) stands for the ratio between a common point of loudness or reference volume level (usually at 400 or 1000 *cps*) and the volume level at another frequency. The faithfulness with which a recorder picks up and records every sound within its frequency response range at the same relative degree of loudness as the original sound determines the closeness of the finished recording to the real thing. That is, a recorder should, ideally, give a "flat" response over its entire frequency range. But this ideal is found only in the most expensive commercial equipment; most equipment will deviate to some extent.

So you will want to remember two things when considering the sound fidelity of a tape recorder: first, the highest and lowest frequencies it will reproduce, and second, how flat its response is between these frequency limits. If audio signals of exactly the same amplitude were fed into the recorder at each in-between frequency, would they be recorded at the same volume? If not, how much would they be above and below an arbitrary reference point?

A perfectly flat system would have no difference, that is, it would have a ratio of 0 *db*. A tape recorder, with specifications such as 30 *cps* to 13,000 *cps*, ±1 *db* at 15 *ips*, for instance, would be a very fine unit.

Machines with larger deviations, however, are satisfactory for much work: A machine with an overall frequency response of 40 *cps* to 10,000 *cps* ±2 *db* at 7½ *ips* would still make excellent recordings of well played music; 50 *cps* to 7,000 *cps* ±4 *db* at 3¾ *ips*—recordings acceptable for many listeners; 80 *cps* to 5,000 *cps* ±5 *db* at 1⅞ *ips*—many listeners would: 1) object to the wide variations in intensity in normal speech; 2) notice the slight differences of intensity between differently pitched passages in music; and 3) find the sound generally irritating.

Dynamic Range is a highly important tape recorder feature for it limits how low a sound and how high a sound can be recorded. If the recording amplifiers have considerable hum and noise in them they will mask over low sounds. A recorder which has a poor dynamic range will not be able to capture the *pianissimo* passages in music, for example. The dynamic range, or signal to noise ratio, is usually expressed in number of dbs. The better class of home recorder will have a dynamic range of 40 *db* or better. Some professional recorders have dynamic ranges of better than 60 *db*. (Symphonic music will often have dynamic ranges of 60 to 70 *db*.)

Equalization Correction. The slower the tape speed, the more closely wave lengths are crowded on the tape. Sounds of higher frequencies, having the shortest wave lengths, suffer most. A good recorder circuit should build up the higher frequencies to overcome this loss of correct pitch caused by low tape speed. The process of doing this is called *equalization*.

When tape speed is doubled (from 3¾ to 7½ *ips* for example), the loss occurs an octave higher, and the equalization should be changed to build up the new high limit.

Recording-Level Indicator. A distortion level of less than three percent is hard to detect. Many table model radios have distortion as high as 10 percent. Recording at too high a volume level: 1) makes it difficult to erase the tape; 2) introduces distortion; 3) magnetizes the recording head; and 4) reduces the natural dynamic volume range. For all of these reasons you'll want a good recording-level meter on the tape recorder you buy.

A single neon or a magic-eye bulb is the simplest effective type of level indicator. A set of dual bulbs (one that flickers continuously and another that flickers when the level is too high) is more satisfactory than the single bulb. A magic eye indicator is better than the neon bulb type. And a volume-unit indicating meter is best.

Inputs. Some of the more professional style recorders have remote control plugs. If you expect to use your machine in theaters or in the field you may want to look for a model equipped with them. Most of the less expensive recorders will handle one microphone (high impedance) and/or one input such as radio or phonograph.

With a more versatile recorder circuit you can mix in a microphone and a phonograph at the same time on separate controls. And the more expensive recorders have inputs such as

Home uses for a recorder are almost unlimited. Narration for home movies, for instance, can be recorded (and synchronized with projector by bar-markings on tape); or dramatic readings, complete with sound effects, can be transcribed. Above, a fire is being simulated with cellophane held near the microphone. The sound of human footsteps in snow are made by squeezing a box of cornstarch; horsesteps on a dirt road, by manipulating two coconut half-shells in a pan filled with sand (for a gravel road, add small pebbles to sand); thunder, by rattling sheetmetal; walking through underbrush, by twisting broomstraws; etc.

line plugs for bringing in sound from a telephone remote line, radio, phonograph, P. A. system, or other source.

Separate Recording and Playback Amplifiers. Some machines with separate record and playback heads also have separate recording and playback amplifiers. With these, the tape can be monitored or listened to as it is being recorded and you can make a continuous check on the recording process, rather than waiting until the recording is finished.

Heads and Head Alignment Adjustments. Dual heads are a compromise if you want your recorder to have maximum usefulness. Most lower- and medium-priced machines have two separate magnetic heads, one for erasing, the other for both recording and playback. For maximum utility, you may want a recorder with three separate heads, one for erasing, one for recording, and one for playback.

For highest fidelity you should choose a machine with adjustable heads so that you can align the heads with the tape. The recording or playback head must always be perpendicular to the tape's direction for good recording.

Editing Ease. On most of the non-professional tape recorders the erasing and combination record-playback heads are shielded with cover plates. These covers look nice but they make editing difficult. So do reels that will not move when the tape is not in "run" position. It is best to remove the cover plates when extensive split-word editing is done.

When marking tape for editing, we prefer to move the tape manually (by turning the take-up and feed reels by hand) with the sound on. On many of the moderate-priced models this cannot be done. You have to run the machine with the motor going full speed, then control tape position by adjusting push buttons and knobs. This makes it hard to find words.

Full vs. Half Sound Tracks. The signal, or strength of magnetization, is stronger on full-track machines. Less area on the tape is used on half-track recordings.

All home recorders are likely to be half-track. On these machines about half the tape width is used to record in one direction, the other half in the opposite direction. That's how you get twice the recording time on a reel of tape on a half-track machine as you do on a full-track recorder. And that's why you spend less for tape with a half-track outfit. But when you cut portions out while editing the track on one half of a tape, you're also cutting out some of the programs on the other half.

Speakers. Low- and medium-priced tape recorders generally have built-in speakers; this is a good feature for portable machines. You should have at least one good six- to eight-in. speaker; a bigger one is better yet.

Most of the better recording units have a jack for plugging in a larger external speaker or for feeding a hi-fi amplifier.

Tone Controls. On most recorders these controls for decreasing or boosting the intensity of the low, middle and/or high tones operate only during playback. On a few they function during both recording and playback.

A single tone control usually does only one thing—eliminates the high frequencies. This makes a muffled reproduction. If a machine has both treble and bass boost and droop controls, you can usually add bass tones and retain the highs, or reduce the bass without producing shrill high frequencies.

Public Address Operation. Any recorder which has switching controls for connecting the microphone directly through the amplifier to the speaker can be used as a public address system.

Batteries. Most portable, battery operated machines require a "B" battery and several flashlight type dry cells for filament and motor operation. Other portable machines use a rechargeable wet battery. Spring-wound models for recording in remote areas are available.

Wherever you want to record, keep in mind what *kind* of material you're going to want to get. If it's to be Junior at home reciting Tennyson, the church choir live or symphony concerts off the radio, then $100 to $200 should get what you want.

If you want to concentrate on voice tapes at work or at school you can buy recorders for $90 to $160. But if you're most interested in taping music and doing the job with excellent fidelity, then you'd better be prepared to spend $300 to $350 or more.

B-Battery Eliminator for Portable Radios

PERSONAL portable battery-operated sets are very convenient gadgets when they are working. Usually when these sets conk out, it's because the A or B batteries have gone dead. Many of today's compact portables use easily-obtained ordinary flashlight cells for A-power. However, the B battery is a specialty item many appliance stores may have to order for you.

When used indoors, it is foolish to waste expensive packaged power when the portable, even if it is not designed for power line operation, can be made to operate off the 115-125 volt *ac-dc* power line, thus saving the B battery for use only when the set is outdoors. This safe, compact B Battery Eliminator (Figs. 3, 4 and 5) costs less to build than the battery it replaces which retails for about $2.50 plus local taxes. You can change over from battery to eliminator use, incidentally, in just about one minute's time!

Look Ma, no B-battery! Eliminator shown in Fig. 3 saves on costly B-batteries.

When your radio is operated with this battery eliminator, you'll notice, first of all, a great improvement in tone quality. That's because most small portables are limited to 67½ volts plate supply, but this eliminator delivers 90 volts *dc* from the power line. Most portable sets are actually designed for best operation at 90 volts, but battery space limits operation to 67½.

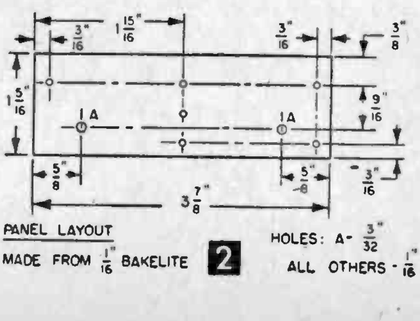
Ordinarily, a portable radio operates without benefit of a ground. However, when operated with the eliminator, a ground is automatically established through the power line. Reversing the line cord plug in the outlet will show you which position does the best job of stepping up the volume and range of the receiver.

Because the size and shape of B batteries vary, we chose a set employing a minimum of space for the B battery. The reader can always use a larger plastic box to contain the eliminator if his set is not as crowded as our receiver. To house the eliminator, we secured a re-use type, hinged, 1 x 1¾ x 4⅜ in. plastic box (originally containing a boy's bow tie). The eliminator itself was 1 in. shorter than the B battery it replaced.

You'll need just five electronic components to make the eliminator: a half-wave selenium rectifier, two electrolytic capacitors and two resistors. Mount these on a strip of 1/16 x 1 5/16 x 3⅞ in. Bakelite. Lay out the Bakelite as shown in Fig. 2, drilling or punching the mounting holes as indicated. With the strip completed, place it inside the plastic box and mark, on the plastic, the locations of the two holes marked "A". Drill 3/32 holes at these points through the plastic, and countersink them on the underside with a 7/32 twist drill.

MATERIALS LIST—B-BATTERY ELIMINATOR

1	hinged plastic box (see text)
1	6 ft. line cord and plug
1 pc	1/16" Bakelite or fiber; 3⅞ x 1 5/16"
2	20 mf., 150 w.v. electrolytic capacitors (Cornell-Dubilier #Br-2015)
1	40 or 50 MA selenium rectifier (Radio Receptor #8J1 or Sarkes-Tarzian #50)
1	3300 ohm, 1-watt IRC type BTA-1 resistor
1	33 ohm, 1-watt IRC type BTA-1 resistor
1 pr	United-Carr battery snap connectors
2	3/48 fh machine screws and nuts



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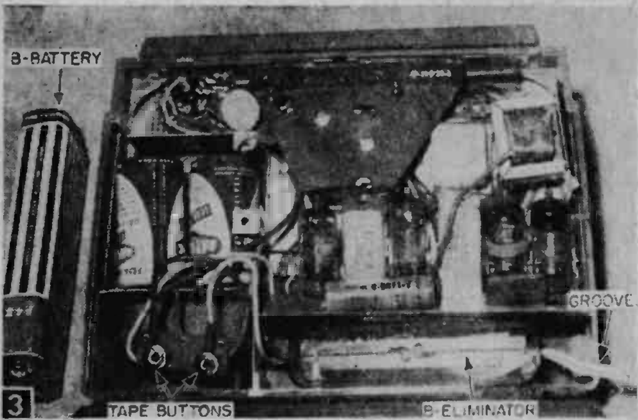
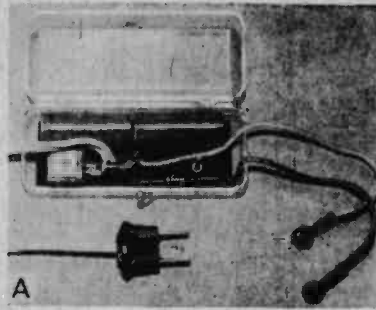
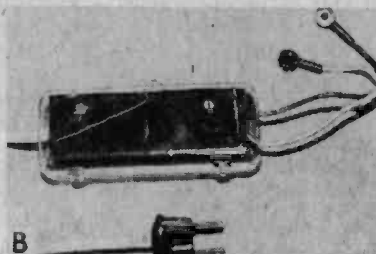
Next, file a groove or slot in one end with a 3-cornered file, 3/16 wide. In the opposite end of the box, file two grooves with a ⅛ dia. rat-tail file. These filed slots accommodate the line cord and the B minus and B plus leads.

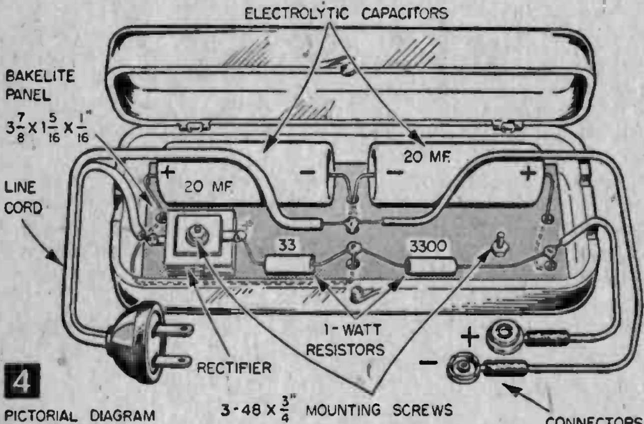
Because of the limited space available, we used a novel method of obtaining tie point lugs for soldering-in components. The two

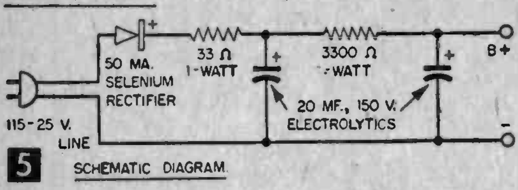






How Eliminator fits space occupied by B-battery with a full inch to spare. To prevent shorting, apply strip of adhesive tape over exposed connector buttons. (A) shows closeup view of eliminator in its plastic box. Slots filed in case provide clearance for line and leads. (B) shows bottom view of eliminator. Pigtail leads of capacitors form direct wiring and tie point lugs. Two fh screws secure the components rigidly inside the plastic box.





20 mf., 150 w.v. electrolytic capacitors were arranged so both negatives were to the center of the Bakelite strip. The pigtail leads were then laced through the 1/16 holes (Fig. 4) as shown in the pictorial. With all but ½ in. of each lead clipped off, the wires were formed into small loops with flatnose pliers. These loops made perfect soldering lugs for attaching resistors and flexible wire leads.

Dotted lines in Fig. 4 show how all cross-over leads are on the underside of the Bakelite strip, completely insulated from components. The B-battery snap connectors may be salvaged from a dead cell, or purchased new where you buy the main components. However, if you buy a strip type connector observe that its leads will be colored the reverse of the actual polarity required. Thus, black or yellow lead will be *plus*, and red lead *minus*. Snaps are wired as in Fig. 4 regardless of lead color.

With wiring completed, place Bakelite strip in plastic box, install a 3-48 flathead machine screw, ¾ or 1 in. long, up through the selenium rectifier and secure with a nut. Insert and secure another 3-48 screw, about ¼ in. long, in the remaining hole. Finally, slip the fixture cord and B-leads into their respective grooves and shut the box cover.

Attach the B-lead snaps to their mates in the set. Apply a strip of adhesive tape over the snap heads to eliminate any possibility of a short circuit. Do *not* plug-in the B-Battery Eliminator until snaps have been connected (you might get a shock).

File a not-too-deep groove in the side of the radio cabinet cover (Fig. 3) to clear the line cord. Cover will help grip wire when it has been closed.

Why didn't we design this unit so as to also furnish A power? First, the flashlight batteries which furnish A power are cheap and readily available. Secondly, it would be necessary to rewire most sets from a parallel to series filament string and add circuit filters. In addition, a voltage dropping resistor generating a great deal of heat would be involved. Finally, the extra components would require too much space.

This little B-battery eliminating power supply in its present form uses very little power, and does not generate heat. It should be disconnected from the power line when the set volume control is turned off. The builder can, however, insert a feed-through Bakelite switch (25¢ in dime stores) in the line cord.—T. A. BLANCHARD.

Decade Resistance Box

By HAROLD P. STRAND

1

Decade resistance box in use in radio servicing job. Various values of resistance are being applied across terminals where a defective resistor was formerly soldered, and which is now unidentifiable due to extreme heating.

Ten ohms to ten megohms instantly available for test or experimental work with this handy, portable unit

PROVIDING 51 different standard 1-watt resistors for instant circuit insertion by means of three 17-point rotary switches and plug-in leads, this decade resistance box is ideal for substitution use in the case of defective or suspect resistors in existing circuits, or as a test selection of values for new circuits. Its application in radio and television service work is obvious, and for experimental work—especially with transistor circuits where the amount of resistance used is often critical—its use is almost a necessity.

The 51 resistors in the unit described in this article range from 10 to 470 ohms, 560 to 12,000 ohms, and from 15,000 ohms to 10 megohms; all of 10% tolerance. Resistors of other values can be used to make up a different set of ranges if desired, and 5% or 1% tolerance resistors can be used where greater accuracy is demanded (and cost is no concern), but the values indicated here will usually be found to encompass all those needed for ordinary servicing or experimenting.

The red plug-in jack on the top panel of the Bakelite case housing the unit is common; the other three jacks (A, B, C in Fig. 2) tap off from the individual switches. With the leads plugged in the common and A, you can use all the resistors in the first group (10 to 470 ohms); changing the second lead to the B jack, you get the second group, 560 to 12,000 ohms; to the C jack, 15,000 ohms to 10 megohms.

Dial plates numbered from 1 to 17 are provided at each switch and a chart cemented to the bottom of the case identifies each resistor value. (The bottom is the only location on the case where a space large enough for the chart is available. If desired, a second chart can be typed up and placed in a transparent plastic envelope for more convenient use at the bench.)

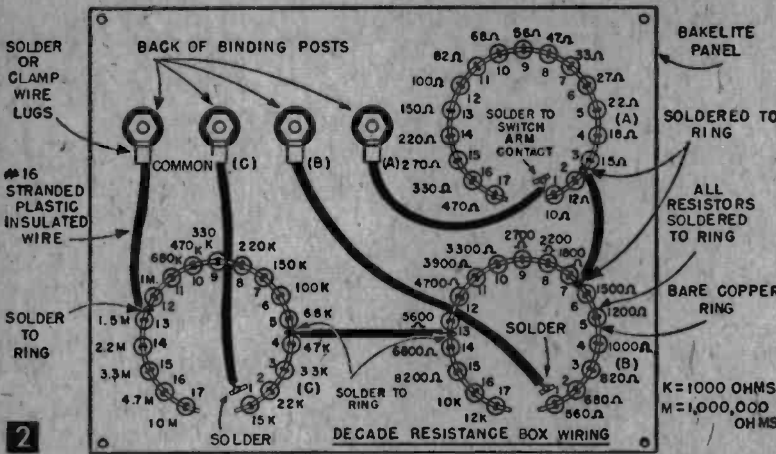
Resistor leads are formed around two nails driven in a piece of wood, thus assuring uniform looped ends and length (see Fig. 3A). Place the nails (6d finish) 1 in. apart on the board and then cut off their heads. Indicate center spacing of the resistor bodies with pencil marks on the board. After bending the leads, cut them off to leave short loops suitable for placing in the switch terminals at one end, for fitting around the bare wire circular common terminal at the other. (Ohmite or Allen Bradley 1-watt resistors should be used because of their comparatively short length. Some other makes are much longer and their use may result in a fitting problem within the case.)

Pass the looped ends of the resistors through the switch terminal holes from the back side so that the loops at the other ends will be turned out. Press them down tightly with pliers and

DECADE RESISTANCE BOX CHART

(A)		(B)		(C)	
1	10	1	560	1	15K
2	12	2	680	2	22K
3	15	3	820	3	33K
4	18	4	1000	4	47K
5	22	5	1200	5	68K
6	27	6	1500	6	100K
7	33	7	1800	7	150K
8	47	8	2200	8	220K
9	56	9	2700	9	330K
10	68	10	3300	10	470K
11	82	11	3900	11	680K
12	100	12	4700	12	1.0M
13	150	13	5600	13	1.5M
14	220	14	6800	14	2.2M
15	270	15	8200	15	3.3M
16	330	16	10K	16	4.7M
17	470	17	12K	17	10M

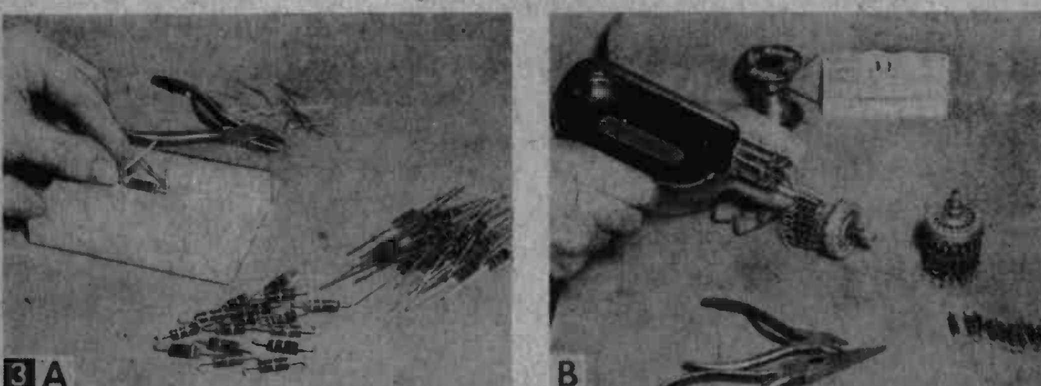
K = 1000 ohms M = megohms



solder (Fig. 3B). As shown in Fig. 2, the #1 terminal is at the right side of the wide spacing on the switch contacts.

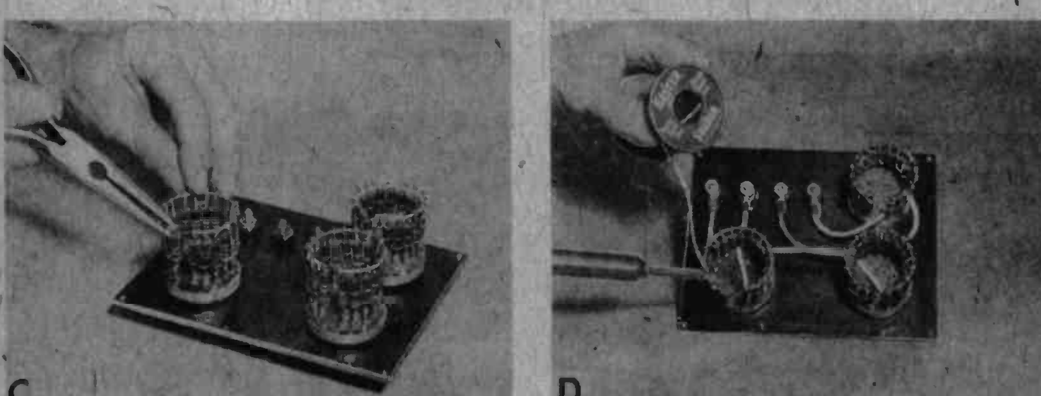
The lowest value resistor for each group of resistors goes to the #1 terminal, values advance counter-clockwise (as viewed from the back). Measure each resistor with a reliable ohmmeter before installing it to make sure that the marked value is accurate to within plus or minus 10% of its markings. When, as occasionally will happen, a resistor is found that is inaccurately marked, substitute another. (If 5% or 1% resistors are used, testing is not necessary. If you are unfamiliar with resistor color coding, an IRC *Resist-O-Guide* can be obtained for 15¢ from any electronics supply store.)

With all resistors soldered to the switches, prepare the Bakelite top panel (Fig. 4)). This piece of black Bakelite can be a part of an old ⅛-in. radio panel or you can send to Forest Products Co., 131 Portland Street, Cambridge, Mass., which will supply one cut approximately to size for $1.15 post-paid (send money order or check). Corner holes are



3 A B

Shape resistor leads around two nails driven in a block of wood to get them of uniform length and with uniform loops (A); then, starting with terminal #1 on each switch with the lowest value resistor, position looped ends of resistors and solder at each terminal (B).



C D

With the resistor-equipped switches attached to the panel, attach formed rings of bare copper wire to free loops, bending them down uniformly over the ring (C); and after the three rings have been placed and leads connected as shown, solder all points of contact to the rings.

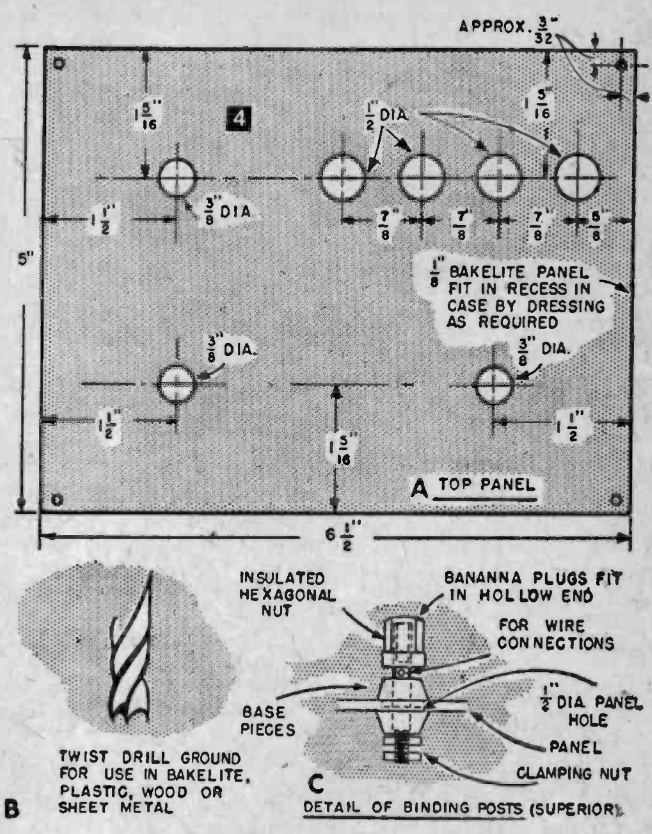
DECADE RESISTANCE BOX—MATERIALS LIST

1 Bakelite case 2¼ x 5¼ x 6¾ (MS 218)
4′ #18 test lead wire
3 17-position switches (Mallory 31117J)
2 banana plugs (MS 209-black)
3 dial plates (Mallory #467, marked 1-17)
2 insulated alligator test clips (black)
3 binding posts (Superior DF30BC-black)
1 binding post (Superior DF30RC-red)
1-watt carbon resistor, 10% tolerance, Ohmite or Allen Bradley—
One of each of the following

10 ohms	560 ohms	15,000 ohms
12 ohms	680 ohms	22,000 ohms
15 ohms	820 ohms	33,000 ohms
18 ohms	1000 ohms	47,000 ohms
22 ohms	1200 ohms	68,000 ohms
27 ohms	1500 ohms	100,000 ohms
33 ohms	1800 ohms	150,000 ohms
47 ohms	2200 ohms	220,000 ohms
56 ohms	2700 ohms	330,000 ohms
68 ohms	3300 ohms	470,000 ohms
82 ohms	3900 ohms	680,000 ohms
100 ohms	4700 ohms	1.0 megohm
150 ohms	5600 ohms	1.5 megohms
220 ohms	6800 ohms	2.2 megohms
270 ohms	8200 ohms	3.3 megohms
330 ohms	10,000 ohms	4.7 megohms
470 ohms	12,000 ohms	10 megohms

All of the above material can be obtained from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y. or in New England from their branch at 110 Federal Street, Boston, Mass.

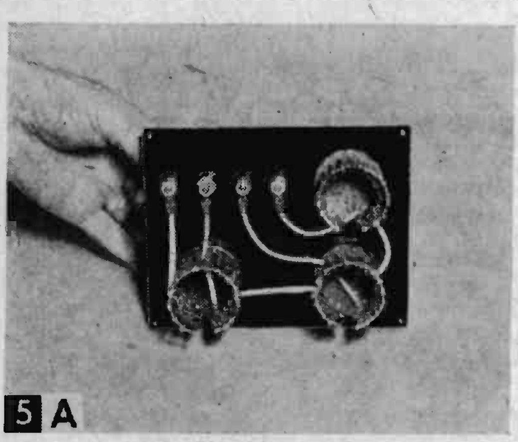
1 piece Bakelite ⅛ x 5 x 6½″
2′ of #16 plastic insulated stranded hook-up wire; 15″ of bare #14 copper wire; four 4-40 machine screws ⅜″ long, binder head plated screws preferred



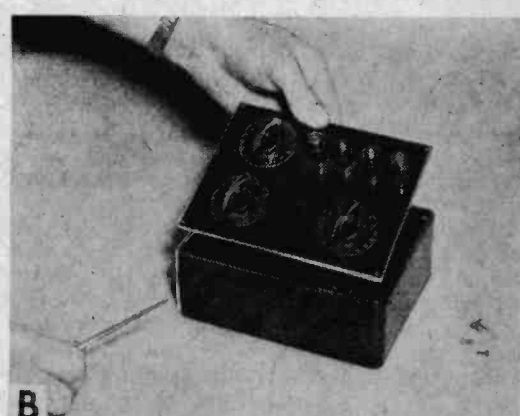
for 4-40 machine screws; the four Superior combination binding posts require ½-in. dia. holes; the switches, ⅜-in. dia. holes. Holes should be made with a twist drill ground as shown in Fig. 4B; regular ground twist drills have a tendency to tear such Bakelite.

Switches come equipped with a round plate having a pin that may be used as a stop. Since all 17 switch contacts are needed for this unit, discard this stop. Cut off the shaft at the first marked point and install, using a washer on each side of the panel, applying cement (such as coil dope) to the lower washer to keep the switch from turning and to keep the dial plate, top washer and nut clamp assembly tight. Then install knobs.

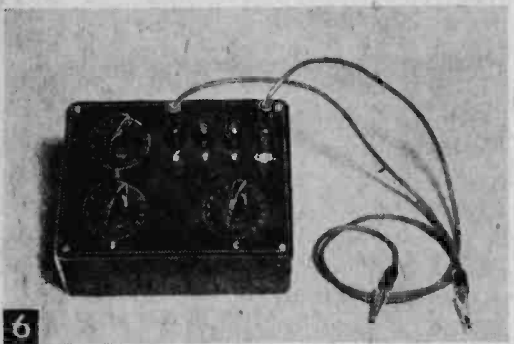
The next step is fitting wire rings to the looped ends of the resistor leads and bending them over tightly with pliers (Fig. 3C). Form the rings from bare copper wire (about #14



Back of the completely wired unit is shown in A. Use #16 insulated wire from the binding posts and also between the ring terminals.



Attach the completed panel to the Bakelite meter case, using 4-40 screws at the four corner holes (B). It fits flush in recess of case.



6

Completed job shows the lettering that was put on with decals sold for the purpose. After decals have thoroughly dried, apply a thin coat of clear plastic with a small brush to make them permanent. Banana plugs and clips soldered to short flexible leads make connections quick and easy.

gage), leaving open ends at the wide-spaced switch contacts. Then connect flexible insulated leads from ring to ring to join them as a common terminal for all resistors and run a lead from one of the rings to the red binding post. Use #16 wire (negligible resistance itself) for these connections (see Fig. 3D). Finally, run a length of #16 wire from each black binding post to the arm contact of the switch it is controlled by (see Fig. 5A).

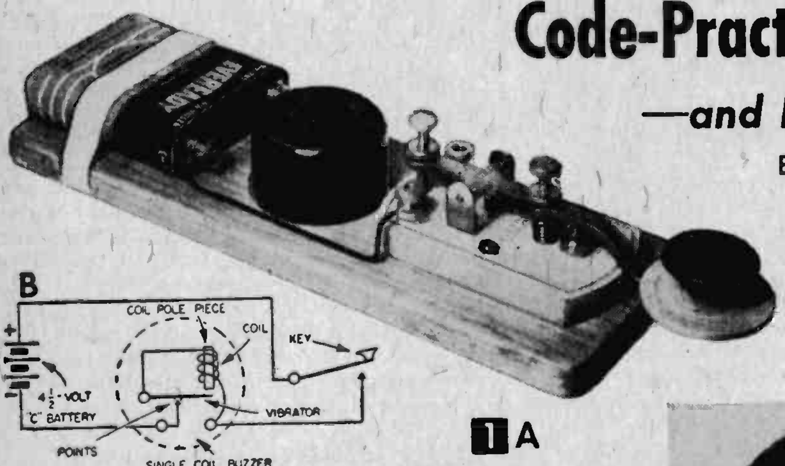
Banana plugs and alligator clips soldered to short lengths of rubber-insulated, extra-flexible, #18 test lead wire make convenient connections between the binding post jacks and the points on the circuit under test. Switches are marked A, B and C, and the binding posts to which each switch is connected are similarly marked for quick identification. You can do this with a fine brush and white paint or use decals as supplied by electronic stores for such work.

The decade resistance box can also be used with the leads plugged into either A and B jacks or B and C, putting the banks of resistors in the two groups used in series for special test cases. Where standard RETMA values only are of interest, however, the leads are used with one in the common and the other shifted to either A, B or C post jack.

Code-Practice Buzzer

—and How to Use It

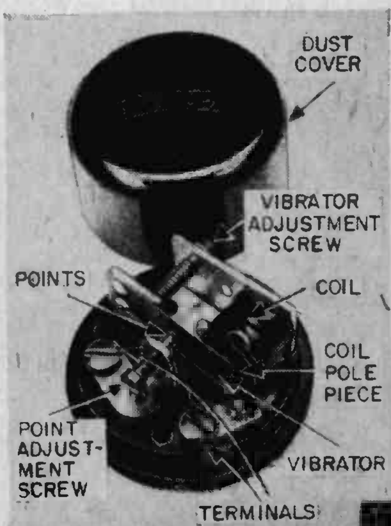
By ARTHUR TRAUFFER



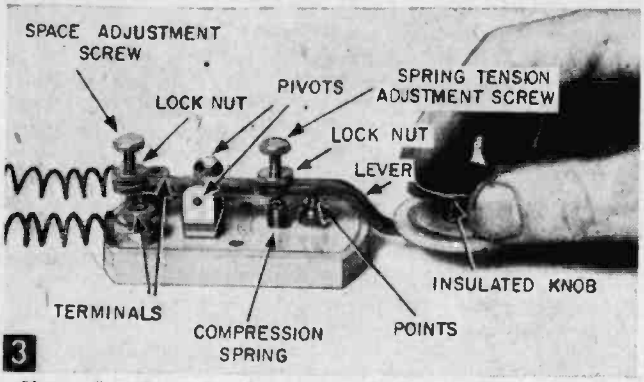
1A

Here, fastened to a ½ x 3 x 9 in. wood base, is a simple code-practice set. The key is at the right, the buzzer is in the center, the "C" battery is on the left. Inset shows schematic representation of same apparatus.

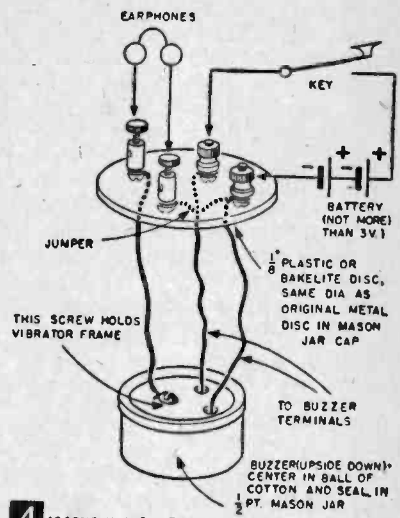
MEET the *Buzzer*, an electromagnetic vibrator used for signaling purposes. Figure 1B gives a typical schematic for a single-coil buzzer. Figure 2 shows the physical make-up of a single-coil, low voltage, high-frequency buzzer. Note in Fig. 2 that the point on the buzzer's vibrator and the point on the left-hand battery terminal touch, thus closing the circuit through the coil (see Fig. 1B). When a source of voltage is connected across the terminals, current will flow through the coil, setting up a strong magnetic field in the pole piece which then pulls the vibrator toward it, thus separating the points. When the points separate, current flow is interrupted, the vibrator returns to its original position, the points again close, and current again begins to flow through the coil and the cycle is repeated. That, in essence, is how



Low-voltage, high-frequency, single-coil code-practice buzzer with dust cover removed to reveal its components. Designed for students of the radio code, this is a Johnson Speed-X Model 114-400.



Above, A code-practice key for the beginner (Johnson Speed-X Model 114-300). Knob has been converted to Navy type by drilling hole in plastic poker chip and fastening it between standard knob and lever. Navy type knob serves as finger rest and reduces fatigue when key is used for long period of time. Below, With this set-up, you can practice code to your heart's content without disturbing other members of the family. The buzzer is muffled by wrapping it in cotton and sealing it in a half-pint Mason jar. You hear the buzzer in the phones.



ASSEMBLY AND WIRING FOR QUIET CODE PRACTICE

a buzzer is made to operate.

The side-to-side movement of the vibrator is so rapid that it gives forth a high-pitched whine. The frequency of this tone, of course, depends upon the number of times the vibrator moves per second. Note in Fig. 2 that there are two adjustment screws, one for the vibrator and one for the points. When these screws are properly adjusted, the buzzer will give a clear high-pitched tone, free from sputtering and raspiness.

A Radio and Telegraph Key is simply a hand-operated switch used to interrupt the flow of current in a radio or telegraph transmitter and thus send a message from one location to another (either through the air or along wires). The message is transmitted by means of the radio and telegraph codes.

The three types of keys most commonly used are: 1) a vertically operated lever, (Fig. 3) on which the dots and dashes of a code are formed by downward thrusts; 2) a semi-automatic, side-to-side operated key (called a "bug") on which dashes are formed by pressing the lever to one side, while the dots are automatically formed by a weight vibrating on a spring when the lever is pressed to the other side; 3) a double-action key (called a "side-swiper"), which is similar physically to the vertically operated lever except that it has a blade that moves from side-to-side to form dots and dashes. The double-action key is similar to the semi-automatic key in operation except that its double-action is much simpler and does not form the dots automatically.

A key, a buzzer and a source of voltage connected as in Fig. 1 will give you a simple and compact code-practice set. In Fig. 1, the base is a ½x3x9 in. piece of wood. The buzzer and key are mounted on the base with *rh* wood screws, and the 4½ v. "C" battery that serves as the source of voltage is taped to the base. Instead of a "C" battery you can use two #2 flashlight cells of 1½ v. each, connected in series to provide 3 v. Leads are soldered directly to the cells, and the cells are held together with adhesive tape. You can also use two #6 dry cells (1½ v. each, connected in series), but these are too large to mount on the base shown in Fig. 1. It's better not to use a 2.5 v. or a 6.3 v. *a-c* filament transformer for powering a buzzer, because of the interference caused in nearby radios and TV sets. And potentials higher than 4½ v. are not recommended for code-practice buzzers, either, because with them you may have excessive sparking and pitting of the points.

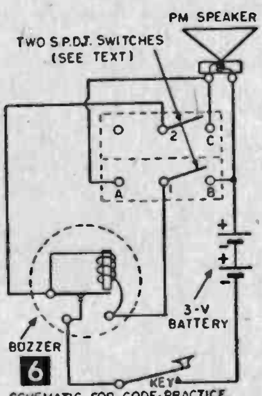
Wire your code practice set with bell wire obtained at the dime store. It isn't necessary to drill holes through the wood base to reach the terminals in the buzzer; simply file notches in its bottom rim and pass the wires through the notches. When mounting the buzzer and key on the wood base, do not draw-up the screws too tightly or you may crack their Bakelite bases.

With a Quiet Code-Practice Set, you can practice the code all you want, any time you want, without disturbing other members of the family. To make a quiet set, put the buzzer in the center of a ball of cotton and seal it in a half-pint Mason jar (Figs. 4 and 5). This will muffle the buzzer's sound, but when you wire in a pair of phones, you'll hear the buzzer in them. Soft, flexible, insulated wire leads should be used to connect the buzzer to the four binding posts on the plastic or Bakelite disc. Stiff wires will permit mechanical vibrations from the buzzer to travel up them and use the plastic disc as a sounding board. The center screw on the bottom of the buzzer holds the bracket to which the vibrator is fastened, so you can make one of your phone terminal connections to it (Fig. 4).

Be sure to place the buzzer in the center of the ball of cotton, because if it should touch one side of the jar, mechanical vibrations will use the jar as a sounding board. And don't pack the cotton too tight or vibrations will pass through the cotton and use the jar as a sounding board. If some do, in spite of precautions, stand the jar on a rubber pad or some other soft material.

If volume in the earphones is too high, you can reduce it by connecting a .001 mfd. capacitor in series with one of the phone leads. The value of the condenser will determine the strength of the signal in the phones, so if with a .001 mfd. capacitor you still get too loud a signal, use 500 mmfd. or 250 mmfd. instead. Once the value of the capacitor has been determined, connect it in place of the jumper between the disc's battery and phone terminals as shown in Fig. 4.

Incidentally, the FM fan who has a set without a tuning indicator can use a buzzer muffled in a jar of cotton as a tuning aid. Tape two #2 flashlight cells to the jar containing the buzzer, fasten one lead from this battery securely to one buzzer terminal on the plastic disc on the jar and fasten the other lead to the other terminal with an alligator clip so that you can disconnect the buzzer when desired. Now, place this unit close to an FM receiver (on top of the set is a good place) so as to cause AM interference with the FM signal being tuned in. Since the function of the FM circuit is to reject AM and to detect FM, adjust the tuning knob of the receiver for the weakest buzzer signal and you will have the FM station "right on the nose." In FM receivers, stations come in at three closely-spaced points on the dial, the center point being the loudest and the correct point. Buzzer volume will weaken at these three points, and will be weakest at the center point.



SCHEMATIC FOR CODE-PRACTICE "AMPLIFIER"

This buzzer "amplifier" is ideal for use wherever a large number of persons assemble to learn the code. No vacuum tubes are used, yet speaker volume is more than enough to fill a large hall.

Amplifying a Buzzer. Instead of quieting the buzzer, you may want to greatly increase its volume so that dots and dashes can be clearly heard by a number of code-practice students anywhere in a room. One way to do this is to place your code-practice set close to the loop antenna on the rear of an AM radio with the buzzer near the center of the loop. The loop will pick up the R.F. energy generated by the buzzer's sparking points and the radio will detect, amplify, and reproduce this R.F. in the usual manner. To pick up the buzzer signal, tune the radio to a quiet place between two stations; volume can be controlled, of course, with the radio's volume-control.

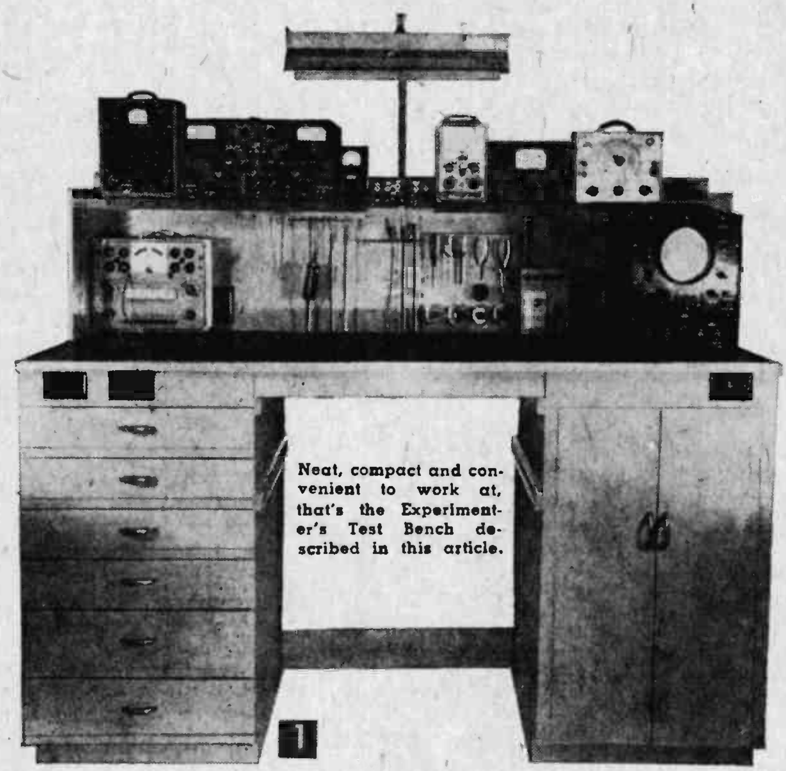
For a code-practice buzzer "amplifier" that will tremendously "amplify" the buzzer's signals without the use of vacuum tubes, see Figs. 6 and 7. The chassis of this unit is made up of two pieces of 7x11 in. 5-ply plywood screw-fastened together and braced with 3x3 in. iron angles (Fig. 7). The front panel of the chassis is ½-in. plywood; the base, 1-in. Buzzer and key are mounted on the base with rh wood screws. Two S.P.D.T. knife switches are mounted side-by-side for volume selection. (If you have a D.P.D.T. switch on hand, you can convert it into two S.P.D.T. switches by sawing through the center of the insulated strip that joins the two blades.)

Use a 5 in. or larger PM speaker with as large a magnet as possible. The larger the speaker, the higher the volume. Cut the proper size hole into the front panel for the speaker, and mount it behind window screening for protection. Two #6 dry cells are connected in series to provide a long-lasting, 3-v. power source.

With the two S.P.D.T. switches, you have a choice of three different buzzer volumes. Referring to Fig. 6, for buzzer only, speaker silent: throw blade 1 to contact B; leave blade 2 open. For medium speaker volume: throw blade 1 to contact A; leave blade 2 open. This puts the speaker voice-coil in series with the battery. Speaker volume is louder than that of the buzzer alone. For loud speaker volume: throw blade 1 to contact B and blade 2 to contact C. This puts the speaker voice-coil across the buzzer's coil.

Experimenter's Test Bench

By W. F. Gephart



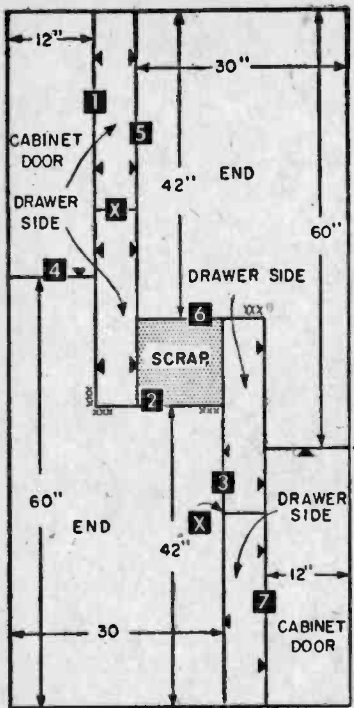
Neat, compact and convenient to work at, that's the Experimenter's Test Bench described in this article.

RADIO-TV experimental work—*and* servicing work—can be done most easily and efficiently where there is adequate work space, accessible test equipment and tools, good lighting, and quickly located parts and supplies. A well-designed test bench, such as that shown in Fig. 1, meets each and every one of these requirements and makes even the tough jobs a pleasure.

The bench itself is constructed of fir plywood and can be built without power tools, although if you can borrow or rent an electric hand saw such a tool will simplify the initial cutting steps. The bench includes a number of optional features which can either be included in the original construction or added later. The work area top is replaceable tempered hardboard which, when it has withstood a maximum of abuse (and its maximum is plenty), can be readily replaced. Electrical outlets are numerous and convenient, and test equipment is located—for the most part—outside of the work area, yet is also conveniently at hand. Finally, there is adequate and convenient storage space for tools and parts.

Begin construction by cutting the 4 x 8 ft. plywood and hardboard panels (see Materials List, last page of this article) as shown in Figs. 2 through 8, the lengths of 1-in. stock as shown in Fig. 9. In making these cuts, arrange a guide board as shown in Fig. 10 to insure straight cuts. Clamp the guide board to the panel being cut so that when the edge of the electric hand saw runs along it, the blade will cut along the previously-marked line on the stock. In the cutting plans Figs. 2 through 7, the small black triangles indicate the side of the line along which the saw blade should run to secure the exact desired dimension, making allowance for the kerf of the saw. In cutting the 1-in. stock, use the regular rip guide with the saw. (Lines marked "xxx" and "x" on the cutting plans indicate points where the end of the cut is made with a hand saw.) In some instances, slight additional cutting will be required to fit as assembly proceeds. (These cuts can be made later with a hand saw if an electric saw is rented for initial cutting.)

After the material is cut, fasten the side-top braces, drawer slides, and shelf supports, to the sides of the cabinets. Figure 11 illustrates how an actual drawer side, plus a scrap of hardboard, is used for spacing drawer slides. The side-top brace is nailed and glued in place and the first



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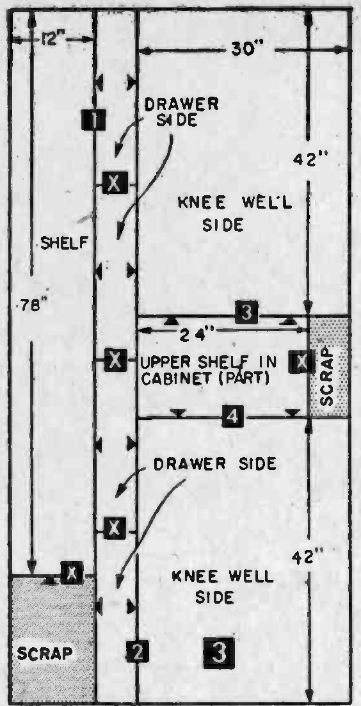
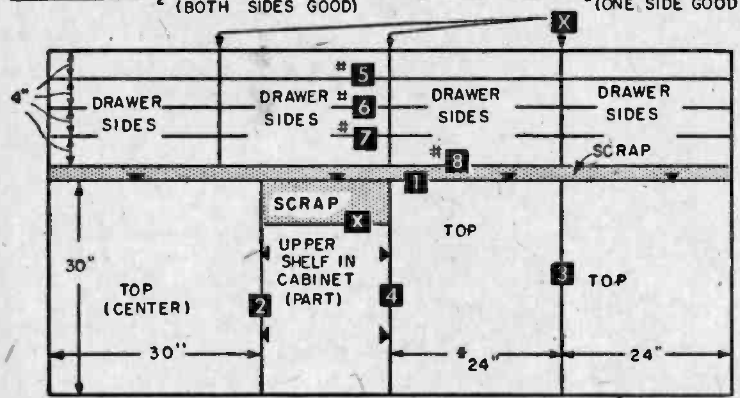
CUTTING PLANS-$\frac{1}{2}$"X4X8' A-B PLYWOOD (BOTH SIDES GOOD)



CUTTING PLANS-$\frac{1}{2}$"4 X 8' A-D PLYW (ONE SIDE GOOD)



CUTTING PLANS $\frac{1}{2}$" X4X8' A-D PLYWOOD (ONE SIDE GOOD)

* MARK AND MEASURE AFTER MAKING CUT NO.3

#-MAKE 4" MEASUREMENTS BETWEEN CUTTING STEPS

4

drawer slide is then spaced as shown in Fig. 11, the strip of hardboard being a measurement of "slack," to allow the drawer to fit loosely. After the first slide is nailed and glued in place, the remaining slides are positioned in the same manner, working from top to bottom. Before the bottom slide is fastened in place, mark the bottom of it and make a cut-out for the "kick-space" at the bottom of the cabinet side.

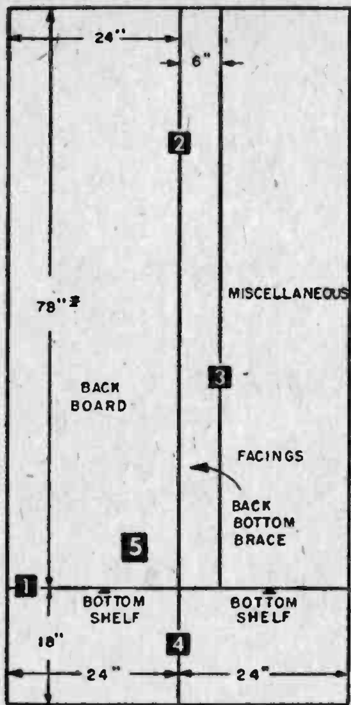
Figures 12, 13 and 14 give overall dimensions of the two cabinets and bench assembly. (Some of the dimensions may vary slightly in actual construction, depending on fit.) In all cases, all joints and supports (drawer, shelf, etc.) are glued, using resin-type glue, as well as nailed.

After the internal members are in place, assemble the cabinets by fastening tops to sides. Cut a piece ½ x 12 in. out of each top to allow for the part of the side that projects above the top (see arrows in Fig. 15) and completely assemble both cabinets, including facings (as in Fig. 15) before assembling units as a bench.

To assemble as a bench, place both cabinet units face down on the floor, parallel to each other and 30 in. apart, with the bottoms even. Then glue and nail the backboard (Fig. 14) in place, following this with the back bottom brace. As the nailing is done, check alignment with a carpenter's square, and while the assembled unit is in this position, cut holes for the electrical outlets in the backboard. Next, raise the unit to its upright position and secure the shelf in place by screwing the shelf brackets to the backboard (27 in. in from each side), the shelf to them, finishing by nailing in from the ends and backboard. At this stage the unit will look as shown in Fig. 16.

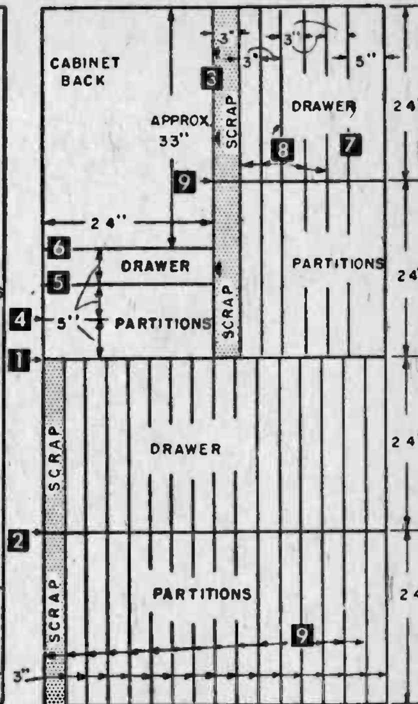
Now assemble the drawers as shown in Fig. 17. If power equipment is available, the hardboard bottoms can be grooved into the sides, front and back for support; if not, glue and nail ⅜-in. sq. strips along the inside bottom of the front, sides and back to support the hardboard bottom. In all cases, small 1-in. metal angles should be fastened between the inside of the fronts and sides to take the strain off the nails when opening or closing the drawers.

Partitioning plans for the drawers are shown in Fig. 18. It is suggested that the top drawer be used for tools; the exact partitioning for it will depend upon your needs. The second, third and fourth drawers (A in Fig. 18) are designed for storage of small parts such as resistors, capacitors, switches, jacks, etc., and the 36-unit partitions shown are recommended. Resistors

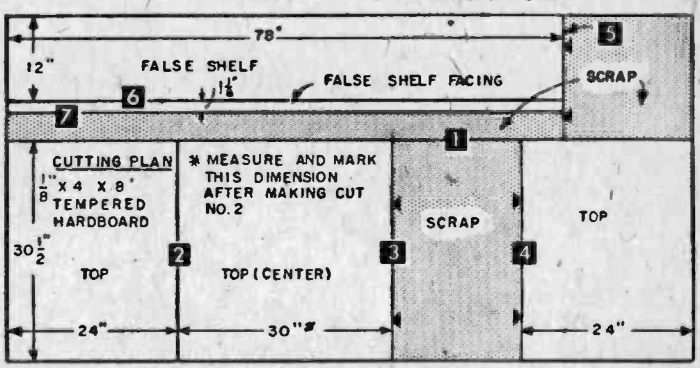


CUTTING PLANS- $\frac{1}{2}$" X4X8' A-D PLYWOOD (ONE SIDE GOOD)

* EXACT LENGTH REQUIRED, ON OTHER PIECES, SAW KERF UNIMPORTANT



6 CUTTING PLANS- $\frac{1}{4}$ X 4 X 8' A-D PLYWOOD (ONE SIDE GOOD) ON CUTS NUMBERS 4 THRU 7, SET GAGE TO 5" AND REPEAT CUTS ON CUTS NUMBERS 8 AND 9, SET GAGE TO 3" AND REPEAT CUTS



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and capacitors are grouped in each compartment (such as 1-1000 ohms, 1000-5000 ohms, etc.), and other parts, such as toggle switches, jacks, potentiometers, etc., each have their own compartments. One-hundred-and-eight compartments are available in the three drawers.

The center-to-center dimensions shown in Fig. 18 may vary slightly, depending on the exact size of the inside of the finished drawer. The exact spacing can be computed by the formulas given; the ¼-in. plywood sections are notched as shown in Fig. 18C. In assembling the partitions, the cross partitions should be on top and all partitions nailed into from the side and back of the drawers. (It is also a good idea to glue and nail them to the bottom of the drawer.)

The fifth drawer (B in Fig. 18) is for storage of transformers, relays, meters, etc. The compartments are larger, but construction principles are the same as for the other drawers.

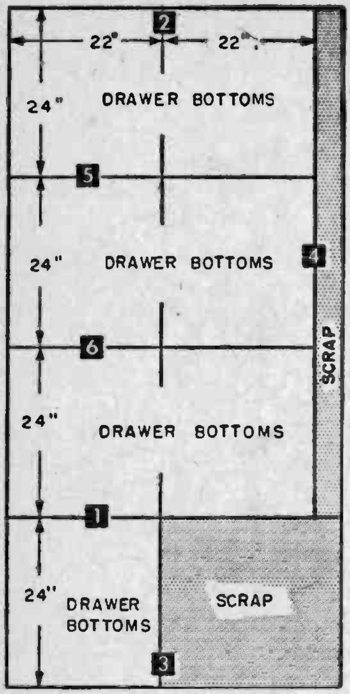
The bottom drawer (Fig. 19) is for tube storage and has a special false bottom to hold non-miniature tubes not in cartons. Built as in Fig. 19, the drawer has maximum capacity, although some users might like more space at the front of the drawer for other tubes. Figure 20 shows a view of the partitions in one of the small drawers; Fig. 21, the interior of the tube drawer, stocked with tubes.

Additional shelves (requiring additional lumber) may be placed in the right-hand cabinet but adjustable shelves using metal mountings should not be used, since the shelves provide bracing for the overall unit.

The center section is designed so that it can be removed and set at a lower level when working with a large chassis. To assemble the center section, first take one of the center section frame pieces (see Fig. 9) and using it as a guide set the top supports of the center section down enough to make the top of the frame piece flush with the top of the cabinet (see Fig. 22). Glue and screw the supports to the sides of the cabinets, making sure that the screws do not go through the side of the left cabinet to interfere with the sliding drawers.

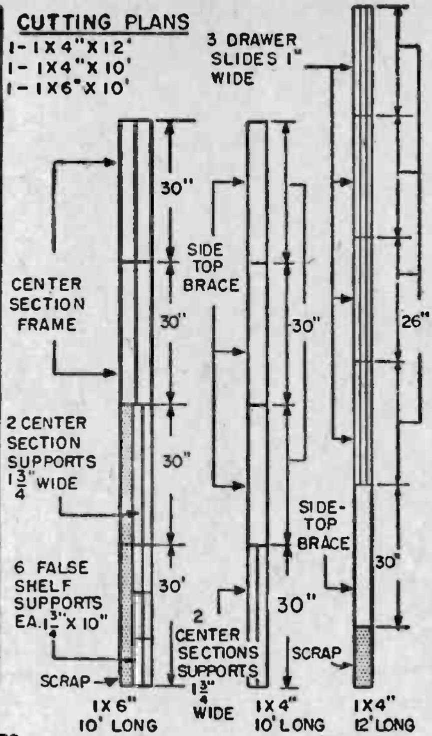
After the supports are in place, assemble the center section by nailing the four frame pieces together and nailing the top to them. The width of the section should be approximately 30 in., but cut to fit the opening between the cabinets. The depth should be 30 in. if the test lead storage plan (discussed under *Electrical Work*, below) is not to be used, 29 in. if it is to be used.

A small barrel bolt (as shown in Fig. 22) holds



CUTTING PLAN 1/8" X 4 X 8' PLAIN HARDBOARD

8 ALL DIMENSIONS APPROXIMATE CUT TO FIT DRAWERS



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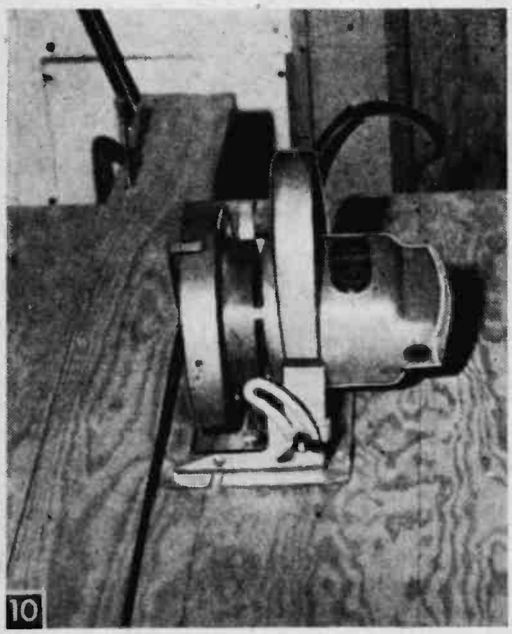


Cutting guide board is clamped to panel with saw blade in place along marked cutting line.

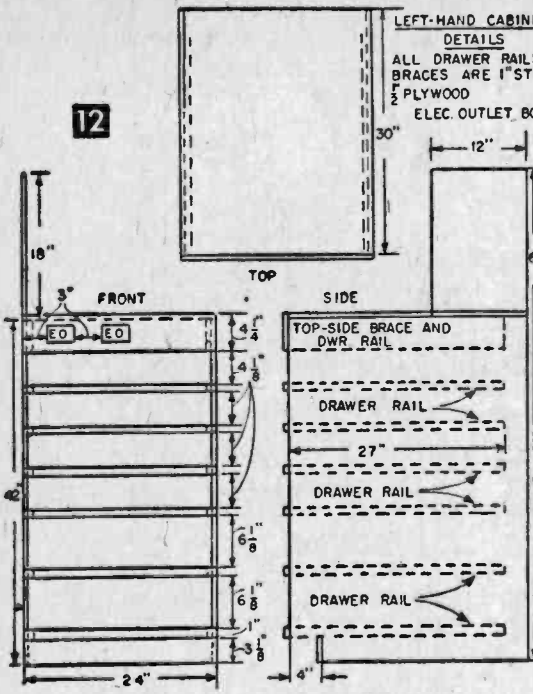
Piece of scrap hardboard spaces drawer slide.

the center section in place. A second one can be mounted on the bottom support if desired.

The hardboard tops of the cabinets and that of the center section may have to be planed or sanded slightly to assure an exact fit. They are fastened to the cabinets and center section with asphalt roofing cement, their back edges secured with a few *small* nails. Sides and front edges are further held in place with aluminum edging which overlaps the tops and is screwed to the front of the bench.

A vise (not shown in the photographs), may be mounted on either corner of the bench, depending upon the individual's preference, clearance around the bench, and the location of test equipment on the bench top.

If a Test Lead Concentrator (discussed under *Electrical Work*, below) is to be used, build a false shelf over the regular shelf by gluing a number of scrap pieces of ½-in. plywood to the top of the regular shelf, allowing space between them along the entire length of the shelf, and at various front-to-back intervals. Then fasten a scrap piece of hardboard 1⅛ in. wide to the front of the regular shelf, with ½-in. holes in it, spaced at regular intervals (between the blocks), and lay the hardboard false shelf on top of the



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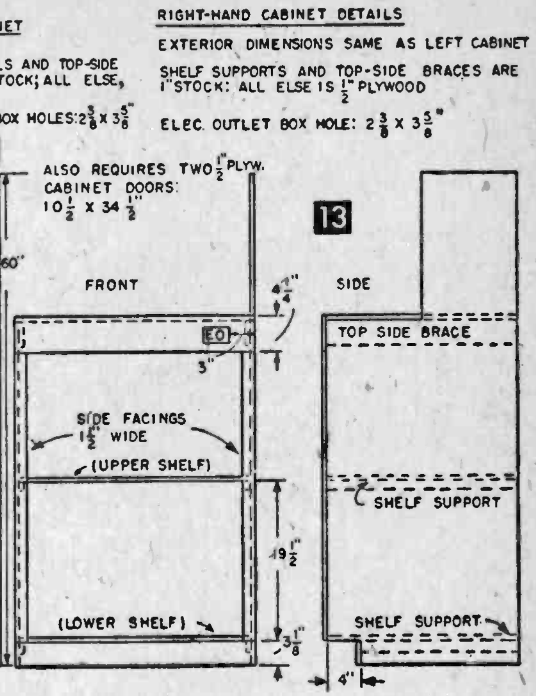

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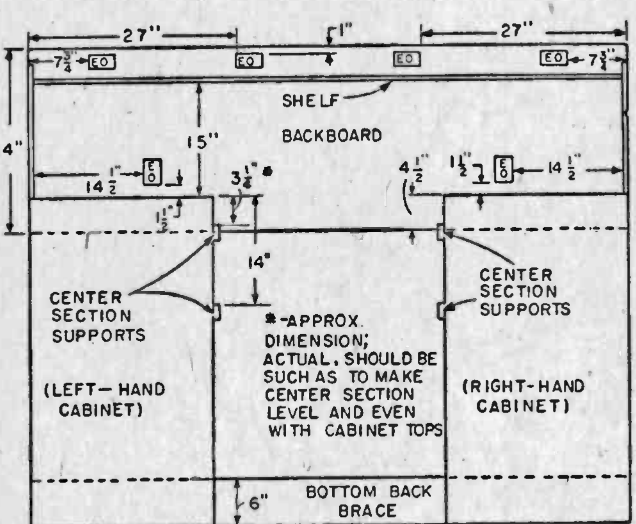


14 ELEC. OUTLET HOLES: 2 3/8 X 3 5/8" — OVERALL CABINET-BENCH DETAILS

blocks. The exact length of the hardboard strips, and the cut-out in the center of the false shelf (for leads to the Concentrator) will depend on the size of the Concentrator panel (see below).

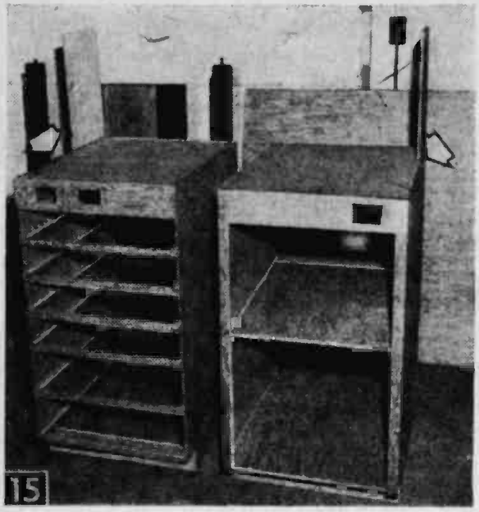
Electrical Work. Use flexible metal conduit (such as "BX" cable) for all wiring. In many localities local ordinances require it; furthermore, such wiring, with the metal covering grounded, prevents the formation of stray *ac* fields which often cause problems in delicate testing or experimentation.

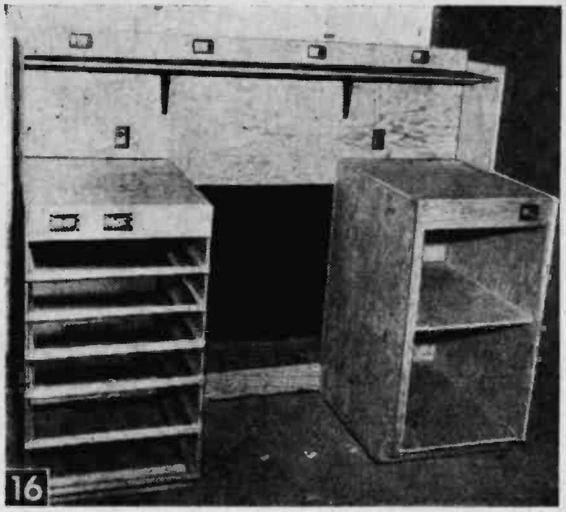
To meet local requirements, as well as the Underwriter's Code, all power outlets should be in standard metal boxes, using approved devices. The proper knockouts should be removed and the cable connectors installed before the boxes are mounted. Boxes should be fastened from the back, their fronts flush with the front surface of the mounting board. Wiring is straight-forward, details and the general plan are given in Fig. 24. Unless you plan to use special high-current devices, #14 wire is sufficient.

The light fixture is assembled from ½-in. pipe as shown in Figure 25. (Threads on the cable connectors are pipe threads and will screw into the ½-in. pipe coupling.) Leaving the elbow joint at the top of the vertical pipe fairly loose, permits the light to be swung from one end of the bench to the other. Completed wiring and light fixture are shown in the rear view of the backboard in Fig. 26.

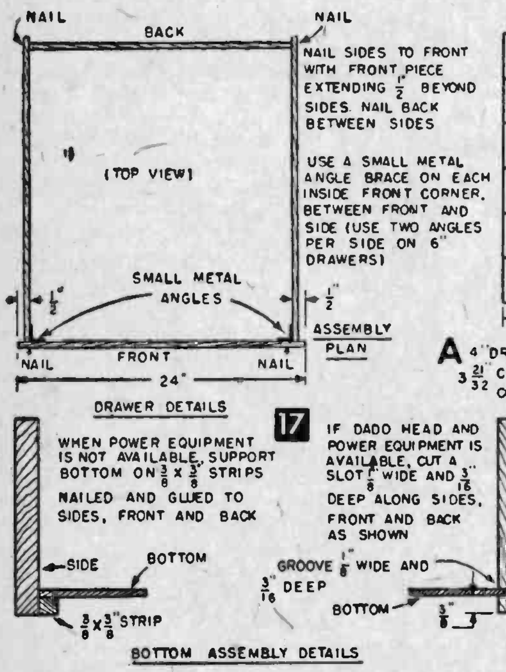
You can use either a fluorescent or an incandescent fixture, but normally, fluorescent fixtures are not recommended, since even the best of them sometimes emanate *rf* interference. A yard light fixture-reflector (see Fig. 27) provides a simple incandescent light.

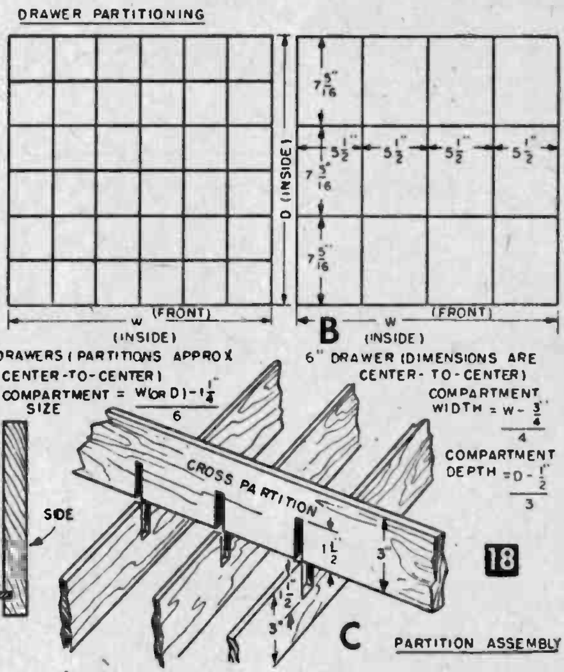
Test Lead Concentrator. Whenever several pieces of test equipment are used, a number of different leads are required; if the equipment is spread across a shelf, long leads are sometimes needed. Thus, in many tests, when several instruments are used, the bench becomes literally





Completed cabinet assemblies with facings in place and holes cut for electrical outlets. Arrows point to offset cuts in cabinet tops (Fig. 15). Cabinet-bench assembly before wiring and top installation (Fig. 15).





festooned with test leads.

A Test Lead Concentrator provides a central point, at the center of the bench, where the terminals of most test equipment is available. It also provides for standard type leads for all equipment, and gives you the option of connecting all equipment to a common ground, with a single lead to the unit under test. The size and number of jacks for such a unit will depend on the equipment you have, but extra jacks should be built in to allow for growth.

The leads for the units to be used with the Concentrator connect to the test equipment at the usual jacks or terminals (thus avoiding any alteration of the equipment), go through a hole in the shelf facing (see Fig. 23) under the false shelf, and connect to the back of the Concentrator. In most cases, all except the ground lead should be shielded wire. Figure 28 shows the relation of two units (a VOM and a VTVM) to the Concentrator. Note that the VOM leads are not shielded.

At the Concentrator itself, a wire is run across the front of the panel along the bottom and connected to a central—common ground—jack (see Fig. 28). If several test instruments are being

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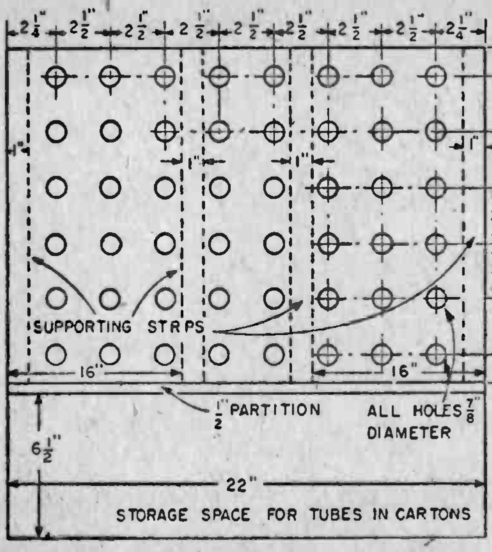
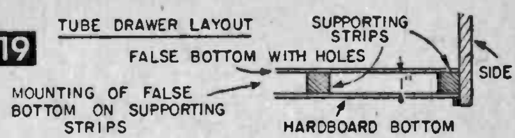


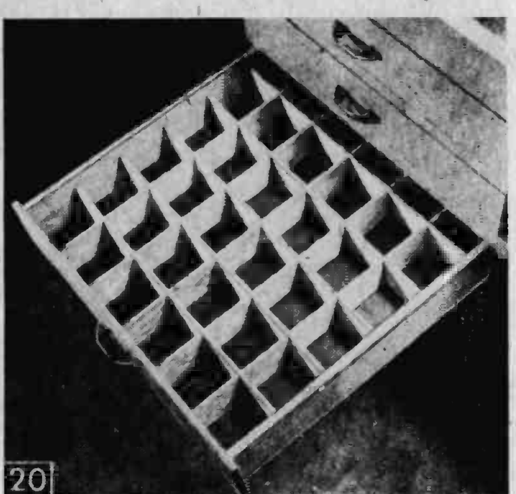


used, and their ground is common, the individual negative terminals of the instruments (appearing on the Concentrator) are jumpered to this bottom wire and a single lead run to the equipment under test from the "Common Ground" jack. (If shelf space is at a premium, a raised shelf can be built over the Concentrator panel, and another piece of test equipment mounted on it.)

Three types of test leads are required for use with the Concentrator; a shielded lead, a regular lead (each full length), and a short, jumper lead (see Fig. 29). The shielded lead has a shielded phono plug on one end and a standard test prod (red) on the other (you'll need at least two of these). The standard lead, with a pin plug on one end and a standard test prod on the other, are used for VOM leads and ground leads (you should have a minimum of two black leads and one red lead of this type). In both of these types of leads, the test prods used have screw-on alligator clips. The short, jumper lead has a black pin plug on one end and on the other an alligator clip for connection to the common ground wire (you'll need at least two). The shielded and regular leads should be 2 ft. long; jumper leads about 4 in. long.

Fused Outlet. Quite often during experimental work, fusing of the primary circuit is desired —or necessary—to protect the equipment. Since ordinary line fuses have too high capacity to offer much protection other than on a dead short, a Fused Outlet, which provides variable fusing, should be installed on your bench.

Figure 30 shows the schematic of such a unit



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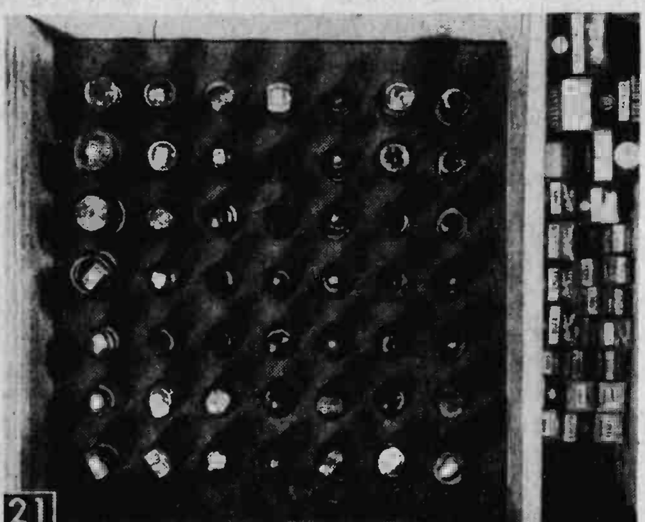
Small parts drawer, 4-in. partitions.



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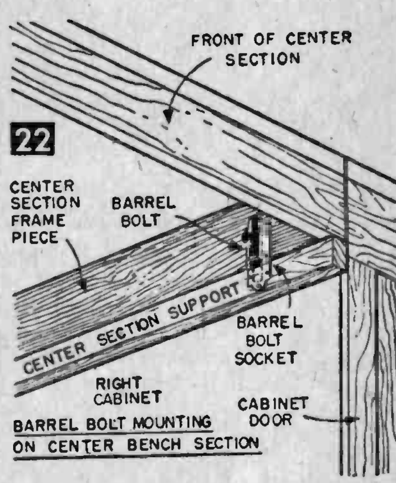
Top view of inside of tube drawer.



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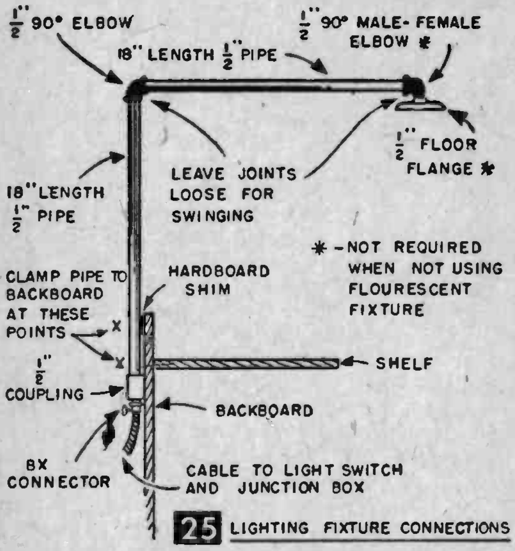
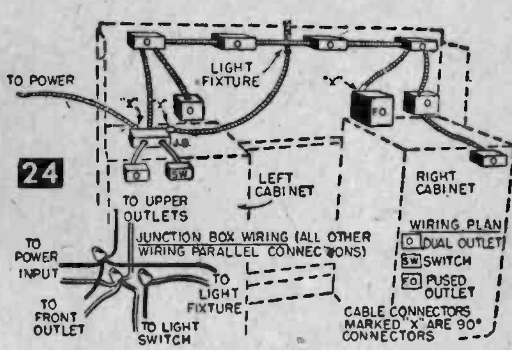
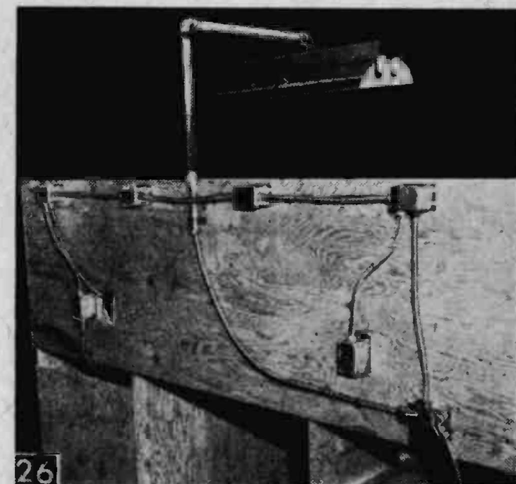


25 LIGHTING FIXTURE CONNECTIONS

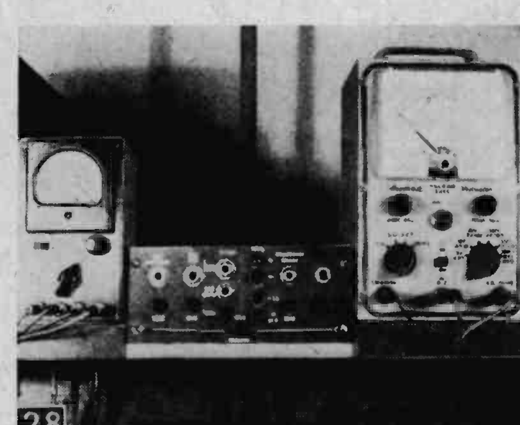
Mounting details of yard light incandescent fixture.

Leads for Test Lead Concentrator go through hole in front strip and run between scrap blocks to back of Concentrator.



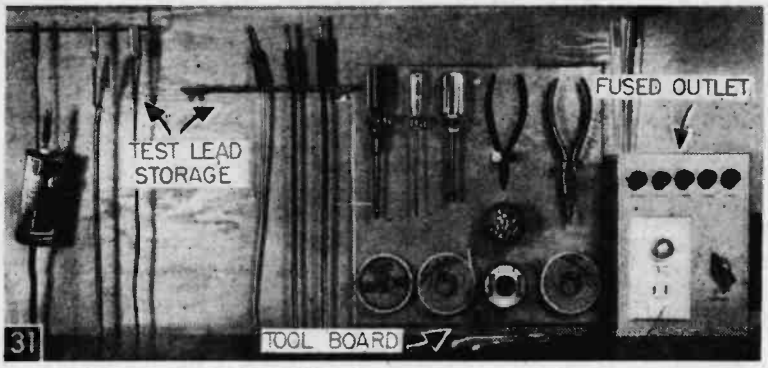


Rear of backboard, showing wiring and light fixture details.



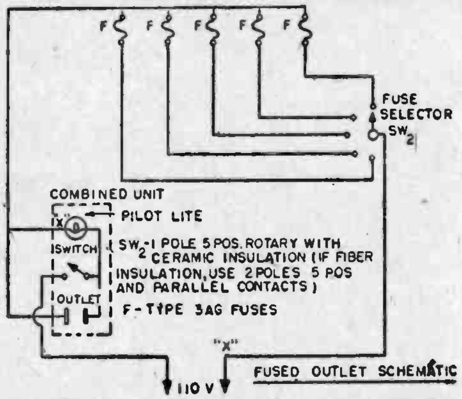
Test Lead Concentrator with leads for VOM and VTVM connected (above).

Test leads for Concentrator unit: shielded lead (left); jumper lead (center); regular lead (right).



31

Backboard below shelf with leads, tools, and fused outlet installed.



30

built with five fuses. By increasing the size of the switch and adding fuse holders, even greater selection would be available. The unit is designed to use 3AG fuses; these are available in sizes from 10 *ma.* to 8 *amps.*

If a pilot light (a handy reminder that the circuit is "on") is wired through the fuse, the capacity of any fuse will be reduced by about 50 *ma.* While a pilot light does make it apparent when the fuse is blown, it does not permit extremely low-current fusing. If extremely low-current fusing is desired, the "X" side of the pilot light should be connected to power lead "X" rather than as shown in Fig. 30.

Enclose the unit in a metal box (to meet code and Underwriter requirements) as in Fig. 31.

Test Lead Storage. Figure 31 also shows a simple means of storing test leads. The center section of the bench is cut 1 in. short (29 in. instead of 30 in.), leaving a 1-in. gap at the back. You can then screw a simple wire hanger (made from coat hanger wire) to the backboard or underside of the shelf, and use this for leads terminating in a clip. Or you can notch a piece of hardboard from the front to take shield leads and mount this on the backboard.

Tool Board. While most tools are stored in the top drawer, the most commonly used ones can be kept handy on top of the bench. Figure 31 shows a simple tool board for such items, tools held in place with small spring utility clips, solder, soldering paste and hook-up wire held in place with long finishing nails. To mark the location of each tool, paint a black outline of the tool (as in case of diagonal cutters in Fig. 31) on the board at the appropriate place.

MATERIALS LIST—EXPERIMENTER'S TEST BENCH

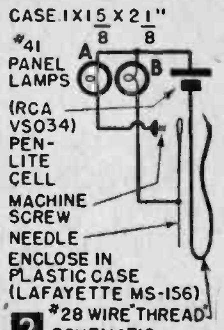
No.	Description
1	1/2" x 4 x 8' A-B fir plywood (both sides good)
3	1/2" x 4 x 8' A-D fir plywood
1	1/4" x 4 x 8' A-D fir plywood
1	1/8" x 4 x 8' tempered hardboard
1	1/8" x 4 x 8' hardboard
1	1 x 4" x 12' #1 yellow pine
1	1 x 4" x 10' #1 yellow pine
1	1 x 6" x 10' #1 yellow pine
9	flush outlet boxes w/o clamps
1	surface utility box
19	#14 armored cable clamps for 1/2" knock-outs
4	#14 90° armored cable clamps for 1/2" knock-outs
1	toggle switch
1	switch cover plate
8	dual outlets
8	dual outlet cover plates
1	blank cover for surface box
25'	2 conductor #14 armored cable (plus length req'd to reach power source)
12'	aluminum bench edging
4	1" butt hinges
8	drawer handles
2	cupboard catches
16	1 x 1" angle braces
1	small barrel bolt
2	10 x 12" shelf brackets
	Misc. nails, screws, glue, etc.
2	18" lengths 1/2" steel pipe
1	1/2" pipe coupling
1	female-female 90° 1/2" pipe elbow
1	female-male 90° 1/2" pipe elbow*
1	1/2" floor flange*
2	steel 1/2" pipe clamps
1	fixture (12" yard light or 2 tube 24" fluorescent)
	*Not required with yard light fixture

No.	Description
	FUSED OUTLET
5	fuse holders for 3AG fuses
1	1 pole, 5 pos. rotary switch
1	interchangeable pilot light unit
1	interchangeable switch unit
1	interchangeable outlet unit
1	3 opening cover plate
1	knob
1	aluminum box, 4 x 6 x 8"
	desired fuses
	TEST LEAD CONCENTRATOR
6	open circuit jacks
2	phone tip jacks (red)
8	phone tip jacks (black)
25'	single-conductor rubber-insulated, shield wire
	For each shielded lead:
1	shielded phone plug
24"	single-conductor shielded wire
1	test prod (red) with attachable alligator clip
	For each regular lead:
1	phone tip plug (black or red)
24"	test lead wire (black or red)
1	test prod (red or black) with attachable clip
	For each common-to-ground jumper:
1	tip plug (black)
4"	test lead wire (black)
1	alligator clip

TOOLS REQUIRED TO BUILD

Minimum:		Additional Desired:
handsaw	hand drill w/drills	electric handsaw
keyhole saw	2 2" C-clamps	electric drill
coping saw	hammer	screwdriver attachment for drill
hacksaw	screwdriver	jigsaw attachment for drill
plane	6" square	24" carpenter's square
	6' rule	

THREAD THE NEEDLE!



2 SCHEMATIC

A steady hand, a little skill, and a lot of patience are all that is needed to thread the needle. Plastic case is opened when game is in play, closed for pocket storage.

SIMPLE enough for a two year-old to enjoy, and difficult enough to liven up any adult party, this economical little game can be constructed in 20 minutes or less. Circuit and material for *Thread the Needle* are given in Fig. 2. The object of the game is to thread the needle without letting the "thread" (No. 28 wire) touch the needle. If the needle is touched by the thread, the circuit of lamp B is completed to the battery and lamp B lights up indicating failure. If you successfully thread the needle, however, lamp A lights up. You'll find that most people will fail several times before succeeding.

Solder connections directly to the lamp bulbs, battery and needle, fastening the lamp bulbs and battery to the plastic case with Duco cement. Stick the needle through a piece of cardboard or balsa wood and cement this to one side of the case. Use Duco to hold the needle point in place. Drill the hole for the machine screw contact which mounts under the needle eye before you fasten the needle.

Use stranded wire for connections if available. It will allow you to close the case more easily when the game is not being used. You may wish to coat the bulb connected to the needle with fingernail polish or thinned red lacquer to make the game more interesting for youngsters, and you can dress the game up by painting the case if you wish.—FORREST H. FRANTZ, SR.

Electronics "Numbers Game" by JOHN A. COMSTOCK

HOW familiar are you with the many numbers most frequently used in radio and electronics? This simple quiz—containing numbers commonly used in electronics—should give you the answer to that question. For the answers to the numbers questions themselves, see page 160.

1) Which of the following is a transistor?
a. 1N543 c. CK705
b. QRK2 d. 21AP4

2) Which of the following is a vacuum tube commonly used in television?
a. 6E5 c. 0Y4
b. 1X2 d. 1V

3) In TV, the ratio of picture width to picture height is:
a. 6:4 c. 4:3
b. 3:6 d. 2:1

4) The common tape recorded speeds in inches-per-second are:
a. 33 1/3" and 78" c. 16 2/3" and 45"
b. 3 3/4" and 7 1/2" d. 33 1/3" and 45"

5) The common commercial power line frequency in the United States is:
a. 60 c.p.s. c. .06 kilocycles
b. 110 c.p.s. d. 30 c.p.s.

6) What is represented by the following number designations?
a. 2 through 12 b. 13 through 83

7) What grade of solder is most often used in electronics work?
a. 40 c. 30
b. 70 d. 80

8) The field repetition rate in television is:
a. 30 c. 20
b. 60 d. 40

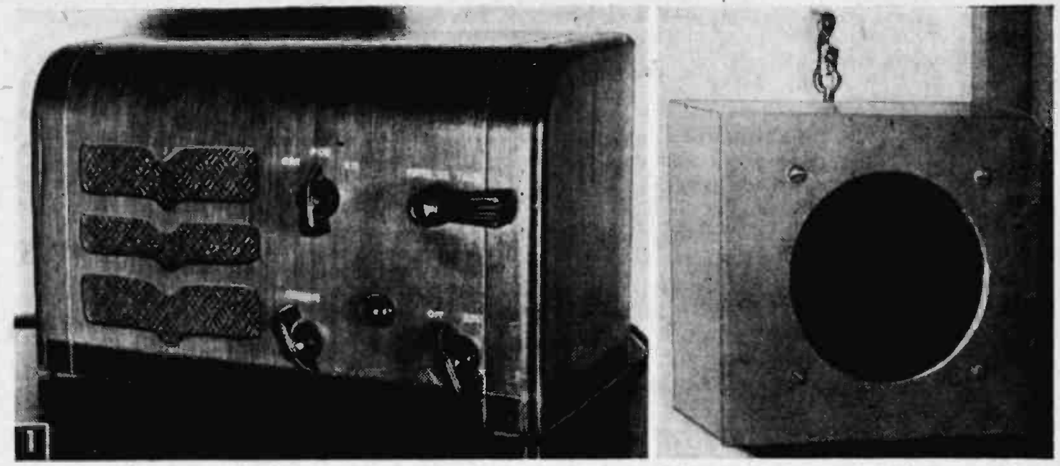
9) How many watts equal one horsepower?
a. 600 c. 746
b. 1,000 d. 95

10) What do the following numbers represent?
a. 16 2/3 rpm c. 33 1/3 rpm
b. 45 rpm d. 78 rpm

11) A black and white television channel is how wide?
a. 4.5 Megacycles c. 6 Megacycles
b. 3 Megacycles d. 12 Megacycles

12) How wide is a color television channel?
a. 3 Megacycles c. 10 Megacycles
b. 6 Megacycles d. 7 Megacycles

(Answers on page 160)



Master station (left) and substation (right) of Instant-Ready Intercom. Master station shown can select from three substation locations.

Instant-Ready INTERCOM

By W. F. GEPHART

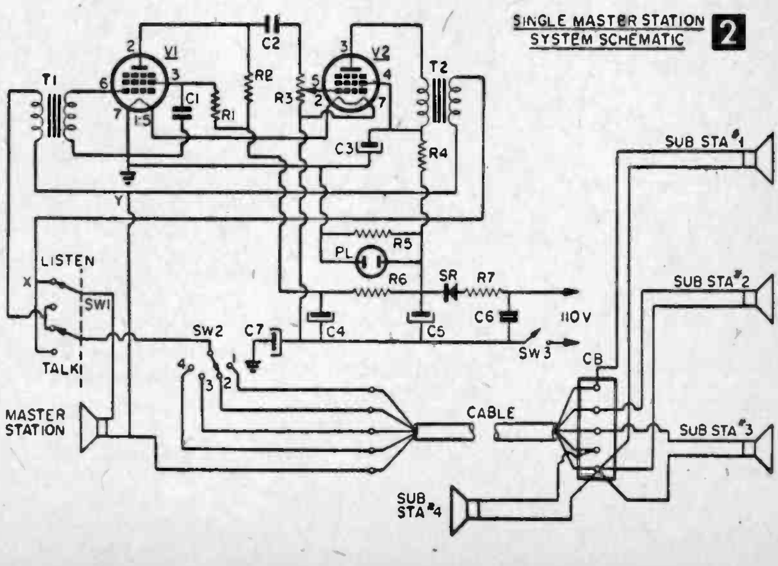
IN MOST home installations, intercom usage is relatively infrequent and it seems a waste of power to keep the intercom on at all times. Yet very few intercom users will tolerate the long warm-up wait required for On-Off operation of most *a-c* operated units. One solution, of course, is to use a battery-powered intercom; but batteries require regular replacement and—in cases of infrequent usage—they deteriorate from age as fast as they do from current drain. So here's a unit (Fig. 1) that is *a-c* powered, yet instantly ready for use.

This unit can be used with multiple master stations and an unlimited number of substations and the volume is sufficient for home use and other relatively quiet locations. No provision is made for talking to more than one substation at a time, however, since the output is not adequate for multiple speaker operation. Normally kept Off, the unit is ready for use approximately 2 seconds after the current has been turned on.

The master station, Fig. 2 (or stations, Fig. 3) is a simple, two-stage audio amplifier, using battery-type tubes (see Materials list) powered by a selenium rectifier circuit supplying both plate and filament voltages. By running the output tube (V_2, Fig. 2) at maximum ratings, the unit has an output of close to ½ watt. (Since all of this output is usually needed—and is never objectionable—a 1 megohm fixed resistance can be substituted for potentiometer R3 in Fig. 2. If you make this change, connect the grid of V_2 between C_2 and the fixed resistance.)

The Talk-Listen Switch (SW1) and the Selector Switch (SW2) are conventional types, except that the Talk-Listen Switch should be spring-loaded to hold in the Listen position (see Fig. 6). The number of poles required for the Selector Switch depends upon the number of stations you want in your installation.

When multiple master stations are used (Fig. 3), the basic amplifier and power supply circuit

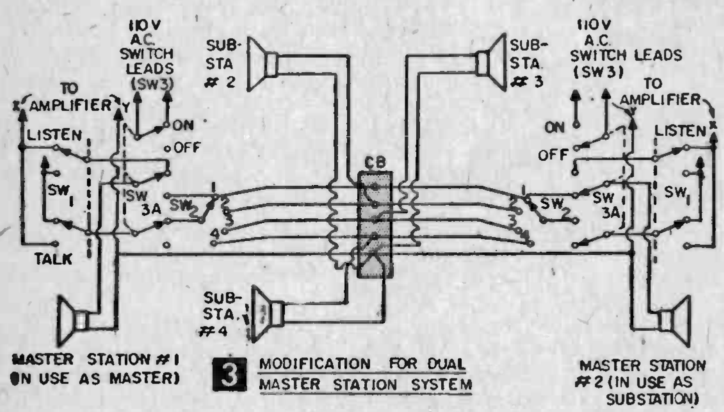


shown in Fig. 2 is used for each master station. The switching circuits and interconnections are slightly different, however, as shown in the example in Fig. 3. A three-pole, double-throw switch (SW3A) is used as an On-Off switch instead of a SPST switch. Switch 3A acts as a power switch, and switches the station to be talked from from substation use to master station use when the power is turned On. In Fig. 3 the master unit on the left is On and the switching circuit connections are the same as those shown in Figure 2. The master unit on the right of Figure 3 is Off—that is, it is connected as a substation unit. If more than one master station is turned on at the same time, there will be a feedback squawk, but no damage will be done to any circuit component.

For single master station unit construction, wire as shown in Figs. 2 and 5; chassis layout is shown in Fig. 4. No particular care need be taken in assembling the master station units, except that the selenium rectifier and other *a-c*

MATERIALS LIST—INSTANT-READY INTERCOM

Chassis 2 x 5 x 7" (Bud CB 629)
R1—1 meg. ½ watt
R2—.27 meg. ½ watt
R3—1 meg potentiometer (or fixed resistance, see text)
R4—2400 ohm, 1 watt
R5—5000 ohm, 10 watt, wire-wound
R6—200 ohm, 2 watt, wire-wound
R7—27 ohm, ½ watt
C1—.02 mf, 200 v.
C2—.01 mf, 200 v.
C3—30 mf, 200 v.
C4, C5—50 mf, 200 v.
C6—.01 mf, 600 v.
C7—25 mf, 25 v.
T1—intercom input transformer (Stancor A-4744)
T2—8000 ohm to speaker, output transformer (Stancor A-3329)
SW1—4PDT spring return switch (Centralab 1451)
SW2—rotary switch (Mallory type 3200J—spring load, see text)
SW3—SPST toggle or rotary
SW3A—3PDT switch (rotary: Centralab 1450, Mallory 3242J)
(toggle: Cutler-Hammer 7613-K2 or 7612-K2)
Speakers
V1—1U4 tube
V2—3Q5 tube
SR—75 ma selenium rectifier
PL—neon pilot assembly (Drake 105)
CB—connector block (see text: Jones type 140 or 141)
Master Cabinet 5⅛ x 6 9/16 x 10 3/16" (available from Allied Radio, catalog #98S930)
Substation Cabinet 4 x 7 x 7" (ICA 3988)



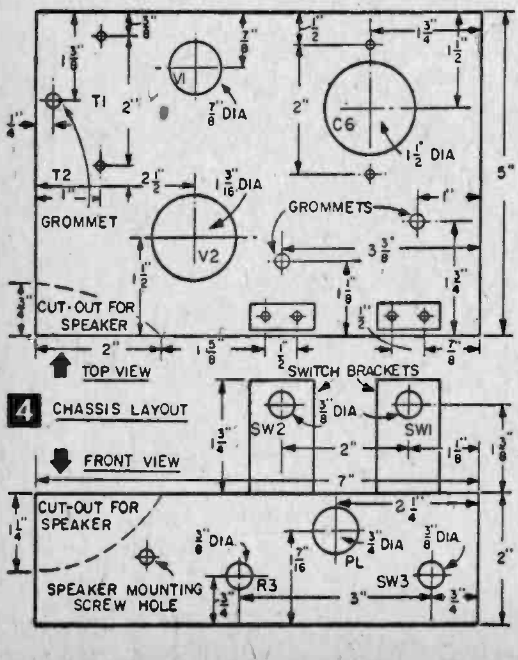
3 MODIFICATION FOR DUAL MASTER STATION SYSTEM

components and leads should be grouped together and isolated as much as possible from the audio frequency wiring and components. This will reduce the possibility of *a-c* hum. If multiple master units are used, and a rotary switch with widely-spaced wafers is available for SW3A, hum can be reduced even further, but even with the switch specified and rather haphazard wiring, the unit has less *a-c* hum than conventional *a-c* models.

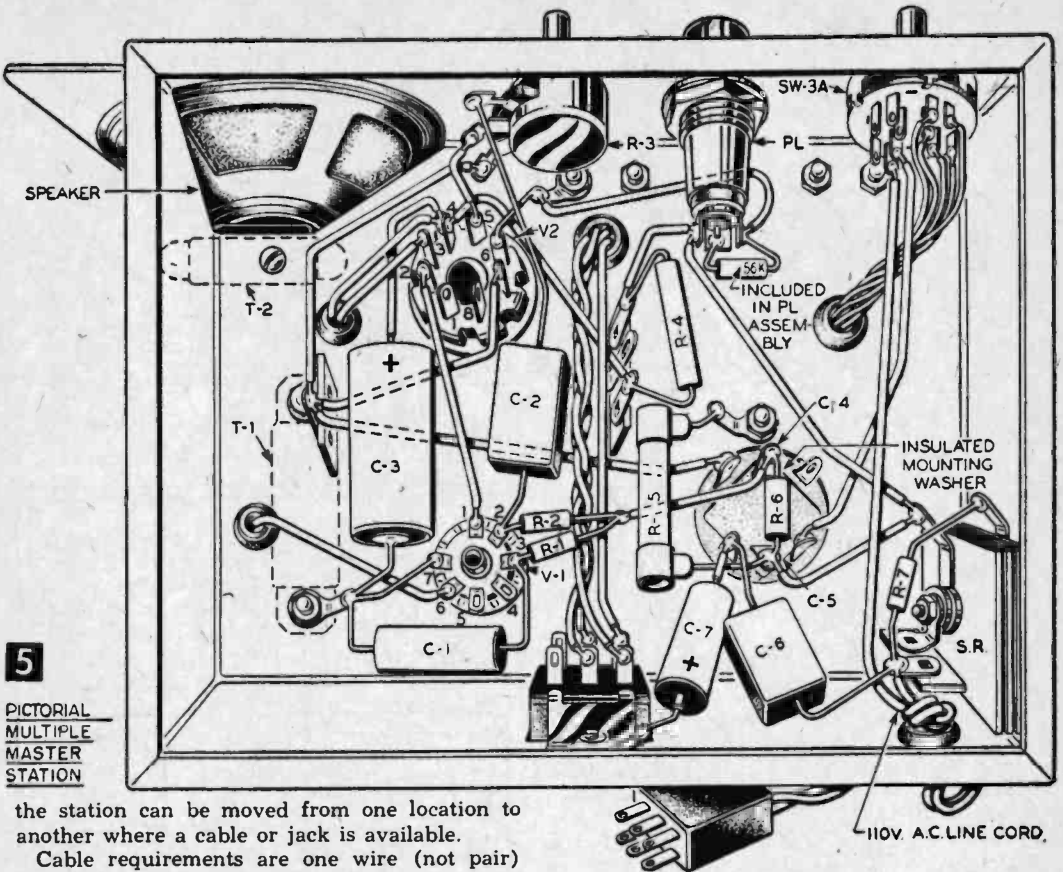
Be sure to keep all leads in the primary of the input transformer (T1) and the secondary of the output transformer (T2) isolated from power (*a-c* or *d-c*) leads or grounds. This is particularly important if multiple master station units are used, since such audio frequency leads are common between units and direct connection is made to the *a-c* line in the power supply.

To dress them up, master units can be built into small radio cabinets (Figure 1); they can also be built into home-made boxes, however. The same is true of the substations which can be installed in a commercially available box (see Materials List), or in a 3 x 5-in. box made of ¼-in. plywood and Masonite. If a substation is to be located on a porch or other outdoor location, it should be shielded from the weather by being placed on the porch ceiling or under an eave. If a weatherproof speaker is not used, the speaker should be mounted face downward to reduce the chance of rubbing in the case of the cone warping due to dampness.

In some cases it might be desirable to have one or more master stations "portable," that is, capable of being used at more than one location. By using plugs and jacks on the intercom cable,



4 CHASSIS LAYOUT



5

PICTORIAL MULTIPLE MASTER STATION

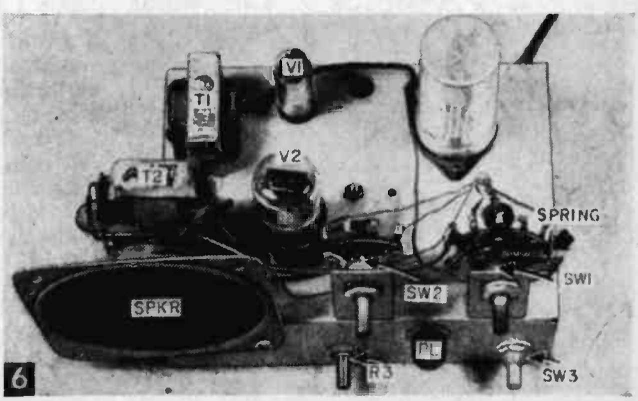
the station can be moved from one location to another where a cable or jack is available.

Cable requirements are one wire (not pair) per station (either sub or master), other than the first master station, and one common wire. Thus, the total number of *wires* required in the cable is equal to the total number of stations in the system. Probably the cheapest line available is antenna rotor cable; this is available as either four or eight wire. If exceedingly long cable runs (over 250 ft.) are made, two or more wires can be paralleled to reduce losses.

In installations where a number of stations are to be used, cabling work and costs can be reduced by using a central connector block (CB in Figures 2 & 3) in an attic or basement, and running all cables to this central point. This will permit the majority of the wiring to substations to be one-pair wire. A centralized connector block is also worthwhile if any subsequent rearrangements are contemplated.

An excellent home use for this intercom system is to "answer" the doorbell. Locate a substation on the ceiling of the front porch and whenever the doorbell rings, turn unit On, switch to "Porch," and query the caller as to identity. Such use makes the disposition of salesmen or peddlers a simple matter.

In another installation of this system, one master station unit was placed in the house, and a second was located in a workshop in a separate building at the rear of the property. A doorbell, parallel-connected to the front door chimes, was also located in the shop, enabling front door "answering" from the workshop. The house-to-shop connection, of course, can lead to the "You either come in to supper now or you don't get any" kind of complication; but then you can always claim your unit wasn't working.



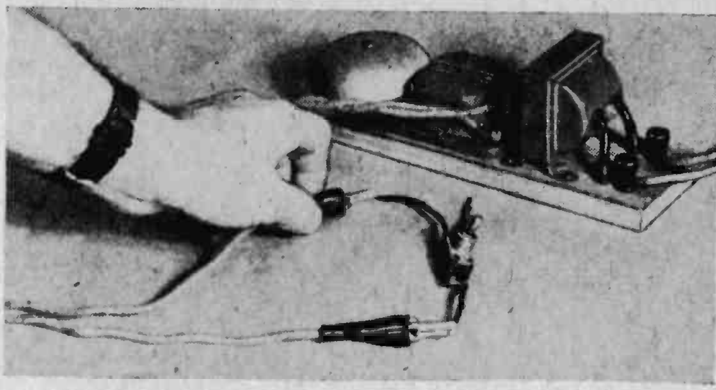
6

Top view of chassis of master station unit. Note spring loading (arrow) of Talk-Listen Switch.

TEST BELL
For the Bench

By

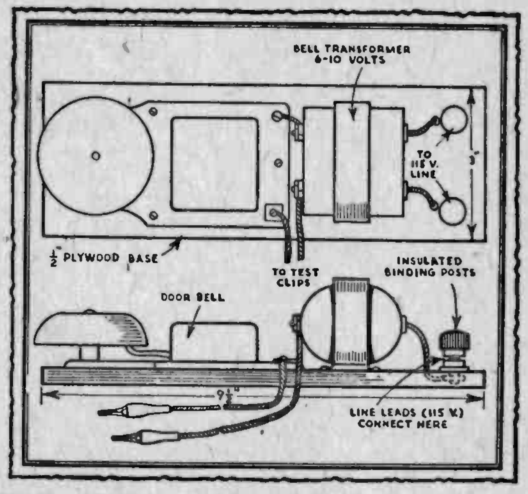
H. P. STRAND



This handy door-bell and transformer unit is used for a variety of low resistance testing. In photo above it is used to find the common terminal of an S.P.D.T. switch. Drawing below shows how hookup is made.

EVERY electrical repair bench should have a test bell for testing continuity of low resistance circuits. Such a bell unit is illustrated in Fig. 1 and the drawings; here a common door bell and a bell transformer have been mounted neatly on a wooden base board. Leads which are completely equipped with alligator clips and insulators are connected in series with the bell and transformer to use as test leads, and insulated binding posts are provided for attachment of the 115 volt line. This piece takes but little room on the bench and is always handy when wanted.

As an example of the usefulness of this tester, an S.P.D.T. toggle switch is being tested in Fig. 1, to determine the common lead, which is not marked. The bell will usually ring through a resistance up to about 20 ohms, depending on the individual bell and voltage of transformer. It is thus possible to use it for testing continuity of coils of low resistance, where it is necessary to pick out the start and finish, in cases where more than one coil or winding is incorporated in the coil unit. In fact, there are countless uses for a handy bell of this sort to the home mechanic.



Mystery Coil

A EUROPEAN electrical experimenter, de la Rive, performed this interesting experiment many years ago. What the device amounts to is a floating cell carrying a coil. The cell generates a current which flows through the coil, the current in turn setting up a magnetic field about the coil. If an ordinary horseshoe or bar magnet is brought near the floating coil, either the coil will be attracted or repelled by it.

Such equipment may be kept on hand for demonstration purposes over a long period if the floating cell is removed from the acidulated water after use and rinsed off with clean water. The cell proper is a circular piece or plug of wood soaked in molten paraffin and carrying two electrodes and the coil of No. 22 copper wire.

The 1 x 2 in. electrodes are fastened to the sides of the plug by means of a small wood screw used also to hold the ends of the copper helix. One electrode is cut from sheet zinc and the other is cut from sheet copper. The solution for the cell is made up of 1 qt. water to ½ oz. of sulphuric acid. Between demonstrations of the device, keep the solution in a stoppered glass bottle.— R. F. YATES.

Crystal Headset

1

NOW you can put together a crystal headset for the price you would ordinarily pay for a cheap pair of magnetic earphones! This crystal headset has much to recommend it. Its sensitivity, frequency range, and clarity of reproduction are superior to magnetic type earphones. Also, it weighs less than two ounces, is easy to assemble, and its "stethoscope" style (Fig. 1) eliminates headband pressure.

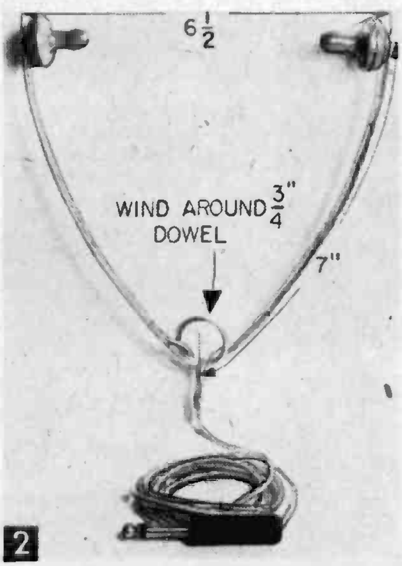
The high impedance and high sensitivity of this crystal headset make it ideal for use with crystal radios, but with proper connections it can be used in any earphone application. Parts for making this headset will cost about $3.25.

Take a 24 in. length of fence wire and make a 1⅓-turn loop in the center by winding the wire around a ¾ in. wood dowel. Form the V with curved sides as in Fig. 2 and then clip off the ends of the wires so the V measures about 7 in. from the bottom of the loop to the ends of the wires. Space between the two free ends of the V should be about 6½ in.

Next hammer the two ends of the V flat (Fig. 3) and drill and countersink holes in them, so the earpieces can be held to the ends of the V by their own screws. You may find slight variations in the earpiece measurements and the lengths of the rear screws. If screw isn't long enough to do a good job, file back of plastic disc flat to compensate for short screw (Fig. 3 inset) or use slightly longer screws of the same diameter and threads. But be sure ends of screws don't extend into the earpieces far enough to touch delicate crystal elements inside. These screws and plastic discs on the backs of the earpieces permit easy replacement of worn connecting cords. Be sure cord connecting clips are in their proper places when you put parts together again.

Wiring. Leave a little slack in the connecting cords where they enter the earpieces, and then tape the cords to the V using a bit of Scotch transparent tape every inch or so. Connect the two earpieces in parallel just below the loop in the V. Since the cords supplied with the earpieces are short, the writer spliced on a 4-foot length of hearing-aid cord while connecting the earpieces in parallel.

Before soldering and taping the splices, be sure the two earpieces are connected in phase, that is, the diaphragm of each earpiece should move in and out together. You can determine this by tracing the cords leads, or by reversing



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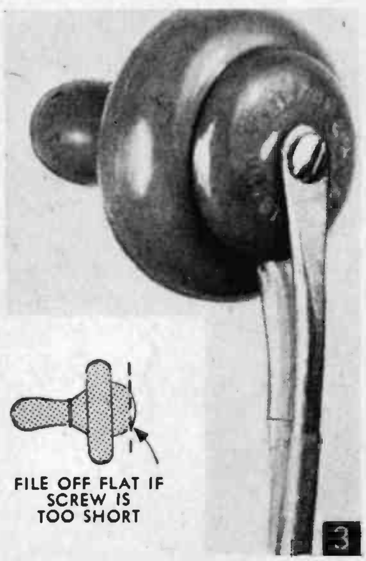

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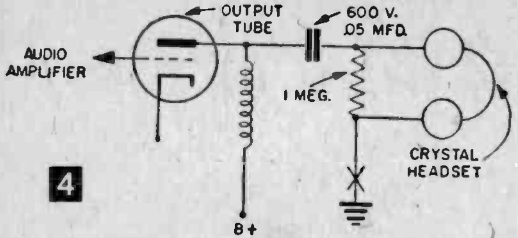


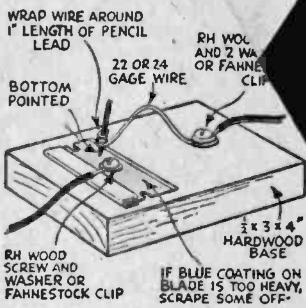
MATERIALS LIST—CRYSTAL HEADSET
24" length of 3/32" dia. galvanized iron electric-fence wire
Two crystal earpieces (Lafayette Radio MS-111. $1.49 each net)
Small roll 1/2 to 1" wide Scotch transparent tape
Two phone cord tips, and/or one standard or midget phone plug
Optional: 48" length of plastic-covered hearing-aid cord

the connections to one earpiece to see when the reproduction sounds the most natural. A pair of phone cord tips or a midget phone plug soldered to the free ends of the cord will complete the headset.

For best results, bend the V so the earpieces are at the correct angle to pipe the sound directly into the ear passages. Bass response is best when the ear inserts fit into the ear passages firmly making a good acoustical seal. Remember that crystal phones should not be subjected to dc voltages, or to temperatures over 130°F.

When using this crystal headset with a crystal radio, connect them as you would an ordinary pair of magnetic earphones. Figure 4 shows how these crystal earphones can be connected to the output stage of a vacuum tu… volt, .05 mfd. blocking capac… high-grade unit. The 1 megohm r… the earphones protects the earph… voltages in case of blocking capacit… ART TRAUFFER.

Improved Razor-Blade Detec…

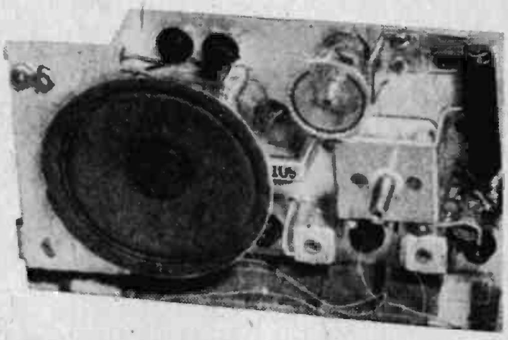


• Here is a more rugged version of the familiar fox-hole, razor-blade "crystal" detector. The original was a piece of pencil lead bridged across the edges of two razor-blades and sometimes used by G.I's in fox-holes to pick up local broadcasting stations. This was fairly sensitive, but it was very difficult to hold an adjustment, as the least vibration or jar caused the lead to rock and roll on the blade edges, resulting in erratic and noisy reception. For the arrangement shown, blue steel single edge or double edge blades (such as *Pal* razors) seem to be the most sensitive, but many other blades also have sensitive spots on them. Use with a conventional circuit and a good antenna and ground.—ARTHUR TRAUFFER.

No Wiring Kinks
in Super-Het Kit

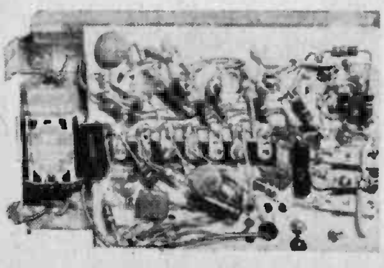
IN ONE evening an amateur can assemble the 6-transistor super-het kit sold by Lafayette Radio, Dept. HPS, 165-08 Liberty Ave., Jamaica 33, N. Y., under their number KT 119. Lining up is simplified by IF transformers which are pre-set at 455 kc. and require little adjustment. Adjusting the tuning capacitor trimmers and the oscillator coil may be done by ear or with a signal generator.

Powered by a 9-v. battery, the set has a built-in speaker for portability but it will operate a separate 8-in. speaker with room-wide volume. The kit costs $33.50, the cowhide case $2.95 extra.

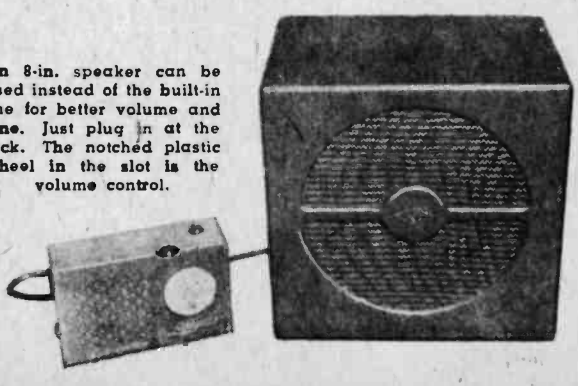


Here the wired chassis is ready for installation in the case. A flat ferrite core antenna is shown fitted in a plastic holder at the bottom.

Nine-volt battery gives room-wide volume.



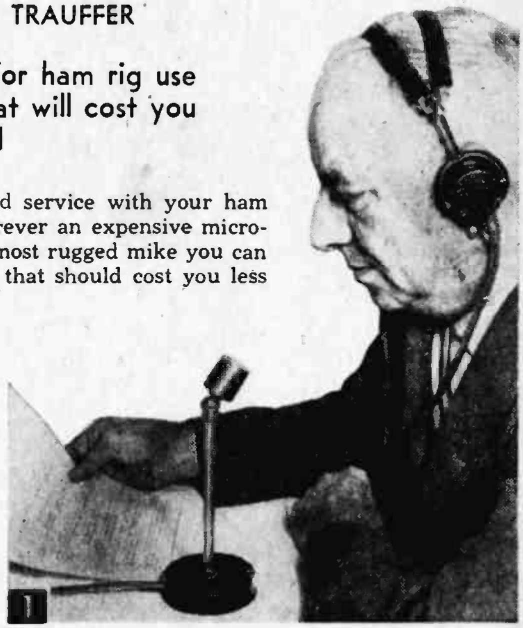
An 8-in. speaker can be used instead of the built-in one for better volume and tone. Just plug in at the jack. The notched plastic wheel in the slot is the volume control.



Crystal Microphone

By ARTHUR TRAUFFER

A simple, high-impedance mike—for ham rig use or with tape or disc recorder—that will cost you less than $3 to build

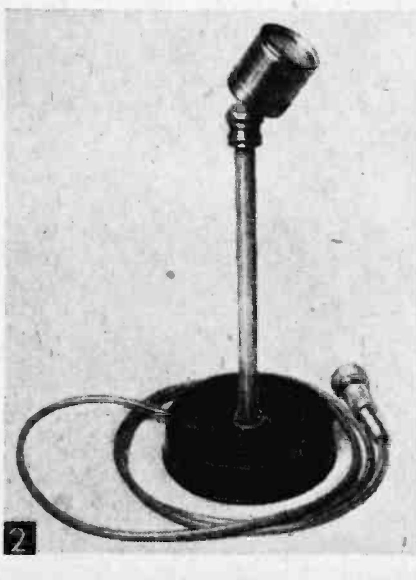


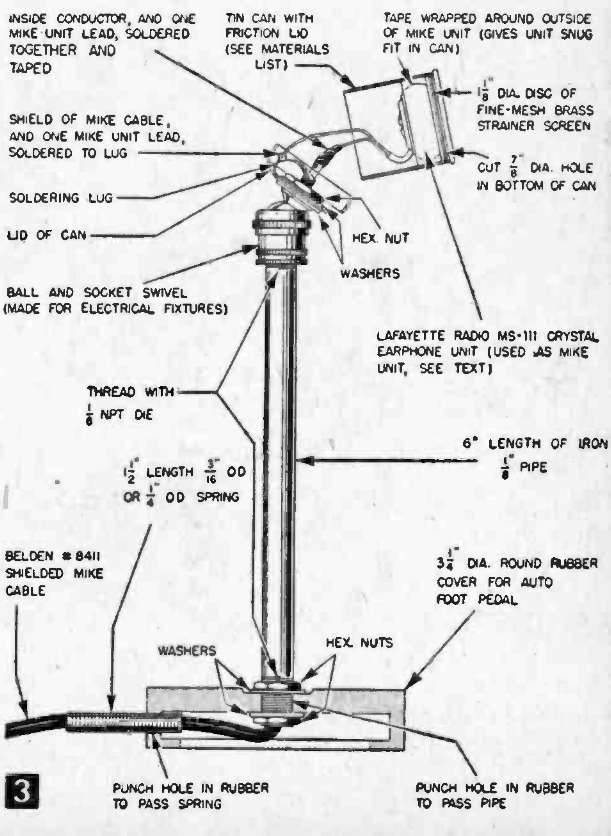
THIS simple little crystal "mike" will give good service with your ham rig, P.A. system, tape or disc recorder, or wherever an expensive microphone is not required. It is, of course, not the most rugged mike you can buy, but you can't expect everything of a project that should cost you less than $3 to build.

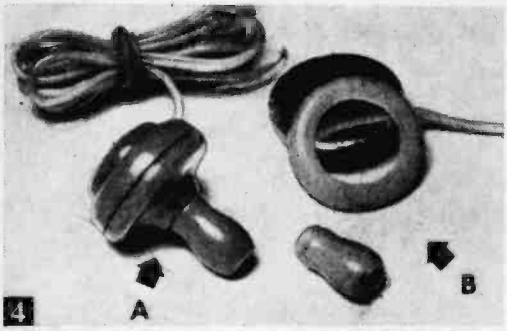
Figure 3 shows you what goes into this project. Note that the rubber foot pedal base is hollow inside making for easy assembly and wiring. It also won't scratch polished furniture surfaces, and the soft rubber cushions the mike against thumps and bumps. A short length of metal spring protects the cable from continual bending where it enters the base.

The small crystal earphone used for the mike unit has high sensitivity and fidelity considering the low price (about $1.49 net). This is not too surprising, since any transducer that gives good results as an earphone will also give good results as a microphone.

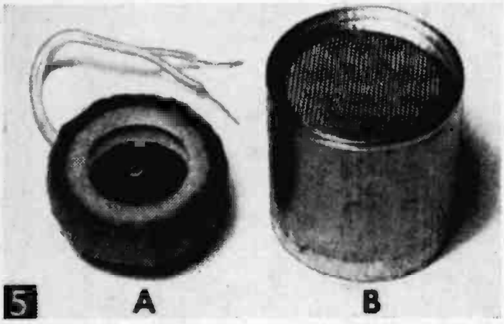
In building this mike, start by enlarging the opening in the crystal earphone, to give it greater efficiency as a mike unit. Pry off the front cover of the earphone unit with a knife blade or single-edge razor blade, but be careful not to touch the thin diaphragm covering the crystal unit as it is easily damaged (Fig. 4). Now twist the ear-plug off the cover, and enlarge the opening







4 (A) Crystal earphone unit as it comes from dealer—(B) After front cover has been removed and opening enlarged with rat-tail file. Cover rim is then snapped back on, without injury to diaphragm.



5 Note how strainer screen has been cemented to inside edges of hole cut in bottom of can (B). Mike unit is then taped (A) for a snug fit.

MATERIALS LIST—CRYSTAL MICROPHONE

No.	Description
1	tin can 1$\frac{3}{16}$" dia., with friction lid (The #1-size "Smooth-On" Iron Cement can is ideal)
1	1½ x 1½" square of fine-mesh brass strainer screen
1	ball-&-socket swivel (made for electrical fixtures) with ⅛ NPT threads on both ends
1	6" length of ⅛ iron pipe with ⅛ NPT threads on both ends
1	round rubber cover for automobile foot pedal (3¼" dia. and ¾" high). (Western Auto Stores, 25¢ pair)
1	1½" length of $\frac{3}{16}$ or ¼" OD steel spring (a piece of dime store kitchen-window-curtain spring was used here)
1	Amphenol 75-MC1F female microphone cable connector
4	⅝" dia. plated brass washers with ⅜" holes
3	brass hexagon locknuts with ⅛ NPT threads
1	soldering lug with ⅜" hole
1	small crystal earphone unit, used as mike unit (Lafayette Radio, Dept. 106, 165-08 Liberty Ave., Jamaica 33, N. Y., Catalog MS-111, $1.49 net. Or Radio Shack Corp., Dept. M106, 167 Washington St., Boston 8, Mass., Catalog R-9021)
	Length of Belden No. 8411 shielded microphone cable

in the cover to a diameter of about ⅝ inch, using a rat-tail file. Then snap cover rim back on the earphone again.

For the mike housing, I used a No. 1-size "Smooth-On" Iron Cement can; these are about 1$\frac{3}{16}$ inches in diameter and have a nice-looking friction lid. The can was cut off to a length of about 1⅛ inches using a fine-tooth thin-blade hacksaw. The rough edge was then smoothed with emery paper.

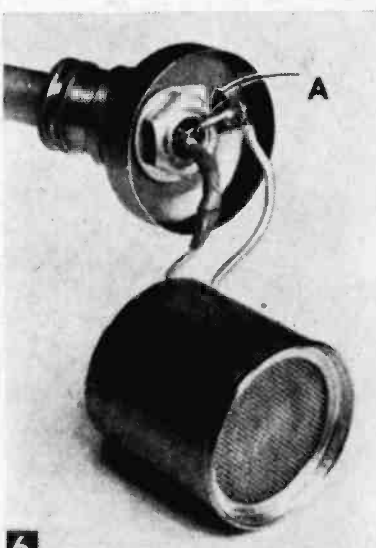
A hole was chopped out of the bottom center of the can and carefully enlarged to a diameter of about ⅞ inch, using a rat-tail file. The rough edge was smoothed, using a knife blade and emery paper wrapped around a wood dowel.

A 1⅛ inch diameter disc was cut from fine-mesh brass strainer screen and cemented to the inside bottom of the can with Duco cement (Fig. 5). The earphone cord was clipped off leaving about 2½ inches on the unit, and ⅜-inch wide tape was wrapped around the outside of the unit (Fig. 5), so that it would make a snug fit.

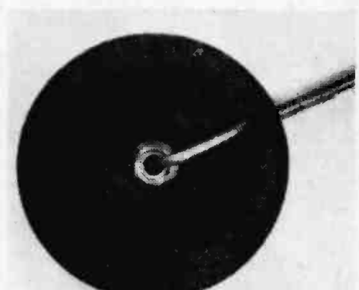
Figures 3 and 6 show how the can lid is joined to the top of the ball-and-socket swivel using a ⅛ NPT brass hex nut with a large soldering lug between the nut and the inside of the lid. Drill (or drill and file) a ⅜-inch diameter hole in the center of the can lid to pass the male threads on the top of the ball-and-socket swivel. Scrape off the coating around the hole on the inside of the can lid so the soldering lug makes good contact.

Using a ⅛-pipe (NPT) die, put a few threads on one end of a 6 inch length of ⅛-pipe, and twist the end of the pipe into the female threads on the bottom of the ball-and-socket swivel. The other end of the pipe is threaded for a length of about ⅝ inch. Punch a hole in the center of a 3¼ inches diameter round rubber automobile foot pedal cover; and enlarge the hole to ⅜-inch diameter using a rat-tail file.

Fasten the ⅛-pipe upright to the rubber base using two large washers and two brass ⅛ NPT hex nuts (Figs. 3 and 7). Punch a hole of the required size in one side of the rubber base, and insert a 1½-inch length of $\frac{3}{16}$ or ¼-inch



6 Large soldering lug is clamped under hex nut holding can lid to top end of swivel. Shield of cable is unwoven and twisted together to form wire (A).



7 Bottom view of mike base showing how cable passes through protecting spring and up into stand tube.

OD steel spring into the hole (Fig. 7). The microphone is now ready to be wired up and the can closed.

Pass one end of a length of Belden #8411 mike cable through the steel spring and up into the ⅛-pipe upright and through the swivel (Figs. 3 and 6). Strip the outside plastic insulation off the end of the cable for a length of about 1 inch. Using a fairly large size sewing needle, unweave the shielding covering on the cable for a length of about ¾ inch, by picking one strand at a time; then twist the loosened strands together to form one twisted wire (A in Fig. 6).

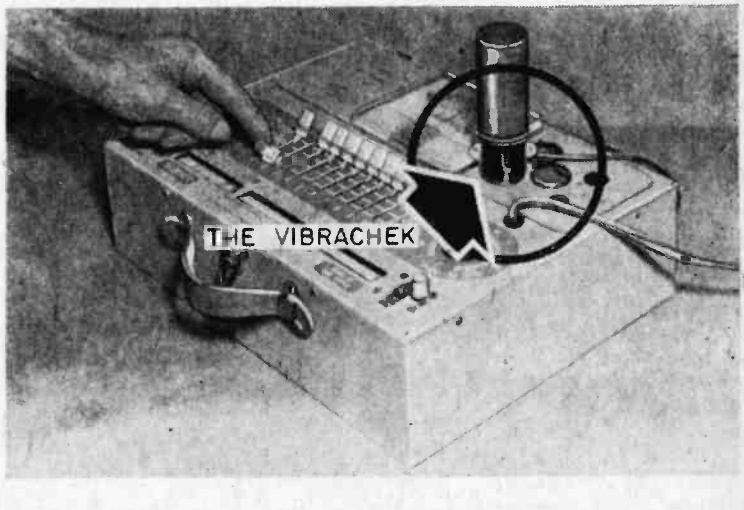
Remove the insulation on the center conductor of the cable for a length of about ¼ inch. Now solder the cable shield and one mike unit lead to the soldering lug. Solder and *tape* the remaining mike unit lead to the center conductor of the cable, as in Fig. 3.

Now close the can, making sure that the bottom of the can makes good electrical contact with the friction lid so the can acts as an efficient shield for the mike unit to prevent hum pickup. Connect an Amphenol 75-MC1F cable connector to the free end of the cable. Remove cable-protecting spring from 75-MC1F. Strip outside insulation from end of cable and prepare shielding conductor as explained above. Strip insulation from end of inside conductor. Solder shield to inside end of spring. Push spring and cable into 75-MC1F, letting inside conductor pass through eye in center of 75-MC1F to hold spring securely. This takes some practice.

Uses for Crystal Mike. Since the crystal earphone unit used here has very high impedance, you can connect this mike directly into the input grid circuit of an amplifier without using an impedance-matching transformer. Of course, any other good small crystal earphone unit or crystal mike unit can be used instead of the one we used. You could also use a small high-impedance magnetic earphone or mike unit, but if you use a low-impedance magnetic or dynamic unit you will have to use an impedance-matching transformer for best results.

If desired, all the metal parts except the screen can be given a coat of enamel of the desired color. Or if you prefer a nice chrome job, you can buy ⅛-pipe and ball-and-socket swivels already chrome-plated. Then you only need to take the can and screen to a plating shop for chrome plating!

Auto Radio Vibrator Tester



VIBRATORS are found in almost all auto radios; they convert the low voltage *d-c* current supplied by the auto's battery to alternating current (*a-c*) which is then put through a step-up transformer to supply the high voltage which is then rectified for the *d-c* plate voltage of the radio's vacuum tubes. When your auto radio behaves in an erratic manner, or fails to work at all, a defective vibrator is the usual cause of the trouble.

The vibrator is enclosed in an aluminum can; it has either three or four pins on the bottom which press into a socket (like a vacuum tube). To remove the vibrator, remove the back cover of the radio and pull out this aluminum can. The vibrator has different-sized base pins, so that it can only be replaced in one way—the correct way.

Until recently, the usual way to determine whether a vibrator was good or defective was to substitute a new vibrator for the old. But now, a vibrator tester is on the market, sold by Lafayette Radio for $2.95, called the *Vibrachek*. It has base pins which fit in the octal sockets of tube testers and it comes in two models, the V-3 for 12 v. 3-prong vibrators, the V-4 for 6 v. and 12 v. 4-prong vibrators.

If the vibrator under test is good, two small lamps on the side of the Vibrachek will light with approximately equal brilliance and will flicker at about the same rates. A defective vibrator will cause one lamp to light much brighter than the other in some cases, in others only one lamp will light, in still others neither lamp will light.—H. P. S.

Quick-Repair of Your Car Radio's VIBRATOR

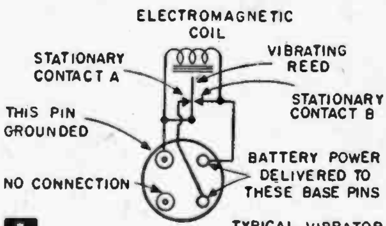
Vibrators list-price in electronics catalogs starting at $2.50 and ranging upward to over $9. With an auto ignition point file, you can renew a vibrator's contacts and save that hefty replacement cost.

THE number one cause of car radio troubles is the failure of the vibrator in the radio's power pack. The vibrator converts the low d-c voltage supplied by the car's storage battery into square-wave d-c pulses which can be fed into the primary of a step-up power transformer, rectified in the secondary circuit and used as B+ in the car's radio.

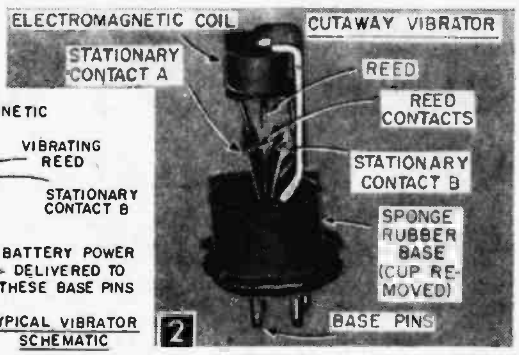
So great a troublemaker is the vibrator, that recently two leading car radio manufacturers introduced sets which eliminate the need for a vibrator. Unfortunately, only a handful of these new, vibrator-less sets are in use. The great majority of car radios, meanwhile, must continue to rely on vibrators—and vibrators are not overly reliable.

A vibrator consists of an electromagnetic coil and a two-contact reed (or armature) which vibrates between two stationary contacts (Figs. 1 and 2). Power from the battery is delivered to the vibrator alternately through the upper and lower halves of the primary of the step-up transformer in the power pack. When you turn on your car radio, the vibrator's electromagnetic coil is energized and the reed is pulled toward stationary contact B. The instant the reed contact touches stationary contact B, the electromagnetic coil is short-circuited and thus de-energized. The reed flies back, its inertia carrying its other contact to stationary contact A, the electromagnetic coil again is energized, the reed is pulled again toward stationary contact B and the cycle repeats itself again and again.

Sparking at the contacts causes oxidation, sticking of the reed, and trouble.



1 TYPICAL VIBRATOR SCHEMATIC



2

Vibrating at 115 *cps* through its neutral position, the reed reverses the *d*-c delivered to the power transformer 57½ times per second. These pulses, fed into the alternate ends of primary of the transformer in the power pack, are stepped-up and rectified to provide the B voltage for the car radio.

Trouble arises—and it often does—when the reed contacts oxidize at one or both of the stationary contacts. Then the reed sticks, fails to vibrate. A stuck vibrator means no reception. It can generally be detected by the absence of the soft

3

With contacts renewed, replace the sponge rubber cup and tape in place. Aluminum foil shielding completes the job.

hum you usually hear when you turn your car radio on. (If the contacts have oxidized only on the A side, however, you may still hear some hum, even though the vibrator reed, and consequently the radio, is inoperative.)

To remedy stuck vibrator contact points, first remove the vibrator from the radio. This used to require removal of the entire set from behind the dash, but in recent years sets have been built so that removal of one or two screws securing the cover plate gives access to the chassis.

On a typical car radio chassis you'll see two aluminum cans. One of them—the smaller—is an electrolytic filter capacitor. The other, larger can contains the vibrator. It's provided with a pin base, and pulls out just like a tube.

With tin snips or sharp diagonal wire cutters, separate the rolled aluminum can from the Bakelite pin base. Underneath this shield can is a molded sponge rubber cup which acts as a noise silencer. The vibrator itself is mounted on a sponge base, further to reduce noise.

Remove the cup and gently draw back the reed and insert a thin auto ignition point file between its contact and stationary contact A. Draw the file back and forth until the contacts are bright. Repeat this same operation with the other pair of contacts. The gap between each pair of contacts should be just wide enough to pass a strip of paper the thickness of the cover of this magazine.

Now replace the sponge rubber cup over the vibrator and make it secure with strips of adhesive or masking tape as in Fig. 3. Operating the vibrator without the shield ordinarily does not introduce interference into the set, but to play it safe, wrap the vibrator neatly in aluminum foil. Make sure that the foil makes positive contact with the chassis when the vibrator is replaced and doesn't short out any pins.—T. A. B.

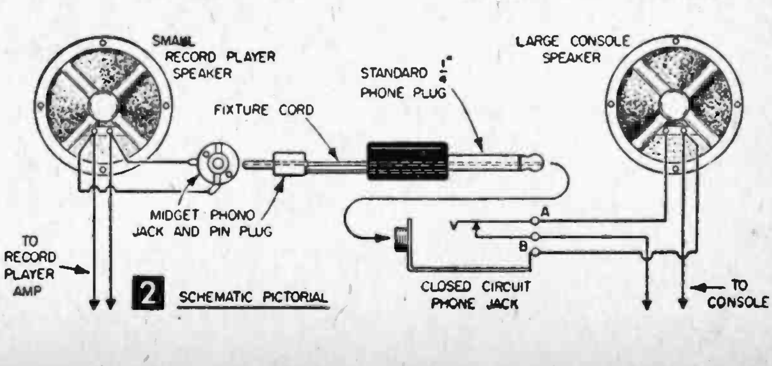
1

A simple circuit alteration converts any portable record player into a quality sound system that can employ your TV or radio console speaker to emphasize those otherwise lost bass tones.

Making Small Record Players Sound Like Thoroughbreds

THE quality of audio reproduction in most portable record players is limited because of the small 4 and 5 in. PM speakers which they usually employ due to space limitations within their carrying cases. It is, however, a simple operation to modify a record player's circuit to afford full-range sound reproduction by employing the large speaker and baffle arrangements of console TV or radio receivers in conjunction with the player's speaker. By using a simple cable and jack arrangement, the speaker of the portable record player will function as *tweeter* for high frequency response and the console speaker will function as *woofer* for low frequency response.

The pictorial wiring plan (Fig. 2) shows how this dual speaker system functions. To make the change, drill a ⅜-in. hole on the motorboard of the record player and fit it with a midget phono jack. Then, solder two leads to the voice coil lugs of the record player speaker terminating them on



2 SCHEMATIC PICTORIAL

Record player and console speakers are operated in parallel by plug-in cable. Removal of plug from telephone jack automatically restores console speaker to normal operation.

the jack lugs, and connect a length of plastic covered "zip" fixture cord to the pin and shell of a midget pin plug which matches the phono jack. The other end of the fixture cord is connected to a standard ¼-in. telephone plug.

Now, enlarge one of the screw holes in an ordinary steel or brass ½x2x2-in. angle bracket to ⅜ in. and screw-fasten this bracket to the back of the console set at a 45° angle as shown in Fig. 3. Next, mount a Mallory #2A closed circuit jack in the ⅜-in. bracket hole. Mounting the telephone jack on the angle bracket allows for easy access to it without moving the console set away from the wall. Moreover, the set is in no way defaced, and can be instantly restored to normal operation by pulling the large telephone plug out of the jack.

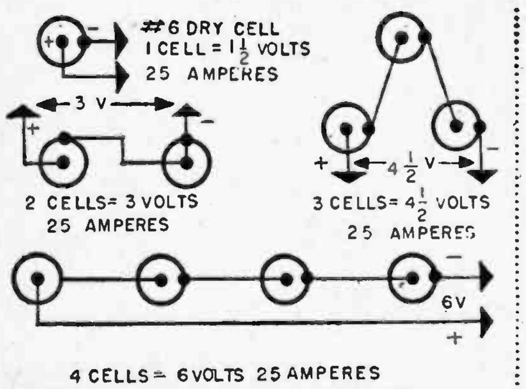
Disconnect one of the console speaker wires and attach to jack lug A, Fig. 2, and run a length of hook-up wire from the vacated speaker lug to jack lug B. Finally, run a length of hook-up wire from the speaker lug, which still has its original wire connected to it, to the frame lug of the closed circuit jack.

To use the player alone, put on a record and warm up the amplifier. Insert the midget phono pin plug in the motorboard jack and insert the telephone plug into the jack mounted on the rear of the console. It is not necessary to turn on the radio or TV set; inserting the telephone plug into the closed circuit jack has automatically disconnected the console speaker from the set so that it will be driven by the record player amplifier. If you enjoy ball games, fights, etc., but are annoyed by never-ending commercials, turn on the TV set, put a long-playing record on the phonograph, and enjoy the game with music and sans commercials.—T. A. B.

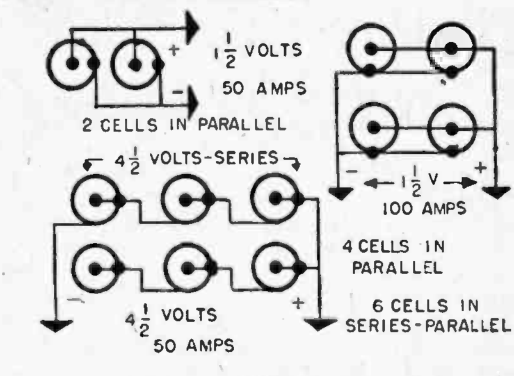
MATERIALS LIST—PHONO ADAPTOR

No.	Description
1	midget phono jack
1	midget pin plug
1	standard telephone jack (Mallory #2A)
1	standard telephone plug (ICA #29 or Mallory #75)
1 length	two-conductor plastic "zip" fixture cord
1	½ x 2 x 2" brass or steel angle bracket

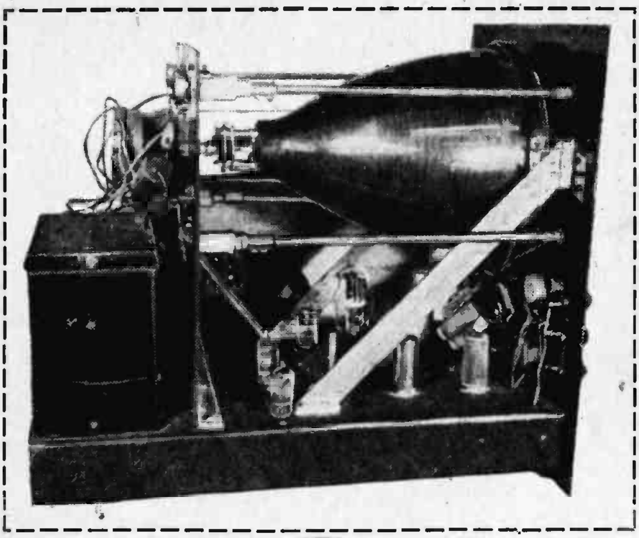
SINGLE CELLS OR BATTERIES CAN BE CONNECTED TO INCREASE VOLTAGE OR CURRENT



SERIES CONNECTIONS OF SINGLE DRY CELLS
VOLTAGE OF 1 CELL X NUMBER OF CELLS = VOLTAGE OF GROUP. CURRENT REMAINS AMPERAGE OF 1 CELL.



SERIES-PARALLEL CONNECTIONS
VOLTAGE OF 1 CELL X NUMBER IN SERIES = VOLTAGE OF GROUP
CURRENT OF 1 CELL X NUMBER IN PARALLEL = AMPERAGE OF GROUP



Front-panel and side-chassis views of 7-in. conversion (see Fig. 3). Note that power supply is placed at rear of chassis.

LARGE SCREEN SCOPES FROM DISCARDED TV SETS

By W. F. GEPHART

STANDING IDLE in the back rooms of many TV-radio service shops, in dealer's trade-in warehouses, and in many attics and garages are hundreds of small-screen television sets that today are considered worthless. Most of these sets, however, can be converted to experimenter's oscilloscopes. The parts can be salvaged and placed on a new chassis and panel, or the existing chassis and cabinet can be adapted as-is.

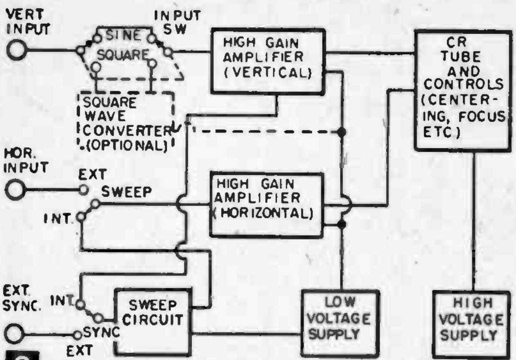
Such a conversion consists of re-building some of the major circuits in the set, but usually the majority of the parts required are in the set as it stands. Since an oscilloscope consists of two high-gain amplifiers, a cathode ray tube with its associated controls, two power supplies, and a sweep circuit (see block diagram, Fig. 2), a TV set which has electrostatic deflection and focus (such as one with a 7EP4, 7GP4, 7JP4, 10GP4 or 10HP4 picture tube) can usually be used with the CR tube and associated controls and the high-voltage supply just as they appear in the set. In many sets the low-voltage supply is more than adequate (both current and voltage-wise) for oscilloscope use, leaving only the two amplifier circuits and sweep circuit to be designed and built.

In TV sets using tubes with magnetic deflection and focus, conversion problems are slightly greater and the focus usually has to be a mechanical control on the back of the unit, near the neck of the tube.

For most uses, the vertical amplifier in the scope should be more sensitive than the horizontal, since the latter is usually required only to amplify the sweep circuit pulses enough to cover the tube face. The gain of the horizontal amplifier should be fairly high, however, to permit the use of external sweeping voltage when required. In both cases, the amplifiers should be push-pull output, to give equal deflection on either side of the center of the tube face.

The gain of the amplifiers will depend upon the type of picture tube in the TV set. Most 7-in. and 10-in. electrostatic deflection picture tubes have a deflection sensitivity of 75 to 250 *v.* per in. (the exact figure for individual tubes is given in tube manuals). This means, for example, that a difference of 150 *v.* between opposite deflection plates of the tube will move the electron beam 1 in. off center. If the polarity is reversed, the beam will move 1 in. off center in the other direction. An alternating voltage of 150 *v.*, then, will swing the beam 2 in.—1 in. on each side of center. Therefore, the voltage (*AF* or *RF*) required to "sweep" the tube face from side-to-side (or top-to-bottom) will equal the tube's deflection *v.*/in. times the *radius* of the tube face. Thus, a 7-in. tube with a 150 *v.*/in. deflection would require an amplifier with about 525 *v.* ($150 \times 3\frac{1}{2}$), while a 10-in. tube with the same rating would require about 750 *v.* (150×5).

Don't let these high output voltages alarm you. Virtually no power is required, and voltage am-



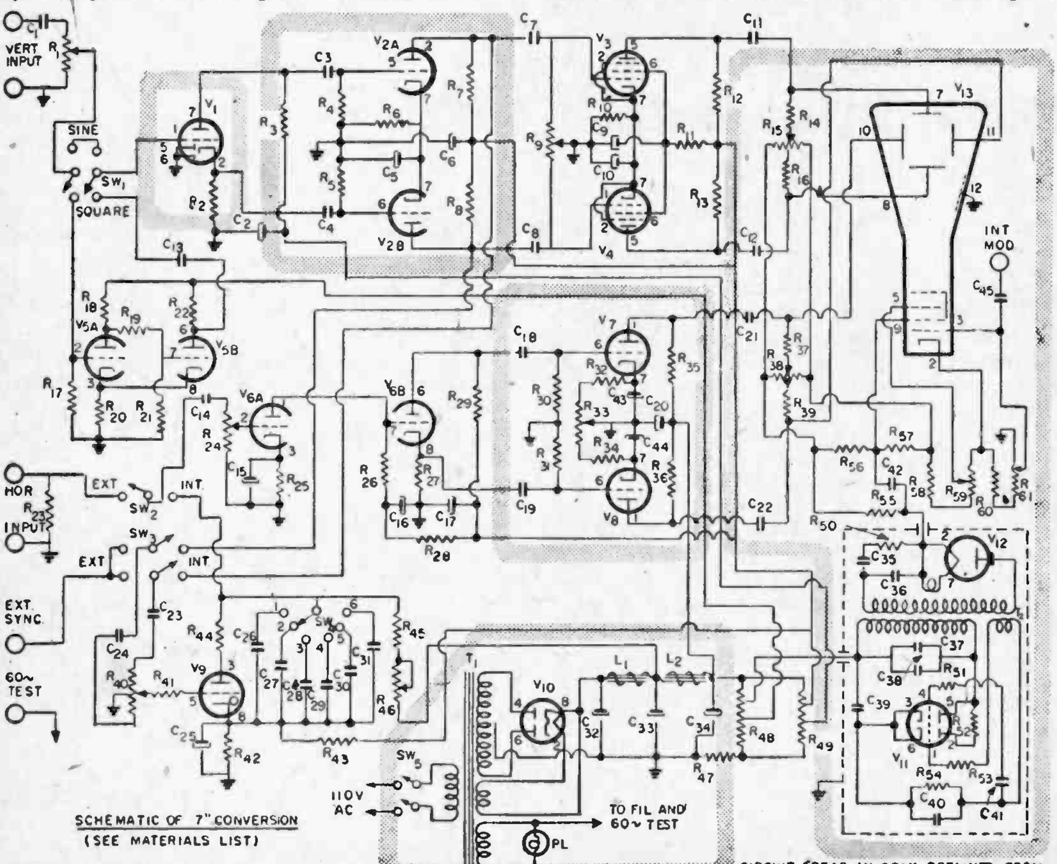
2 BLOCK DIAGRAM OF OSCILLOSCOPE

plifier stages can easily furnish these voltages.

In magnetic deflection tubes, the deflection/in. data is not available, and must be determined experimentally. To do this, set up the picture tube, with proper anode and filament voltages, so that a spot appears on the face of the screen. Then apply experimental voltages to the vertical and horizontal deflection yokes to see what voltage is required to move the spot 1 in.

In determining amplifier gain, it must be decided what over-all sensitivity is required. Usually .1 *v.* per in. (meaning that .1 *v.* input to the amplifier will cause the CR tube beam to move 1 in.) is the minimum input sensitivity acceptable; .05 *v.*/in. is better. If the tube has a deflection rating of 150 *v.*/in., and the over-all sensitivity is to be 05. *v.*/in., the amplifier must amplify .05 *v.* up to 150 v., or it must have a voltage gain of 3000. Since one stage cannot very well have such high gain and high-voltage output, two or more stages will be needed, but neither stage gain need be too high, since the total gain is the product of the individual stage gains. To get a gain of 3000, for example, one stage could have a gain of 50, another stage a gain of 60, the total being 50 x 60, or 3000.

Amplifier design data is available in many tube manuals, and from this data circuits can be designed around tubes and parts in the TV set. Select a pair of tubes from the set (preferably high-gain triodes or remote cut-off pentodes) and, using the resistance-coupled amplifier data, select the values giving the highest gain. Note the bias on the tubes under the recommended conditions, and divide the output voltage desired (total deflection voltage required to cover the tube) by the voltage gain of the circuit, making sure that the input voltage required (to get the desired output voltage) does not exceed the tube's bias. If it does, other tubes of higher gain



SCHEMATIC OF 7" CONVERSION (SEE MATERIALS LIST)

CIRCUIT AREAS IN GRAY OBTAINED FROM TV SET CONVERTED

3

MATERIALS LIST—SCOPE CONVERSION (Fig. 3)

Desig.	Description	Desig.	Description
R1	4 meg pot ("Vert. Gain")	C2, C6, C9, C16, C17, C20, C32, C33, C34	8 mf., 450 v.
R2, R3	20K, 1 watt	C3, C4, C7, C8, C14	.25 mf., 400 v.
R4, R5, R26, R41, R50	.1 meg., ½ watt	C5, C10, C15, C25, C43, C44	10 mf., 25 v.
R6	120 ohm, 1 watt	C11, C12, C21, C22	.005 mf., 6000 v.
R7, R8, R12, R13	51K, 1 watt	C13, C18, C19	.1 mf., 400 v.
R9	.1 meg pot ("Vert. Bal")	C23, C24	.02 mf., 400 v.
R-10	690 ohm, 1 watt	C26	.2 mf., 400 v.
R11, R20, R27, R29	47K, 1 watt	C27	.04 mf., 400 v.
R14, R16, R37, R39, R56, R57, R60	2.2 meg., 1 watt	C28	.01 mf., 400 v.
R15, R38	5 meg. C.T. pot. ("Vert" & "Hor" Centering)	C29	.0025 mf., 400 v.
R17	.5 meg., ½ watt	C30	600 mmf., 400 v.
R18	68K, 1 watt	C31	125 mmf., 400 v.
R19	.24 meg, ½ watt	C35, C36	500 mmf., 6000 v.
R21	92K, 1 watt	C37	750 mmf., 600 v.
R22, R28	22K, 1 watt	C38	350-1100 mmf. trimmer
R23	5 meg., ½ watt	C39	.01 mf., 400 v.
R24	2 meg pot ("Hor Gain")	C40	.0015 mf 400 v.
R25	2500 ohm, 1 watt	C41	360 mmf., 600 v.
R30, R31	.33 meg, ½ watt	C42	.001 mf., 6000 v.
R32, R34, R42	2K, 1 watt	C45	.05 mf., 200 v.
R33	5K pot ("Hor Bal")	T1	350-0-350 v. @ 150 ma., 6.3 v. @ 5 amps., 5 v. @ 2 amps.
R35, R36	.2 meg., ½ watt	L1, L2	8 Henry, 150 ma. choke
R40	.2 meg C.T. pot ("Sync")	V1	6AT6
R44	500 ohm, 1 watt	V2	6J6
R45	1 meg, ½ watt	V3, V4	6AK6
R46	5 meg pot. ("Fine Frequency")	V5	12AT7
R47	15K, 25 watt W.W.	V6	12AU7
R48, R49	25K, 25 watt W.W. adj	V7, V8	6AB4
R51, R53	68 ohm, ½ watt	V9	884
R52	100 ohm, ½ watt	V10	5V4G
R54	75K, ½ watt	V11	6SN7
R55, R58	1 meg., 1 watt	V12	1B3G
R59	5 meg pot ("Focus")	V13	7JP4
R61	.25 meg pot ("Intensity")	PL	6.3 volt pilot light
SW1	DPDT toggle ("Input")		
SW2	SPDT toggle ("Sweep")		
SW3	DPDT toggle ("Sync")		
SW4	1 pole, 6 pos rotary ("Coarse Frequency")		
SW5	DPST toggle ("Power")		
C1	.5 mf., 600 v.		

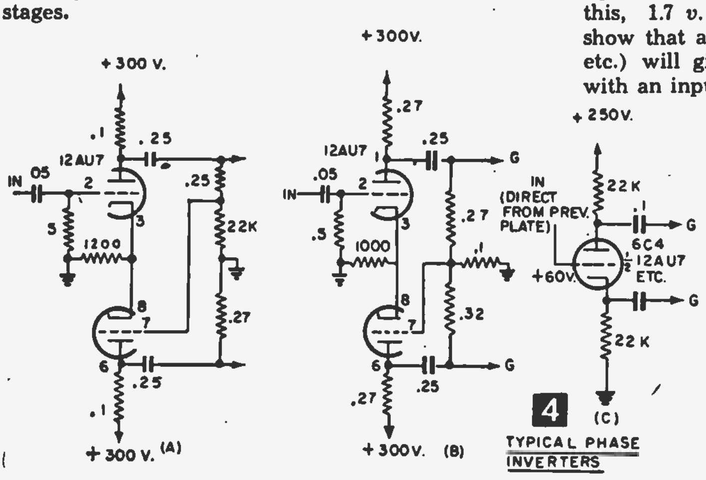
Note: Small 7" or 10" screen TV sets can usually be obtained at low cost from any local TV-radio repair shop or TV dealer. Sets with 10" screens can also be obtained from the Video Electric Company, 79 Clinton Place, Newark, N. J., if none are available to you locally.

must be selected.

Next select another pair of tubes from the TV set, and select data from the charts that will furnish an output voltage sufficient to fully drive the stage planned above. Determine the voltage gain of this stage from the charts, and, multiplying by the voltage gain in the first stage designed, see if sufficient over-all gain has been developed. If not, continue with another stage.

The phase inverter, which has no gain, should be at a low level so that full advantage of push-pull operation can be utilized in the high gain stages.

Here's how these calculations would be made: Using a 7EP4 CR tube, which requires 100 v./in. deflection, and desiring an input sensitivity of .05 v./in., total voltage gain required is 2000. The resistance-coupled amplifier design charts show that a 6AU6 (with proper resistances, etc.) will give a voltage gain of 230 with a grid bias of 2.1 v. Dividing this gain of 230 into 375 v. (the required output voltage for full deflection), gives a required input voltage of about 1.7 v. This input voltage is within the bias of the tube. To drive this, 1.7 v. is needed; the tube data charts show that a 12AU7 (with proper resistance, etc.) will give a voltage gain of 12, which, with an input of about .14 volt, will give the required output. The total gain of these two stages is 12x230 = 2760, which is in excess of requirements, and—assuming no losses—would mean that an input voltage of .132 volts would give full-tube deflection (or the equivalent of about .038 v./in. input). Since this input sensitivity is greater than required, a no-gain phase inverter can be put in front of these stages and the unit will still have the desired over-all gain.



4 TYPICAL PHASE INVERTERS

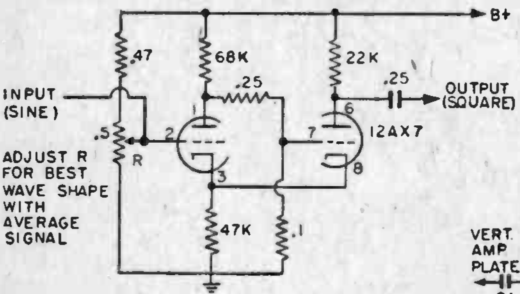
The horizontal amplifier is designed in the same way, again using tubes from the TV set whenever possible. Usually an input sensitivity of .5 *v.*/in. is sufficient for this purpose. Since power supplies in TV sets are usually ample to power all of these amplifiers, the remaining step is to design a sweep circuit for your scope.

There are two general types of sweep circuits used in commercial oscilloscopes: 1) the gas-discharge tube type, and 2) the multivibrator type. The gas-discharge tube is the simplest type, but it has limitations of maximum sweep frequency (usually 30,000 to 35,000 c.p.s.).

When the sweep frequency of a scope is equal to the frequency of the vertical input signal, one complete cycle will appear on the screen. When the input frequency is twice the sweep frequency, two cycles will appear, and so on. When the input frequency is more than 10 times the sweep frequency, the pattern becomes difficult to read, particularly when using a small CR tube. For example, with a 7 in. tube when there are 10 complete cycles on the screen, each cycle is less than ¾ in. wide.

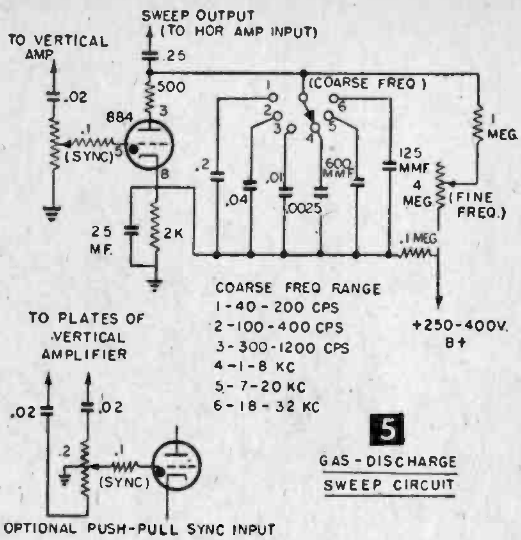
The maximum sweep frequency required would then depend upon the normal use of the scope. In TV work, where very high frequencies are encountered, a high sweep frequency would be required and a multivibrator sweep circuit would be necessary. In audio and low frequency *RF* work, a lower sweep frequency could be used and a gas-discharge sweep circuit would be adequate.

Very low sweep frequencies (such as 20 or 30 c.p.s.) are not feasible with a TV tube oscilloscope. The persistency of the coating on TV tubes is less than that on conventional CR tubes, and the trace (which is white, incidentally, not green) will disappear at low frequencies.



7 SQUARE WAVE CONVERTER

To lock in the pattern, a part of the vertical input signal is fed into the sweep circuit as a synchronizing voltage. This is taken from the vertical amplifier, but it should be a very low voltage to prevent distortion. The exact point for tapping to secure this voltage, and the dropping resistances to be placed in the line, can be determined by trial and error, using the lowest voltage that will lock the pattern in.



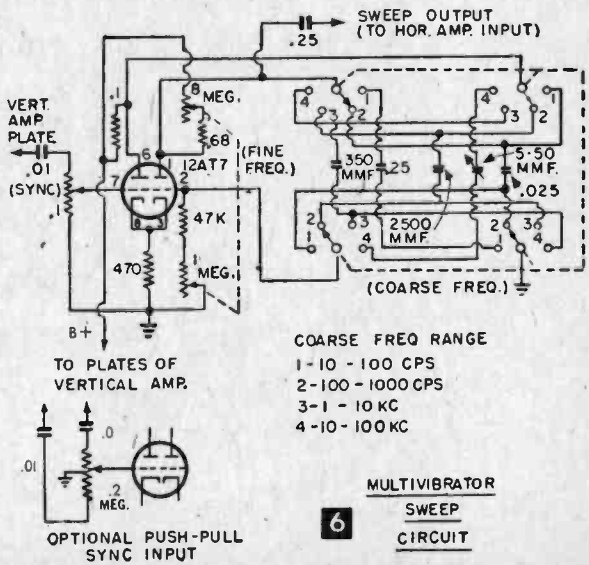
5 GAS-DISCHARGE SWEEP CIRCUIT

Figure 3 shows the complete schematic of a 7-in. oscilloscope made from a discarded TV set. The majority of the components outlined in grey were secured from the TV set itself. Figure 4 shows three typical phase inverters; Figs. 5 and 6, the two types of sweep circuits.

Basically, these are the major circuits required for an oscilloscope, but another useful circuit is that shown in Fig. 7. Distortion is more evident in square waves than in sine waves, and many scope users prefer to convert sine waves to square waves for scope viewing. Figure 7 shows a simple square-wave converter that can be built into the scope if desired, preferably in the vertical input section (as shown in Fig. 2).

When making your conversion, remember:

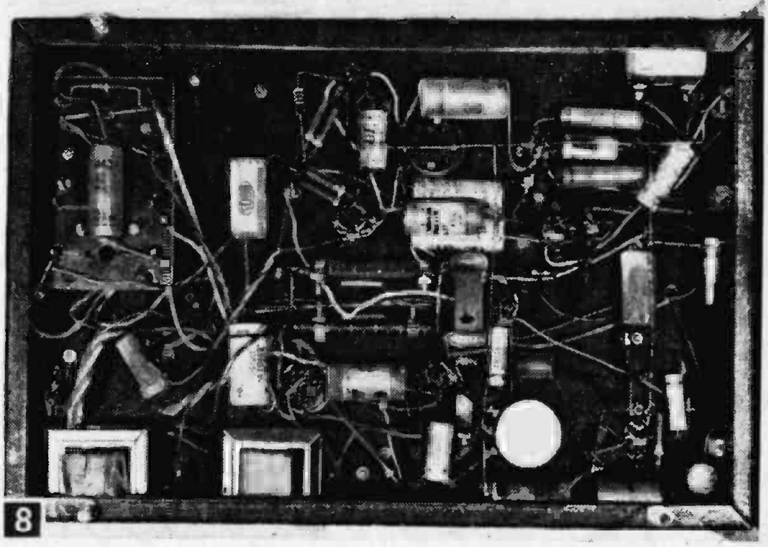
1) Most TV set high-voltage supplies consist of an *RF* oscillator whose output is fed into an air-core transformer, and then to a high-voltage rectifier.



6 MULTIVIBRATOR SWEEP CIRCUIT

This circuitry should be well-shielded, both from the standpoint of *RF* shielding, and high-voltage protection. Usually the high-voltage supply, complete in its shielding, can be transferred from the TV set.

2) Electrostatic deflection picture tubes are easily affected by stray *ac* fields (this will show up as a thick or wavy line trace instead of a sharp line), and good *ac* shielding should be used throughout your scope. If the power transformer is not shielded, place a steel shield plate (or the chassis) between it and the CR tube. In some cases, a steel shield may also be required around the neck of the CR tube.



8 Under-chassis view of 7-in. conversion. Scope was built on new chassis, using some new components, many from TV set converted (see Fig. 3).

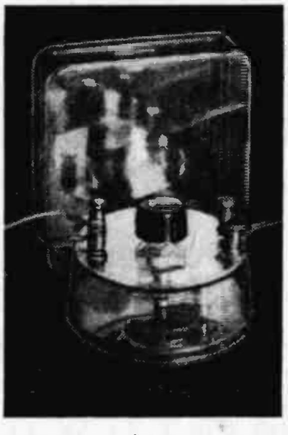
3) Certain picture tube controls (such as centering, brightness, etc.) have extremely high voltage on the controls; they should always be used with an insulated shaft. Also, whenever possible, all controls and components carrying these high voltages should be isolated from other controls or components.

4) If at all possible, when the scope is built on a new chassis, the picture tube mountings from the TV set should be used. CR tubes are somewhat delicate, *and extremely dangerous if they shatter*. Care should be exercised when mounting the tube to be sure that no strain is placed upon it.

5) If the set is to be completely re-built on a new chassis, a long, narrow chassis is preferable, with the horizontal amplifier down one side, the vertical down the other (both inputs at the front), and the other circuits in the middle. In such cases, both the high and low voltage power supplies should be at the back of the chassis, as far from the input as possible.

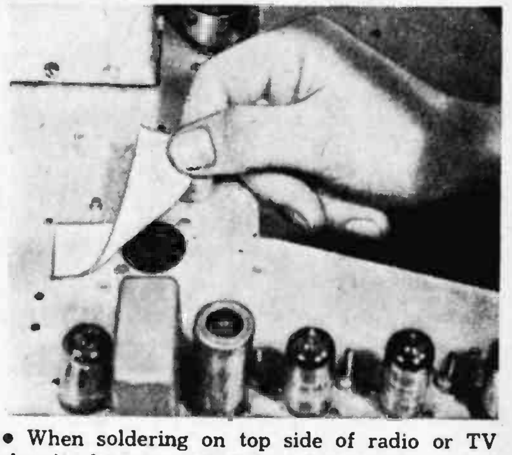
Figures 1 and 8 show views of a re-built TV tube to oscilloscope conversion. Note that the power supplies are at the back of the inner-panel (which has a steel shielding plate on the front of it), and that the amplifiers are built down the side of the chassis.

Kitchenware for UHF Experimentation



• Plastic food containers make good looking low-loss chassis and cabinets for various ultra-high-frequency assemblies. Many of these containers are made of Styron, a member of the polystyrene family and a very good insulator. Containers are cheaper than sheet polystyrene, and come already formed. Photo shows 2 styles which are especially handy. The round one is an experimental FM crystal set using a germanium diode, which slope-detects close-by FM stations.—A. T.

Solderless Tube Sockets



• When soldering on top side of radio or TV chassis, dropping solder in an open tube socket can cause trouble. Eliminate this possibility by placing a strip of wide adhesive tape over the open socket.—H. Leeper.

CAP Cadets receive communications training with real equipment whenever possible. These Blue Island, Illinois cadets are shown at the control console of "Big Mo" (Yellow Fox 75), a 400-watt semi-trailer mounted mobile unit maintained by the Illinois Wing, during a recent practice alert.

Civil Air Patrol Radio

The world's largest privately owned shortwave network

By CORKLEIGH E. WHITE

Time: Late August, 1955. **Place:** East Stroudsburg, Pennsylvania—Torrents of rain brought by Hurricane Diane have turned normally peaceful Broadhead Creek into a raging flood; all of the usual approaches to East Stroudsburg are washed out. Only one slim link with the outside world remains—the damaged remnant of a steel railway bridge.

An excellent example of CAP ability to adapt material at hand for maximum versatility is this combination ambulance-radio station-equipment trailer maintained by the O'Hare CAP Squadron for emergency use in the Chicago area.

IT IS a very slim link, indeed. Most of the bridge's foundations have disappeared and the remaining structure has been pounded and tortured until only one twisted girder is left in place.

Within the town and throughout the surrounding farmland, hundreds of homes have been washed out. Streets are flooded, commerce is at a standstill, thousands of persons are in need of food, warm blankets, dry clothing and medical supplies.

But how are rescuers to know exactly what is needed—and where? It is imperative that some means of communication with East Stroudsburg authorities be established, and the call goes out for volunteers.

First to respond is Warrant Officer Philip Hardaker, a member of the Civil Air Patrol's Stroudsburg Squadron. Clutching his small VHF transceiver tightly in one hand, Hardaker inches painfully across the single remaining girder of the railway bridge.

He reaches the far side just in time. Only minutes after he has crossed, the girder gives way and topples into the river below.

For the next 72 hours, Hardaker's small VHF transceiver keeps East Stroudsburg in contact with CAP stations across the river and with CAP aircraft circling overhead. His messages enable armed services helicopters to pinpoint the location of marooned families and to drop supplies to them. His work is credited by rescue officials as being responsible for saving many, many lives. (The exact number of persons who perished in the great flood of 1955 is unknown, but it is a fact that more than 80 bodies were found in the Stroudsburg-East Stroudsburg area alone after the flood waters had subsided.)

Hundreds of stories like Hardaker's are on file at Civil Air Patrol's National Headquarters in Washington, D. C. What, then, is this CAP radio system? How is it staffed, equipped and organized? Who does the maintenance? And who pays the bills?

Before attempting to answer these questions, let's take a look at the Civil Air Patrol organization as a whole and see what makes it tick. Founded on December 1, 1941, just six days before the Japanese attack at Pearl Harbor, the Civil Air Patrol has grown until today it has more than 91,000 volunteer members. Its founders were civilian pilots who wanted to do their part toward making America strong, but who—for physical or other reasons—were unable to join the armed services. Today, some 51,000 of CAP's members are cadets—young men or women 14 years of age or older who are engaged in an intensive aviation education program.

Described by officials of the United States Air Force's Air Rescue Service as its "right arm," CAP members use their own private planes and liaison planes donated by the Air Force, Army and Navy to fly each year more than 60% of the total search hours flown by all agencies on aerial searches within the continental limits of the United States. Some 6000 of these light planes, together with more than 11,700 fixed, mobile and airborne radio stations, can be mustered in an emergency.

They can be put to work in a surprisingly short time, too. Just recently, for example, a flying farmer en route from Springfield, Illinois, to Danville in the eastern part of the state, was reported overdue by the Civil Aeronautics Administration. Although the report came in during the small hours of the morning, 20 aircraft and as many radio stations were in service by dawn. They found their target in less than three hours and many of the search participants were back working at their regular jobs by noon of the same day.

A routine mission, but it speaks well for the thousands of hours CAP units spend annually in training to maintain their proficiency.

What kind of pay do Civil Air Patrol members receive for their services? The answer: nothing whatsoever. They even buy their own uniforms, the U. S. Air Force uniform with distinctive CAP insignia. Adult members pay an annual membership assessment for the privilege of promoting aviation. Although the Air Force does pay for fuel and lubricants used by CAP members on Air Force-requested missions, the only real compensation most members get is the satisfaction of a job well done.

Organized into eight regions covering the 52 wings (48 states plus the territories of Hawaii and Alaska, the Commonwealth of Puerto Rico and the District of Columbia), CAP members are further subdivided into some 2500 groups and squadrons. Each of these units is authorized to use two medium-frequency, fixed radio stations and as many mobile and airborne stations as necessary. Flexibility, mobility and reliability, the keynotes of the net, enable CAP to blanket the United States with dependable communica-

CAP planes must fly low and slow over rugged, often dangerous terrain to locate victims of air crashes and other disasters. When the "target" has been found, a message flashed over the CAP radio net will bring a radio-equipped mobile support unit to the scene in a hurry.

CAP WING	WING CALL	FIXED	MOBILE	AIRCRAFT
Alabama	KIG-442	Golden Rod	Hot Rod	Ram Rod
Alaska	KWA-677	Sourdough	Mulluk	Aurora
Arizona	KOF-424	Thunderbird	Geronimo	Tomahawk
Arkansas	KKI-719	Dogwood	Razorback	Diamond
California	KME-284	White Bear	Black Bear	Brown Bear
Colorado	KAF-357	Pikes Peak	Red River	Blue River
Connecticut	KCC-590	Nutmeg	Rambler	Racket
Delaware	KGC-462	Gabby	Vagabond	Barfly
District of Columbia	KGC-463	Aero	Aerodyne	Aeronaut
Florida	KIG-444	Sparrow	Crane	Eagle
Georgia	KIG-443	Red Star	White Star	Blue Star
Hawaii	KUA-341	Firebrand	Mobile	Hiboy
Idaho	KOB-425	Magpie	Rabbit	Hornet
Illinois	KSC-952	Red Fox	Yellow Fox	Blue Fox
Indiana	KSC-953	Red Fire	Blue Fire	Green Fire
Iowa	KAF-358	Corn State	Bulldog	Cyclone
Kansas	KAF-359	Jayhawk Post	Jayhawk Bug	Jayhawk Bat
Kentucky	KIG-445	Middleground	Whirlaway	Jet Pilot
Louisiana	KKI-720	Magnolia	Muskrat	Pelican
Maine	KCC-591	Pinetree	Pinekarr	Pineayr
Massachusetts	KCC-592	Freedom	Pilgrim	Clipper
Maryland	KGC-464	Plant	Tug	Jet
Michigan	KQD-405	Red Robin	White Robin	Blue Robin
Minnesota	KAF-360	Starfish	Dog Fish	Cat Fish
Mississippi	KKI-721	Mockingbird	Jay Bird	Snow Bird
Missouri	KAF-361	Blue Bird	Red Bird	Black Bird
Montana	KOF-426	Father	Mother	Angel
New Jersey	KEC-994	Zigzag	Domino	Aircan
Nebraska	KAF-362	Wigwam	Buffalo	Meadowlark
Nevada	KOD-427	North Wind	Yellow Jacket	Red Spider
New Hampshire	KCC-593	Profile	Bobcat	Saucer
New Mexico	KKI-722	Pueblo	Zuni	Navajo
New York	KEC-995	Empire	Tomcat	Wildcat
North Carolina	KIG-446	Red Dog	Blue Dog	Mad Dog
North Dakota	KAF-363	Black Foot	Sioux	Mohawk
Ohio	KQD-406	Black Hawk	Gray Hawk	White Hawk
Oklahoma	KKI-723	Sooner	Oilwell	Gaswell
Oregon	KOF-428	Beaver Fox	Beaver Muskrat	Beaver Bird
Pennsylvania	KGC-465	Keystone	Rolling Stone	Flight Stone
Rhode Island	KCC-594	Rhody	Little Rhody	Air Rhody
Puerto Rico	WWA-353	Pineapple	Sugar	Hurricane
South Carolina	KIG-447	Kiddy Car	Side Car	Box Car
South Dakota	KAF-364	Dakota	Mandan	Cheyenne
Tennessee	KIG-448	Blue Chip	Red Chip	Gold Chip
Texas	KKI-724	Eagle Nest	Gold Eagle	Blue Eagle
Utah	KOF-429	Uncle Willie	Uncle Mike	Uncle Able
Vermont	KCC-595	Pico	Marble	Mansfield
Virginia	KIG-449	Blue Flite	Green Flite	Red Flite
Washington	KOF-430	Fir	Maple	Ash
West Virginia	KQD-407	Lowland	Overland	Highland
Wisconsin	KSC-954	Badger	Scooter	Buzzard
Wyoming	KOF-431	King	Queen	Jack

tions support for Civil Air Patrol's aerial activities.

Most CAP radio equipment is furnished by the members themselves. A small proportion comes from military surplus stocks. Transmitters range in power from portable units of less than one watt output to husky 400-watt control stations.

Some equipment is hand-tailored for CAP use by talented members. One excellent example of such handmade equipment is the tiny ½ watt, dry-cell powered VHF transceiver built by Major Leo Streff of Paxton, Illinois, the Illinois Wing's Director of Mobile Communications. Designed for use in light planes not equipped with electrical systems suitable for powering radio equipment, Streff's unit has given consistently good results at ranges up to 50 miles from altitudes of 2000 feet.

Quality standards for CAP radio stations are high. All transmitters must be crystal-controlled and capable of operating within .01% of frequency. Monitor stations in each region make frequent checks to insure that all equipment is remaining within tolerance

Light, compact equipment is extremely important to the Civil Air Patrol. Here, Major Leo Streff, Director of Mobile Communications for the Illinois Wing, is shown demonstrating the tiny ½ watt transceiver he designed for use in CAP's light planes to his wife, Captain Evelyn Streff, Illinois' Director of Communications Training.

and that operators are confining their transmissions to official CAP business.

Although operating on military frequencies loaned to its civilian auxiliary by the U. S. Air Force, control of the member-owned stations remains under the jurisdiction of the civilian unit commanders. Six high frequencies and one very high frequency are presently in use, with another very high frequency to be added shortly.

The high frequency wave lengths are used primarily for intra-state traffic over distances of 200 or 300 miles between fixed and mobile stations. Because of its line-of-sight characteristics, VHF is reserved primarily for ground-air, cadet training and local communications, although many operators have erected elaborate towers and antennas to extend the advantages of clear, static-free VHF operation over considerable distances.

"Tactical" call signs are used by all CAP stations. Many of them are derived from state or regional nicknames, or from major industries. "Badger" and "Corn State," for example, appropriately describe Wisconsin and Iowa base stations. The Wing carrying this patriotic practice to the furthest extent is probably Oklahoma, where base stations, mobiles and aircraft are known respectively as "Sooners," "Oilwells," and "Gaswells." In states where it is permitted, many CAP members who have equipped their automobiles with mobile radios use abbreviations of their CAP call signs on their license plates.

Civil Air Patrol radio operators are volunteers, as are all CAP members. Many are housewives, an occupation that presents special advantages because the ladies are usually able to monitor their assigned frequencies during the day, when most male operators must be out earning a living.

One of these valuable ladies is Captain Evelyn Streff, operator of the Illinois Wing's primary control station, "Red Fox 8," and Director of Communications Training for the wing. A CAP member since 1951, Evelyn handles as many as 20 separate pieces of traffic every day between the 459 licensed CAP stations under her jurisdiction. In addition, she makes daily traffic checks with the Great Lakes Region's control station at Detroit, and occasional contacts with passing Air Force aircraft. In spite of the demands on her time made by three very active children and an electronics technician husband, she usually manages to keep her station in operation from 6:30 in the morning until 7 or 7:30 at night. In emergencies she has been known to operate the clock around.

How does she find the time?

"It's not always easy," Evelyn says. "But if you feel that the job you're doing is important enough, you'll find that you can make the time somehow."

Illinois, like most states, conducts a daily half-hour net for all stations who are able to check in during the daylight hours. Many operators, of course, are not ordinarily available during the day and must pass traffic before going to work in the morning or after returning home in the evening. Indeed, some regularly check in with the mobile stations in their cars on the way to and from work.

Among the most unusual CAP stations are those operated by Indians of the Navajo Reservation in Arizona. Since 1951, when a squadron was first established on the reservation, "the wind that speaks" has many times summoned the life-saving assistance of planes of the Arizona Wing. Today, there are three CAP squadrons on the reservation, and 32 landing strips have been built.

Is the network growing?

"Yes, indeed," says Captain John W. Scott, USAF, Director of Communications at CAP's National Headquarters. "The network has grown steadily, both in numbers and in quality. In 1955 alone, we added over 700 stations."

And what does the U. S. Air Force say about the CAP radio net?

In a message lauding CAP on its 15th Anniversary, General Nathan F. Twining, then USAF Chief of Staff, said:

"Well trained and well organized, the Civil Air Patrol provides immediate aid and assistance to the private citizen and to the nation in time of emergency . . . a radio network of thousands of CAP stations which stand ready for duty . . . has earned our deep respect for its work in flood and hurricane disaster . . ."

And now, how about you? Got a quiet evening coming up soon? Drag the old short-wave receiver down off the shelf, hook up an antenna and start tuning the dial.

You'll recognize CAP frequencies by the tactical call signs they use. You may even think you've accidentally stumbled into a zoo if you happen to tune in when the Badgers, the Black Hawks and the Red Dogs are all on the air at the same time. But whatever you hear, you'll know that the volunteer radiomen and women of the Civil Air Patrol are on the job, ready and willing to do their part when disaster strikes.

How to Get Three Speeds from a Two Speed PHONO MOTOR

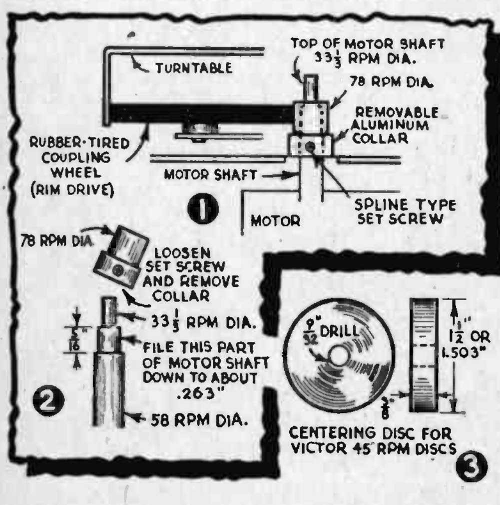
By ARTHUR TRAUFFER

Fig. 1. The centering disc for Victor 45 rpm records. The writer turned his disc from cold-rolled steel.

IF YOU own a General Industries Model-DR dual-speed (78 and 33 *rpm*) phono motor which plays both standard discs and Columbia LP's, you can, by a simple operation, convert it to play in addition the new 45 *rpm* RCA-Victor discs. An inspection of the motor (Dwg. 1) reveals that the 78 *rpm* part of the motor shaft is a removable aluminum collar held by a spline type set-screw. When set-screw is loosened and collar removed you will find the motor shaft measures about .3115 in. and gives turntable a speed of about 58 *rpm.* Pack cotton around motor shaft to keep metal shavings out of motor bearings, and while motor is running, file shaft down to about .263 in. or just enough to give exactly 45 *rpm.* (Dwg. 2). Now the table speed can be shifted from 45 to 33 *rpm* instead of from 78 to 33 as formerly and the aluminum collar can be put back on the motor shaft to play 78 *rpm* discs.

Fig. 2. The works of the General Industries Model-DR dual-speed phono motor. Pencil points to the 78 rpm diameter on removable aluminum collar over motor shaft.

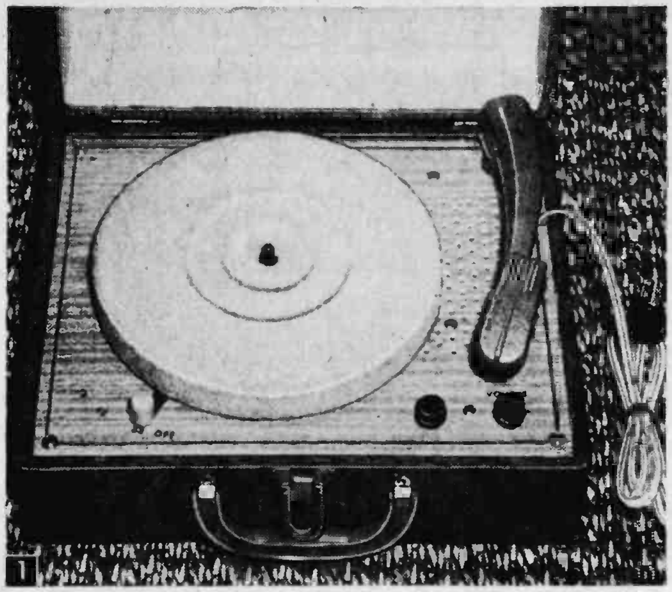
Fig. 3. The 78 rpm aluminum collar has been removed by loosening spline set-screw. Pencil points to part of motor shaft that has been filed down to .263 in. or just enough to give exactly 45 rpm. Aluminum collar can be put back for 78 rpm.



Use a new or clean file to file shaft to 45 *rpm.* The motor shaft turns in a counter clockwise direction; move the file against the direction of turn. Take a little at a time off the shaft and test for speed each time to prevent obtaining a turntable speed below 45 *rpm.* Turn centering disc on a lathe from cold-rolled steel, fiber, plastic, or even hardwood (Dwg. 3).

Removing Enamel Wire Insulation

• To remove enamel insulation on magnet and hook-up wire quickly and cleanly, wrap a piece of sandpaper around the wire and give a twisting, rotary motion.—E. L. BURNER.



1 Seven and one-half pounds light, this compact record player plays 33, 45, and 78 rpm. records loud (if you like) and clear.

Midget Record Player

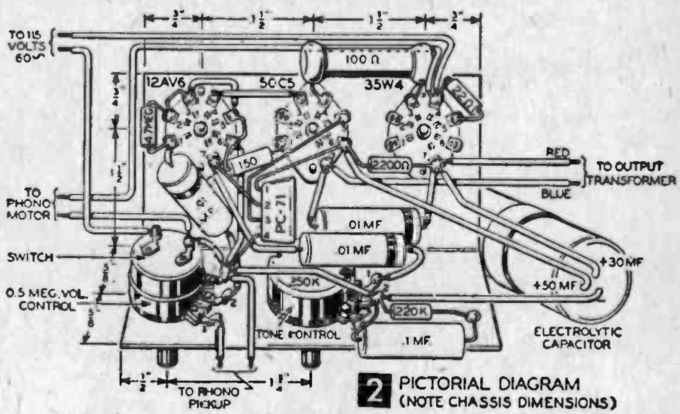
By
THOMAS A. BLANCHARD

WEIGHING just 7½ lbs., this electric phonograph plays all records from ordinary 78's to 7-in. 45's and 12-in. LP's. Its compact three-tube amplifier employs a triode input, pentode output and a half-wave vacuum tube rectifier, giving more volume than the average small speaker can handle. (The 4-in., round PM speaker shown in Fig. 6 is adequate for this volume, but for even finer tone quality use a 4 x 6-in. oval PM speaker.) Variable tone control—a feature not found on many larger phonos—is provided, and five individual components have been eliminated from the resistance coupled amplifier by employing a Centralab PC-71 triode couplate, a ceramic printed circuit about half the size of a postage stamp containing three capacitors and two resistors.

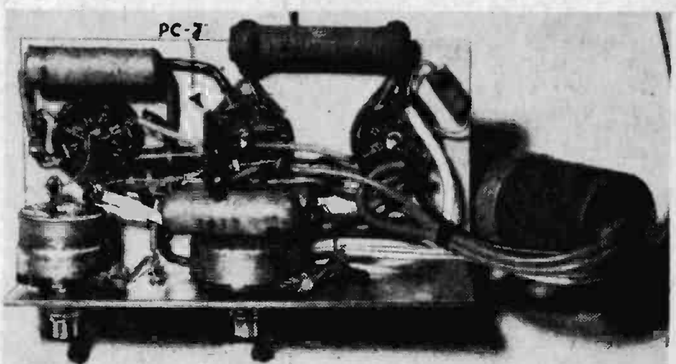
Construction of the amplifier is detailed in Figs. 2 and 3. The chassis may be aluminum, copper or steel; socket holes are ⅝-in. dia. Holes for volume and tone controls are ⅜-in. dia. These controls should be midget types such as Mallory, CTS, or Stackpole to fit the chassis apron. When controls with ¼-in. mounting bushings are used, attach the chassis to the ¼ x 9½ x 11⅞ in. hardboard motor board with 6/32 machine screws and nuts. If controls have ⅜-in. or longer threaded bushings, use the control nuts to secure the chassis to the motor board.

Figure 4 shows the locations of mounting holes. The phono-motor opening is for a three-speed General Instrument model with 8-in. turntable. If a different type motor is used, line up the turntable post at the exact point indicated in Fig. 4 and cut the opening in accordance with the manufacturer's template.

To insure proper record tracking and minimum needle pressure, use a pickup arm designed for microgroove records. The Shure #92U or Astatic #510-LT-4AG pickups are inexpensive all-speed types furnished with osmium tipped .002 needles. For best

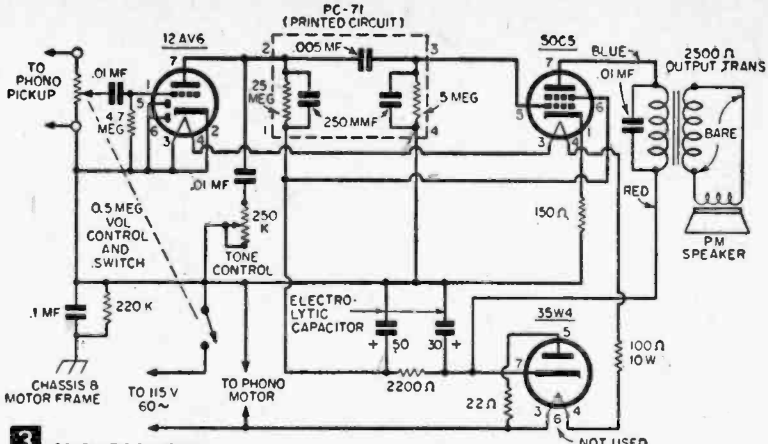


2 PICTORIAL DIAGRAM (NOTE CHASSIS DIMENSIONS)

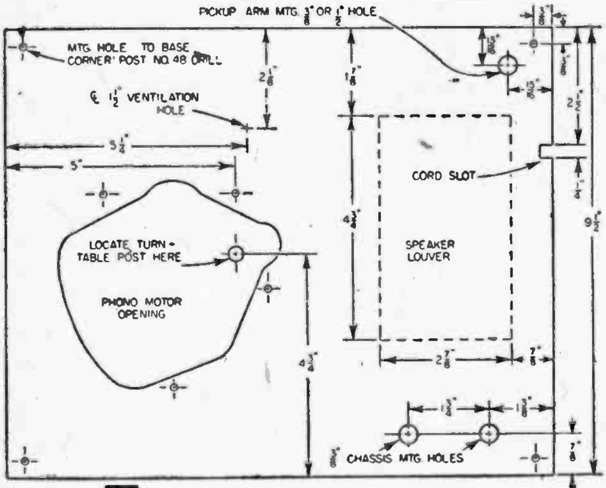


quality and maximum record life use a long-play, sapphire-tipped needle, size .001, in the pickup for LP's and 45's. Ordinary 78 *rpm* records play best with a .003 osmium or sapphire-tipped needle.

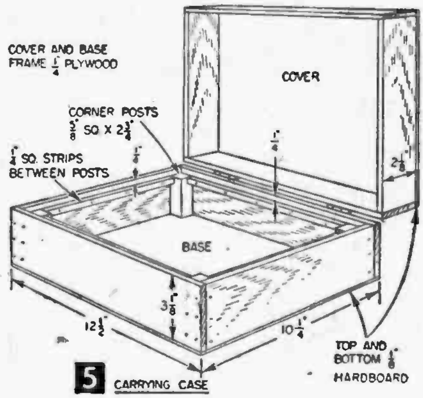
Since swivel mounting bushings on pickup arms vary, ⅜-in. *or* ½-in. is indicated in Fig. 4 as hole size for the pickup arm. The speaker louver may be slotted, drilled or cut out and fitted with metallic grille cloth.



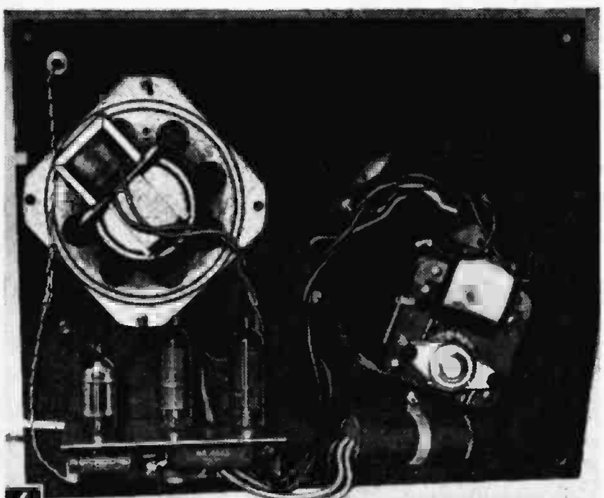
3 SCHEMATIC DIAGRAM



4 MOTOR BOARD



5 CARRYING CASE



6

Bottom view of completely assembled motor board with amplifier, pickup arm, speaker and three-speed motor in place.

MATERIALS LIST
MIDGET RECORD PLAYER

Amt.	Description
1	3½ x 4½" metal chassis
3	7-pin miniature wafer or molded sockets
1	2500 ohm output transformer (50L6 type)
1	4" round or 4 x 6" oval PM Speaker
1	6' line cord and plug
3	.01 mf., 200 w.v. plastic tubular capacitors
1	.1 mf., 200 w.v. plastic tubular capacitor
1	30-50 mf. dual electrolytic capacitor
1	Centralab PC-71 couplate (or Erie equiv.)
1	4.7 meg., ½-watt resistor
1	222,000 ohm ½-watt resistor (220K)
1	2200 ohm 1-watt resistor
1	22 ohm 1-watt resistor
1	100 ohm 10-watt wire-wound resistor (ICA type AB)
1	0.5 meg. midget volume control-switch, plus push-on or set-screw knob
1	250,000 ohm midget tone control (250K), plus push-on or set-screw knob
1	¼ x 9½ x 11⅞" hardboard
2	⅛ x 10½ x 12½" hardboard
	89" of ¼ x ⅜" plywood
	11" of ⅝" sq. softwood
1	Astatic #510-LT-4AG, or Shure #92U all-speed pickup arm
1	General Instrument 3-speed motor with 8-in. turntable
	Miscellaneous hardware

With wiring completed and all component parts in place on the motor board, test the record player by supporting the motor board on four 1x1-in. wood posts, 3-in. long, and playing a record. If there is hum from the amplifier, run a wire from the grounding lug on the motor frame to the amplifier chassis. If, with the volume control fully advanced, there is a tendency to howl, ground the bushing of the pickup arm.

Construction of the carrying case is detailed in Fig. 5. Brads are used for assembly and plastic, leather-grained fabric is glued to the outside of the case. Hardware (latch, hinges and handle) is inexpensive and available at hardware stores or luggage shops. Use "slip-pin" hinges (the kind you find on typewriter and tape recorder cases) so that the cover can be removed when 12-in. LP's are played.

Four #8, 1½-in. binding-head screws secure the completely assembled motor board (Fig. 6) to the base of the carrying case, screwing into the corner posts.

Repair Simple Radio Troubles

Resurrect that old radio in attic or basement, or rejuvenate the set you're now using

Explore many other possible sources of trouble before you investigate the wiring under the chassis.

THERE are still far too few radio servicemen available to handle all the work they are called upon to do. Most radio owners yell for help the first time any little thing goes wrong, and if the neighborhood service man cannot come at once, the householder is deprived of the use of his radio, perhaps for days.

A surprisingly large percentage of these jobs involve simple troubles that can readily be repaired by the home craftsman.

By making these minor repairs yourself you can insure uninterrupted use of your radio—and the work itself is fascinating.

These instructions can profitably serve as a guide for checking a great many of the simple and obvious troubles which can occur in radio sets and can be repaired with ordinary shop tools. Once you have checked a receiver for these simple defects and have proved to yourself that some more serious trouble exists, you can justifiably take your receiver to a radio serviceman for repairs.

Examine Line Cord

People have called radio servicemen to their homes an astonishingly large number of times simply because the line cord plug came out of the wall outlet. Therefore, direct your attention to this plug first. Be sure it fits snugly in the outlet. Examine its wire connections at the terminal screws. Make sure that power does exist at the wall outlet, by plugging a floor or table lamp into that outlet.

Breaks in the line cord itself are also frequent. These can usually be detected by bending the entire length of the cord through your fingers. If the insulation on the cord is damaged in any way, the entire cord should be replaced. Once insulation begins wearing, it will deteriorate rapidly along the entire length, and taping of damaged portions is not advisable. The chassis must be removed from the cabinet in order to replace the cord, and the connections at the receiver end of the cord must be soldered. This is a simple job for anyone who knows how to use a soldering iron.

Plug Position Is Critical

With the receiver turned on and tuned to a station, try reversing the position of the plug in the wall outlet. There are a great many receiver-home situations in which the position of the plug is critical. If better reception is obtained in one position, mark both the plug and the outlet with crayon or other means to designate that position.

Defective tubes are undoubtedly the most common causes of troubles in radio receivers.

Fortunately, it is often possible to spot the bad tube by inspection or sense of touch. You can buy a new tube just as readily as could a radio serviceman, and can make the replacement with considerable financial saving to yourself and considerable saving of a trained radio man's time.

First of all, turn on the set and wait about one minute for tubes to warm up. Now inspect each tube in turn to see if a characteristic red glow of the filament is present. For metal tubes, for glass tubes which are hidden by other parts, and for glass tubes constructed in such a way that the filament cannot be seen, allow the set to warm up for about five minutes and then feel each tube in turn. Touch metal tubes lightly and carefully the first time, because some of them can get hot enough to give a painful burn. If one or two tubes in the receiver have no filament glow and remain cold, it is very likely that these tubes are defective.

In universal a.c.-d.c. receivers, the filaments of all the tubes are usually connected in series, like a string of Christmas tree lamps, so failure of one tube will cause them all to be cold. There is no convenient way to determine which tube is bad without instruments, so all of the tubes will have to be tested.

Have Tubes Tested

Testing of all tubes is a routine part of every radio service job. You are therefore fully justified in removing all the tubes from your set and taking them to a shop for testing. When tubes are brought to the shop loose (not in the set), they can be checked in a few minutes. A charge of five cents per tube for testing is fully justified, but most shops will test tubes free.

When removing tubes from a receiver for testing, be sure that you will be able to replace the tubes in the correct sockets. The safest plan involves making a rough layout of the top of the chassis, showing the position of every tube socket and type number of the tube which belongs in each socket. This is desirable even though the sockets themselves are marked, because it is not uncommon to find discrepancies between tube and socket numbers. Sometimes a diagram of this type is attached to the inside of the receiver cabinet by the manufacturer.

Tubes can usually be removed without trouble by pulling firmly upward while rocking gently from side to side. Top cap connections and metal shields should of course be removed before taking out the tube. Note on your diagram the tubes which have shields, because it is extremely important that the shields be put back on the tubes requiring them. Also, if there is any possibility that leads to top caps of tubes can become interchanged, identify these leads also on your diagram.

If the receiver trouble is noise or intermittent failure, you may be able to locate the cause before removing the tubes by tapping each tube in turn with your finger while the receiver is in operation. If the noise increases or if a change in receiver operation is noted when a particular tube is tapped, a new tube should be secured.

In general, tubes which differ only in the last letters of the type numbers are interchangeable. These last letters merely indicate some of the mechanical characteristics of the tubes:

M—Metal envelope and octal base
G—Glass envelope and octal base
GT—Short glass envelope and octal base
L—Used with letters G, M or T to indicate a locking base (loktal) tube

Thus, the 6A8 metal tube is ordinarily interchangeable with 6A8G and 6A8GT glass tubes. When metal tubes are not available for your use, glass equivalents are ordinarily given automatically by radio stores. It is usually necessary to use a shield with a glass equivalent; these cost about a dime each, and come with a special base strip which automatically grounds the shield to pin No. 1 on the tube base. Usually, however, exact replacement types will be available.

PILOT LAMP IDENTIFICATION CHART

Type No.	Bead Color	Bulb and Base	Volts	Amp.
40	Brown	Tubular Screw	6-8	.15
41	White	Tubular Screw	2.5	.50
42	Green	Tubular Screw	3.2	.50
43	White	Tubular Bayonet	2.5	.50
44	Blue	Tubular Bayonet	6-8	.25
45	Green	Tubular Bayonet	3.2	.50
46	Blue	Tubular Screw	6-8	.25
47	Brown	Tubular Bayonet	6-8	.15
48	Pink	Tubular Screw	2.0	.06
49	Pink	Tubular Bayonet	2.0	.06
49A	White	Tubular Bayonet	2.1	.12

Type No.	Bead Color	Bulb and Base	Volts	Amp.
50	White	Small Globular Screw	6-8	.20
51	White	Small Globular Bayonet	6-8	.20
55	White	Large Globular Bayonet	6-8	.40
292	White	Tubular Screw	2.9	.17
292A	White	Tubular Bayonet	2.9	.17

Type 40A is exactly the same as Type 47. Type 49A may not be obtainable, but can be replaced with Type 49.

Types 43, 44 and 46 are used in tuning meters, where replacement with the correct type is particularly important. Be sure the right type is chosen.

Since tube types are constantly being modified and improved, and new types are constantly being added to the list of those available, for older radios especially there are quite a few cases in which other tube types will give equally satisfactory results. A list of these interchangeable tubes accompanies this article.

Pilot Lamp Replacements

Pilot lamps ordinarily serve the dual purpose of illuminating the tuning dial and indicating when the receiver is turned on. In larger receivers additional lamps are used for other indicating functions. Burned-out pilot lamps are readily replaced.

In most cases it will be entirely sufficient to remove the defective lamp and take it to the radio shop or hardware store, asking for a duplicate lamp. If you order by mail, however, and if there are no legible markings on the old lamp, you can determine the type number of any pilot lamp for ordering purposes with the aid of the accompanying pilot lamp chart.

If a pilot lamp burns out frequently, use a lamp having a higher voltage rating. The light will be dimmer but probably still adequate.

Pilot lamps in universal receivers should be replaced as soon as possible because they are often connected in parallel with a portion of the voltage-dropping resistor or a portion of the rectifier tube filament. Failure of the pilot lamp sends excessive current through the other path, and this may cause failure of the resistor or rectifier tube.

Hunt for Loose Connections

It is not unusual for a radio serviceman to charge as much as five dollars for resoldering a single loose connection, because it takes a corresponding amount of his time to locate that connection before he can repair it. Here are suggestions for finding this particular trouble yourself.

Starting on top of the chassis, wiggle each exposed lead vigorously with your fingers or a stick of wood. Tap each part and terminal with the stick of wood. Check the antenna system in the same manner, paying particular attention to indoor antennas which run around the room and may make intermittent contact with metal objects in the room. Wiggle all plugs accessible from the outside of the receiver. All this is done, of course, while the receiver is turned on.

If noise occurs or there is a change in receiver operation when a particular part, terminal or wire is moved, concentrate on that location until you find the exact defect. Remember that vibrations can be transmitted through large parts and through the chassis, so the first point at which you produce noise may not be the defect. The trouble can easily be traced, however, by tapping more carefully so as to disturb as few other parts as possible.

If no defect is found outside the chassis, turn off the receiver and remove the chassis from its cabinet. Now, with the chassis upside down, and with the loudspeaker connected, turn on the receiver and proceed to tap or otherwise move each part, terminal and wire under the chassis.

Caution: When working with a universal receiver, there will sometimes be one line cord plug position in which the chassis of the receiver is hot with respect to ground. The use of a wood stick for tapping purposes is particularly advisable here unless you have some means for determining which plug position connects the chassis to the grounded side of the power line.

Sometimes a trouble will develop only after a receiver has been in operation for ten or fifteen minutes. Here the bad connection will be caused by heat given off during operation of the set. With the chassis removed from the cabinet, free circulation of air will prevent parts from reaching normal operating temperatures and the set will work satisfactorily. The trouble can be "forced" in these cases by directing an electric heater at the underside of the chassis. Once heat has caused the trouble to develop, you can hunt for the bad connection as just described.

Replace Noisy Controls

If operation of the volume control, tone control or any other continuously variable control causes loud crackling noises in the loudspeaker,

RADIO TUBE INTERCHANGEABILITY CHART

Note: When a tube is made with several different envelopes all using the same base, it is listed only once in this chart. Therefore, disregard suffix letters like G, GT, GT/G, etc., when looking up tubes unless the same type of tube is listed with different suffixes.

Type No.	Interchangeable with	Type No.	Interchangeable with
1V	6Z3	25X6	25Z6
2A3H	2A3	25Z6	25X6
2X2	2Y2, 879	37	76
2Y2	2X2, 879	40	01A
5E1	1A1	40Z5	45Z5/40Z5
5T4	5U4	43MG	25A6GT/G
5U4	5T4	44	39/44
5W4	5Y3G, 5Z4	45A	45
5Y3G	5W4, 5Z4	56A/56AS	76
5Z3	83V	57A/57AS	77
5Z4	5Y3G, 5W4	58A/58AS	78
6AB6G	6N6G	64	36
6AF6G	6AD6G	65	39/44
6B6G	6Q7G	67	37
6C5	6J5	68	38
6C6	77	76	37
6D6	78	77	6C6
6G5	6U5/6GS	78	6D6
6J5	6C5	83V	5Z3
6N5	6AB5/6N5	84	6Z4
6Q6	6T7	84MG	84/6Z4
6T5	6U5/6G5	86	76
6T7	6Q6	117L7	117M7
6U5	6U5/6GS	117M7	117L7
6U5	6Z5	150	50
6X5	6W5	171/171A	71A
1A4	1A4T	182A	71A
1A4P	1A4T	182B	483
1B4	1B4T	183	483
1B4P	1B4T	551	35/51
1D5G	1E5G	585	50
1D5GP	1E5G	586	50
1D5GT	1E5G	879	2X2
1F7G	1F7GH	951	1B4T
1F7GV	1F7GH	1232	7G7/1232
6Z3	1V	1852	6AC7/1852
6Z4	84	1853	6AE7/1853
12B7	14A7/12B7	PZ	47
14Z3	12Z3	PZH	2A5

that control is defective and should be replaced. It is not ordinarily practical to repair these controls. Get new ones.

Before removing the old control, draw a picture diagram showing all connections to the terminals of the control, so that you cannot possibly make any mistakes when connecting the new control. Remember that a little care taken while troubleshooting can save you much time and effort—*and* needless expense.

When ordering a new control, it is essential to give as much as possible of the following information:

1. The make of the receiver. This is usually printed on the front panel.
2. The model number of the receiver. This will be found printed on the rear of the chassis or on a label attached to the inside of the cabinet. It is best to copy all numbers which you find, exactly as they appear on the set. Admittedly, there will be times when no numbers whatsoever can be found.
3. Name of defective part, such as volume control, tone control, etc.
4. Electrical value of part, if known.
5. Manufacturer's part number, if known.
6. A list of all tubes used in the receiver. (This is particularly important if you are unable to find the model number.)

Practically all receivers bear a notation to the effect that the set was manufactured under an RCA license. This definitely does not mean that you have an RCA set unless confirmed by other markings.

Noisy switches can oftentimes be repaired by taking them apart and cleaning the contacts with carbon tetrachloride or other cleaning fluid, then bending the movable contact arm to provide increased contact pressure. Careful inspection will usually reveal how to correct the trouble.

Loudspeaker Troubles

The various possible troubles which can occur in loudspeakers will usually reveal themselves by their own peculiar sounds or by complete absence of sound. The output transformer, which is usually mounted on the loudspeaker, is perhaps the commonest trouble in this category. An open primary wire is the usual defect, and blocks all signals. You can therefore suspect the output transformer when no program sounds are heard but there is the normal faint hum coming from the loudspeaker. Preliminary confirmation of the trouble can be made by removing and replacing a tube while the receiver is in operation; this should produce a click or thud in the loudspeaker if the output transformer is good, but no sound if the primary is open. Try this test for several tubes, one at a time, but not on the rectifier tube. Of course, continuity of the output transformer primary winding can be checked as a positive test if you have an ohmmeter.

The chief problem in replacing an output transformer is securing the correct new part. An exact duplicate part can sometimes be secured by giving all the data specified for ordering volume controls, but radio men today usually prefer to secure a universal output transformer, designed to fit in a large number of sets. About all you need to give when ordering a universal output is the type number of the tube in the output stage of the receiver (if this stage has two identical tubes, be sure to indicate it). A universal unit will have a number of taps on the secondary winding, and instructions for making correct connections will invariably accompany the transformer. In the absence of instructions, however, simply connect the voice coil leads to the two terminals which give maximum volume and fidelity. The voltage at these leads is very low, so you can hold the leads in your hands while hunting for the best terminals.

A rattling sound which is particularly noticeable on low or bass notes can be caused by looseness of the cone around its outer edges. This trouble is cured simply by regluing the cone to the frame of the loudspeaker with loudspeaker cone cement or household glue.

Simple Noise Test

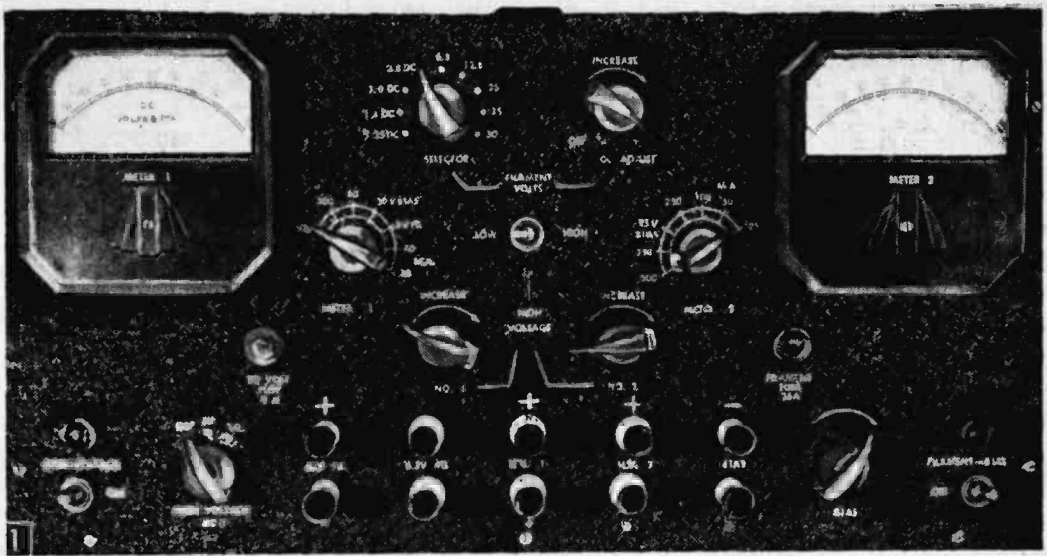
Another cause for raspiness is an off-center voice coil, which rubs against the metal pole pieces of the loudspeaker. In most loudspeakers the voice coil can be recentered by loosening the adjusting screws (there may be only a single screw at the center of the cone, or there may be three screws anchoring the spider outside the cone), and placing quarter-inch strips of a calling card between the voice coil and the center pole and tightening the screws again. Four strips spaced equally around the coil are usually sufficient. Use the thickest card which will go into the space without forcing.

Loose spider screws can themselves cause rattling sounds. Dirt in the space surrounding the voice coil can cause raspiness.

To determine whether noise is originating inside or outside your receiver, turn on the receiver, make sure the noise condition exists, then short together the antenna and the ground terminals with a screwdriver. If this clears up the noise, you know that the trouble is either due to an antenna system defect or is due to noise interference being picked up by the antenna system. If shorting has no effect on the noise, you know that the trouble is either in the receiver or is due to noise signals coming in over the power line, trouble not easily removed.

A humming sound heard at all times, even when the loudspeaker is disconnected, can usually be traced to vibrating laminations in the power transformer of an a.c. receiver. First try tightening the mounting bolts of the transformer. If this does not reduce the hum sufficiently, drive a few triangular glazier's brads between the laminations, or simply drive in enough ordinary nails or brads to stop the vibration. This will not affect the performance of the transformer.

In servicing your receiver at home, make haste slowly and *think* before you tinker.

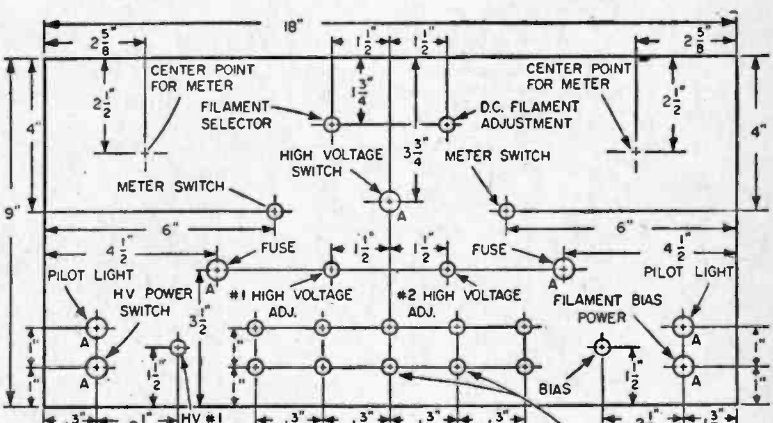


Put it on the panel, connect it to a power source and you're through forever wasting time and losing temper jerry-rigging dropping resistors to get the test voltage you want.

EXPERIMENTER'S Power Supply

By W. F. GEPHART

A VERSATILE, variable voltage, utility power supply is an essential piece of equipment for every electronic experimenter's test panel. The unit shown in Fig. 1 provides a wide variety of controlled voltages and it can be constructed of ordinary components, many of which can be found in the shop junk box, or at surplus stores. It is versatile in that any one of a number of different tube types can be used in the unit without the necessity of re-wiring, and, in many cases, a sub-par tube will work quite satisfactorily in it. This power supply provides the following voltages:



2 FRONT PANEL DIMENSIONS - USE 9 X 18 X 12" CABINET (ICA # 3831) TERMINAL HOLES, 3/8 DIA. FOR FIBER SHOULDER WASHERS HOLES MARKED "A" 1/2" ALL OTHERS 3/8"

1) *high voltage,* variable between 100 and 450 v. *d-c*, at up to 200 *ma.*

2) *medium voltage,* variable between 40 and 450 v. *d-c*, at up to 100 *ma.*

3) *d-c* filament voltages, continuously variable from 1 to 3 v., at up to .2 *amp.*

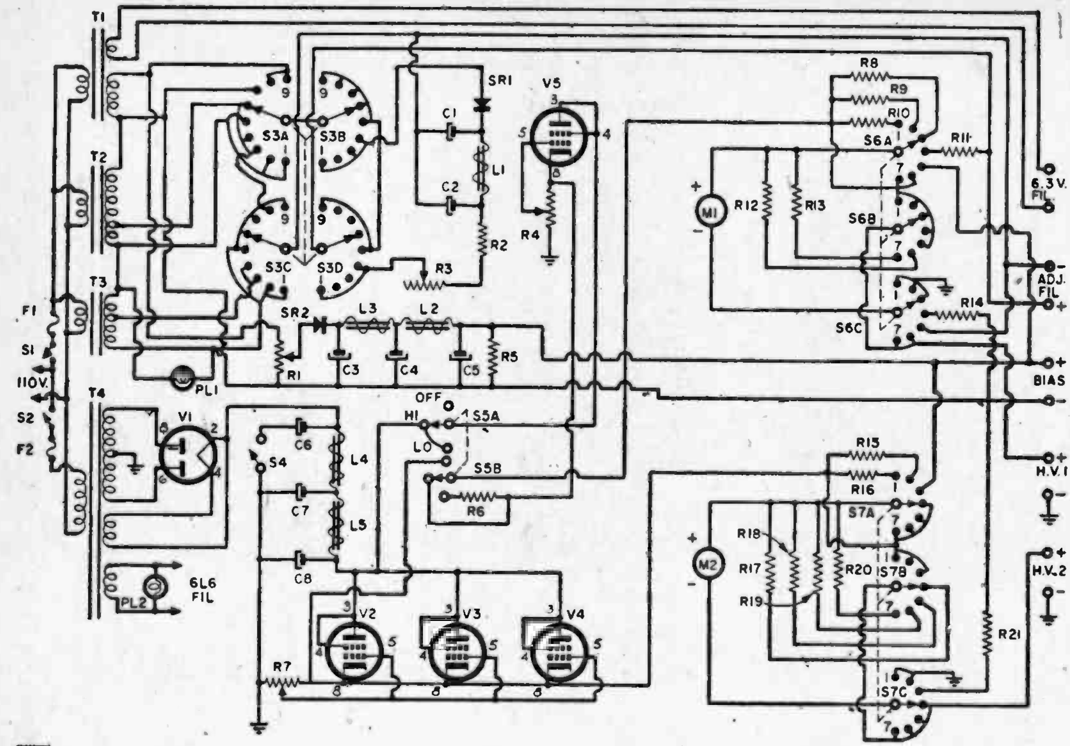
4) *a-c* filament voltages of 6.3, 12.6, 25, 35 and 50 v., at up to 2 *amps.*

5) *d-c* bias voltage, variable from 0 to 25 v., at up to 30 *ma.*

6) separate 6.3 v. *a-c* filament voltage, at 2 *amp.*

The high and the medium voltages can be used simultaneously, so long as the total current drawn from both does not exceed 200 *ma.*, and, at the same time, either the variable *a-c* or *d-c* filament supply can be used with the bias supply, as long as the total current from these latter sources does not exceed 2 *amps.* The separate 6.3 v. *a-c* filament supply can be used at all times in conjunction with the other voltages.

Thus the unit can furnish two high *d-c* voltages for plate applications, continuously variable, an *a-c* or *d-c* filament voltage, and *d-c* bias—all si-



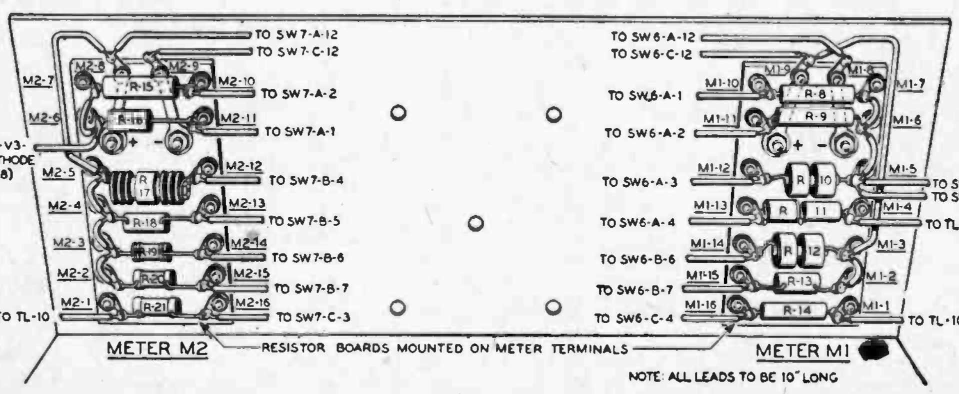
3 SCHEMATIC

Notes on Schematic—Filament Voltage Selector Switch S3: Pos. 1—1.25 volt d-c, Pos. 2—1.4 volt d-c, Pos. 3—2.0 volt d-c, Pos. 4—2.8 volt d-c, Pos. 5—6.3 volt a-c, Pos. 6—12.6 volt a-c, Pos. 7—25 volts a-c, Pos. 8—35 volts a-c, Pos. 9—50 volts a-c; High Voltage Range Switch S4: closed, "High," open, "Low"; Meter #1 Range Switch S6: Pos. 1—600 v, Pos. 2—300 v, Pos. 3—60 v, Pos. 4—30 v bias, Pos. 5—3 v d-c filament, Pos. 6—60 ma, Pos. 7—30 ma; Meter #2 Range Switch S7: Pos. 1—500 v, Pos. 2—250 v, Pos. 3—25 v bias, Pos. 4—250 ma, Pos. 5—100 ma, Pos. 6—50 ma, Pos. 7—25 ma.

multaneously. If the *a-c* filament voltage required is 6.3 v., then both this and a *d-c* filament voltage can be obtained at the same time.

The high-voltage supply is a conventional full-wave rectifier supply, fed into a two-section filter —which can, through S4 (see Fig. 3), be changed from choke to condenser input to give higher voltage (with less regulation) when required. The output from the filter goes to two separate degenerative type variable control circuits.

This type of control system can best be understood by thinking of the control tubes (V2 through V5) as resistances which can be varied by varying the bias on the tubes. When operating at zero bias, the voltage drop across a tube is small, and maximum output voltage appears across the load resistance in the cathode circuit (R4 or R7). When the bias is high, the tube acts as a high resistance, and the voltage drop across the tube is much higher than that across the load resistance in the cathode circuit. The ratio of these two voltage drops is dependent upon the



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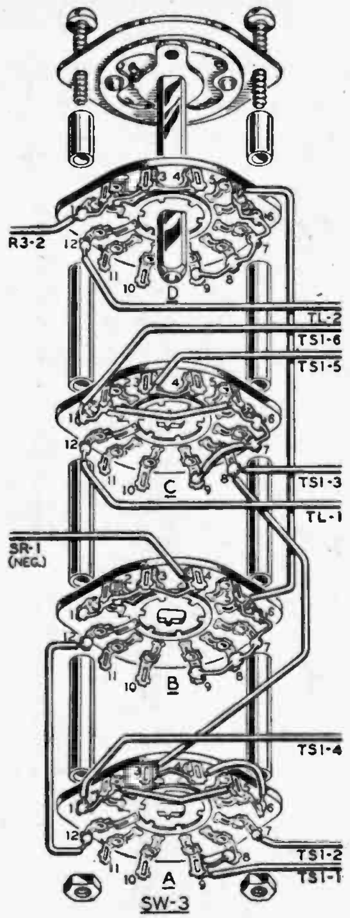
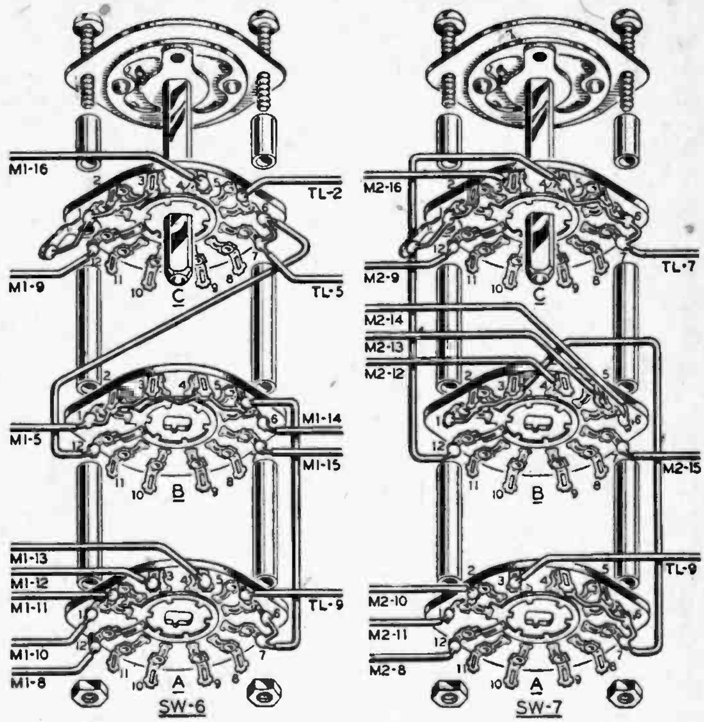




5

SWITCH WIRING

characteristics of the tube, the amount of bias, and the cathode resistance. The lower the cathode resistance, the higher the ratio.

Bias for control, however, is secured from the cathode resistance, and a certain amount of current always flows through this resistance. The resistance cannot be too low, since this would cause excessive current flow and necessitate a high wattage cathode resistance. A higher resistance than that indicated could be used for R4 or R7, but it should always have at least a 2-watt capacity.

Using 6L6 tubes for V2 through V5 and 70,000 ohm potentiometers for R4 and R7 as specified in the Materials List, the minimum voltage obtainable with a choke input filter and no load, is about 90 v.

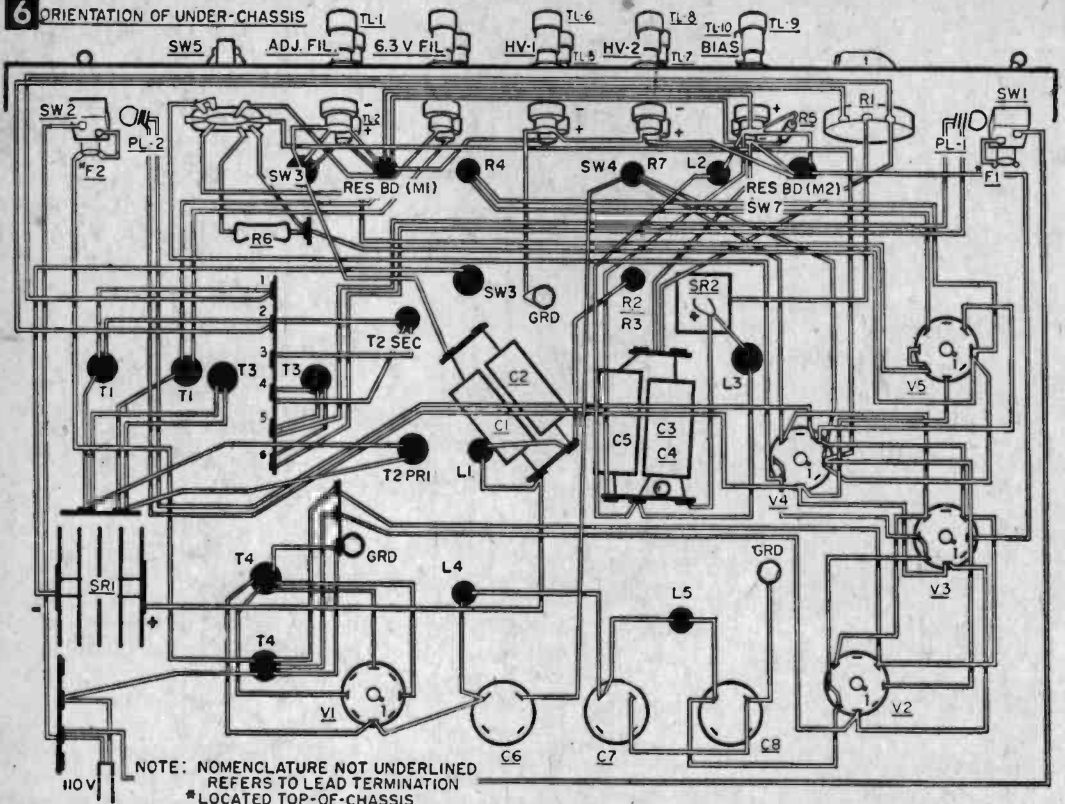
For one of the two separate variable control systems, three control tubes (V2, V3 and V4) are wired in parallel, thus providing sufficient current capacity. Type 6L6 tubes were used since we had an adequate supply of this type, removed from public address service because of noise, hum, etc., on hand. At 100 *ma.* per tube, this section then has a capacity of 300 *ma.*, well in excess of the current carrying capacity of the transformers and chokes in the circuit. Type 6L6's need not be used, however; any of the following tubes can be used in their stead (maximum current per tube in *ma.* is given in parentheses following the tube's number): 6AC7 (50); 6B4-G (100); 686 (60); 6F6 (50); 6G6 (20); 6K6 (40); 6L6 (100); 6V6 (60); 6W6 (50); 6Y6 (70).

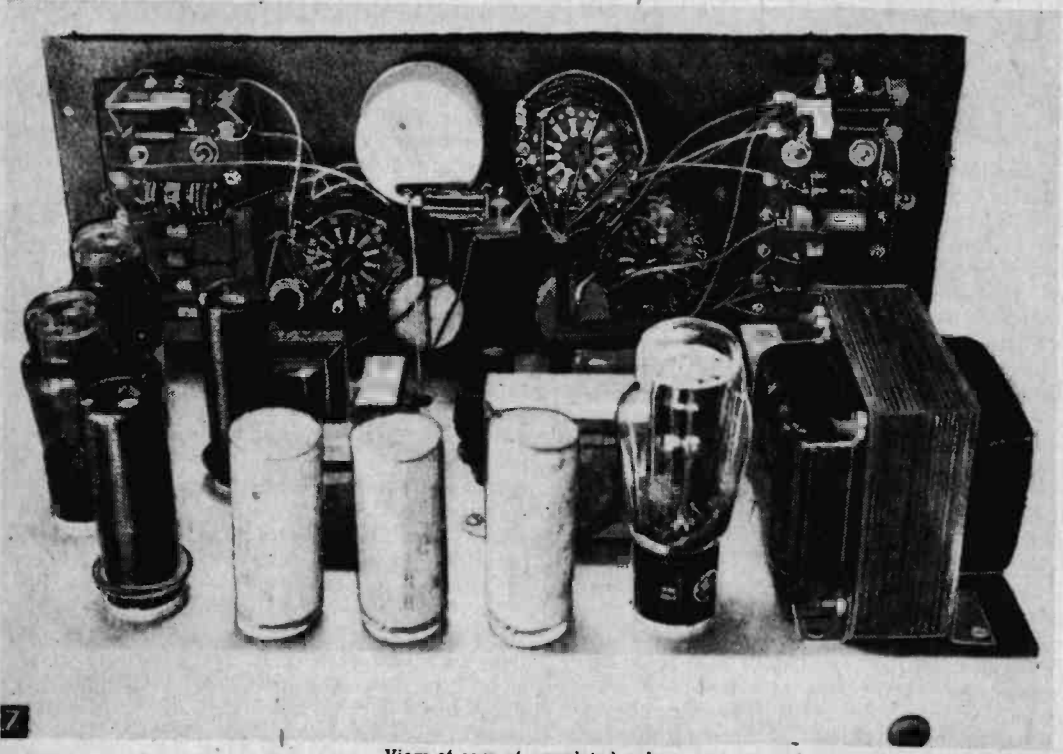
On the other variable control system, the filter section output is connected to the single control tube (V5, Fig. 2) through control switch S5 which provides a high or low range (the low range being secured through dropping resistor R6), and an Off position. In the Off position of S5, the current being drawn through the multi-tube control system can be measured on meter M2, the voltage simultaneously on meter M1.

The filament-bias supply consists of three separate transformers with outputs wired in varying series arrangements through the filament selector switch S3. For *d-c* output, these voltages are fed through S3 into a selenium rectifier circuit with a rheostat-controlled output to compensate for the varying load which might be drawn from the supply (one or more tubes in either series or parallel) causing different voltage drops within the filtering system.

The bias supply is varied by changing the input into the rectifier-filter system so as to present a more constant loading to the external circuit under test. A dual section filter is used, with high impedance chokes. Load resistor R5 can be omitted from the circuit if an external resistance is always used in the circuit under test. R5 can

6 ORIENTATION OF UNDER-CHASSIS





7

View of rear of completed unit.

MATERIALS LIST—EXPERIMENTER'S POWER SUPPLY

R1—2500 ohm, 4 watt potentiometer
R2—20 ohm, 25 watt, wire wound
R3—60 ohm, 100 watt rheostat
R4, R7—70K 4 watt potentiometer
R5—5 megohm, ½ watt
R6—2500 ohm, 5 watt wire wound
R8—12,000 ohm, 1 watt, 1%
R9—60,000 ohm, 1 watt, 1%
R10—120,000 ohm, 1 watt, 1%
R11—1200 ohm, 1 watt, 1%
R12—1.45 ohm, 1%
R13—3.20 ohm, 1%
R14—6,000 ohm, 1 watt, 1%
R15—50,000 ohm, 1 watt, 1%
R16—100,000 ohm, 1 watt, 1%
R17—.275 ohm, 1%
R18—.72 ohm, 1%
R19—1.71 ohm, 1%
R20—4.36 ohm, 1%
R21—5,000 ohm, 1 watt, 1%
C1, C2—50 mf., 50 v., electrolytic
C3, C4—15 mf., 30 v., electrolytic
C5—30 mf., 30 v., electrolytic
C6, C7, C8—8 mf., 500 v., electrolytic
L1—2 Hy at 200 ma. (Stancor C-2325)
L2, L3—20 Hy at 15 ma. (Stancor C-1515)
L4, L5—2 Hy at 250 ma. (Stancor C-2991)
S1, S2, S4—SPST toggle switches
S3—4 pole, 9 position rotary switches (Mallory 1341L)
S5—2 pole, 3 position rotary switch (Mallory 3223J)
S6, S7—3 pole, 7 position rotary switches (Mallory 1331L)
V1—5U4G
V2, V3, V4, V5—6L6 (see text)
PL1, PL2—6.3 v. pilot lights
F1—¼ amp. Littelfuse
F2—2 amp. Littelfuse
SR1—200 ma. selenium rectifier
SR2—20 ma. selenium rectifier
M1, M2—5 ma. meter (see text)
T1—Sec: 6.3 v. at 2 A: 25 v. at 1 amp.
T2—Sec: 18 v., tapped at 6 v. and 12 v. ("Tri-Volt" Bell transformer)
T3—Sec: 6.3 v. at 1.2 amp. (Merit P-3074)
T4—Sec: 400-0-400 v. at 200 ma., 5 v. at 3 amp., 6.3 v. at 5 amp. (Thordarson 24R07)
Chassis and Cabinet (see text)
Knobs, binding posts, pilot light holders, etc.

also be reduced to a value as low as .5 megohm (which will cause a higher "bleeder" current, thus reducing the capacity of the supply) if it is felt that little, if any current will be drawn from the bias supply.

The values for resistors R8 through R21 will depend upon the internal resistance of the meters M1 and M2 which you use. The values given in the Materials List for R8 through R21 were calculated for the meters that we used. Formulas for determining these values are:

$R = \frac{1000 \times E}{I}$, where R is the size of the unknown series resistor in ohms, E is the upper limit of the desired voltage range, and I is the full scale deflection (in *ma.*) of the meter; and

$R = \frac{i \times r}{I}$, where R is the size of the unknown shunt resistor in ohms, *i* is the full scale deflection (in *ma.*) of the meter, *r* is the resistance of the meter, and I is the upper limit of the desired current range (in *ma.*).

Construction. The circuit components required for this power supply are inexpensive and readily available; parts mentioned by manufacturer's name and model numbers in the Materials List are ideally suited for use with the unit, but substitutions of equivalent parts and values can and should be made at will to keep the unit's cost as low as possible. For example, a single 100-ohm, 25-watt rheostat would be the ideal component to use for d-c filament control, but we had R2 and R3 on hand and they work quite satisfactorily. Filament transformer T1 is a surplus item, but any 25 v. transformer could have been used, and the second 6.3 volt supply furnished either by paralleling T3 or providing an additional 6.3 volt transformer, depending on current needs. The 5 *ma.* meters used were also on hand, but 1 *ma.* meters would have been better suited to the applications. Since the 5 *ma.* meters draw appreciable current, the bias scales were calibrated to read what the voltage *will be* with the meters out of the circuit, since it was contemplated that no current would be drawn from the bias supply and that the meters would be used for other purposes during tests.

Parts placement on the chassis is of little importance except that heavy components should be placed near the edge of the chassis for better support. The shunts for the meters are mounted on a plastic plate which is then mounted on the meter terminals. This saves space, wiring, and simplifies meter removal if such removal should prove necessary.

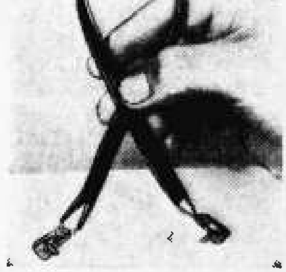
The chassis and panel layout are planned together and, whenever possible, parts on the chassis should be placed reasonably close to related controls on the panel. We used a 3 x 11 x 17-in. chassis in a 9 x 12 x 18-in. cabinet, but you may want to use units of slightly different size depending upon what you have available in your parts box.

Panel arrangements are often overlooked when designing equipment. Symmetrical arrangements (Fig. 2) not only look well, but when well-planned are also logical; that is, controls related to each other (or to meters, jacks, etc.) are placed together. Controls which are used the most should have the greatest clearance for fingers, and all controls should be located reasonably clear of the high voltage terminals. With large posts mounted, wire according to the schematic and pictorial wiring diagrams (Figs. 3, 4, 5 and 6) and your unit's ready for use.

The use of decal letters, dials and symbols (as in Fig. 1) not only improve the appearance of the panel, but also make the usage simpler and more efficient.

Use TV Lead-in for Radio Lead-in

• Odd pieces of twin TV lead-in or transmission lines may be used as shown in photo at right for window lead-in cables for radios. Attach a couple of clips such as used on dry batteries to the two ends of wire of the twin line to complete the job.—H. L.



1

Earphone "speaker" protruding through plastic case will, under favorable reception conditions, provide enough volume for listening at a maximum distance of a few feet, as shown here.

Down to an absolute minimum, the cabinet dimensions for this set are a minute 1¼ x 3 inches

Transistor Wrist Radio Uses Earphone "Speaker"

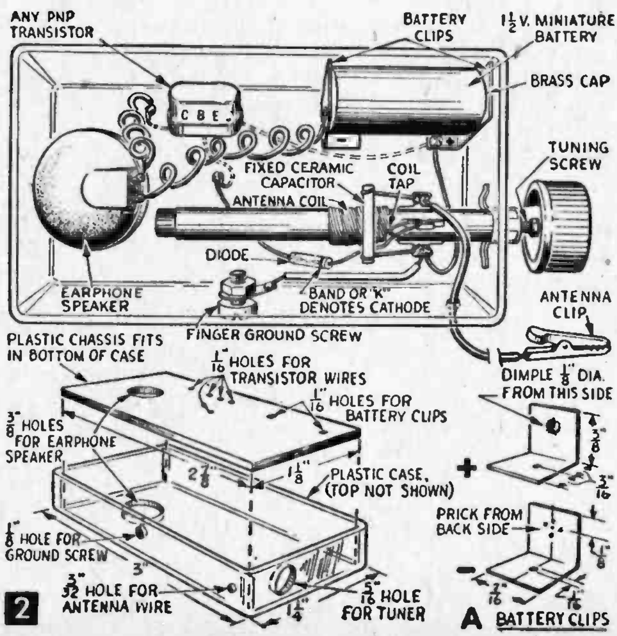
IN ORDER to make this little wrist radio easy-to-construct, no printed circuits, special jeweler-made parts or other gimmicks are used. A hearing aid phone installed in the case serves as a speaker of limited range (see Fig. 1). In localities where reception is weak, the removable hearing aid phone may be taken out of the set and used as an earphone. The set dimensions for this self-contained, transistor radio are the absolute minimum for a tuneable set which uses parts available from any radio supply house.

The radio case is a transparent ¾ x 1¼ x 3 in. plastic trinket box. Cut a 1⅛ x 2⅞ in. plastic chassis from thin Bakelite or fiber to make a snug fit inside the case. This plastic plate provides a rigid mounting for the transistor and battery clips and allows you to complete all wiring before mounting the finished radio in the case.

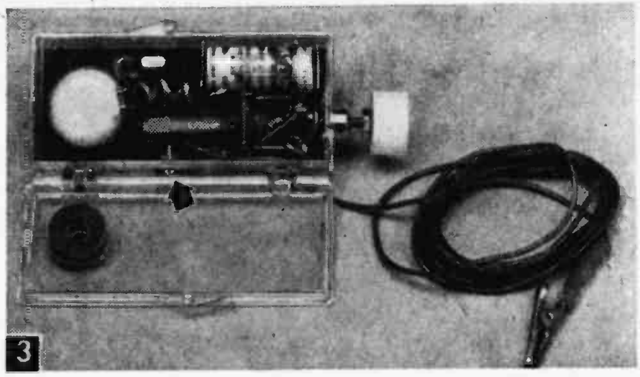
Form the battery clips from small tin strips bent to L-shape as in Fig. 2A. To save the space taken up by conventional mounting screws, rivet clips to the chassis with #3 pure copper tacks. Insert the tack through bottom of chassis, clip off all but 1/16 of the excess, then peen with a small hammer with chassis resting on a steel block or anvil-vise.

Mount the transistor, Fig. 2, by drilling three 1/64-in. holes and inserting the leads through the openings in chassis. Drill two additional holes adjacent to the transistor and thread B (base) and C (Collector) leads of transistor to topside of the Bakelite chassis plate. Run the E (emitter) transistor lead directly to the plus battery clip and solder (Fig. 2). Make small loops with tweezers in the transistor B and C pigtail leads; these loops form tiny lugs to which the diode is soldered to B and one of the earphone leads to C.

When soldering the transistor and diode, be sure to push a wad of wet cleansing tissue against the wires so heat from the soldering iron is not transmitted into these delicate parts.



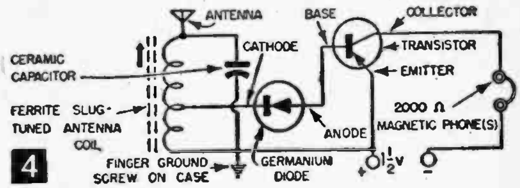
2



Touching head of machine screw (see arrow) greatly increases the volume of this miniature set.

MATERIALS LIST—TRANSISTOR WRIST RADIO

Amt.	Description
1	plastic box, 3/4 x 1 1/4 x 3 in.
1	Bakelite chassis plate, 1/16 in. thick x 1 1/8 x 2 7/8 in.
1	Ferrite adjustable screw antenna coil (Tuner Ferri-Loopstick 51C036)
1	100 mmf. ceramic capacitor (to tune 1500 to 880 kc.)
	OR
1	270 mmf. ceramic capacitor (to tune 880 to 550 kc.)
1	Diode detector (any germanium general purpose type)
1	Transistor (any PNP inexpensive type)
1	Magnetic type earphone (1500 to 10,000 ohms. Do not confuse with crystal phones of similar appearance)
	Miscellaneous hardware—see text



The tuner is a ferrite slug-tuned loop antenna coil, such as is used for regular superhet radios. Unsolder the outside coil lead from its terminal lug and unwind the coil until 21-inches of wire have been removed. At this point, carefully scrape away the cotton insulation, form a tiny loop or twist for the tap, then rewind the wire and resolder to the lug. The small loop is the tap point for connecting the cathode (or banded) end of the diode detector. Some loops are now provided with a blank lug. This lug may be used to terminate the tap lead, thus insuring a rigid terminal point.

A fixed ceramic capacitor connected across the loop determines the set's tuning range. To tune from 1500 to about 880 *kc.*, use a 100 *mmf.* capacitor. Use a 270 *mmf.* capacitor to tune from 880 to 550 *kc.* Attach capacitor to coil before mounting coil in plastic case, as it might be burned by iron working in close quarters. Also connect the antenna and ground leads to the coil lugs at this time.

Note that the tuning coil is mounted in the end of the plastic box (Fig. 3). A snap-mount clip on the end of the coil causes the coil to lock in place when pushed into the 5/16-in. hole drilled in the end of the case. Always push from the end of the coil and never apply pressure to the coil lugs as they will break off.

A standard miniature magnetic earphone (crystal types won't work) is inserted through a 3/8-in. hole drilled through both the Bakelite chassis and plastic case. (You can set aside the plug-in cord provided with the earset for future use.) Make the connection to the earphone "speaker" with small escutcheon pins or brads (your local hardware store has them). If pins are too long, clip off excess metal with wire cutters. Do not solder leads to pins while in phone.

To make the larger holes in the case, for the earphone and tuning coil, first drill small holes through the plastic; then enlarge these with a burring reamer. These inexpensive hand reamers are one of the few tools which will drill a smooth, even hole in plastic, to the exact size required. The 1/8 through 1/2-in. size, available from hardware stores, is ideal for radio work.

Drill a 1/16-in. hole through the side of the plastic case for the flexible antenna lead. Attach a small battery clip to the antenna wire for signal pickup. When using the radio, you can attach this clip to the finger stop of your dial phone (Fig. 1) or any metal part of a rural phone will do, too. If the direct connection with a phone overloads the set and makes for very broad tuning, attach the clip to a pie tin or piece of aluminum cooking foil and set the phone on the metal plate. A water pipe, lamp fixture or the like may also make a good antenna.

In some localities, if the signal is weak, you can increase it 100% by using the human body as a counterpoise antenna (ground). Note that a binding head machine screw (see arrow in Fig. 3) has been attached to the side of the case. A lead connects from this screw to the ground-side lug of the tuning coil. Touching this screw with your thumb or finger will make the volume zoom. You'll find, in fact, that the pressure applied to the screw will vary the volume. So relaxing the tension of your touch will retard the volume without turning dials.

To secure the earphone in the case without damaging it, while still allowing it to be easily removed, we merely cemented a sponge rubber grommet inside the cover of the plastic case (Fig. 3). Of course, a piece of thick felt will also serve as a suitable retainer.

This radio operates on a single 1½ volt transistor hearing aid battery costing about 15¢. Any cell measuring 7/16 in. diameter and 1⅛ in. long will do. Typical batteries available from any local hearing aid dealer are Eveready #E340E, Zenith N, and Ray-O-Vac #716. No switch is provided . . . nor needed. A strip of adhesive or Scotch cellophane tape is wound around the cell and joined with a tab. To remove the cell, merely pull on the tape tab, and battery comes out easily.—Thomas A. Blanchard.

Battery Charger

for Photo-Flash and Flashlight Cells

1

Charging on the dry-cell recharger brought this cell from its .74 reading on the tester up to the .8 new-cell reading.

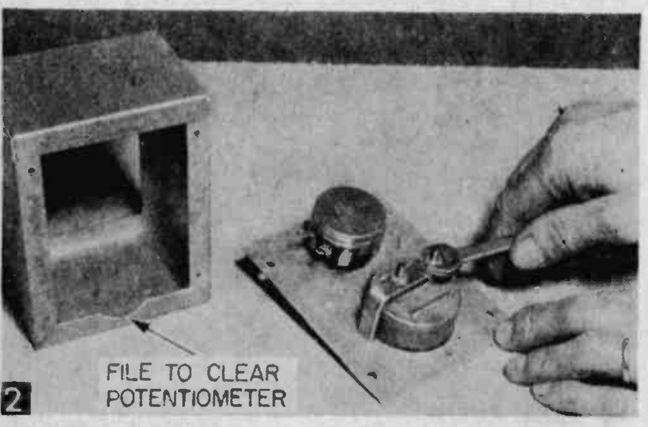
PHOTOGRAPHERS who use flash bulbs will find they can prolong the life of battery cells by giving them a boost with this charger after about every 30 to 40 shots. Also of value to those who use flashlights constantly, this charger can accommodate three sizes of cells—singly or in combination. Naturally, a single cell is recharged more quickly, or in about one to three minutes, while with three cells in the clips it may take about three times as long.

To build, first fit milliammeter and wire-wound potentiometer, used as a variable resistance, to the front panel of a gray-finished utility cabinet (Figs. 2 and 3). Some meters use small screws and nuts around the front rim but the one illustrated has a U supporting clip with insulating washers that fit over meter terminals for clamping. File a section out of the lower rim of the cabinet (Fig. 2) for potentiometer clearance. Next, attach the filament transformer to the cabinet bottom with screws and nuts and bring the line cord in through a rubber grommet. Insert the S. P. switch and fix it with the locknut (Fig. 3). Attach rubber feet to the underside of the cabinet with 4-40 screws and nuts.

Make a terminal board from 3/16-in. clear plastic or *Bakelite* and also cell terminals of brass or phosphor bronze strips and clips (Fig. 4) which attach to the board with 4-40 x 3/16-in. screws in tapped holes. These short screws will not go entirely through the plastic to ground to the metal box. Attach a plastic-insulated stranded #24 gage wire lead at an end screw at each strip assembly, then drill holes to pass the wires into the cabinet (Fig. 3).

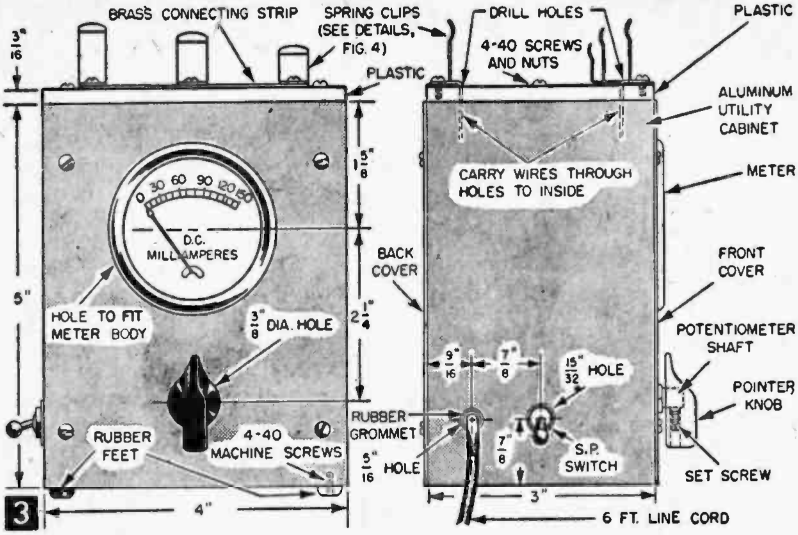
The two yellow terminals usually found on rectifiers are for a-c or input connections from the transformer secondary, the red one is the positive d-c terminal and the two bridged together with a soldered jumper is the negative d-c terminal (Figs. 5 and 6). Solder the wires to the resistance control, leaving one blank, then mount the rectifier to the right side of the cabinet with a 4-40 center screw and nut. Solder all connections except those at the meter. If meter terminals are not marked plus and minus, it may be necessary to interchange them later if the meter reads down scale. Drill 24 holes in the back cover of cabinet for ventilation (Fig. 7). Attach covers with screws supplied.

After all connections are made, plug in the unit and check for d-c polarity at the cell terminals. A voltmeter with marked plus and minus terminals can be used or two leads equipped with spring clips can be attached to the clips and their ends then placed in strong salt water. Bubbles will appear around the *negative* lead which should go to the back strip. The other lead goes to the



2

Variable resistor has been mounted to the front cover and meter is being installed. Note curve filed in case for clearance.

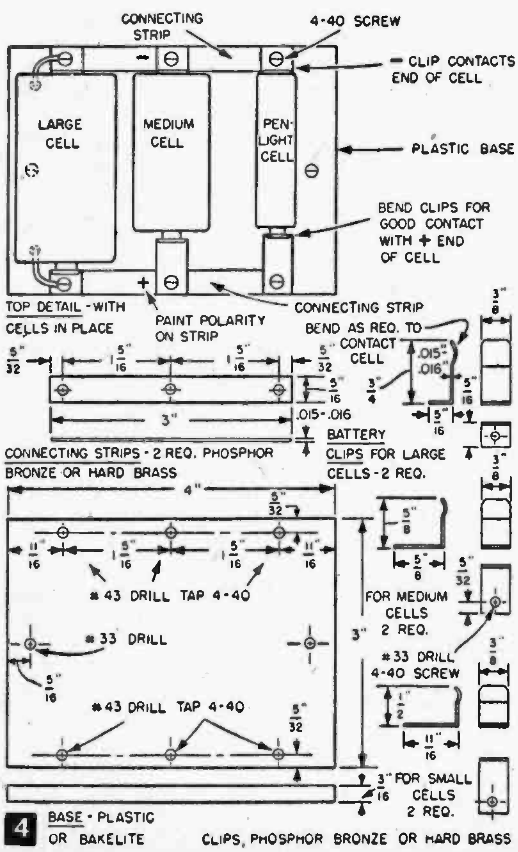


3

positive strip at the front. Mark the strips for quick identification. Always place cells in the clips with the positive terminals toward the front.

Although a recharged cell need not be tested after charging, you can use a low-reading d-c voltmeter, having a fairly high resistance, to test it. Or, you can use the tester described in this handbook on pages 142-144. With this tester, a good or new cell will register about .8 on the meter. The cell we tested showed .74 (Fig. 8A). After being charged for two minutes at 120 ma. the reading was .8 (Fig. 8B). Along with two others similarly recharged, this cell has since been used intermittently for about three months and is still going strong with periodic recharging.

To illustrate that voltage is increased, we charged a cell showing but 1.27 on a voltmeter (Fig. 9A) for five minutes at 120 ma. A second meter reading showed 1.40 (Fig. 9B). Another short boost brought the voltage up to 1.45 (Fig. 9C). While low cells can often be boosted, the voltage usually drops quickly and they are good only for emergency use. Best results are obtained by recharging for a minute



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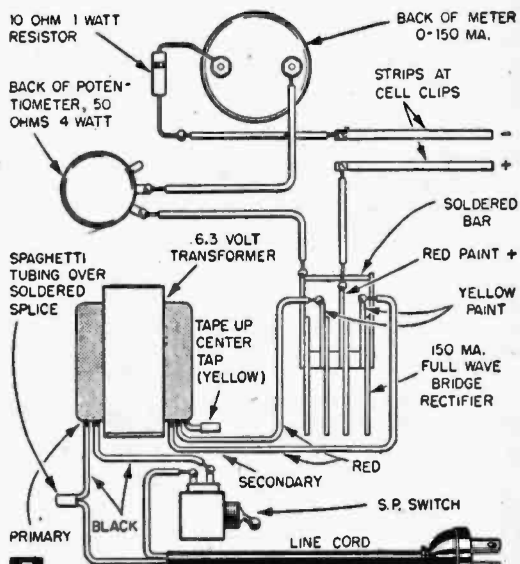
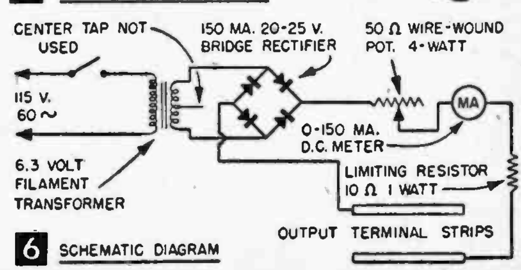
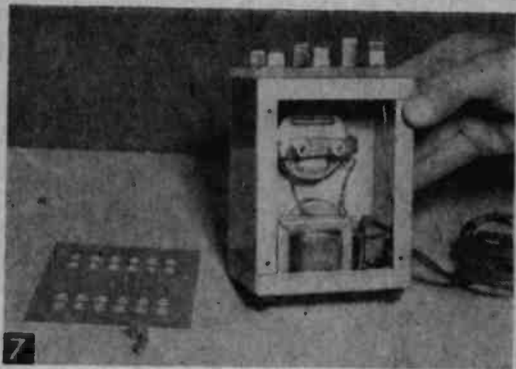


5 PICTORIAL WIRING DIAGRAM



6 SCHEMATIC DIAGRAM


7

Wiring is complete and ventilated back is about to be installed.

MATERIALS LIST—DRY CELL CHARGER

Amt	Description
1	aluminum utility cabinet, hammertone gray finish, ICA 29811 5 x 4 x 3" with removable front and back covers
1	round panel meter, 0-150 d-c milliamperes Shurite #5308
1	50 ohm, 4 watt wire-wound potentiometer IRC Type WPK-50 or Clarostat 3 watt Type 58-50
1	filament transformer, 117v 60 cy. primary, 6.3v at 1.2 amp. secondary. Stancor P-6134, Merit P-3074 or any similar types, such as Triad F-14X.
1	S.P.S.T. toggle switch 3 amp. 125v
1	rubber grommet for 5/16" hole
6 ft	flat rubber line cord #18 conductors
1	attachment plug cap
4	rubber mounting feet or knobs 3/8" O.D. Use type designed for machine screws, such as Allied Radio 44N763
1	pointer type knob for 1/4" shaft
1	10 ohm 1 watt carbon resistor
	Above obtainable from electronic supply houses or Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., or Allied Radio, 100 N. Western Ave., Chicago 80, Ill.
1	Sarkes Tarzian full-wave bridge type selenium rectifier, 4-1" x 1" plates. 150 ma. D.C. 25v rating. Model 154B. (Local supply house or Durrell Distributors, 222 Mystic Ave., Medford, Mass., $1.95 P.P.)
1	piece clear plastic or Bakelite 3/16 x 4 x 3" (scrap from old electrical apparatus or from Forest Products Co., Inc., 131 Portland St., Cambridge, Mass. $0.75 P.P. paid in U.S.)
1	piece hard brass or phosphor bronze about .015-.017 x 3/8 x approx. 12". For strips and cell contact clips (metal supply houses or shops using such material). Misc. screws, nuts, hook-up wire, etc.

or less at 75 (size C cells)-100 (D cells) ma. and for penlight cells, one to three minutes at 30-40 ma. after each prolonged cell use. This usually can be repeated several times before chemical decomposition causes cells to become useless.

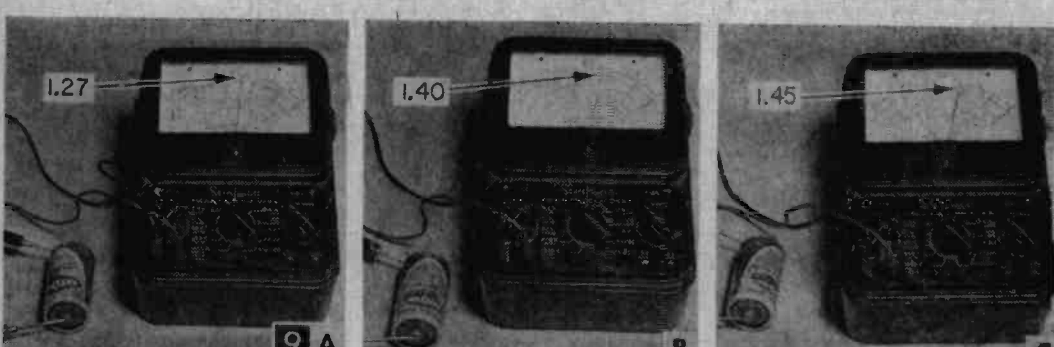

8 A


B

The first tester reading on the cell being recharged in Fig. 1 was .74, above, left. Right, after the recharging, the reading jumped to .8, normal for a new cell.

Good battery cells register about 1.5 to 1.55 on a voltmeter of high resistance, such as 20,000 per volt multimeter. When voltage reads 1.4 or so, charge to bring back to normal. If a flashlight is involved, boost cells when the light is not as bright as it should be. If recharging does not appreciably brighten the light, the cells probably should be discarded.

In general, the charging time and current rate will depend on cell size and condition, smaller cells requiring a lower charging rate and shorter time. If there is noticeable warmth during charging, reduce rate and/or time, as internal heating is harmful to the cell.—Harold P. Strand.



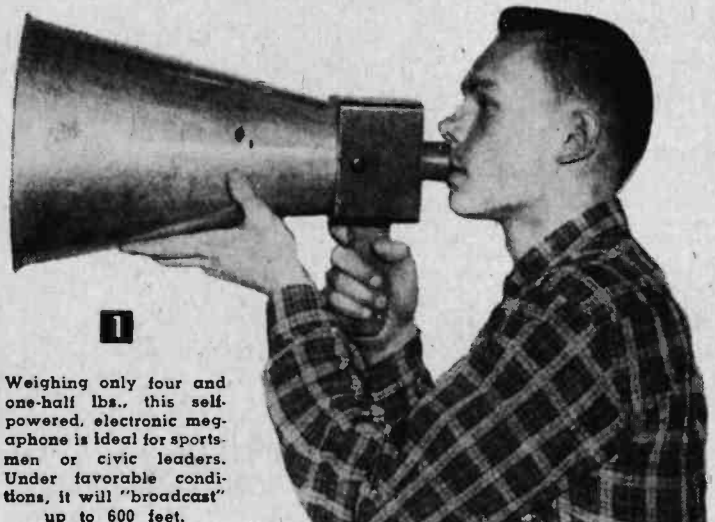
9 A B C

Cell first recorded 1.27, was recharged, then showed 1.4. After a second recharging period, the reading was 1.45. Usually, when a cell takes this much recharging, it will not hold the charge for very long.

Transistorized Electronic Megaphone

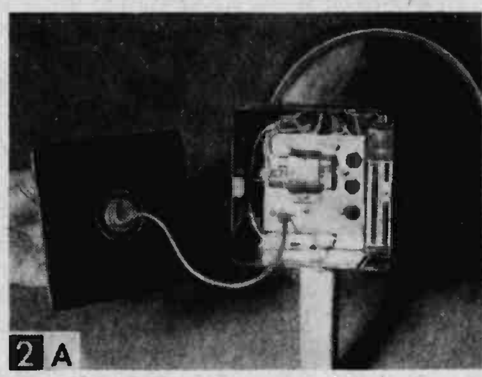
Highly portable, self-contained P.A. with a 500-ft. plus range

By HAROLD P. STRAND

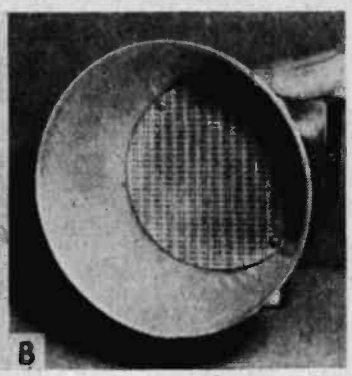


1

Weighing only four and one-half lbs., this self-powered, electronic megaphone is ideal for sportsmen or civic leaders. Under favorable conditions, it will "broadcast" up to 600 feet.



2 A



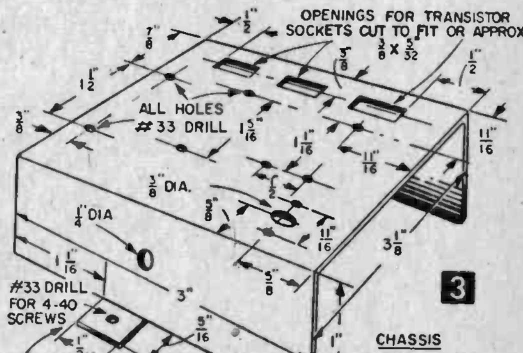
B

Fig. 2A (Left) Cover removed to show housing components (detailed in Figs. 3 and 4). Note small microphone mounted in cover plate at left, with its leads plugged into amplifier chassis. Fig. 2B (Right) Front of megaphone, showing how grille cloth mounted over wooden ring holding speaker presents neatly finished appearance.

WHETHER you skipper your own cabin cruiser, or are active in local civic groups which hold or sponsor sports events, public meetings or rallies, you'll find this highly portable, self-contained "public address" system mighty handy for long distance hollering. Come to think of it, this megaphone might be just what your wife would like to have for summoning the children for supper. It will "broadcast" intelligible speech from 500 to 600 feet, depending on weather conditions.

This unit is designed for medium level voice amplification. Transistors employed in an amplifier circuit allow the use of small, light batteries contained in an attached housing back of the horn (Fig. 2). It has a volume control, although raising or lowering the voice level usually serves to control the output volume. A push-button switch on the pistol grip handle is controlled by the forefinger. Holding the switch closed turns the power on from the 22½ volt battery and the 3 volt bias battery. Releasing the switch eliminates power drain when megaphone is not in use.

Since the *in-use* maximum current drain at the loudest volume level is about 40-50 milliamperes from the 22½ volt battery, and about 2.5 from the 3 volt battery (used as



3

MATERIALS LIST—ELECTRONIC MEGAPHONE

Electronic parts listed below were supplied by Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.

- 1 6" P.M. speaker, 2:15 oz., magnet. Oxford 6EVS 3.2 ohm voice coil or Utah equivalent, with 4-6 watts rating
- 1 Shure microphone, MC-11 controlled reluctance type, 1" diameter
- 3 transistor sockets MS-275
- 3 G. E. 2N44 transistors
- 1 RCA type phono jack and plug
- 10" shielded cable, small diameter (about 1/8" O.D.)
- 1 10,000 ohm miniature volume control VC-34
- 1 Burgess XX15 B battery, 22 1/2 volt
- 2 Burgess #Z penlight cells
- 1 three-prong plug to fit XX15 battery
- 1 AR-109 driver transformer
- 1 AR-138 output transformer
- 1 Argonne 8 mfd 15 volt capacitor, 15v
- 1 47 ohm 1/2 watt resistor
- 1 22,000 ohm 1/2 watt resistor
- 1 1200 ohm 1/2 watt resistor
- 1 #6 solder lug or more if needed for ground conn. (see below)
- 1 Bakelite terminal strip 7 terminals, two grounded, Jones 55-C
- 2 Bakelite terminal strips 2 terminals, one grounded, Jones 51-A (Note: You can use 5 terminals on first and 1 terminal on second strip mentioned above, all lugs to be insulated and use solder lugs under chassis screws for ground connections)
- 1 miniature knob for 1/8" shaft MS-185
- 1 piece plastic grille cloth about 7 x 7"
- 1 D.P.S.T. push leaf switch, Switchcraft 1004 or Mallory 1014
- 1 speaker cone made of half-hard .032 sheet alum., riveted or with lock seam, front end rolled bead, 12 3/4" long, 9 1/2" O.D. large end, 4" O.D. small end. Robert Towne, 49 Abbott Avenue, Everett, Mass., will make them for our readers for $7.25 P.P. in U.S., express or money order

BAKELITE—supplied by Forest Products Co., 131 Portland Street, Cambridge, Mass., for $3.00 P.P. in U.S., express or money order.

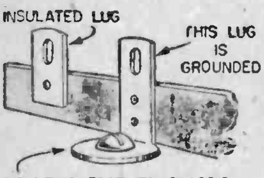
- 1 pc black paper base 1/4 x 5 x 5". Cut and dress to tightly fit inside housing
- 1 pc black paper base 1/8 x 5 x 5". Cut and dress to fit on outside front of housing
- 2 pcs linen base natural finish 1/8 x 5 x 2 1/4" (handle sides)
- 1 pc paper base natural finish tubing 1 1/2" O.D., 1/16" wall, 1 7/8" long (mouthpiece)

MISCELLANEOUS METAL AND WOOD STOCK (Try local metal-working and cabinet shops)

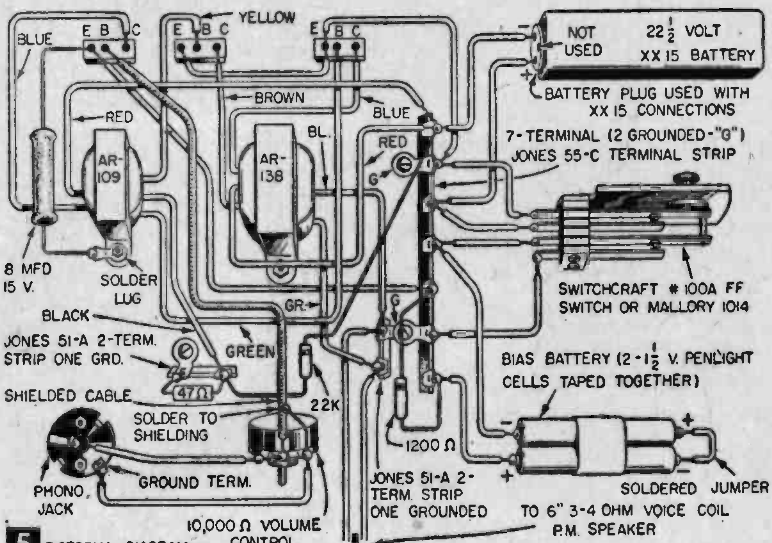
- 1 pc aluminum about .050 x 3 x 5 3/4" (chassis)
- 1 pc aluminum half-hard alloy or material that can be bent but has reasonable rigidity, 1/8" x 13/16" x about 11 3/4" (handle frame)
- 1 pc aluminum half-hard alloy about .040-.045 x 3 9/16 x 18 1/2" (housing) can also use soft sheet steel about .034"
- 1 pc aluminum half-hard alloy 3/32 or 1/8" x 5/8" x about 17". Bend to form speaker U bracket support
- 1 pc hard brass or phosphor bronze about .010 x 2 3/8 x 7/8" (clip for bias battery)
- 1 pc dry maple or birch 3/4 x 4 1/2 x 4 1/2". Turn to tapered disc to fit tightly in small end of cone
- 1 pc hardwood plywood such as birch 1/4 x 7 x 7". Cut-out ring to hold speaker in cone

Misc. hook-up wire, screws, nuts, paint. Pliobond cement, etc.

Note—Pure aluminum bends too easily for our purpose. What is commonly called half-hard can be formed or bent but is strong and rigid. Some trade numbers are 3003H14 half-hard, 11H14 half-hard and 5052H34 quarter-hard. Any similar type could be used where a test shows it workable for bending but as rigid as soft steel. Lightness of aluminum makes it ideal for keeping megaphone light. Usually supply houses do not sell small quantities so it has to be picked up in shops using this stock.



Terminal strips 55-C and 51-A have grounded lugs as shown above for connection of leads going to ground. If strips with all lugs insulated are used, simply use solder lugs under chassis screws for ground connections, as at AR-109 transformer feet.

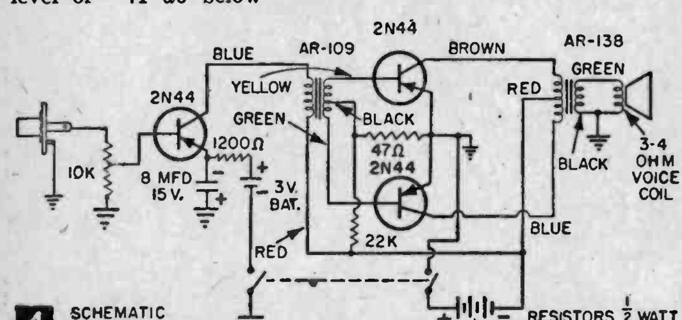


5 PICTORIAL DIAGRAM

bias in the emitter of the driver stage), battery life should be quite high.

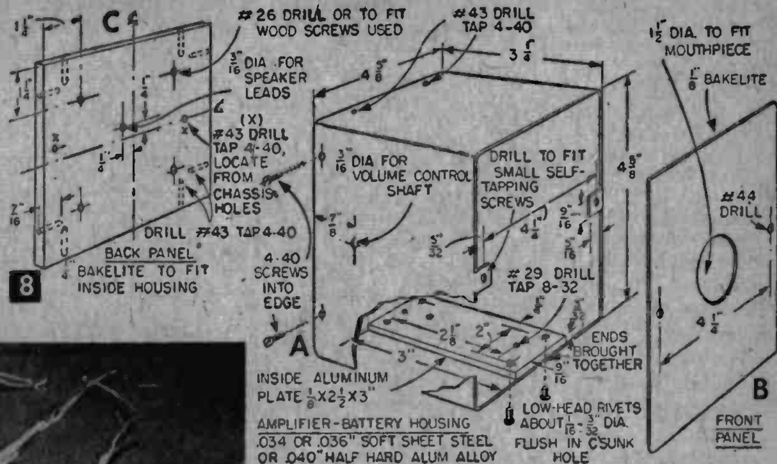
The Shure controlled-reluctance type microphone has an output level of —71 *db* below one volt per microbar, and an impedance of 1000 ohms. It is only one inch in diameter. It is mounted in a Bakelite tube, which also serves as the mouthpiece (Fig. 2).

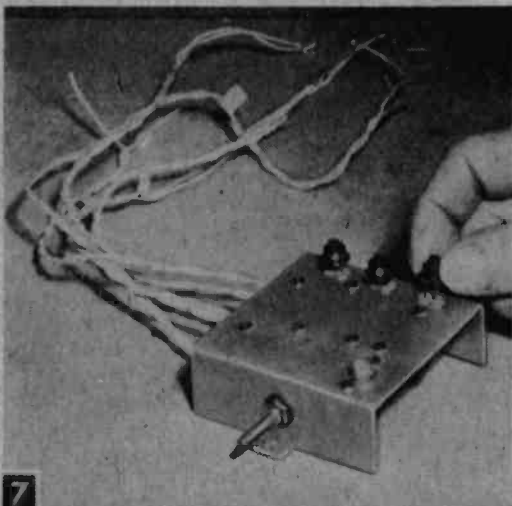
The 6 in. permanent magnet type speaker with its 2.15 ounce Alnico magnet is fixed part way down in the cone as in Fig. 2. The three G.E. 2N44 transistors in a push-pull circuit which power



4 SCHEMATIC DIAGRAM

the unit, have much higher collector power dissipation than ordinary transistor radio types, such as the 2N107. In addition, the AR-138 output transformer, used can handle more power than the AR-119 or 120 as usually used in radios. Thus you get a surprising volume from this miniature equipment.





7 Test-mounting three audio transistors in their sockets. Leads from these transistors will need to be cut off to about 7/16-in. length with diagonal pliers, but transistors should not be permanently placed in sockets until megaphone assembly is complete, ready for cover plate to be put on (Fig. 2A). Wire leads to batteries, switch and speaker are identified with marked tabs of white tape to assure correct connections. Plus battery lead is also marked to avoid error.

Parts for this megaphone should cost you from $35 to $40, which is only about two-thirds the cost of a typical commercial unit.

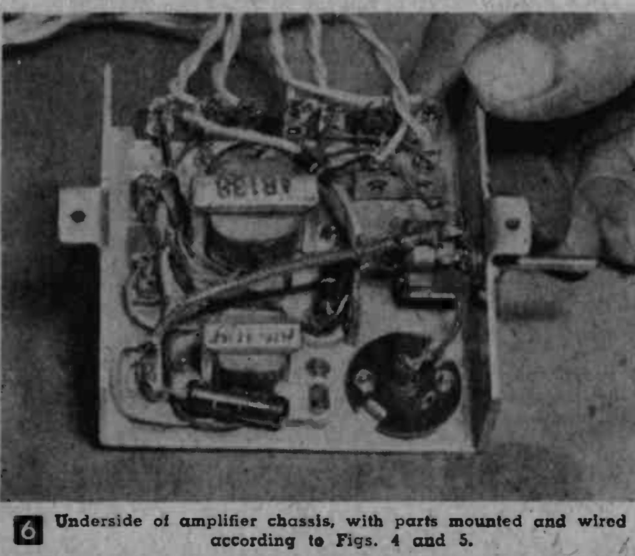
Building the Amplifier. Bend up the chassis from sheet aluminum and drill openings for components as in Fig. 3. Figs. 6 and 7 show both sides of this chassis with all parts mounted. Note terminal strip at one end (Fig. 6) for leads to battery, speaker and switch. The input from the mike is at a phono jack in the top of the chassis and the volume control is placed in a side opening, where its shaft will project through the housing for an outside control with a knob.

Use a short piece of shielded wire from volume control to base of first transistor, since this is a sensitive input lead and grounding the shield prevents or minimizes possible hum. Place two small terminal strips in the chassis as in Fig. 5, to provide tie points for soldering leads.

You won't need much hook-up wire in this circuit as the transformers come equipped with leads that are carried to the proper points and soldered. Use only rosin-core solder and apply enough heat from a small iron or soldering gun to fully flow the solder. In making connections to terminal strips, make sure the lugs grounded to the chassis are used for ground connections *only*, as indicated in Fig. 5. If you use other types of terminals by the way, where all lugs are insulated, provide small solder lugs under chassis screws for ground connections.

Next lay out pattern for the amplifier housing (Fig. 8) on sheet aluminum or soft sheet steel (about .034 in.). Housing can be bent over a piece of angle iron in the vise (Fig. 9). Make sure the box is square.

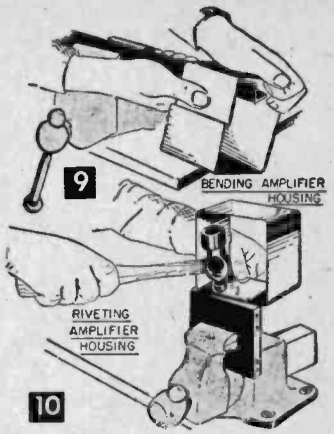
After bending up the housing, bring its two edges together and rivet a piece of ⅛ in. thick aluminum placed inside over the joint (Fig. 10). Drill holes for the short 3/32 in. brass



6 Underside of amplifier chassis, with parts mounted and wired according to Figs. 4 and 5.

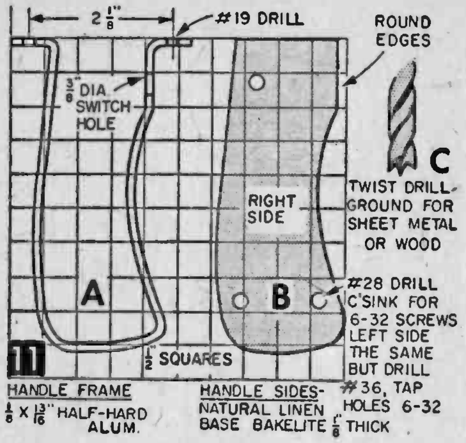
Forming the amplifier's sheet metal housing, using the rounded edge of a piece of angle iron held in the vise.

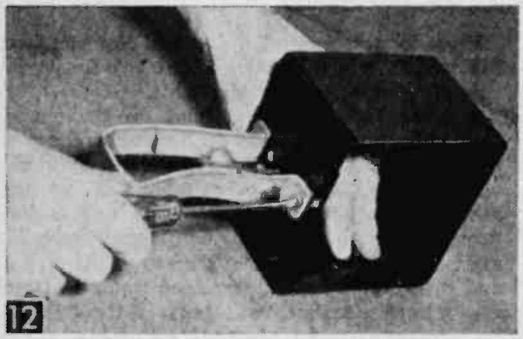
Edges of shaped housing are brought together and riveted to an aluminum plate.



rivets, and head the rivets over on the inside in countersunk holes so that the rivets will come flush.

To form the frame for the pistol grip handle





After fastening switch through its hole in handle with locknuts, attach handle frame to amplifier housing. Note that housing has been finished with primer, then black enamel lightly rubbed with steel wool.

which is of aluminum stock about 3/32 to 1/8 in. thick and soft enough to be bent, lay out the pattern (Fig. 11A) on paper with 1/2 in. squares. Then, carefully bend the aluminum stock to its proper shape over various forming pieces held in the vise.

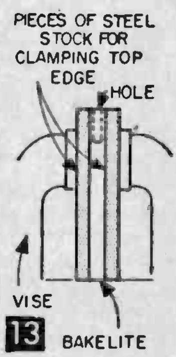
Install the switch in its hole with locknuts and attach the handle frame to the housing, using two 8-32 machine screws in holes drilled and tapped into the housing and inside plate (Fig. 12).

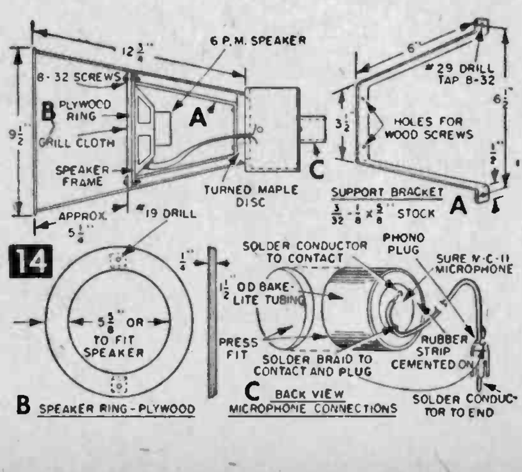
Because the aluminum cone could be difficult for an amateur to make we recommend you purchase one as indicated in the materials list, or have your local tinsmith make one up for you (Fig. 1). These commercial ones have a neat rolled bead at the front end which helps to stiffen the cone.

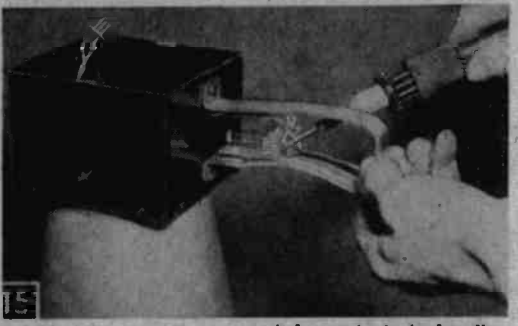
To assemble the speaker, you'll need a hardwood disc which fits tightly in the 4 in. end of the cone (Fig. 14). Turn this from maple in any woodturning lathe, giving it a taper to properly fit and come flush with the end. Insert it from the large end of the cone, tapping it down into place. Fasten it with four 3/8 or 1/2 in. #7 flathead brass wood screws, inserted through the aluminum and into the wood disc in holes spaced and drilled equally around the circumference. Pliobond cement on the disc edges will further insure its remaining in place.

Figure 14 shows how a piece of 1/4 in. thick black Bakelite, which was carefully cut and fitted to the inside dimensions of the housing as in Fig. 8E, is attached to the maple disc in the end of the cone, using four 3/4 in. #9 roundhead wood screws. Holes for these screws must also be drilled in the maple block so you won't split the wood. Next fit the Bakelite panel into the amplifier housing until it is flush with the edge, and use 4-40 machine screws in drilled and tapped holes to secure it.

Make sure when doing this fitting the switch button is on side of housing nearest speaker cone, and tabs on housing are on the end of housing away from cone. When drilling and tapping Bakelite in its edge, by the way, clamp the Bakelite in a vise so the tap will not tend to split the material, since it splits rather easily in end grain. You can drill the required holes in the metal with







Soldering connections to switch terminals in handle of megaphone—see Fig. 5.

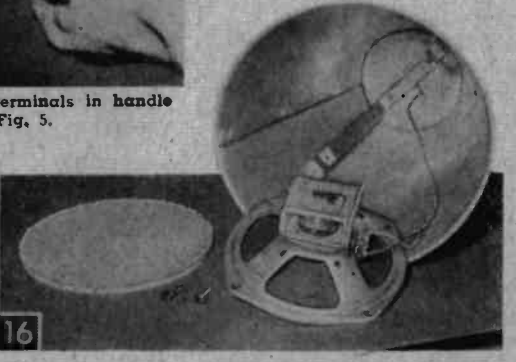
Bakelite in place, but only allow drill enough of a depression in the Bakelite to mark where to drill for tapping. Use a #33 drill through the metal and then change to a #43 drill for making the holes in the piece of Bakelite. Then use a 4-40 tap in each drilled hole.

Before fitting the amplifier to the Bakelite piece you have already attached to the cone, first drill a #29 drill hole through the Bakelite *and* also the wood disc in the cone just off the center (Fig. 8E), for the speaker wires. Pass the speaker leads through this hole and then fit the amplifier chassis against the Bakelite piece and secure it (Figs. 2A and 3), making sure the control knob shaft is allowed to project through the hole for it drilled in the side of the housing. The chassis should also be so located in the housing so that the 22½ volt XX15 battery will fit between the chassis and the housing (Fig. 2A) when wedged with a folded piece of cardboard.

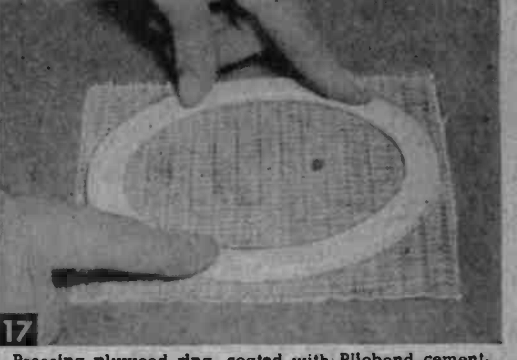
The switch contact wires are brought through their hole (Fig. 8C) in bottom of the case, and connected as shown in Fig. 5 and Fig. 15. Solder a plug to the two leads that go to the battery and make a knot in one of them which will easily identify the *plus* lead for you. Examination of the way the three-prong plug fits in the battery quickly shows which terminal of the plug is plus.

Mounting the Speaker. Figure 14 shows how the speaker is held part way down in the cone by mounting it to a support that is bent up from any light metal, as in Fig. 14A. Since the size of the cone and the speaker size may vary a little, the exact length of the bracket is not given. But it should be such that the screws used to secure the speaker ring (Fig. 14) will pull the ring down tightly in the taper of the cone, coming to rest with the speaker against the support at two of its mounting holes. Fig. 16 shows the bracket support attached to the wood disc at the base of the cone. Note that the leads have already been soldered to the speaker terminals.

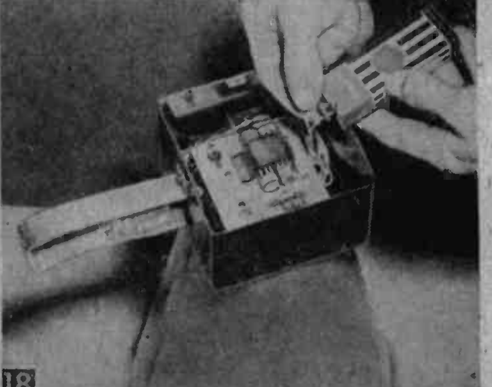
After jigsawing out the plywood ring which fits over the front of the speaker (Fig. 14), cement plastic grille cloth to the ring with Pliobond cement (Fig. 17). After this dries, trim off cloth around the ring with scissors. Make two holes in the ring for the two 8-32 machine screws that turn into the ends of the speaker support in tapped holes.



Note speaker supporting U-bracket attached to wood disc at far end of horn. Speaker will mount against this bracket and grille cloth-covered wood ring at left will cover front of speaker. Note connected speaker leads going back through wood disc to amplifier.



Pressing plywood ring, coated with Pliobond cement, down firmly onto square of grille cloth.



Installing 22½ volt B-battery in amplifier housing. See Fig. 2A for battery position in housing.

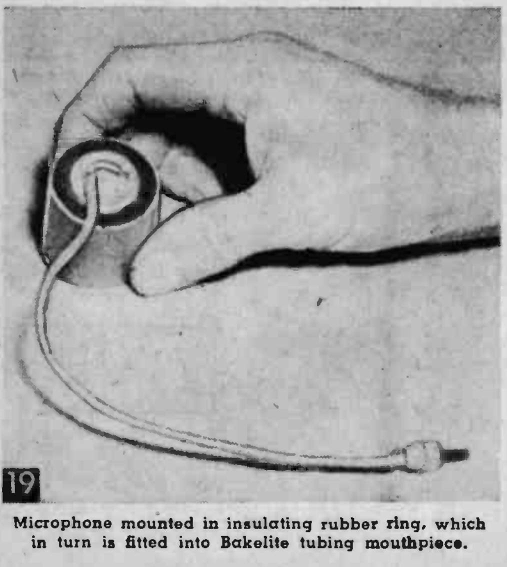
CLIP HOLDER FOR BIAS BATTERY MATERIAL—.010" HARD BRASS OR PHOSPHOR BRONZE

You can now connect the 22½ volt battery and place it between the chassis and the housing (Fig. 18) using folded cardboard to wedge it tightly in place. You can also place the transistors in their sockets now.

Mounting the Mike. The microphone mounts in a rubber strip which in turn is cemented into a 1½ in. diameter Bakelite tubing mouthpiece (Fig. 2A, 14A and C, and 19). The mouthpiece then fits tightly in a hole made in the front Bakelite housing cover, using a fly cutter in the drill press. Before installing mike in the mouthpiece tube, connect a 6 in. length of shielded flexible wire to the terminals and a phonoplug to the other end (Fig. 2A and 14C). Make up the strip into which the mike will mount from the type of sponge rubber used to seal car trunks and doors; it is sold in auto supply stores. This rubber should be about ¼ in. thick, ½ in. wide and long enough to be formed around the mike and have its ends meet. Apply Pliobond cement to outside edge of mike and one surface of the rubber. Then, after a few seconds wrap the piece around the mike, tie with string and let dry for about an hour. Then untie string, apply cement to outside surface of rubber, and press the assembly of mike and rubber in mouthpiece tube until about flush with the end (Fig. 20).

Attach the 3-volt bias battery, consisting of two penlight cells in series, to the chassis under a spring clip bent up from thin hard brass or phosphor bronze (Fig. 18A). The leads were soldered to the battery terminals (Fig. 5). To enclose the megaphone handle, make up Bakelite sides as shown in Fig. 11C, and attach to handle frame with screws and Pliobond cement.

Using the Megaphone. If you test the megaphone indoors in a small room, you may find a whistle will develop when you press the pushbutton and try to talk. This is because sound bounces from walls and enters the microphone to



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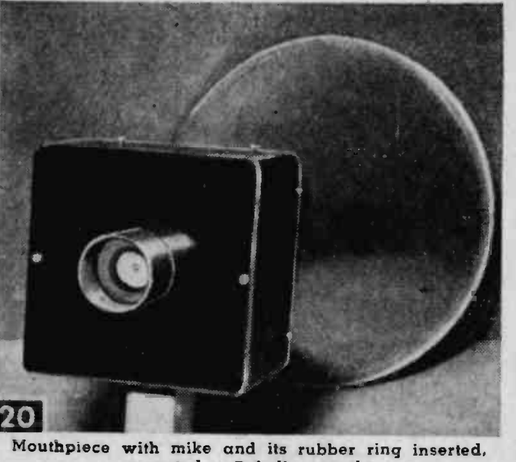
Microphone mounted in insulating rubber ring, which in turn is fitted into Bakelite tubing mouthpiece.



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Mouthpiece with mike and its rubber ring inserted, mounted to Bakelite panel.

set up a series of oscillations—a common occurrence where a high-gain amplifier, a mike and a speaker are in close proximity to each other. When used outdoors or in large areas, however, this sound has less chance to rebound and there should be little tendency to whistle.

You can use the volume control setting to keep the gain down enough to eliminate whistle when testing indoors. Or, if you want to cut down any tendencies to whistle, line the space inside the cone back of the speaker, and the interior of the box housing the amplifier, with felt. Also cement a piece of felt to the inside surface of the cover. I used a standard dress goods or fabric store type of felt and Permatite Liquid Adhesive R-6229 (from Sears).

For longer battery life, you can place a second XX15 battery in the housing and connect it in parallel with the other one. Simply splice on two leads from the original two battery wires and connect a plug to them, making connections so that the batteries will be plus to plus and minus to minus or parallel. You'll get the same 22½ volts but double the current capacity. The second battery can be taped in place where convenient in the roomy housing.

When using the megaphone, talk close to the mike, even placing the lips directly up to the mouthpiece. This will give maximum volume and also help to prevent stray sounds from entering to cause undesirable oscillations. Avoid taking deep breaths through the mouth while it is close to the mike but rather breathe through the nose. With a little practice, you'll be able to transmit intelligible speech under good atmospheric conditions for distances of 500 to 600 feet, depending on the direction and force of the wind.

Draftsman's Tape Holds Tight

• Draftsman's tape makes an excellent "third hand" to hold electronic components together during assembly or soldering. Due to its high insulation, the tape can be left on permanently, or can be peeled off easily.—J. A. McRoberts.

Fun with a One-Tube
ELECTRONIC ORGAN

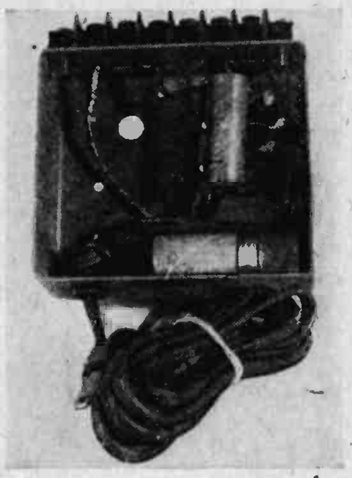
Completed electronic organ consists of: left, 20-key console with control providing 4 tone ranges; center, 5 in. PM speaker; and right, 1-tube oscillator.

It plays tunes with tone effects ranging from a reed organ to a bass tuba

By THOMAS A. BLANCHARD

THIS novel electronic organ employs a simple tuned oscillator circuit, much like that employed in elaborate electronic instruments. However, where the real organ uses many individual oscillators as well as mechanical devices for its effects, the little organ described here limits its scope to a simple one-tube circuit. Yet with its simplicity and limitations, this organ produces musical effects ranging from tuba- to fife-like tones. In the middle ranges, it sounds much like any reed type organ. The organ keyboard consists of 20 chromatic notes. These may be played in a choice of four ranges from treble to bass. The tap-switch on the keyboard functions much like the "stops" on a conventional organ.

The heart of the instrument is the oscillator. A small metal chassis 3¾ in. long, 3¼ in. wide, and 1½ in. high is made to general design shown in illustrations. However, oscillator can be wired up on a wooden base, if desired. Our pictorial wiring plans show oscillator details so that assembly may be left to individual choice. The oscillator employs a type 117L7/M7GT tube. This tube is really two tubes in one glass envelope: a power pentode and a half-wave rectifier. And since it has a 117-volt filament, no resistor or transformer is needed to lower "heater" voltage. The 117L7/M7GT contributes much to the circuit's simplicity.

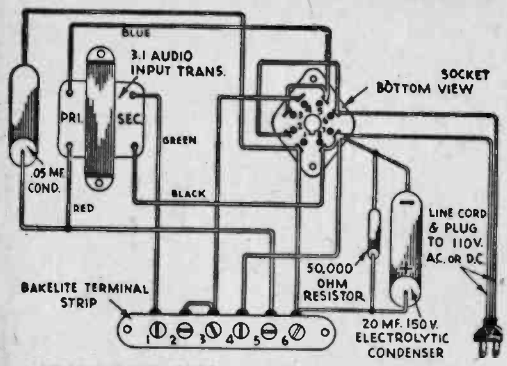


Bottom view of oscillator-amplifier which is heart of organ. Lower right, 20 mf. condenser; center, .05 mf. condenser, with tube socket below it. Tube and input transformer are located on top of chassis.

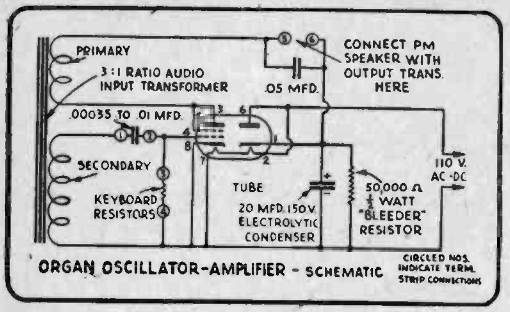
A 6-post terminal strip on front of chassis provides means for connecting PM speaker, keyboard, and range control. Since the oscillator is a complete assembly in itself, overall construction of organ is greatly simplified. After obtaining components given in materials list, wire according to picture plan.

With the oscillator completed, test it by connecting a .00035 mfd. fixed mica condenser across terminals #1 and 2. Then attach a 470,000 ohm, ½ watt resistor across terminals #3 and 4. Finally attach a PM speaker (through a matching PM output transformer) to terminals #5 and 6. Plug cord into power line and allow oscillator to warm up. After warming up, oscillator should produce a high whistle. If not, check wiring carefully. If everything is in order, reverse primary connections of 3:1 ratio audio input transformer. This will place primary and secondary polarity in proper relation and unit will then oscillate.

Now if the 470,000 ohm resistor is replaced with a somewhat higher value, a different tone will be heard. Therefore, since each change in grid return resistance produces a different tone, a string of resistors, each with a "tuned" value, will reproduce all tones in the musical scale. The keyboard, therefore, is actually nothing but a series of switches—each black and white key closing the circuit along a series resistance network, and causing a different resistance to be placed between grid and ground of oscillator tube.



ORGAN OSCILLATOR-AMPLIFIER – PICTURE PLAN



ORGAN OSCILLATOR-AMPLIFIER - SCHEMATIC

To save time, you can use well-seasoned white pine Xylophone keyboard (see drawings) in place of piano-type keyboard. Use only dry material unless you want organ to be out of tune or worse! Arrange 20 nickled or brass thumbtacks in the manner shown. Under each tack secure resistor leads. It is very important that all connections are *solid!* Inspect tacks to be sure they are not tarnish-proofed with clear lacquer. If so, soak them in acetone to remove this film. *Be certain that keyboard resistors are exactly the values given in Table A, and that no open or poor connections exist anywhere between R1 and R20.*

With Xylophone keyboard finished, solder length of wire to free end of R20. Connect this lead to terminal #3 on oscillator. Run another length of flexible insulated wire from terminal #4 to a radio test probe. With the .00035 mfd. condenser still across terminals #1 and 2, you are ready to go. Touch each tack head with the probe tip and you get an electronically-produced note corresponding to those given on the keyboard diagram. Now shut off oscillator and change .00035 mfd. condenser to a larger value: .0006, .001 or .01 mfd. The .01 mfd. will produce very low tones; .0006 and .001 mid-ranges.

Now with a working knowledge of the gadget, you can build up a regular type keyboard, if you wish, entirely from scratch, or get a head-start by purchasing a 20-note toy piano for about $3.00. In the latter case, remove bells or chimes and revise key actions into individual switches in the following manner. There is usually enough room inside the average toy piano to include oscillator and a small PM speaker, making the organ completely self contained. You'll find that key actions in most toy pianos, as well as real instruments, work on knife-edge pivot system (see "exploded" plan of keyboard). Base of keyboard consists of two pieces of well-seasoned ¼ in. plywood.

Each of these pieces measures 12 in. long by 4¾ in. wide. Take one panel and rip-saw into two pieces making cut 2¾ in. from the edge to give you one panel 2¾ x 12 in. and another 2 x 12 in. With brads and glue, attach 2¾ x 12 in. panel to 12 x 4¾ in. sub-base. The knife-edge pivot strip is placed against edge of 2¾ in. panel, and sandwiched-in by the remaining strip of 12 x 12 in. plywood which is also glued and nailed to sub-base.

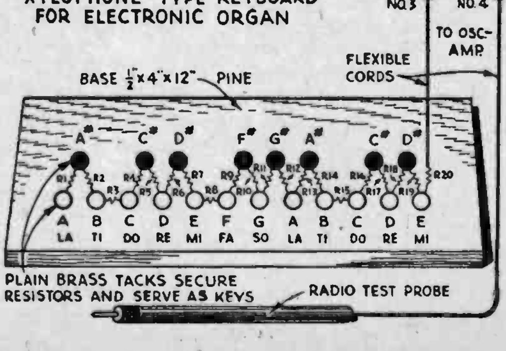
The knife-edge strip is a 12 in. length of ⅜ in. steel band such as is used to secure shipping containers. If you can't secure one, use a 12 in. hacksaw blade or have a tinsmith cut a strip of 20-gage sheet metal to 12 x ⅜ in. Next cut out keys to dimensions on a jig saw. Use as narrow a saw blade as possible to slot each key on the

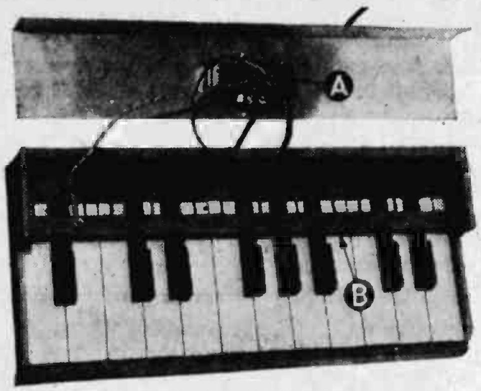
TABLE A—ONE-TUBE ELECTRONIC ORGAN

No. Req'd.	Description
2	68,000 ohm, resistors * (R1, R2)
3	56,000 ohm, resistors (R3, R4, R5)
1	68,000 ohm, resistor (R6)
1	47,000 ohm, resistor (R7)
4	39,000 ohm, resistors (R8, R9, R10, R11)
3	33,000 ohm, resistors (R12, R13, R14)
3	27,000 ohm, resistors (R15, R16, R17)
2	22,000 ohm, resistors (R18, R19)
1	470,000 ohm, resistor (R20)
1	six-post terminal strip
1	.0003 mfd mica capacitor
1	.00005 mfd mica capacitor
1	.0006 mfd mica capacitor
1	.001 mfd mica capacitor
1	.01 mfd mica capacitor
1	5 position tap switch
1	pointer knob
1	.05 mfd 400 volt capacitor
1	3:1 audio input transformer (Stancor A-53)
1	tube socket (octal)
1	117L7/M7GT tube
1	47,000 ohm, ½ watt resistor
1	20 mfd, 150 volt, electrolytic capacitor
1	output transformer (Stancor A-3328)
1	5" PM speaker
1	line cord and plug

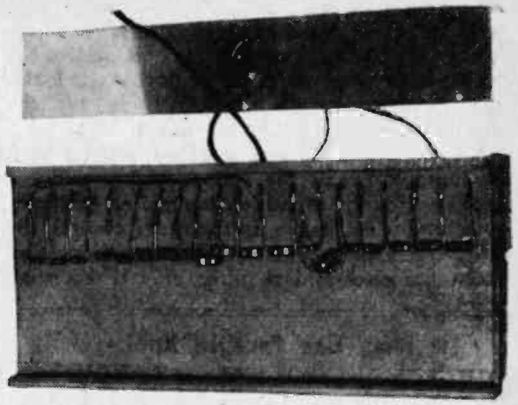
* Keyboard resistors R1 through R20 should be standard values, ½ watt size and 5% (gold band) or 10% (silver band) accuracy.

"XYLOPHONE" TYPE KEYBOARD FOR ELECTRONIC ORGAN





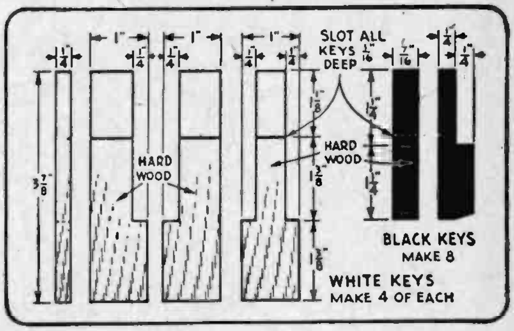
Console with aluminum cover removed. Note condensers and tone switch (A); position of contact bar (B). Keys slip under safety pin springs. Depressing key causes pin to raise and contact bar.



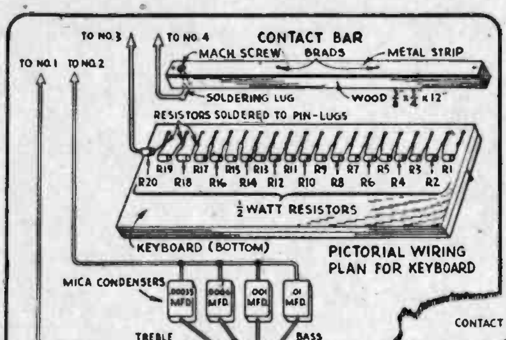
Bottom of keyboard showing resistors R1 to R20 soldered to projecting ends of safety-pin springs.

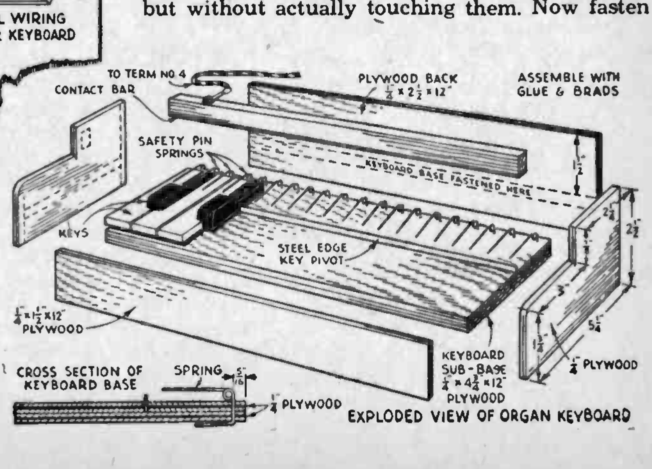
underside to a depth of 1/16 in. Now arrange keys on base according to positions shown in photos. You'll find the individually-notched keys will ride on the steel edge in teeter-board fashion.

With all keys in place, draw a line across rear of base 5/16 in. in from edge. At center of each key position, make a centermark on parallel guide line. Do this manually as plotting off fixed spaces will possibly result in key-springs falling in the wrong position. Obtain two cards of #2 safety pins (20 pins) and with diagonal wire-cutting pliers, clip off clasp from each. Now, at each of the 20 marks along previously plotted parallel line, drill a hole (slightly smaller than safety pin) through keyboard base. Now push a spring through each hole. Bend projecting portion of pin on underside of base *down* (see cross-section view in plans). With all safety pin springs in place, raise each one up and slide proper key in place. When key is depressed, it will now spring back. Align and adjust each spring so that it falls in center of respective key. Now turn keyboard over and wire in the 20 resistors as shown. Projecting portions of springs serve soldering lugs.



Finish the console with front, side and rear panels tacked and glued as shown. Now cut a strip of wood 12 in. long, 3/4 in. high, and 3/8 in. thick for the contact bar. To the 3/8 in. side fasten a strip of brass, aluminum, or tinplate with several brads. At a point where it won't interfere with the key action, solder length of insulated wire, or mount a soldering lug as shown. Set this bar, metal-faced side down, into the console. Position it as close to springs as possible, but without actually touching them. Now fasten





bar securely at each end of console with small wood screws. As each key is pressed, lever action causes individual spring to raise and contact the bar. This closes circuit and sounds that particular note. Springs may be individually adjusted by careful bending with flatnose pliers.

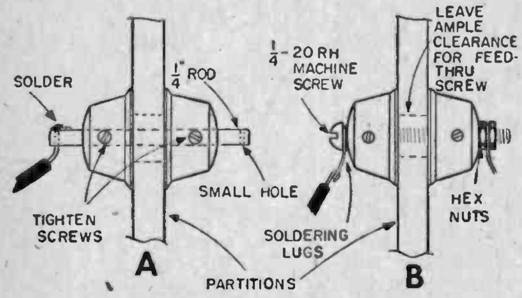
A metal cover consisting of a piece of light aluminum conceals the actions and provides a mounting for the 4-position tap switch and mica capacitors which make up the range control. By notching end panels of console, cover front slips into these slots and requires only three small screws across rear top edge to secure it.

Since this organ employs but a single oscillator, it is necessary to strike only one key at a time. The natural limitations of the circuit do not permit the playing of chords, but this is, at worst, only a slight shortcoming.

However, a little practice with the device will result in rapid fingering that is not possible with any instrument other than those of electronic nature. The novel effects gained by virtue of the electronic circuitry of this instrument greatly offset its shortcomings.

New Use for Old Knobs

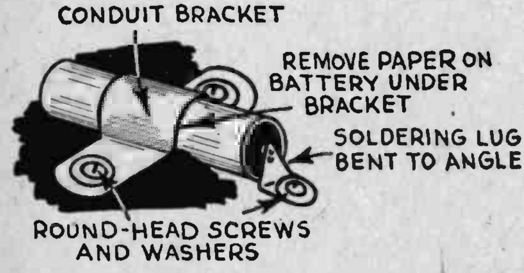
• Use discarded radio knobs as feed-thru insulators in radio and electrical work. To mount them, remove set-screws and run a ¼-in. drill all the way through the knobs. Pass a ¼-in. brass or copper rod through the knobs and partition; press both knobs firmly against partition and tighten set-screws (see A). Solder the wires into small holes drilled through the ends of the rod. In an alternate method (B), use a ¼-20 *rh*



brass machine screw, washers, hexagon nuts and soldering lugs instead of the smooth rod. A ¼-in. dia. threaded rod can be used in place of the machine screw, with a pair of hexagon nuts on both ends.—ARTHUR TRAUFFER.

Connecting and Mounting Flashlight Cells

• To make connections to flashlight cells and hold batteries securely, remove paper wrapper around battery; mount battery on block of wood with conduit bracket and a couple of *rh* wood screws. Bend large soldering lug at an angle and mount



in front of battery so it contacts center electrode. Use one of conduit bracket mounting screws, and screw holding soldering lug, for binding posts when making connections to battery. Place washer under each of these screws. Two batteries can be mounted in line for a series connection, if desired.—ARTHUR TRAUFFER.

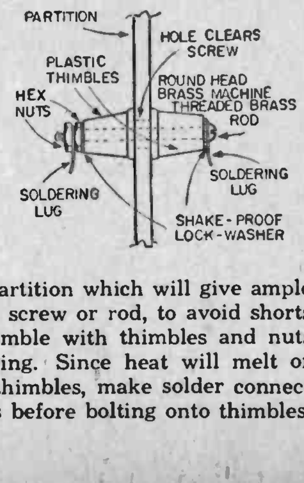
Auto Antenna Bayonet Connector

• When your auto radio begins to give intermittent reception, check the lead-in to antenna connection. If road vibration has caused the antenna to shake free of contact with the lead-in

bayonet tip, slip a short length of compression spring over the tip. Allow spring to extend beyond tip enough to make constant contact with the antenna when plugged in its socket.—K. H.

Thimble-Size Insulators

• Plastic thimbles sold at notions counters or variety stores (especially those made of polystyrene) can be used to make neat-looking, low-loss feed-thru insulators. Drill a hole through metal



panel, cabinet or partition which will give ample clearance for brass screw or rod, to avoid shorts or losses, and assemble with thimbles and nuts as shown in drawing. Since heat will melt or soften the plastic thimbles, make solder connections to solder lugs before bolting onto thimbles.

TV dealers will usually test tubes free. Most stores are equipped with a high-grade general purpose tube tester, similar to the large one in use by the dealer at left. Some dealers also have grid circuit testers (like the small one in the lid of the large tester) for checking critical tubes for grid emission.

Testing TV and Radio Tubes

By L. G. SANDS

DEFECTIVE tubes cause more than 90% of radio and television set troubles. Burned-out tubes cause a set to quit working; weak tubes cause poor performance (and under some conditions can stop the set from working). Yet the average person does nothing about having his radio or TV set's tubes tested until the set quits completely—and then is surprised when the serviceman says that several tubes should be replaced.

The electron tube is a reliable device. The jet bomber and the guided missile—to name only two of many similarly indebted mechanisms—depend upon it, so it has to be reliable. Even so, a vacuum tube has a limited life, limited, because of the physical limitations of its individual components.

The typical tube contains a *heater* which is surrounded by another element known as a *cathode.* (Some tubes have a single element which combines the functions of both heater and cathode.) When an electric current flows through the heater, it heats the cathode and the cathode emits electrons. These electrons flow to a metal cylinder known as the *plate,* attracted by the positive charge on the plate. To reach the plate (in every type of tube except diodes which have only plate and cathode elements), the electrons flow through a spiral wire assembly known as a *grid;* some tubes have more than one grid. Grids affect the flow of electrons because of changes on them, allowing either more or fewer electrons to reach the plate. All of these elements are enclosed in a vacuum inside a glass envelope (sometimes a metal envelope is used instead of glass).

A tube will fail to operate entirely if the heater burns out. It will fail to operate properly when the cathode becomes worn out and fails to emit enough electrons. And sometimes structural defects inside the tube may cause one of the grids to come in contact with another grid, the plate or the cathode, causing a short circuit and rendering the tube inoperative. If the glass envelope breaks, the tube will also fail to operate.

A perfect vacuum is never achieved in the process of making tubes and some gas will always remain inside the tube. A gassy tube is one in which an excessive amount of gas remains; such a tube is often indicated by a blue or purple glow inside the envelope. Finally, a very prevalent defect which causes erratic operation of television sets and distortion in hi-fi systems is one called *grid emission,* a condition in which the grid or grids emit electrons as well as the cathode.

Several million tubes are replaced each year because some type of testing apparatus indicated that they were defective. The apparatus may be the radio or telvision set in which the tubes were in use or it may be an instrument known as a tube tester. Except for obvious structural breakage such as broken envelopes or shorted base pins, you cannot determine just by looking at a tube whether it is good or bad. You cannot, of course, see inside metal tubes, and usually you

TABLE A—Tube Tester Kits

1) SECO GCT-5 KITESTER has all the parts required to assemble and wire your own Grid Circuit Tester. Otherwise, identical to the SECO GCT-5. Available through electronics parts distributors. Price: $19.95

2) HEATHKIT TC-2 tests most tube types for emission and shorts. Has illuminated roll chart listing tube test information. Provided ready to assemble and wire. Heath Company, Benton Harbor, Mich. Price: $29.50

3) KNIGHT TUBE TESTER KIT checks for emission and shorts. Provided with roll chart. Ready to assemble and wire. Allied Radio Corp., 100 N. Western Ave., Chicago. Price: $29.75

4) PRECISE 111K tests for transconductance and emission. This is more elaborate tester for checking both tubes and transistors. Sold through electronics parts distributors. Price: $79.95

The professional service technician usually checks tubes by substituting new tubes for those he knows from experience to require most frequent replacement. He also tests certain tubes for grid emission with the grid circuit tester. Grid emission is a very frequent cause of TV ailments and is not readily detected with general-purpose tube testers.

cannot see inside glass-envelope tubes because of the silver or dark coating on the inside surface of the glass. (Incidentally, blackening or discoloration of the glass envelope does not necessarily indicate that there is anything wrong with a tube.)

Ordinary tubes have a rated life of 1000 hours. Many last much longer, some quit after a few minutes or a few hours of use. To insure your getting maximum performance out of your TV, radio or hi-fi set, its tubes should be tested at frequent intervals. You may tolerate and be unaware of substandard performance because tube deterioration may have been very gradual: when new tubes are installed, you may be surprised by the marked improvement. By waiting until your set quits completely, you are not getting all the performance that is built into it.

Getting Tubes Tested. The easiest and perhaps the best way to test tubes is to call a reliable radio or TV service shop and have a trained technician check the set and the tubes in your home. Sometimes the technician will bring along a large, bulky tube tester and check each tube individually. This takes time, however, and requires muscle, so the typical technician today carries spare tubes and a *grid circuit tester* which fits inside his tube caddy. If a set has quit entirely, he usually knows from past experience with the same type of set which tube has blown. Once that tube has been replaced, he observes the performance of the set and by substituting other new tubes for old ones and noting any improvement in set performance, determines which —if any—other tubes should be replaced.

The serviceman will next check certain tubes for *grid emission* and *inter-element* leakage with his grid circuit tester, usually finding two or three that may still perform satisfactorily but which—according to his grid circuit tester—have slight grid emission and thus can cause erratic performance after extended operation. Tubes with excessive grid emission, of course, won't work at all in some applications.

Checking Your Own. Instead of calling a technician to test tubes and check your set in your home, you can take the tubes to a service shop or TV store to have them checked. Testing them is easy. The hard part is getting them out of your set initially, and then replacing them in the correct sockets.

In the case of a TV set, first remove the back cover. Usually there is a printed diagram glued or stapled inside of the cabinet that indicates the type number and location of each tube.

To play it safe, number the tubes on this diagram and attach pieces of adhesive tape marked with matching numbers to each tube in the set. (Take the tape off when you replace tubes since some of them get very hot.)

Some tubes may be enclosed inside metal shields. These shields must be removed when the tubes are to be tested, and reinstalled when the tubes are replaced. And don't overlook tubes located inside a protective metal housing on the chassis of your set when you're pulling tubes for testing.

When the back cover of the set is removed, the power cord is also disconnected, or a safety switch is actuated so that the set cannot be

TABLE B—Typical Tube Testers

1) A.B.C. TESTER has three sockets for testing filaments of most tube types used in television sets, including picture tubes. If the indicator does not light, the tube is defective. If the lamp does light, however, the tube may or may not be good; further tests with a more complex tester should be made. Although this tester does not check anything but filaments, it can be a handy time saver for the do-it-yourself man. Omega Electronics, 670 N. Michigan Ave., Chicago. Geiger Engineering Corp., 3738 W. Lawrence Ave., Chicago 25. Price: $3.95

2) SUPERIOR TC-55, a low-priced, general-purpose tube tester for the experimenter with a modest budget. Tests most commonly used tube types. Moss Electronic Distributing Co., 3849 10th Ave., New York 34, N. Y. Price: $26.95

3) SECO GCT-5, a special type of tube tester for checking for grid emission and inter-element leakage. Finds grid defects usually missed by general-purpose tube testers. This type of tester is used in addition to a general-purpose tube tester and often by professionals to supplement tube-substitution test methods. Sold through most electronics parts distributors. Price: $29.95

4) TRIPLETT 3412-A, a general purpose tube tester which checks all modern tubes for shorts and emission. Sold through radio parts stores. Price: $77.91

5) HICKOK 539A, a professional lab tube tester for the expert. More critical than most lower priced tube testers. Sold through electronics parts distributors. Price: $287.00

Many super markets, service stations, druggists and hardware stores have installed serve-yourself tube testers.

turned on. Service technicians sometimes use cheater cords to permit operation of the set with the back cover removed. Don't try it! The safety features built into your set are there for the purpose of protecting you from a dangerous shock.

Neither should you attempt to take out the picture tube for testing. You can easily break the glass and suffer serious injury. If you have doubts about the condition of the picture tube, call in a service technician. But remember, lack of a picture or a poor picture does not necessarily mean that the picture tube is defective.

Most electronics dealers and electronic service shops will test tubes without charge. Most will not try to sell you tubes unless you need them. If you should install new tubes, however, and then reinstall some of the old ones in their place and find that the set works just as well, don't jump to the conclusion that you have been gypped. In some TV set circuits even very weak tubes will work. In some other circuits, on the other hand, you may have to try two or more new tubes to find one which will operate satisfactorily.

Super markets, gas stations, hardware stores and drug stores are among the enterprising business firms which have installed serve-yourself tube testers. These testers are usually loaned by the wholesaler; the dealer provides floor space and receives a commission on the tubes he sells. Detailed instructions for use are posted at or adjacent to the tester.

Tube Testers for the Home Workshop. If you are sufficiently interested in electronics, you will want to buy the necessary equipment for tube testing at home (see Table A and Table B). Tube testers are advertised for sale for as little as $1.97, but a really critical tube tester sells for as much as $695. There should be a difference—there is.

So-called tube testers selling for under $5 test only for open filaments. (An ohmmeter, though not so convenient to use, will make the same test.) Although an open tube filament is the most frequent cause of *total* failure of a radio or TV set, it is far from being the biggest cause of defective tubes.

In most table model radios (and in many late model television sets), the tubes are connected in *series*, in Christmas-tree light fashion. If one tube burns out, all or several other tubes will also fail to light, and in such a case an inexpensive tester can locate the one offending tube. But, in

TABLE C—TUBE TYPES WHICH SHOULD BE CHECKED FOR GRID EMISSION

(as well as for shorts and electrical merit)

3AV6	6AB4	6BC8	6U8
3BA6	6AG5	6DB6	6X8
3BC5	6AH6	6BE6	12AT7
3BE6	6AK5	6BH6	12AU6
3CB6	6AK6	6BH8	12AU7
3CF6	6AM8	6BJ6	12AU7A
3CS6	6AN8	6BK7A	12AV7
4BC8	6AR5	6BK7GT	12AX7
4BQ7A	6AS6	6BQ7AT	12AY7
4BZ7	6AS8	6BX7GT	12AZ7
5AM8	6AU6	6BY6	12BA6
5AN8	6AU8	6BZ6	12BA7
5AS8	6AW8	6BZ7	12BD6
5BK7A	6BA6	6CF6	12BE6
5J6	6BA7	6CG7	12BH7
5U8	6BA8	6CL6	12BH7A
	6BC5	6J6	12BZ7

TABLE D—Testing Tubes at Home Without a Tester

1) Obtain a supply of pre-tested spare tubes, at least one of each type (preferably more) used in the set.

2) Assuming set does not work satisfactorily, turn the set on for 10 minutes to let it warm up.

3) Turn set off and remove back cover.

4) Feel each tube to see if it is warm. (Careful—some tubes get very hot.) If one tube is cold and the others are warm, replace this tube with a new one. (A cold tube may be burned out. In some sets the tubes are connected in series in Christmas-tree light fashion and all or several tubes may be cold even if only one is burned out.)

5) Replace back cover and try set. If it does not work, substitute a new tube for an old tube, one at a time, trying set each time. If a new tube does not do the trick, put the old tube back before replacing the next one.

6) Once the set is working, replace each tube, one at a time, to note any improvement in performance. Don't forget that the set must be turned *off* every time a tube is removed or installed.

7) Leave new tubes in place whenever an improvement in performance is noted, even if slight. The overall improvement in performance when several tubes are replaced can be appreciable.

8) If a Grid Circuit Tester is available, test applicable types of tubes (see Table C) for *grid emission*. Some tubes which work OK now but fail to pass the grid test may cause serious, hard-to-find trouble after extended operation as tube gets hotter.

9) Throw away weak or defective tubes so that they won't be used again.

general, such a tester is not much better than no tester at all.

A kit of parts for building a tube tester that will check the electrical performance of a tube can be purchased for about $30. Ready-made tube testers can be bought for a similar price. A more adequate tester, however, costs about $70 in kit form and over $100 assembled.

The cheaper testers are seldom as critical as the more expensive testers and may pass tubes as OK when they should be rejected. Some testers measure what is known as *emission*, or current flow through a tube; others—like the Hickok —measure transconductance; and some use plate conductance or some other term or form of measurement for indicating the degree of *merit* of a tube. (Transconductance is a technical term denoting the change in current in one tube element as caused by a change in voltage at another element.

The conventional tube tester has a meter scale with numbers, plus a red and green section to indicate *Good* or *Bad*. Also, most testers are equipped to test for *shorts*. Nearly all are relatively easy to operate if instructions are carefully followed.

A radio and television tube filament checker such as the one shown above will test TV picture tubes as well as ordinary vacuum tubes.

Most tube testers do not check for grid emission, but a check of this condition is critical usually only with miniature tubes (see Table C). The professionals use a special tester for this test in addition to a general-purpose tube tester. Grid circuit testers such as the Seco GCT-5 are available ready-made for about $30, or for $20 in kit form.

To test tubes yourself, test first for shorts. If the short indicator lamp flickers or glows, do NOT press the *merit* test button or the meter of the tester may be damaged. Tap the tube while testing for shorts to detect intermittent shorts.

If the tube passes the *short* test, then press the merit test button and note the meter reading. If it is in the green, reduce the filament voltage to the next lowest value (for example, for a 6.3-volt tube, set filament at 5 volts). If the meter reading now drops into the red zone, this may mean that the tube is nearing the end of its useful life and should be replaced.

Having passed the short and merit tests, most tube types should next be checked for grid emission in a grid circuit tester. This is the acid test for miniature tubes. At one shop it was noted that 90% of the tubes whch failed to pass the grid emission test, checked OK on a conventional, general-purpose tube tester. So, is it important to check for grid emission? TV technicians seem to think it is since by doing so they have been able to reduce callbacks drastically.

Poor picture contrast; grainy picture; twisting, pulling and bending; jitter and bounce; buzz and poor fringe area reception are among the hard-to-find troubles caused by grid emission. If a grid circuit tester is not available to you at home, take the tubes to a shop that does have one or substitute new tubes for old ones, one at a time, until the trouble clears up.

When no tube tester is available, tubes can be checked at home by the substitution method, installing one new tube at a time in the place of an old one and observing the picture or sound for change in performance (see Table D).

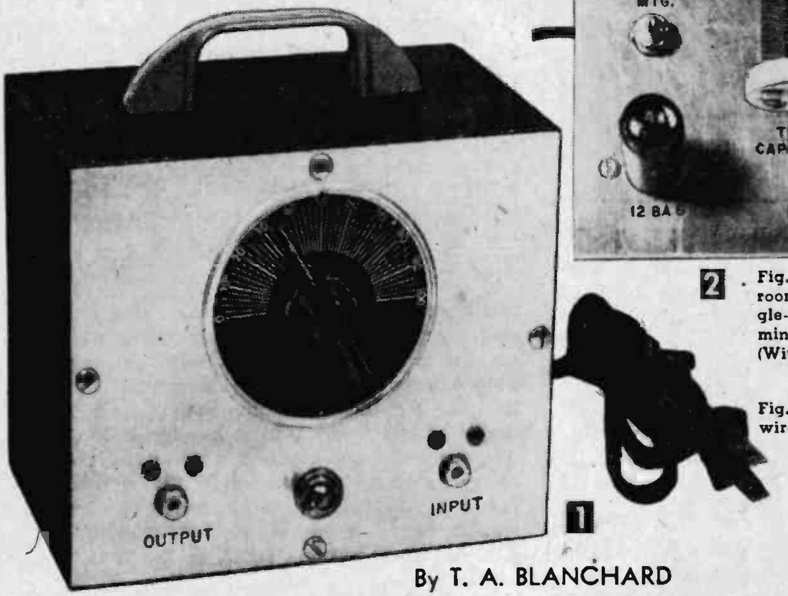
About Buying Tubes. A new tube is not necessarily a good tube. There are duds in any batch of new tubes. Sometimes, several tubes in a single batch may be below standard. Tube manufacturers turn out over 100,000,000 radio and television receiver tubes each year. Tube prices are low and demand is great. In spite of stringent quality control methods, some bad tubes get by.

To play it safe, buy tubes of a known brand, RCA, Philco, Sylvania, Tung-Sol, General Electric, etc. Buy from a reputable dealer and beware of phoney bargains. Most retail dealers will sell tubes only at the suggested list price, and small-town wholesalers often refuse to sell to anyone but legitimate dealers. (The wholesale price is about half of the suggested list price.)

Bargain tubes are often packaged in plain white cartons or with an unknown label. They may be rejects, seconds or just plain used tubes. Or they may be perfectly good surplus tubes. You have no certain way of knowing. Tube manufacturers use cartons bearing their own label or a private brand for tubes intended for the replacement market. When you buy new tubes have them tested then and there to make sure they are OK.

A new tube may not operate properly after a short period of use because it may have developed excessive grid emission which went undetected by a conventional, general-purpose tube tester. Or it may quit functioning due to some other cause after a few hours of use. If a tube gets through the first 200 hours of its life, however, it generally lasts a long time. Most new tubes will give long and satisfactory service.

Versatile Oscillator



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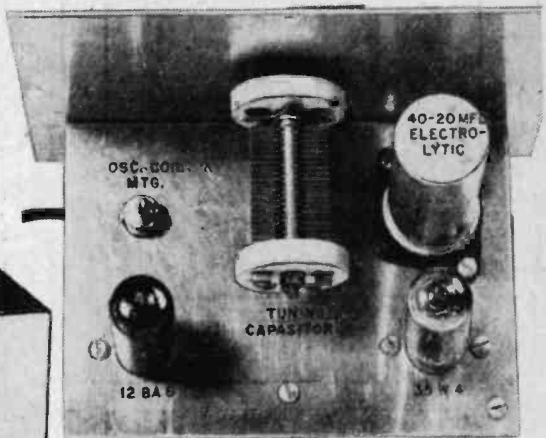


2 Fig. 2. Chassis provides ample room for using standard-size single-gang capacitor instead of the miniature type shown above. (With standard size, insulate rotor plates from chassis.)

Fig. 1. Trim oscillator is both wireless broadcaster and test instrument for aligning.

By T. A. BLANCHARD

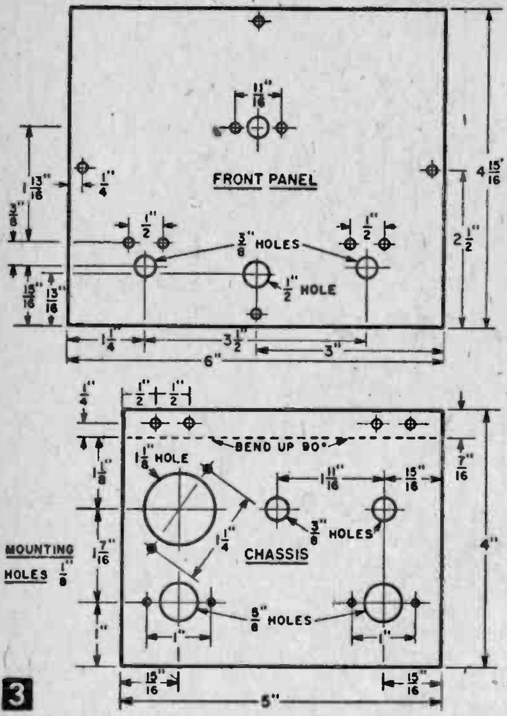
This compact oscillator plays records by wireless and generates signals for aligning superhet receivers

THIS compact oscillator performs double duty as an efficient wireless record player and signal generator. Employing a miniature 35W4 rectifier and a miniature 12BA6 pentode in a grid-modulated Hartley-type oscillator circuit, the trim assembly shown in Fig. 1 measures only 6 x 5 x 4 inches. A signal generator is a most useful tool when aligning a superheterodyne type receiver that is "out of whack."

The oscillator is built into a standard metal radio utility box (sold by all radio parts suppliers). These boxes are available in a variety of sizes—in black wrinkle steel or hammertone aluminum, which is a bit more expensive than steel. A plastic drawer pull from the dime store provides a neat carrying handle. To get started building the oscillator cut the chassis from 16 or 18-gage aluminum and cut the necessary component mounting holes as shown in Fig. 3. Bend down a 7/16 in., 90° fold along the front edge of the chassis for attaching to the front panel of the cabinet. The same screws which secure the chassis to cabinet also fasten the *input* and *output* jacks to the front panel. Instead of using two of the single round phono jacks, a double rectangular phono jack strip was cut in half. If you use the round single jacks, however, separate mounting holes and screws will be required. When purchasing the jacks, order a pair of phono tip plugs at the same time to match the jacks. One phono plug connects to the phono pickup at the oscillator. The other tip is used for a shielded or unshielded output wire from the oscillator for testing and aligning. Arrange the components on chassis as shown in Fig. 2 and pictorial wiring plan (Fig. 5). A can-type dual-electrolytic capacitor with a 40 and 20 *mfd.*, 150 *w. v.* rating mounts over the 1⅛-in. dia. hole. The electrolytic capacitor should be of the *insulated* type. This unit resembles any other can-type electrolytic capacitor, except that it includes a black paper tube which insulates the can, plus a Bakelite mounting plate instead of the usual metal plate. Fig. 2 shows the capacitor with paper tube removed. The tube is not essential, but the Bakelite mounting plate is required to insure a shockless isolated ground circuit.

The oscillator coil is a regular Hartley tapped type, the same kind used in small portable superheterodyne receivers. Two suitable types are indicated in the Materials List. Sometimes the Hartley coil is cataloged simply as 6SA7 or 12SA7 type. Oscillator coils are built with either a metal bracket for mounting with screws and nuts or a snap-in fastener. After mounting tube sockets and a 2-lug terminal strip, you may begin wiring the oscillator following the pictorial wiring plan. (Fig. 5).

When using the oscillator as a home broadcaster, the maximum capacity of the tuning capacitor need not be over 250 *mmf.* This will tune from about 1700 *kc.* to 1000 *kc.* approxi-



3

MATERIALS LIST—OSCILLATOR

1 metal radio utility cabinet, 4 x 5 x 6". (ICA #3812, or #29812)
1 aluminum chassis, 5 x 4"
1 hartley-type oscillator coil. (Stanwyck #201, Meissner #14-1033)
1 can-type electrolytic capacitor, insulated type. 40-20 mfd., 150 v. (Sprague, Mallory, C-D, Aerovox.)
1 Single Gang Tuning Capacitor. (250, 410 or 450 mmf. The 410 mmf. size is suggested.)
2 7-pin miniature wafer sockets
2 phono jacks and plugs to match
1 toggle switch 1 slide switch (both s.p.s.t. type)
1 6-ft. line cord and plug
1 2-lug terminal strip

Fixed Capacitors

1 68 mmf. mica or ceramic capacitor
1 56 mmf. mica or ceramic capacitor
1 470 mmf. mica or ceramic capacitor
2 .05 mfd. molded paper capacitors

Fixed Resistors

1 470 or 500 ohm, 25-watt wire wound resistor
1 4700 ohm, 2-watt carbon resistor
1 4700 ohm, 1-watt carbon resistor
1 47K (47,000) 1/2-watt carbon resistor
1 1 1/2 megohm, 1/2-watt carbon resistor

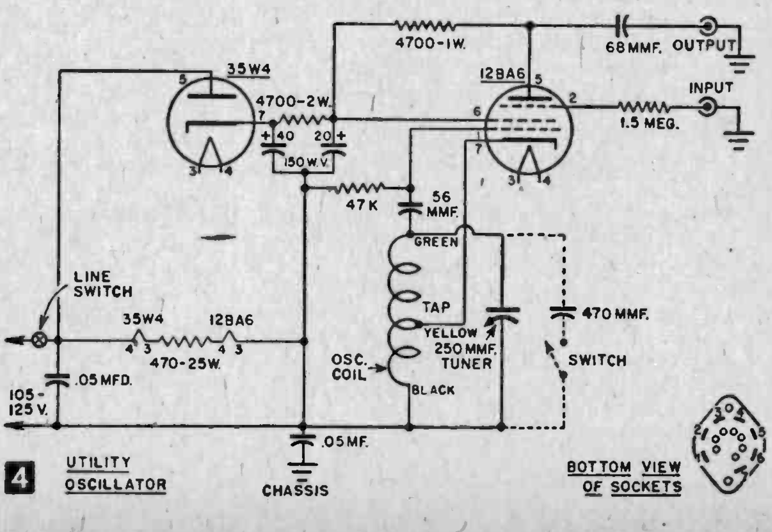
mately. However, greater range is required when using the device as a signal generator. Therefore, a fixed mica capacitor of 470 *mmf.* is shunted across the variable capacitor to tune below 550 *kc.* (see schematic plan, Fig. 4.)

You can replace the miniature tuning capacitor with 410 or 450 *mmf.* maximum capacitance. The standard size capacitors cost much less than the miniature units, and there is ample room on the chassis for the larger sizes. You will still have to use a fixed capacitor with the larger tuning capacitor when tuning below 550 *kc.*, however.

Since the oscillator employs no step-down transformer, a voltage-dropping resistor is wired in series with the tube heaters. Mount this 470 or 500-ohm, 20- or 25-watt unit near rear of chassis and away from other components, as shown in Fig. 6.

PHONO OSCILLATOR. (Wireless record player). Solder inner wire of shielded phonograph pickup wire to center pin of jack *plug*. Solder shield braid to the outer shell of phono plug. Insert this lead from the phonograph into the *input* jack of oscillator. To make up a broadcasting antenna, solder several feet of ordinary insulated hookup wire to the center pin of the remaining phono plug. Leave the outer shell unconnected. Plug this flexible lead into the *output* jack of the oscillator to broadcast from the oscillator. Turn on your radio and the oscillator and allow both to warm up about 30 seconds. Tune the radio between 1600 and 1300 *kc.* where no regular station comes in and slowly tune the oscillator until a strong purring signal is heard from the radio.

Another method of tuning oscillator to radio is simply to start a record on the turntable and tune oscillator until the recorded music comes from the radio. When tuning the oscillator, you will hear a signal at several points on the dial. However, there will be only one point where the signal is heard clearly and without heterodyne whistles in the background. Therefore, when tuning the oscillator, be sure your set is receiving the fundamental signal being transmitted and not one of the harmonics.



4 UTILITY OSCILLATOR

SIGNAL GENERATOR. When using the oscillator as a signal generator, you will first have to locate three frequency settings on the oscillator, as accurately as possible. You may be able to use a professional signal generator from your local school against which your homemade oscillator may be calibrated. Tune the professional signal generator first to 1700 kc. and feed the signal from the output plug, through a shielded wire, to antenna post of a radio set. After tuning the radio to receive the professional generator's 1700 *kc.* signal, disconnect the generator. Be careful not to change the radio's dial setting during this operation. Now attach the output cable of your oscillator to the radio's antenna post, and tune the oscillator until the radio picks up its fundamental signal. Mark this 1700 *kc.* dial setting for future reference, on your oscillator.

Repeat this calibrating procedure with the professional signal generator next tuned to 1500 *kc.* and again at 455 *kc.* Your homemade oscillator will now have three precise frequency adjustments. The fourth setting is obtained by connecting 470 *mmf.* fixed capacitor across the oscillator's tuning capacitor.

If you don't have access to a professional signal generator, you can calibrate the oscillator with a good radio set. First, tune the radio so variable capacitor plates are wide open. The radio will then be tuned approximately at 1700 *kc.* Attach inner *output* lead of oscillator to antenna post of radio and tune oscillator until its carrier signal comes in over the radio. Mark oscillator dial at the precisely tuned point as 1700 *kc.* Now tune radio below 550 on its dial so capacitor plates are fully meshed. This is *approximately* 455 *kc.* but it's best to check this setting against a professional signal generator for calibrating the 455 *kc.* setting. Switch-in the 470 *mmf.* fixed condenser and tune the oscillator until signal is again heard through the radio. Mark this setting on oscillator dial as 455 *kc.*

Finally, to obtain the 1500 *kc.* setting, disengage the 470 *mmf.* fixed capacitor across tuning capacitor and tune radio dial to 1500 *kc.* Tune the oscillator until its carrier signal is heard through the radio, and mark this setting on the dial as 1500 *kc.* The 1500 *kc.* setting can be fairly accurately located since there are a great many stations in the United States operating on 1490 *kc.* By tuning your radio just above one of these 1490 *kc.* broadcasters—just enough so their signal is not heard, the set will be very close to 1500 *kc.* The 1500 *kc.* setting may also be located in many parts of the country by tuning in either WTOP in Washington, D. C. or KSTP in St. Paul. Both of these stations operate on 50,000 watts, 1500 *kc.* and may be received in many parts of U.S. and Canada at night.

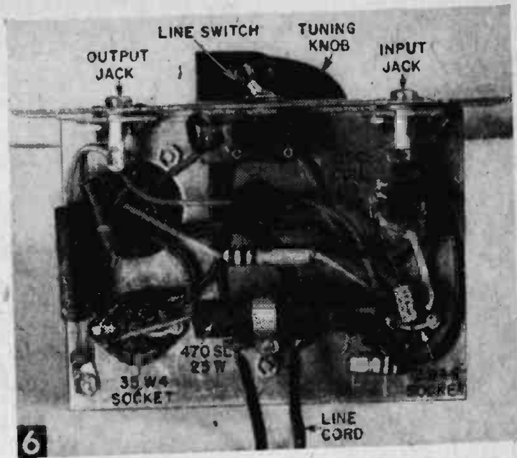
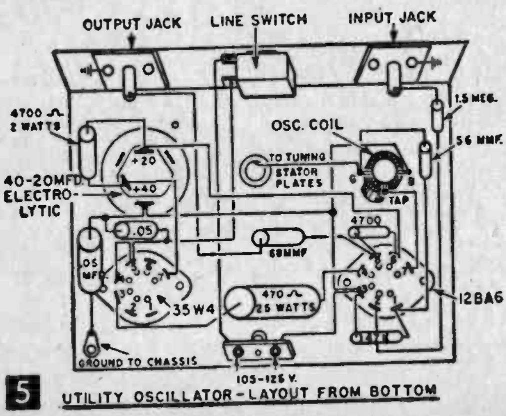


Fig. 6. Bottom view of oscillator. Although compact, there is plenty of room for components.



5 UTILITY OSCILLATOR-LAYOUT FROM BOTTOM

ALIGNMENT FOR 455/465 KC. I.F. SUPERHETS. One of the most troublesome problems in radio servicing is the alignment of the I.F. sections of a receiver for peak performance. To use the oscillator for this job, insert the shielded lead into *output* jack on oscillator. Connect the inner cable wire to the stator plates of R.F. section of tuning capacitor (section with the large plates). Then ground the shielded braid of cable to the radio set chassis. Tune oscillator to 456 *kc.*

Tune the radio so variable capacitor plates are fully closed, and turn up volume control. Now, with a *plastic blade* screwdriver, made by filing a knitting needle to a screwdriver edge, adjust the screws on the *second* I.F. transformer until the "purring" carrier signal of the oscillator comes through at peak volume. Since this volume may be considerable, retard the volume control so carrier signal comes in distinctly.

With the plastic blade screwdriver, adjust the screws of the *first* I.F. transformer to again raise the volume of the carrier's "purr." The I.F. transformers can be given a final polishing off by a final adjustment of the *second* I.F. and another adjustment of *first* I.F. screws.

The final adjustments of aligning the radio set are for tracking the gang tuning capacitor. Connect the inner wire of the shielded *output* cable from the oscillator to the antenna post of the radio. If the radio has no antenna connection, place a plain unshielded wire from the output jack of oscillator near the radio's antenna loop, or tape the output wire to the radio's loop for adequate capacitance pick-up. No actual connection need be made to the loop.

Tune both the oscillator and radio dial at 1700 *kc.* Now adjust the small trimmer capacitor below the oscillator section small plates of tuning capacitor with plastic blade screwdriver until oscillator signal is loudest. Finally, tune oscillator and radio to 1500 *kc.* and adjust the small trimmer below the R.F. section large plates of tuning capacitor for maximum volume with the plastic blade screwdriver. With these adjustments for peaking performance, your receiver alignment is finished!

Magnetic PENDULUM

HERE'S a natural for electrical experimenters and physics students—a pendulum kept in motion indefinitely by two electro-magnets, which are of the same polarity and thus repel each other (Fig. 1).

One magnet, fixed on the lower end of the pendulum arm swings toward another magnet attached to the backboard. Just before the swinging magnet actually touches the fixed magnet, a switch actuated by the motion of the arm makes contact. This energizes the two magnets and the repulsion effect takes place. The arm swings away and then returns again only to be repelled. This pendulum action will take place indefinitely at a rate of about 70 strokes per minute.

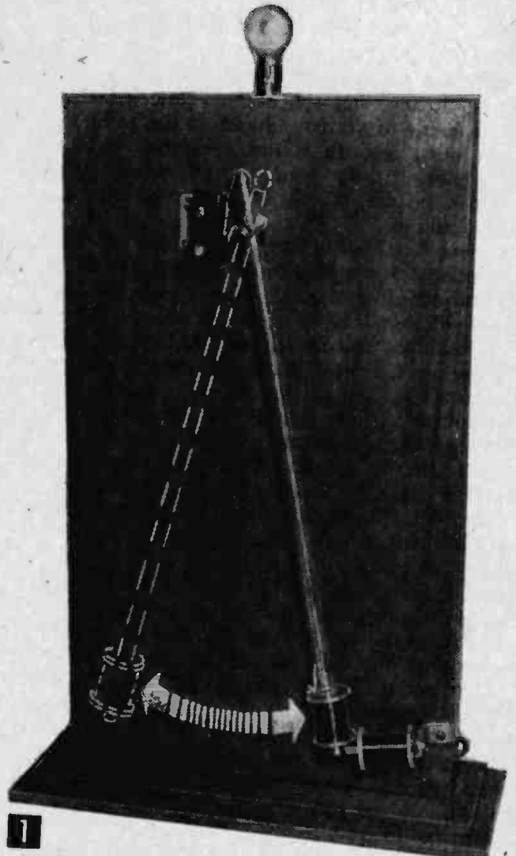
Before anyone hollers perpetual motion, however, let's note that there is a power source which is needed to energize the magnet's polarity, and parts do wear out eventually and have to be replaced.

Note the neon lamp which has been added on top of the unit. This flashes at each swing of the arm. For those who insist on a practical use for such an experimental gadget, it could conceivably be rigged up as a movable display.

The S.P.D.T.-type Microswitch used in this unit has one normally-open contact and one normally-closed contact. The magnets are connected in a circuit to the common terminal and the normally-open one so that, as the pendulum arm swings against the switch operating lever, the contacts close and the desired action takes place. The normally-closed contact is connected in a circuit with a neon lamp, so that the bulb will blink at each swing of the pendulum.

Power for operating the unit is taken from a regular 115 volt *ac* house line. The selenium rectifier stack in this circuit provides half-wave pulsating *dc* current as required by the magnets.

Constructing the Base. Figure 2 shows you the dimensions of the 3/8 in. thick birch base pieces and backboard. Note in Fig. 2 the 1¼ in. wide framing strip glued and bradded at the back of the backboard panel to form a shallow box-like section. Attach this frame to the top base piece with glue and two screws. Then glue and clamp bottom base piece to top base piece. Countersink all brads and screws and fill holes with



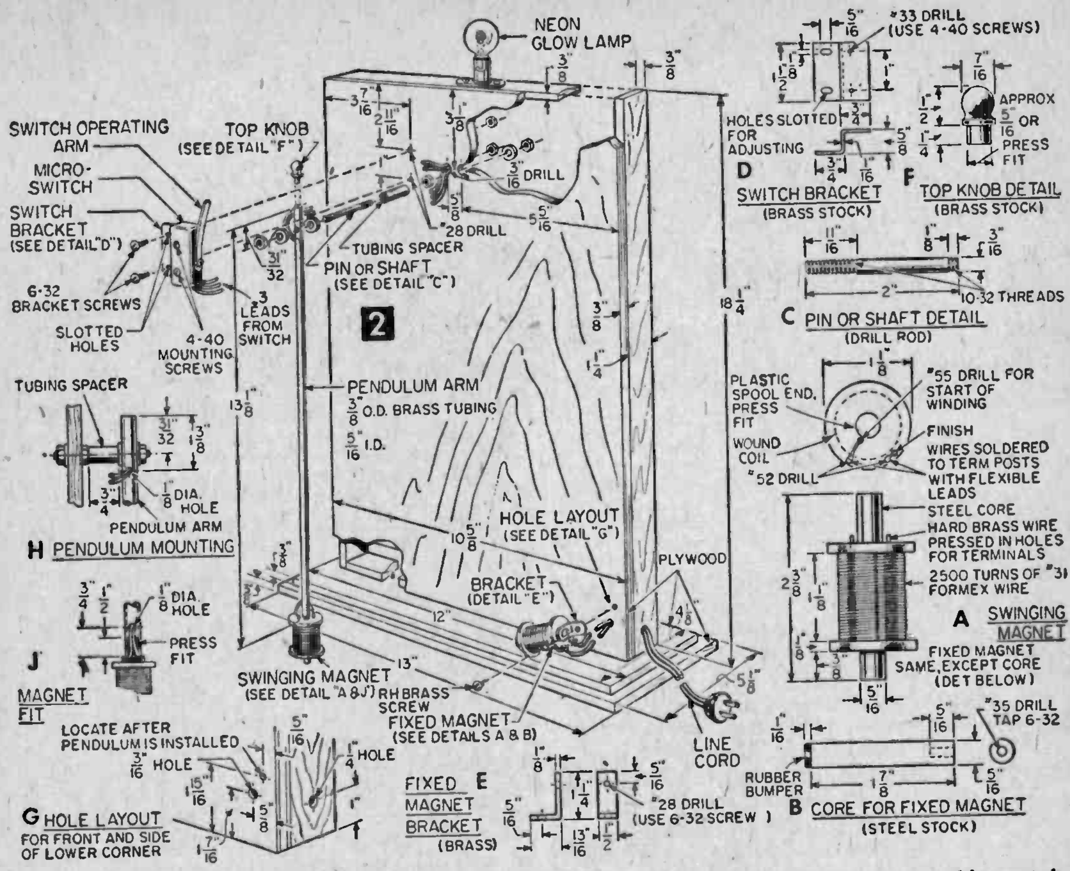
1

Pendulum at the extreme right position of its swing. Dotted lines indicate extreme left position and travel of pendulum.

Plastic Wood. Then, with sandpaper, dress all mating edges off flush and round corners slightly. Finish with a generous, brushed-on coat of walnut oil stain (allow it to dry 5 to 8 minutes before wiping off all stain remaining on surface). About 4 to 6 hours later, apply several thin coats of white shellac diluted with about 20% alcohol or shellac solvent, lightly rubbing down each coat with fine steel wool after shellac hardens. Finish with paste wax polished briskly with a cloth.

(If wood is not of very close grain, apply some paste wood filler mixed with walnut stain, before applying the shellac. Apply with a piece of burlap, allow to dry a few minutes and then wipe off across the grain. Allow an hour to dry before applying shellac.)

Making the Pendulum Arm (Fig. 2). First,



MATERIALS LIST—MAGNETIC PENDULUM

No.	Description	Use
1 pc	birch plywood 3/8 x 10 5/8 x 18 1/4"	
1 pc	birch plywood. 3/8 x 5 1/8 x 13"	
1 pc	birch plywood 3/8 x 4 1/8 x 12"	
2 pcs	birch plywood 3/8 x 1 1/4 x 18 1/4"	
2 pcs	birch plywood 3/8 x 1 1/4 x 9 7/8"	
1 pc	brass tubing 3/8" O.D. 5/16" I.D. 13 1/8" long	(pendulum arm)
1 pc	soft steel or iron rod 5/16" dia. 2 3/8" long	(magnet core)
1 pc	soft steel or iron rod 5/16" dia. 1 7/8" long	(magnet core)
4 pcs	plastic or Bakelite 1/8 x about 1 1/2 x 1 1/2"	(make round spool ends)
1 pc	brass 1/8 x 1/2 x 2 1/8"	(fixed magnet bracket)
1 pc	brass rod 1/2" dia. about 1" long	(turn to make knob on top of arm)
1 pc	steel drill rod or other smooth steel 3/16" dia. 2" long	(pendulum arm support and bearing)
1 pc	brass tubing 1/4" dia. 3/4" long with 3/16" I.D.	(spacer for arm)
3	10-32 nuts and washers (brass)	
1 pc	brass 1/16 x 1 1/2 x 2 1/8"	(switch bracket)
2	4-40 rh machine screws 1" long	(switch mounting)
2	4-40 nuts	
2	6-32 rh or buttonhead screws 5/8" long	(bracket mounting)
2	6-32 nuts and washers	
1	Microswitch #BZ-2RL S.P.D.T. with operating lever	
1	bayonet-type socket with mounting flange double contact candelabra type	
1	NE-32 1 watt double contact G-10 neon glow lamp	
1	5000 ohm 1-watt resistor	
1	Federal miniature rectifier, type 1028-A 250 ma. or any similar, half-wave 130 v. input type	
1	4-terminal chassis solder terminal strip	
1	1-terminal chassis solder terminal strip	
7 ft	#18 flat rubber lamp cord	
1	attachment plug cap	

About 1/4 lb of #31 Formex or Formvar Heavy magnet wire

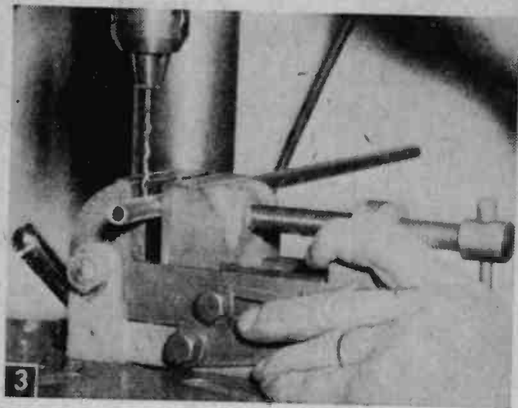
3 ft of #28 extra flexible insulated wire or other small lead wire

About 6 ft #24-26 flexible, insulated wire for backside circuit hookup
Misc. stain, shellac, screws, etc.

Note: If you can't find brass tubing and steel rods at local hardware store or metal suppliers, try Charles A. Cole, 1355 Church St., Ventura, Calif.

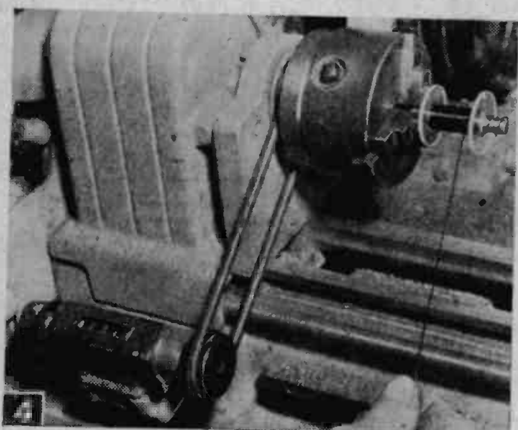
obtain a 13¼ in. long piece of brass tubing (⅜ in. O.D., 5/16 in. I.D.), stocked by some hardware stores and most metals suppliers. Dress the ends off smoothly to make this tubing 13⅛ in. long when finished. Turn the brass knob which fits on top of the pendulum arm in a lathe and have it a press fit for the end of the tubing (Fig. 2F). This knob actuates the switch lever.

At the lower end of the arm, ream out the inside diameter of the tubing, if necessary, to get a press fit for the end of the steel magnet core that will be attached to the arm (Fig. 2J). Drill two holes in the tubing for the entrance and the exit of the lead wires that go to the magnet (Figs. 2H and J). Also, drill a 3/16-in. hole, 31/32 in. from the top of the pendulum arm, for the drill rod steel shaft or pin on which the arm will swing (Fig. 3). Have this hole a close but free fit for the shaft so the arm swings freely but without side motion or excessive looseness. The shaft is cut and threaded from drill rod as shown in Fig. 2C. Threading can be done by holding rod for shaft in lathe chuck and using tailstock to hold threading die squarely to the work. Then slowly turn



3

Drilling 3/16 in. diameter hole in pendulum tubing, for steel shaft which will support pendulum arm. Make sure hole is drilled at perfect right angle and exactly in center of tubing, by locking tubing between the V's of the vise. For a smoother hole you might use slightly undersize drill and then ream to size.



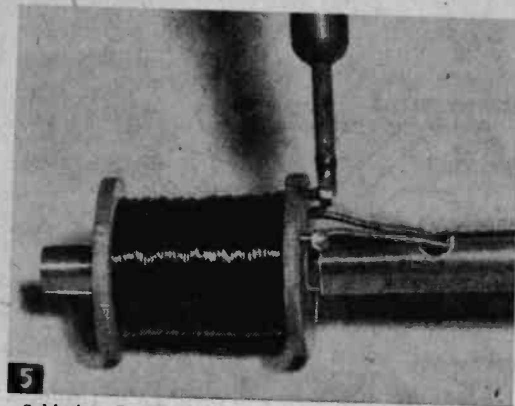
4

Magnets can be wound on the lathe, using a temporary turn counter rigged up like this with a rubber vacuum cleaner belt, and 1:1 ratio pulleys. Wind turns as evenly as possible, so surface of finished coil will be comparatively level.

die stock by hand and take up advance with tailstock screw.

Making the Magnets. Figures 2A and B show how the cores for both the *pendulum* and *fixed* magnets are made. To drill and tap the hole in the end of the fixed magnet's core (B in Fig. 2), secure the end of this core in the lathe chuck, and then use a center drill first, followed by a #35 drill. For accurate tapping, allow the tailstock center to enter the hole in the end of the tap wrench to thus keep the tap in line. Then slowly work the tap in by hand, taking up the advance with the tailstock screw. Apply some oil and be very careful not to break off the tap, working it back and forth a bit as the cutting of the threads advances.

Make four spool ends from 3/32 or 1/8 in. thick plastic (Fig. 2A). You can either turn these in the lathe after cutting them out roughly round



5

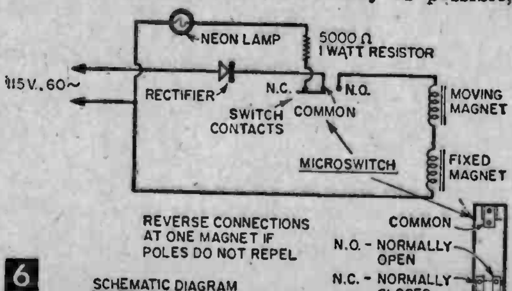
Soldering flexible leads to terminal pins, after movable magnet's core has been pressed into pendulum tubing. Avoid too much heat on pins or they may loosen in plastic.

on a jigsaw, or, with care, make them round to a marked line on a sanding disc. The center holes in the spool ends must be a press fit on the steel cores. Press the plastic ends on the steel cores so that they will be 1⅛ in. apart between the inside surfaces, to give you the correct amount of winding space. One end of the core should project ⅜ in. beyond the spool end in each case. Wrap a layer of paper masking tape around core area between the spools, to act as insulation between the core and the coil that is to be wound on.

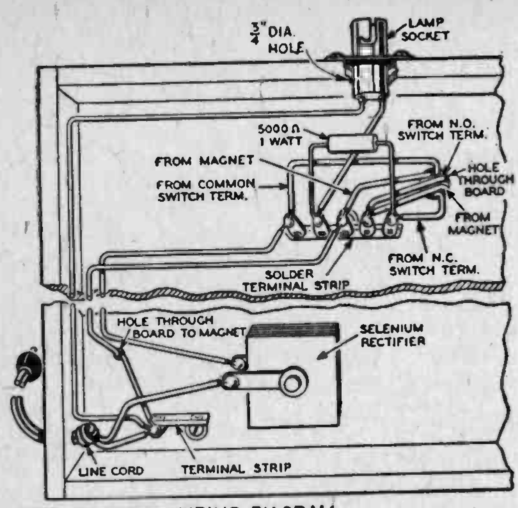
Drill a hole with a #55 drill through the spool end, at the side that will represent the back end of the spool, and make this hole come through close to the taped core for the start end of the winding (Fig. 2A). Drill a second hole close to the outer edge of the plastic for the finish end. To make sure spool ends stay in place, apply a little Pliobond cement at the inside junction of the taped core and the ends, and allow this to dry.

Figure 4 illustrates how magnets can be wound on a lathe at slow speed (100-200 *rpm*) with a turn counter belted to the lathe spindle to count the required turns. You can rig such a counter system by bolting or clamping a counter to the lathe bed, then fitting a 1-in. diameter pulley to the counter shaft and a second 1-in. diameter pulley over the lathe spindle, where it is locked in place by screwing on the chuck.

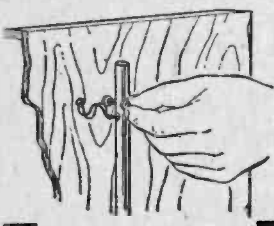
After winding on 2500 turns of #31 Formvar or Formex magnet wire, as evenly as possible,



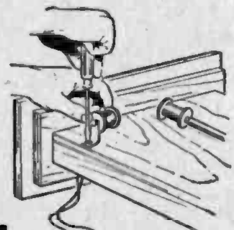
6 SCHEMATIC DIAGRAM



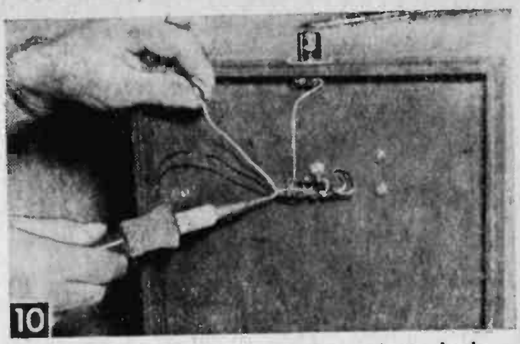
7 PICTORIAL WIRING DIAGRAM (AS VIEWED FROM BACK)



8 ATTACHING PENDULUM



9 ATTACHING FIXED MAGNET



10 Soldering connections at terminal strip on back.

bring the finish end out the hole provided in the spool end (Fig. 2A). Wind both coils exactly alike. Since the two coils are to be connected in series, there will be a total of 5000 turns in the circuit.

When winding is complete, there should be a margin of about ⅛ in. remaining on the spool ends beyond the coil. Drill two #52 holes in this space (Fig. 2A), but avoid touching the winding with the drill. Next, tightly press into these holes two pieces of ¼ in. long brass or copper wire; these will act as terminal posts or pins to which the flexible lead wires will be soldered. Clean the ends of the magnet wire and wrap them around these terminal posts. (To clean off Formex insulation, hold a match under the end of the wire a few seconds, then clean with fine sandpaper.)

With the magnet core pressed into the end of the brass pendulum tube, carry two pieces of #28 flexible insulated lead wire down through the tube, and solder them to the terminal pins (Fig. 5). (Very small, extra flexible wire must be used here, so that it can be coiled up at the top end before it enters a hole in the backboard, and still have good flexibility as the pendulum swings.)

Figure 2 shows the holes you will need to drill in the backboard and details D and E in Fig. 2 show the brackets you will need for the switch and the fixed magnet. Attach the pendulum arm to the board as in Fig. 2H. Follow the wiring arrangement indicated in Figs. 6 and 7, and the installation of components shown in Figs. 8 through 10. Note in Figs. 2 and 9 how the fixed magnet is secured with a ½-in. #7 roundhead brass screw and washer through its supporting bracket.

You can vary the position of the fixed magnet by swinging the bracket mount so that when the arm is held up to allow the two magnet cores to touch, they will meet without striking the spool ends. Then tighten the screw down. Cut a 1/16 in. thick rubber piece to 5/16 in. diameter circular shape. Cement this to the end of the fixed magnet core (Fig. 2B) with Pliobond cement, to act as a bumper in case the swinging magnet should touch the fixed magnet's core.

Mount the indicating neon lamp on top of the backboard in a flange-type bayonet socket (Fig. 7), fixed in a ¾ in. diameter hole bored in the top surface. Attach the switch to a brass bracket (Fig. 2D) which has slotted holes, so that switch position can be adjusted as required. The switch position is critical since it has to energize the magnets at the precise moment that the swinging magnet pole almost touches the fixed one. The two magnets are so connected that like poles are produced in the two, so that there is repulsion action. In making the connections, try the operation with the power on and see if the swinging magnet is repelled or attracted. If the two attract, simply reverse the leads to one magnet.

A final touch is to make up and attach a backboard of ⅛-in. Masonite, to cover the wiring and enclose the live connections.

To Operate the Pendulum, make sure unit is on a level surface, then plug in the cord and swing the arm by hand until the two magnets touch. After that they will continue operation.

The switch position may need adjusting at first, to find the point for the best action. With the swinging magnet held up to the first one by hand, you should feel the repulsion when it is about ½ in. away from the pole of the fixed one. Apply a drop of light oil to the pendulum shaft occasionally to assure free motion.

If run without stopping, the operation of this pendulum will be limited only by the life of the switch (capable of millions of operations before failure), and the number of times the coiled leads can be flexed without breaking.

Dress Up that Low Price RECORD PLAYER

By ARTHUR TRAUFFER

LOW-PRICE record players are often sold minus everything but the bare essentials, as was the case with the one shown in Fig. 1. But suppose we see what we can add to this player which will improve it. First, let's purchase a chrome drawer handle (for about 25c) and mount it on the front of the player cabinet (Fig. 2).

The flocked finish on most low-price turntables is pretty hard and doesn't wear too long, so let's cut a heavy brown felt disc the same diameter as the turntable, cut a 5/16 in. diameter hole in the exact center of the felt disc, apply a thin coat of LePages' glue (thinned with a little hot water) to the turntable top, and press the felt disc on evenly. This felt covering is easier on your records and also helps to reduce rumble.

For an arm rest and lock (Figs. 2, 3, and 6), which is handy when player is being carried, cut and drill a simple plastic strip as shown. Give the top of the strip a slight clockwise twist so that it will line up with the side of the curved pickup arm. Remove crystal from the arm temporarily so that you can drill a 5/32 in. hole through side of arm for a 6-32 *rh* (roundhead) brass machine screw about ½ in. long, a hexagon nut and a thumb nut (Fig. 4). Attach plastic arm rest to side of cabinet with two 6-32 *rh* brass machine screws about ¾ in. long, positioning the arm rest so that screw on arm slips into slot freely.

If player is to be carried about, you'll want to have line and pickup cords neatly coiled and out of the way. To do this, mount two simple S-shaped brackets on back of player cabinet (Fig. 5). Bend the two brackets from 2 x 2 x ½- x 1/16 in. brass angle brackets (the dime store has them). Mount brackets about 7½ in. apart with four ¾ in. long 6-32 *rh* brass machine screws.

Fig. 1. BEFORE—record player as it came from the dealer.

Fig. 2. AFTER—all dolled up! Note chrome handle, layer of felt on hard turntable, arm rest and lock, and brackets for reeling up line cord and pickup cable.

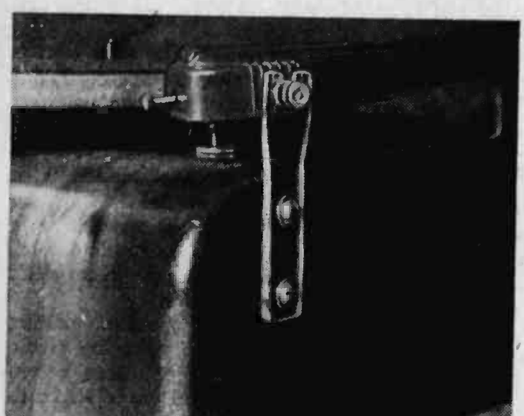
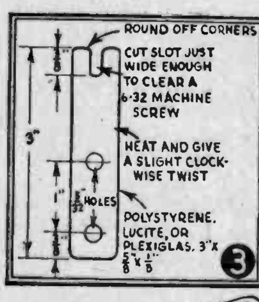
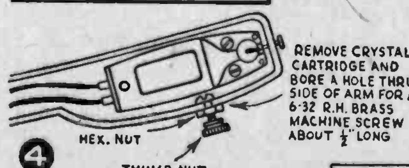
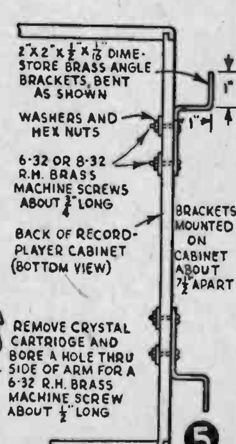
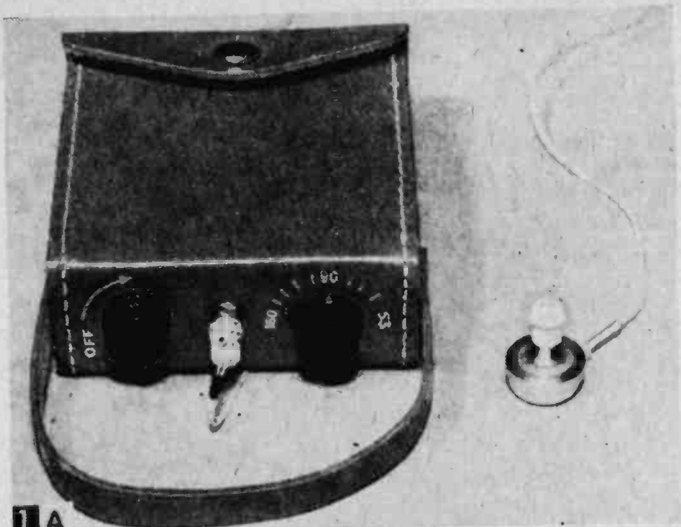


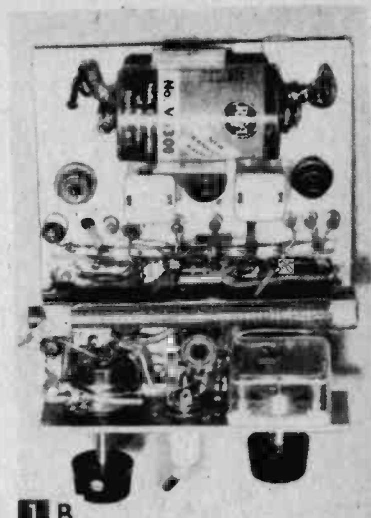
Fig. 6. Closeup of plastic arm rest and lock.









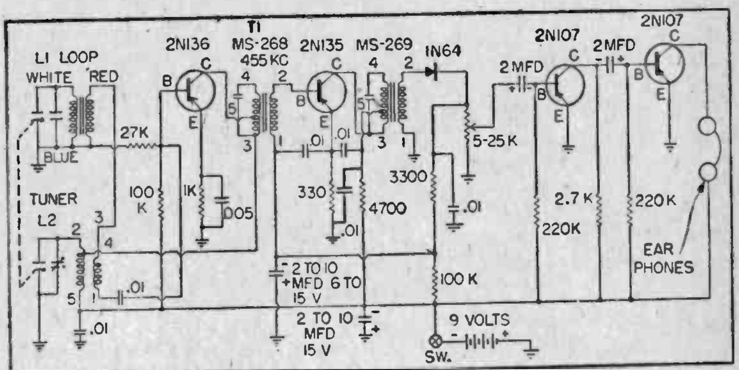


Strap allows set to be toted or tucked into pocket. Leather case (1A) may be purchased or handcrafted. Top view of simple, L-shaped chassis (1B). Loop coil snaps into fuse clips supported on spacers and a simple aluminum clip secures the miniature 9-volt transistor cell.

Play-as-You-Go Pocket Portable

HERE is a four-transistor, superheterodyne pocket-size set (Fig. 1) that will play anywhere—or almost anywhere. Because of the small size of the ferrite rod "loop" antenna, the sensitivity of this set—without employing an external antenna—is somewhat limited, but if you live in a community with stations operating on 10,000 watts or more power, no external antenna connection will be needed.

If you don't live in such a community, wind about three turns of plastic, stranded wire around the end of the ferrite loop where the leads are located. Tape the other end of the wire and attach a small battery clip or alligator clip to it. When this clip is attached to a metal object such as a metal screen, lamp standard, or phone box, even far-distant stations can be received, and the dangling wire alone may be sufficient for even the weaker local stations.



2 SCHEMATIC WIRING DIAGRAM

HOLE SYMBOLS

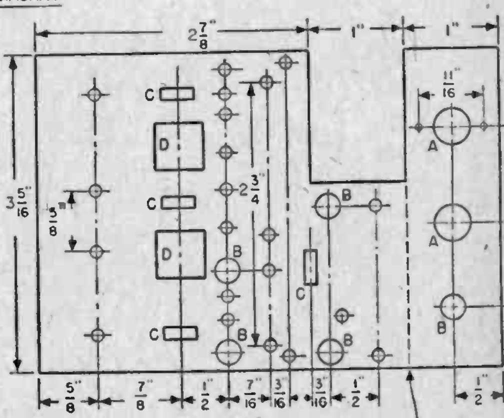
A - HOLES - $\frac{3}{8}$" DIA.

B - HOLES - $\frac{1}{4}$" DIA.

C - HOLES - $\frac{11}{32}$" X $\frac{1}{8}$"

D - HOLES - $\frac{1}{2}$" SQ.

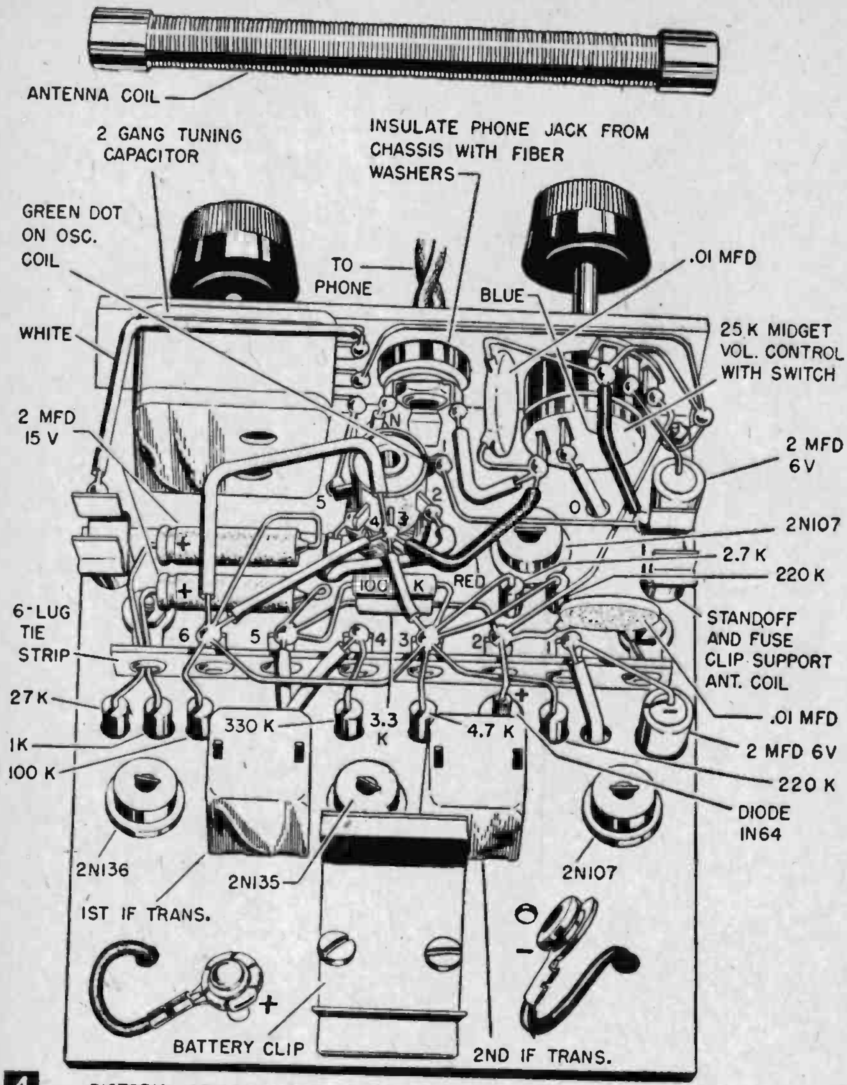
UNMARKED HOLES ALL $\frac{1}{8}$" EXCEPT THOSE ADJACENT TO A WHICH ARE $\frac{1}{16}$"



3 CHASSIS LAYOUT

NOTE: VERTICAL SPACING BETWEEN HOLES NOT CRITICAL EXCEPT WHERE DIMENSIONS APPEAR

BEND UP 90°



4 PICTORIAL WIRING DIAGRAM (TOP VIEW)

have no connecting leads since the connection is already made by an internal capacitor.

The tiny Bakelite transistor sockets are secured to the chassis by spring locking rings. Use a screwdriver blade to press and lock the ring to the socket body. The oscillator coil mounts firmly to the chassis without the use of brackets or screws. Simply insert a rubber grommet into the ¼-in. chassis hole, moisten the Bakelite coil tube with your lips, and press into the grommet hole.

Small components such as resistors, the diode detector, and electrolytic capacitors are neatly and firmly anchored by means of a six-lug tie-strip with separate grounding lugs at each end (see Fig. 6). Note that positive and negative positions are indicated for electrolytic capacitors and diode detector. Capacitors use the conventional plus (+) sign. Diodes, however, may indicate the positive side with either a dot or a band at one end of the unit. Components are positioned in the row of holes running parallel with the tie-strip, allowing pigtail leads on the top of chassis to terminate on the appropriate strip lug while the pigtail lead on the opposite end of the component terminates on its respective transistor socket lug on the underside of the chassis.

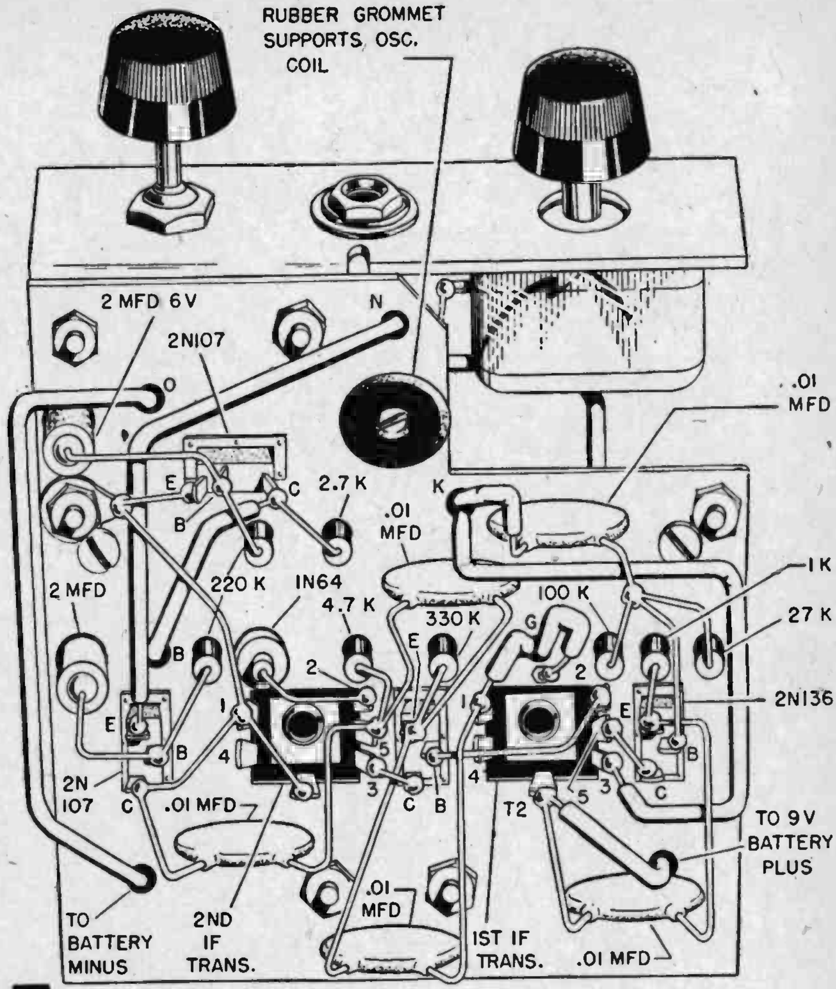
Chassis holes B, G, N and K in Fig. 5 allow passage of hookup leads from the top to the underside of the chassis. Practically all circuit connections can be made with the component pigtail leads. Since most of these leads are quite short, only the longer leads and those passing from one side of the chassis require insulation. Spaghetti radio tubing may be used for insulating purposes, or insulated vinyl hookup wire may be employed

The set's pee-wee dimensions are made possible through use of a sub-miniature two-gang, plastic encased tuning capacitor, volume control, phone jack, and I.F. transformers. These parts are readily available from the source given in the Materials List. When completed, this tubeless transistorized superhet will be no larger in size than two packages of king-size cigarettes.

The set is assembled on a simple, L-shaped chassis made from a piece of #14 gage aluminum measuring 3-5/16 x 5 in. Drill holes as indicated in Fig. 3 and bend up the end 90° as indicated by dotted lines. Then mount components as shown in Figs. 4, 5 and 6. The I.F. transformers are secured to the chassis by bending the end can lugs over the chassis after properly positioning each unit over the ½ x ½ in. chassis holes. Note that these ground lugs are not numbered in Fig. 5. Note also that the insulated lugs #4 on these transformers as in the case of battery connector leads.

Mounting of the ferrite rod antenna coil is done last. To support the ferrite rod, mount two Littelfuse clips on ½-in. by 3/16-in. dia. spacers using ¾ in. 4-40 machine screws to secure to chassis. All other screw-fastened components use ¼-in. by 4-40 machine screws and nuts.

To insulate the miniature phone jack from the chassis, place a fiber washer on each side of the ⅜-in. mounting hole, with jack centered in the opening. A miniature matching phone jack is used to attach the earphone cord. Because the conducting material in the cord is tinsel, it will not solder to the phone plug lugs directly. In removing insulation from the tinsel cord do not "skin" it off with a knife or wire stripper, but apply the tip of a soldering iron to it and melt away about ¼ in. and with a single strand of wire, such as found in fixture cord, bind the exposed tinsel much as you would tie a fishing fly. Then solder the cord tips to the phone plug lugs. Before screwing down the plug cap, cut out a small piece of cardboard and place it between the lugs to prevent the lugs from shorting against the plug cap as the cap is screwed down.



5 PICTORIAL WIRING DIAGRAM (BOTTOM VIEW)

Wire as shown in the schematic, Fig. 2. With wiring completed, install the transistors in their respective sockets, secure the RCA #VS-300 miniature 9-v. battery in the aluminum clip and attach snap connectors. To roughly align the set, provide an external antenna connection as previously described, turn on set with volume control at maximum and tune set until a station is heard. A good quality hearing aid type phone—one with a resistance of 2,000 to 10,000 ohms should be used with this unit. Do not expect results with imported crystal phones or "dynamic" phones from the Orient. Fine, British-made magnetic phones cost only a few cents more than the others; many U. S. made hearing aids are equipped with these British earphones.

With a screwdriver blade, fashioned by filing flat the end of a plastic crochet needle, turn the slug screw in the oscillator coil *in* until signal is loudest, or about 4½ turns from the slug's flush position. Note that on the back of the tuning capacitor there are two screws marked "Ant." and "Osc." These are the trimmer adjustments. Turn the screw marked "Ant." until the movable half-moon plate is ¾-meshed with the stationary plate. Next turn the "Osc." screw until its rotor plate meshes halfway with the stator plate.

The oscillator coil screw may be again turned a trifle left or right until peak signal strength is obtained. Set should now tune in numerous stations and, if of sufficient signal strength, they will come in without the external antenna pick-up.

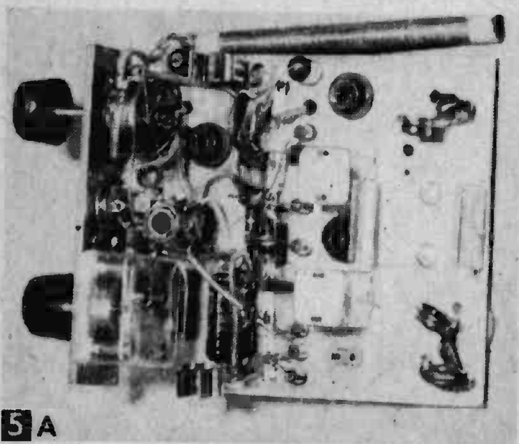
This set can be housed in a variety of cabinets, but a leather instrument case such as that shown in Fig. 1A makes a neat arrangement. It is very

MATERIALS LIST—POCKET PORTABLE

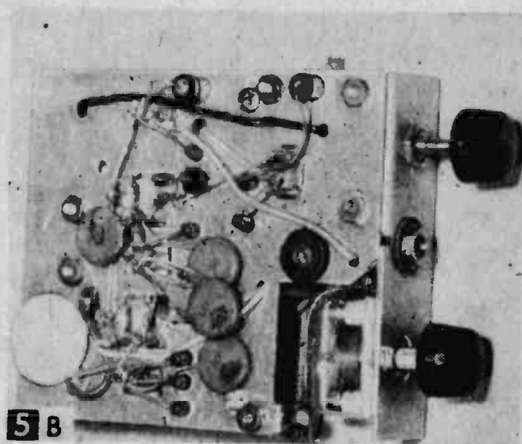
No.	DESCRIPTION
1	pc. #14 gauge aluminum 3⁵⁄₁₆x5"
1	2-gang miniature superhet tuning capacitor. 211 mmf. "Ant.": 101 mmf. "Osc."
2	2 mfd., 6v. electrolytic capacitors
2	2 mfd., 15 v. electrolytic capacitors
6	disc-type ceramic capacitors, .01 mfd.
1	disc-type ceramic capacitors, .005 mfd.
1	germanium diode detector, 1N64 or 1N48
1	GE type 2N136 transistor (Osc.-Mixer) (Converter)
1	GE type 2N135 transistor (I.F. Amp.)
1	GE type 2N107 transistor (Audio Amp.) (Driver)
1	GE type 2N107 transistor (Power Amp.)
1	25K ohm, sub-miniature potentiometer w/switch
2	220K ohm, ½-watt composition resistors
1	4.7K ohm, ½-watt composition resistors
1	2.7K ohm, ½-watt composition resistors
2	100K ohm, ½-watt composition resistors
1	1K ohm, ½-watt composition resistors
1	330 ohm, ½-watt composition resistors
1	3.3K ohm, ½-watt composition resistors
1	27K ohm, ½-watt composition resistors
1	1¹⁄₁₆" dia., knurled pointer knob for ¼" shaft
1	1¹⁄₁₆" dia., plain knob for ⅛" shaft
1	rubber grommet for ¼" hole
1	battery clip
2	Littelfuse clips: 2¼x½" spacers

No.	DESCRIPTION
4	transistor sockets
2	snap type battery connectors
2	soldering Lugs, #6
2	screws 4-40x¾" w/nuts
4	screws 4-40x¼" w/nuts
1	6-lug tie-strip
1	sub-miniature phone jack and plug set with insulating fiber washers
1	9 v. miniature transistor radio battery (RCA #VS-300)
1	battery mounting clip
1	1st I.F. transformer for transistor INPUT (T_1) (Lafayette MS-268 or (Automatic BS-725)
1	2nd I.F. transformer for transistor OUTPUT (T_2) (Lafayette MS-269 or (Automatic BS-726)
1	ferrite rod antenna coil (L_1) ¼"x3½" (Lafayette MS-272)
1	miniature oscillator coil (L_2) for transistor Service (Lafayette MS-265)
1	magnetic type hearing aid phone (2000 ohms or higher)

All components listed are available either singly or in complete kit form from Lafayette Radio Div., R-W-T, Inc., 165-08 Liberty Avenue, Jamaica 33, L.I., N.Y.

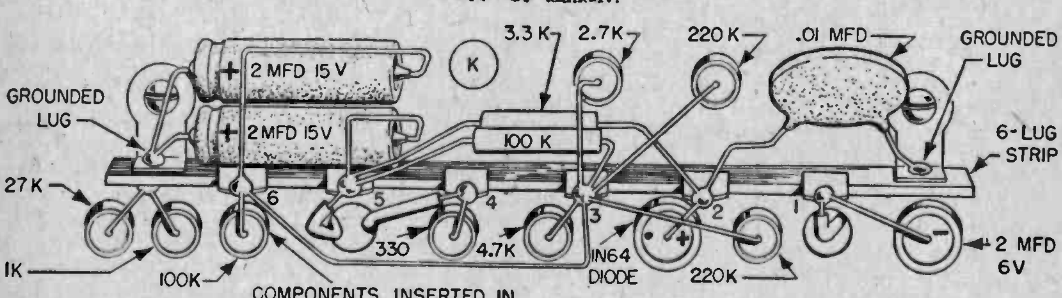


5A



5B

Left, top of chassis with battery removed, as well as one transistor to reveal miniature 3-pin socket. Note rigid mounting for components provided by 6-lug tie-strip. Right, underside of chassis. Except for long leads which are covered with plastic spaghetti insulation, short wires and disc capacitor leads are bare since shorts are unlikely.



6 CLOSE-UP DETAILS OF TIE-STRIP LOOKING DOWN ON CHASSIS

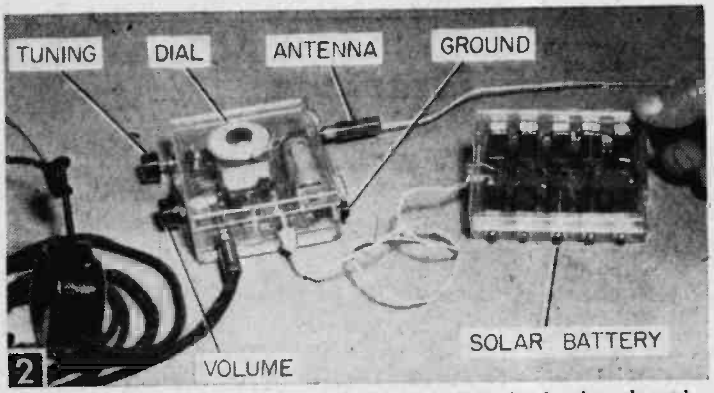
important that such a case have inside dimensions sufficient to accept the chassis; to avoid damage to components, inside measurements must be 1³⁄₁₆ x 3½ x 4 in. If a commercially made case isn't readily available, handcraft and hobby shops stock leather and bindings along with simple instructions for making a case to suit your needs.

If you are not too concerned with compactness, the sensitivity of the set can be increased by using a larger ferrite antenna coil and mounting it as far away from the set chassis as possible. Both the standard and miniature "loops" have the same red, white and blue color-coding.—T.A.B.

Midget 10-Cell Solar Battery

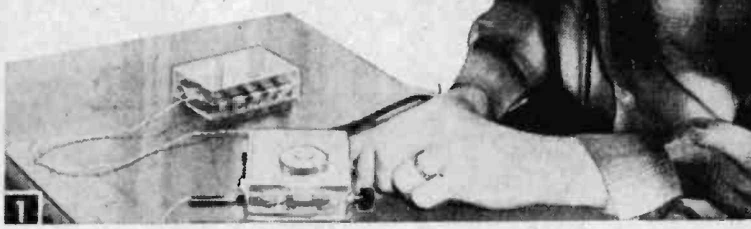
Powers Two-Transistor Radio

A T.R.F. receiver (with improved selectivity) that can run on the sun



Above. The receiver with the solar battery and 2000 ohm headset plugged into their jacks.

Right. The convertible radio is operating here entirely on solar energy. Plugging the solar battery into its jack automatically cuts the mercury battery out of the circuit.

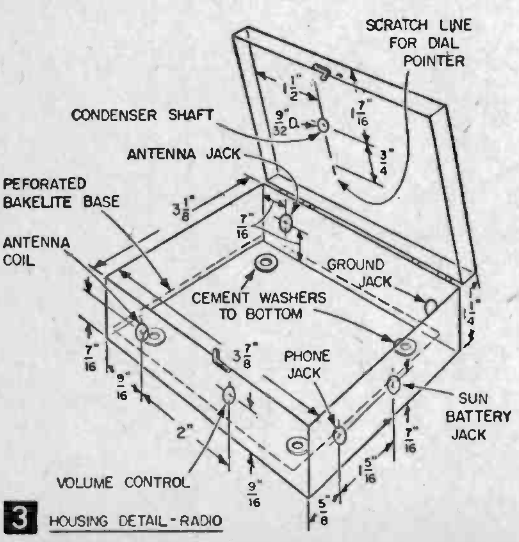



HERE is a two-transistor radio with a built-in mercury battery for use on dull days or at night, and a separate solar battery for use in bright sunshine or under strong artificial light (Figs 1 and 2). The radio can be built for about $10, the solar battery for approximately $15.

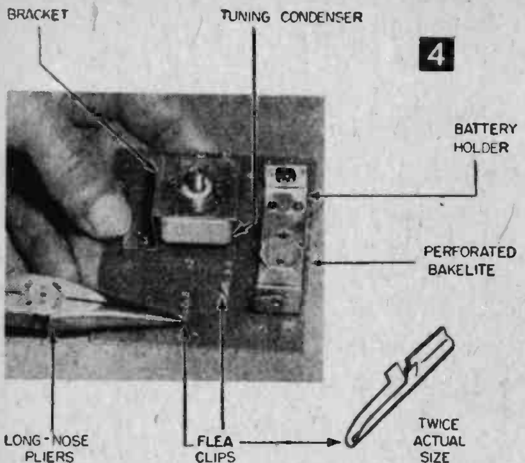
The simple tuned radio frequency type of circuit serves satisfactorily if the stations are not too closely spaced together on the dial, as is the case in some city areas. However, selectivity has been improved by using a tapped ferrite antenna coil of new design, which eliminates the need of partially unwinding the coil and tapping it or winding additional coil over the original one as is sometimes done to get a better low impedance match to the transistor.

By HAROLD P. STRAND

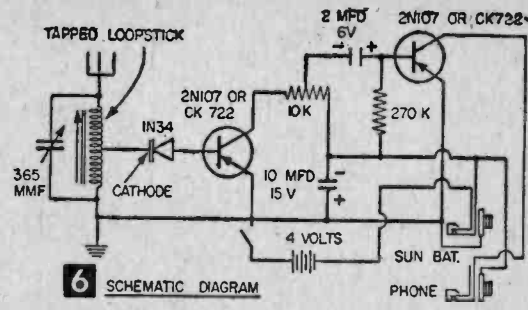
Start construction by cutting out the base for mounting the components and making terminal connections from 1/16 in. perforated Bakelite. Press tiny terminals called "flea" clips into the holes of the board to form convenient tie points, partially cutting off projecting ends on underside of base (Fig. 4). Use a 2-56 tap in the perforations for making threads for screws to mount condenser and battery holder, or enlarge the holes and use 4-40.



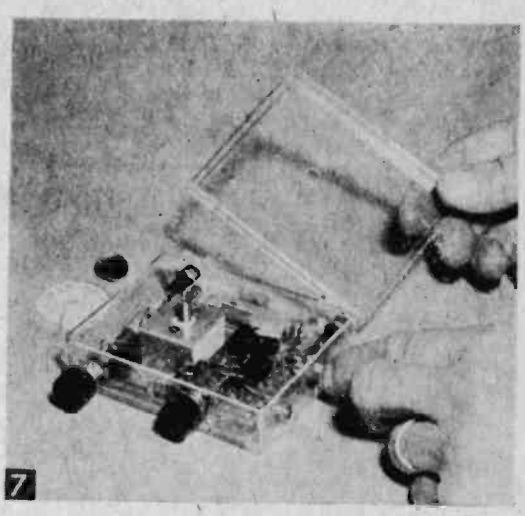
3 HOUSING DETAIL - RADIO



Terminals and tie points are provided with flea clips that press into the holes. Use diagonal pliers to cut off the projecting ends of the clips on the other side, leaving about 1/32 in., then slightly spread the remaining ends so clips will stay in place. Insert, close-up of flea clip.



6 SCHEMATIC DIAGRAM



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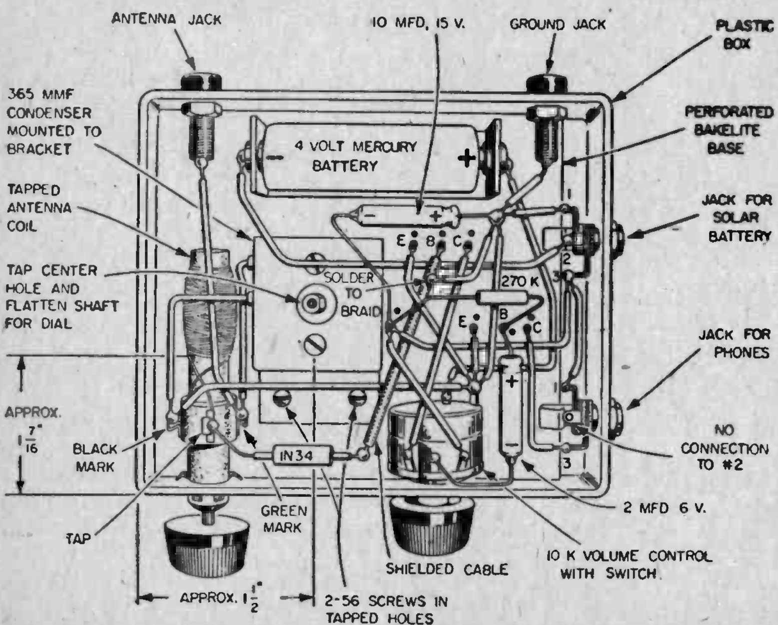
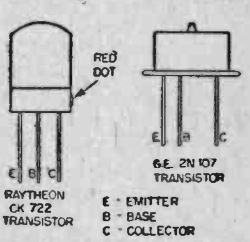
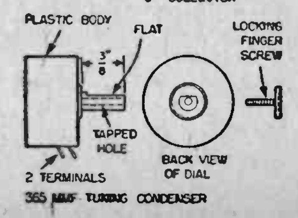
To remove cover, first separate one hinge by pulling lightly, then tip cover so that a twist will unlock the other hinge. To replace cover, place it in the position shown above so the hinge pin enters at this side. The other hinge is then pressed together.

Drill the holes in the 1¼ x 3⅛ x 3⅞ in. plastic case carefully, since this material cracks quite easily (Fig. 3). For the larger holes, use a smaller drill and hand ream to size. There are two holes in each of three sides, four in the bottom and one in the cover to clear the condenser shaft. Cement 1/16 in. thick washers to the bottom of the box over the holes used to secure Bakelite board to box, to act as spacers, and screw board in place with 4-40 machine screws.

With all components in place as shown in Fig. 5, start the wiring (Fig. 6), using any small plastic-covered hook-up wire such as #24 or 26 gage. Solder all connections carefully. At the transistor terminal clips, connect and solder the other leads first to protect the transistors from receiving too much heat.







5 PICTORIAL DIAGRAM

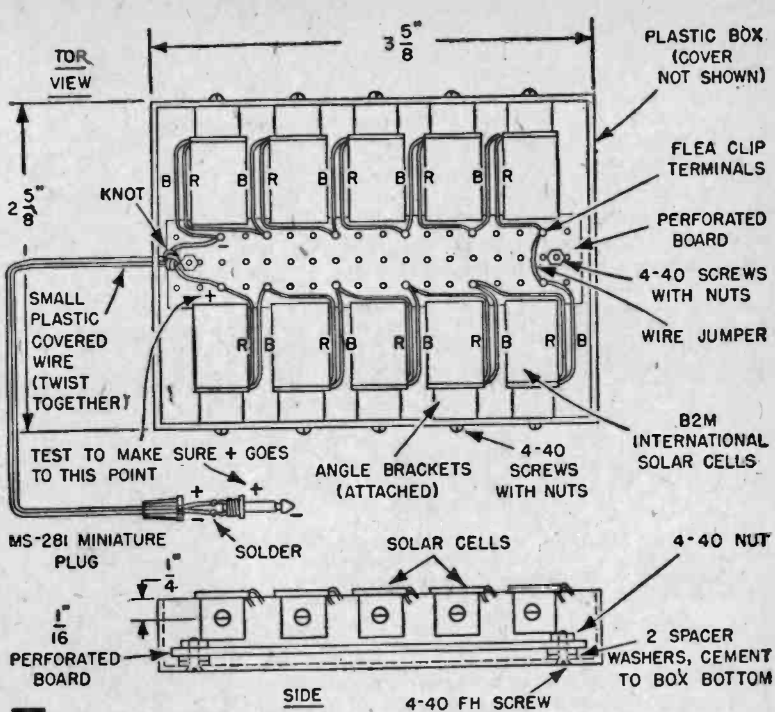
• LOCATE FLEA CLIP TERMINALS APPROXIMATELY AS SHOWN

Use long-nose pliers to absorb the heat while holding each transistor lead for soldering.

With wiring complete, install condenser dial, the shaft having been cut off to about ⅜ in. (Fig. 5). The dial fits on the end in a flattened recess, with a center screw retainer to hold it tightly fixed, which is installed last after cover is closed. Place the battery in its holder, spreading holder if necessary, and taking care to get the plus and minus ends to correspond with the polarity shown in Fig. 5.

A short length of antenna wire and a ground connection may be necessary in some areas; however, good reception is possible in many cases by simply clipping the antenna lead to the finger stop of a dial telephone and using no ground, or to the wire frame of a large lamp shade. Or you can wrap several turns of insulated wire around several slats of a metal venetian blind and these slats picking up radio energy will deliver it to the receiver inductively.

To assemble the solar battery, attach the cells to the sides of the 1 x 2⅝ x 3⅝ in. plastic box with 4-40 screws and nuts in drilled holes (as in Fig. 8). Mount a strip of the perforated Bakelite, such as was used in the radio, in the center to take the flea clips for lead connections. Connect all cells in series, that is, connect the red wire from one cell to the black of the next at a soldered connection and carry this to all cells, using a short jumper at the end of the two rows to join them as shown. This will leave one black (negative) and one red (positive) left over to connect at terminals to the leads with a plug on the end. It is very important to observe the polarity of the leads between cells, at the battery output terminals, and also at the plug connections so that the battery will be correctly connected. The positive lead is soldered to the positive plug terminal which is grounded to the body of the plug, the negative



8 SOLAR BATTERY

MATERIALS LIST—SOLAR OR DRY CELL RADIO

All material available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., or 110 Federal Street, Boston, Mass.

Amt.	Description	Lafayette Cat. (1957)
1	plastic case 1¼ x 3⅜ x 3⅞"	MS-298
1	tuning condenser 365 mmf	MS-274
1	tuning dial	KN-25
1	condenser mounting bracket	MS-310
1	transistor tapped Vari-Loop antenna coil	MS-299
1	10,000 ohm miniature volume control with switch	VC-28
2	miniature knobs for ⅛" shaft	MS-185
2	sub-miniature jacks	MS-282
2	sub-miniature plugs	MS-281
2	insulated tip jacks	MS-213 or PJ-23
2	phone tip plugs	MS-212 or PJ-11
1	Mallory mercury 4 volt battery	TR-133R
1	battery holder	MS-139 for Z cell
1 pc	perforated Bakelite sheet 1/16 x 3 11/16 x 6⅞"	MS-305
2	transistors, G.E. 2N107 or Raytheon CK722	
1 pkg	flea terminal clips (12)	MS-263
1	2 mfd 6 volt Argonne condenser	
1	10 mfd 15 volt Argonne condenser	
1	270,000 ohm ½ watt resistor	
1	1N34 diode (or 1N34A, 1N48, 1N64)	
2	Mueller test clips #45 for antenna and ground connections	
12 ft	plastic insulated stranded wire #22 to 24 gage (for antenna and ground lead)	
3 in.	shielded cable, Beldon 8885	
3 ft	hook-up wire, plastic-covered, #24 gage or smaller, solid or stranded	
	2-56 or 4-40 machine screws (from hardware stores) and 1/16" thick washers	
1	2000 ohm headphone (Cannon AM-15-2, about $2.08), or hearing-aid-type earpiece with less volume and tonal quality (Cat. #MS-260, $3.95)	
	Solar Battery	
1	plastic case 1 x 2⅝ x 3⅝"	MS-159
10	International Rectifier Corp. B2M solar cells ($1.47 ea., including wire leads and mounting brackets)	
1 pc	perforated Bakelite sheet about 1/16 x 3⅜ x 1 1/16", cutting from radio piece	
1 pkg	flea clips (12)	MS-263
3 ft	small gage plastic-covered wire for solar battery leads. Can use hearing aid cord (not tinsel type) or other stranded wire of about 26 gage	

to the terminal which is insulated to form the tip connection or negative side. If the leads are twisted together to form a cable, it may be hard to trace individual wires. In this case, use an ohmmeter or other indicating device to trace the wires at both ends to get the connections correct, or use a voltmeter with the battery in the sun to check for correct polarity. The radio will not work on reversed polarity of either the dry or solar battery and may be damaged.

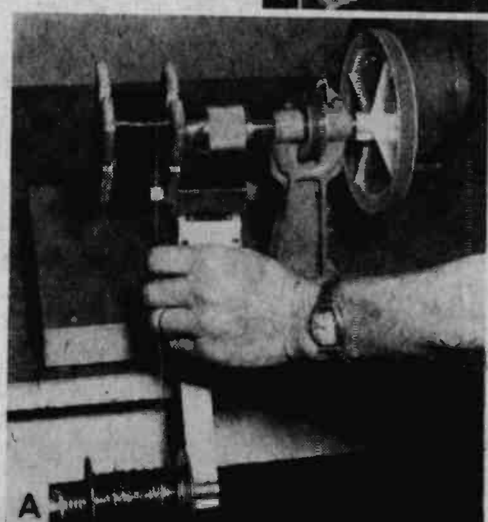
This solar battery is useful for powering any one- or two-transistor radio or other equipment having very light current requirements. Our radio uses around .45 milliamperes, which allows a voltage of about 2.7 volts, and which is sufficient to run the set very well. With twice as many cells connected in series-parallel, you get twice the output current, but it is probably better to employ larger cells in a straight series circuit for such cases.

Electrical Coil-winding Machine

By HAROLD P. STRAND
Craft Print Project No. 265

UNLESS you have a metal-turning lathe, or some similar machine capable of holding and turning a coil-winding form at a slow speed, winding a coil having hundreds of turns on it can be quite a chore. To answer the need for such a machine for those of you interested in making home-built electronic devices requiring coils for special size transformers, solenoids, etc., the electric-motor driven winder shown in Fig. 1 has been developed.

The winder is powered with a used Hoover vacuum-cleaner motor purchased at a repair shop for $5. It is of the *ac-dc* or universal type which is subject to speed control with a variable resistance or reactor and is of a large heavy-duty type. The machine's foot controlled reactor (Fig. 1) has an infinite number of speed control steps; it will not heat up in use, wasting power; and has no wiping contacts usually employed with a resistance control.



Variable speed, foot-control switch regulates speed of motor when winding coil. Photo A shows how magnet wire is hand guided from spool to coil windings.

When purchasing the vacuum-cleaner motor, turn it on and observe the commutator. There should not be appreciable arcing at the brushes which could indicate a short in the armature winding. Failure to run at its customary high speed is another indication of defective armature windings. However, worn carbon brushes could also produce these effects, so check the length of the brushes—they should be at least 7/16 in. long. Also check the armature-shaft bearings for wear. Remove the motor from the cleaner and attempt to move the fan and shaft from side to side. Any side movement indicates worn bearings. A little end play, in and out movement of the shaft, is permissible, however. Select a motor having a 3/8 in. dia. shaft on it.

Left, Cleaning disassembled motor with rag moistened in kerosene. Right, Clean commutator with fine sandpaper to inspect it for grooves or ridges.

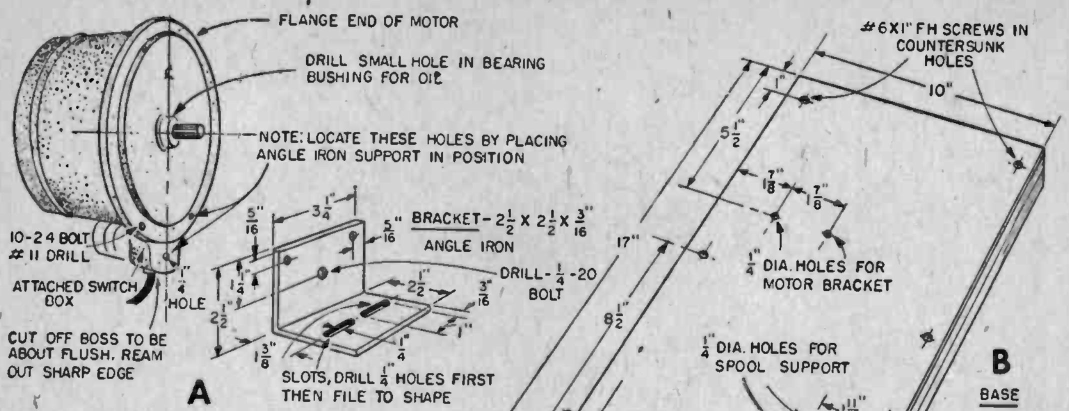
A 150-watt lamp is connected in series with motor to reduce its speed when test running.

After purchasing a motor in the best possible condition, take it apart and clean with kerosene or carbon-tet. First remove the brush holders and brushes from their supports on the insulated ring. Then remove the two screws at the ring of the outside bearing cap, disassemble the motor as in Fig. 2. When cleaning, do not immerse the wound parts in cleaning fluid, merely wipe them off with a cloth dampened with the cleaning fluid or brush off the dirt if it is dry and loose. Clean the armature commutator with fine sandpaper as in Fig. 3. If ridges or grooves appear on the commutator after cleaning, have it turned down in a lathe and lightly sand smooth. Then clean out any deposits between the segments, which might cause shorts, by scraping with a thin but sharp tool. A quick test for shorts or grounded wiring in the armature can be made by having it tested on a growler at your local automotive generator repair shop. If it is found that new armature-shaft bearings are needed, they can best be installed at a vacuum-cleaner repair shop while you have the motor apart. At this time also saw off the 3/8 in. armature shaft so that it will project only 1 in. beyond the outside edge of the bearing when assembled. Be sure to apply a drop or two of light machine oil on the bearings when assembling the motor and install new brushes if the old ones are worn down to under 7/16 in. in length. Since these motors operate in a clockwise direction, when facing the shaft, change the direction of rotation by interchanging the two brush leads. Later, after testing the motor, adjust the insulated brush ring so that the brushes will be located at a point

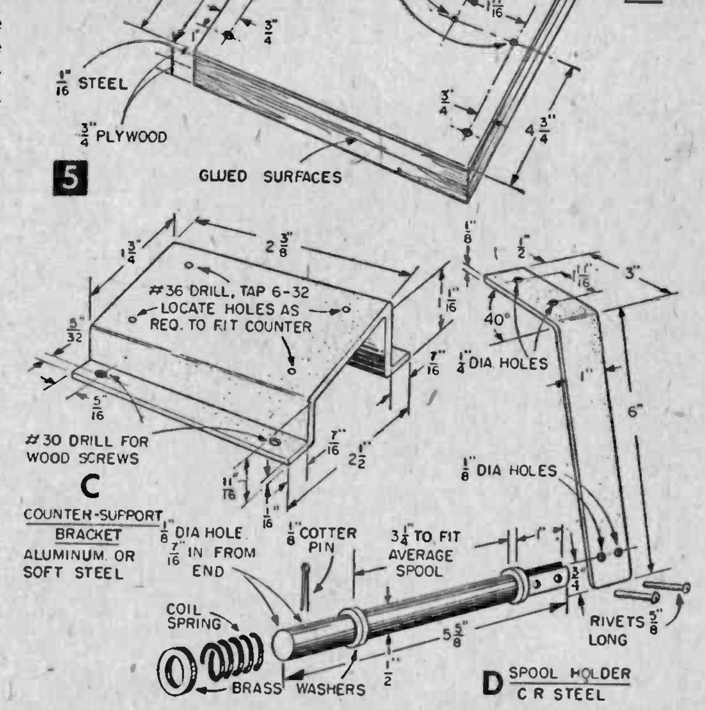
MATERIALS LIST—COIL-WINDER

Main Motor Unit

No.	Description
1	used universal motor from a (Hoover) vacuum cleaner, having a 3/8" dia. shaft, vertical mounted with toggle switch on base
1	1½" dia. V-pulley for small belt with ½" dia. hole (Sears Roebuck)
1	bushing to reduce ½" pulley to 3/8" shaft (½ O.D. x 3/8 I.D. x 1" long). (Boston Gear Works, 14 Hayward Street, Dept. SM, Quincy 71, Mass. or local distributor)
1	6" dia. pulley for small belt with ½" dia. hole (Sears Roebuck)
1	polishing stand with ½" shaft (Sears Roebuck)
1	½" chuck to fit shaft (Sears Roebuck)
1	small V-belt, 3/8 x 24" (Sears Roebuck)
1	Bakelite surface type toggle switch with slotted base Leviton #1210 (electrical supply store)
10-14 ft	round rubber, light duty vacuum cleaner cord (vac. cleaner shop)
1	attachment plug cap (electrical supply store)
1 pc	2½ x 2½ x 3/16" angle iron 3¼" long (scrap piece from a metal-working shop)
1	rubber vacuum cleaner belt, 4 3/8"—4 5/8" dia. when laid in a circle (vac. cleaner shop)
1 pc	aluminum or hot rolled soft steel 1/16 x 2 3/8 x about 4½" (scrap) (bend to make counter support)
1	Revolution Veeder-Root counter with reset knob or key, 4 or 5 figure columns with right hand column indicating direct single turns. Purchase from large hardware and machinery supply concerns or write to Veeder-Root Inc., Ninth Floor, 27 Sargeant Ave., Hartford, Conn., for nearest distributor or try surplus concerns
2 pcs	fir plywood ¾ x 10 x 17" (base)
1 pc	cold rolled steel 1/16 x 10 x 17" (sheet metal shop)
1 pc	Bakelite or brass 1½ dia. x about 1½" long (turn to make counter pulley), or purchase 2 Cat. #PVL 1.5 pulleys from Boston Gear Works. For sprocket drive, order two K2520 sprockets and 19" of ¼" pitch chain
4	¾" dia. rubber headed tacks for base feet
1 pc	cold rolled steel 1/8 x 1 x 9" (spool holder)
1 pc	cold rolled steel ½" dia. x 5 5/8" long or make it longer if larger than 3¼" spools are to be used (spool holder)
3	brass washers about 1" diameter, 1/8" thick to fit over ½" shaft (spool holder)
1	coil spring to fit over ½" shaft, 1" long, about .075" piano wire (spool holder)
1	cotter pin 1/8" dia., 1" long (spool holder)
2	soft iron rh rivets 1/8 x 5/8" (spool holder)
	miscellaneous screws, nuts, washers, paint, etc.



where the speed and torque of the motor will be at maximum. These motors were also designed to operate in a vertical position and have a drilled shaft and wick to supply oil to the lower bearing. To operate in a horizontal position, drill a 1/16-in. hole at the top side of the extended end of the bearing so that oil can be applied directly to this bearing. After reassembling the motor, test run it with a 150 watt lamp connected in series as in Fig. 4 so that the motor will operate at a reduced speed. Check the commutation and let the brushes run in to a good fit.

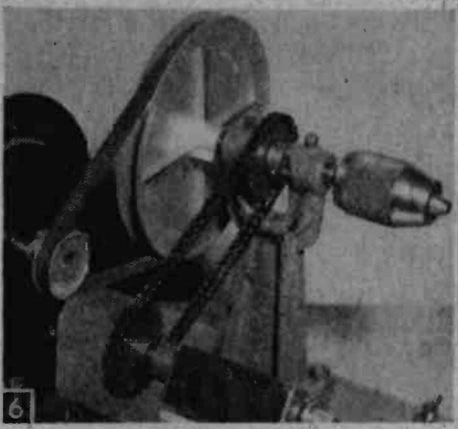


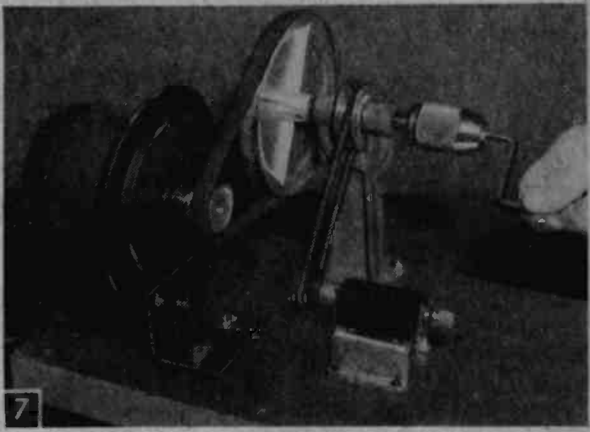
Make the motor bracket (Fig. 5A) and fasten to the motor flange with three bolts. To make the slotted holes used to fasten the bracket to the base, drill three 1/4-in. holes side by side and file to a slot by hand or with the filing machine (Fig. 6) described in the Home Electrical Handbook Vol. 3. Since it is difficult to purchase a 1½ in. dia. V-belt pulley with a 3/8 in. bore, a ½ O.D.x3/8 I.D. bushing is placed in the ½ in. hole of the pulley. Drill through the bushing so that the pulley setscrew can be tightened down against the motor shaft.

Make the base (Fig. 5B) next by gluing two pieces of ¾ in. plywood together to form a 1½ in. thick piece. Have a 1/16 in. thick piece of sheet steel cut to the exact size of the plywood base at your local sheet-metal shop and fasten to the base with six #6x1 in. *fh* screws countersunk flush with the steel base top. Dress the edges of the steel top with a sanding disc and slightly round the top corners with a file. Then lay out and drill the holes for the motor bracket and spool support. To finish the base, give it two coats of gray paint on the edges and bottom of the plywood and attach four ¾ in. dia. rubber headed tacks to the underside at the corners for feet.

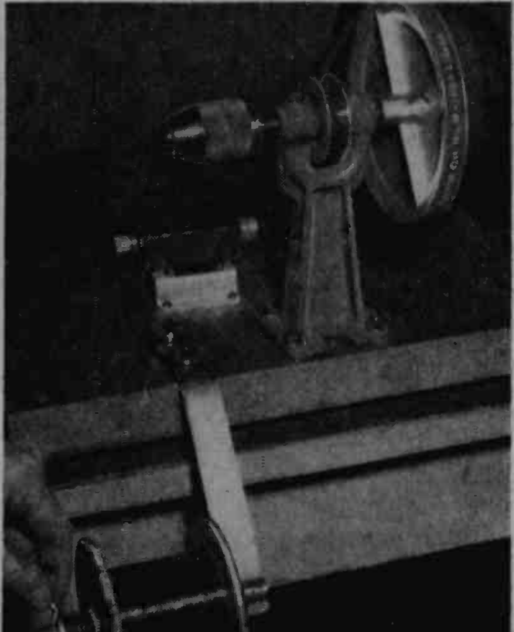
After purchasing the counter, (see Materials List for source of supply) make the counter support bracket (Fig. 5C). Since the counter must rotate at a one-to-one ratio with the polishing-head shaft, a pulley having the exact same diameter as the small pulley on the polishing-head (Fig. 7) must be made for the counter shaft. If you have a metal-turning lathe this becomes a fairly simple matter. Make the pulley for a round, rubber vacuum cleaner belt. Drill and tap the pulley for a 6-32 set-screw to fasten it to the counter shaft. If you do not have a metal turning lathe, purchase the two 1½-in. pulleys noted in Materials List. Bore one to ½ in. for polishing head and bush the other to suit counter shaft. A chain and sprocket drive (Fig. 6) which costs about $5 for parts, would assure accuracy.

The winder parts can now be assembled to the base for testing. Loosen the set-screw in the small pulley of the polishing head, slide the





Left, Alternate drive design using chain and sprocket assures positive accuracy in counting number of turns. Right, Making accuracy check of counter by turning polishing head shaft by hand a counted number of times.



A cotterpin retains spool and spring which applies braking action on spool to prevent spinning.

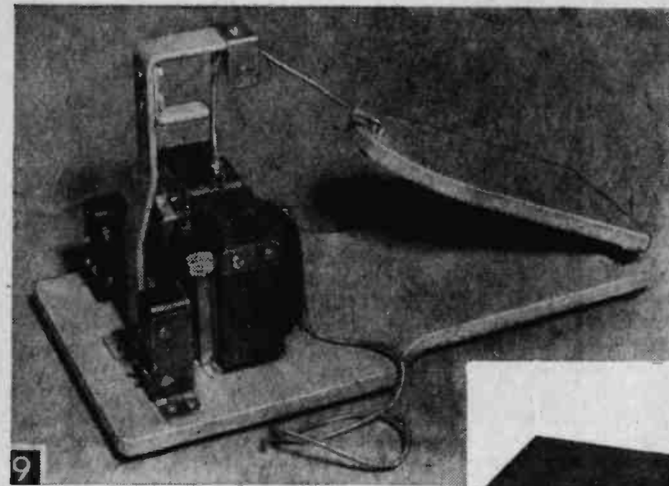
threaded shaft and slip the vacuum cleaner belt on the small pulley. Reassemble the shaft and place a 6 in. dia. V-belt pulley on the end of the shaft having the left-hand threads. Bolt the motor to the base first. Then, with the V-belt on the motor and polishing head pulleys pulled taut and in line with each other, mark the base for the polishing head mounting bolts, drill and fasten the head to the base. Locate and mount the counter on the base in the same way.

To check the counter drive for accuracy, mount a hand-tight drill chuck on the polishing-head spindle and grip a piece of wire bent to the shape of a handle in the chuck jaws as in Fig. 7. Then mark the chuck or 6 in. pulley with a spot of paint or crayon so that the number of revolutions can be counted as the crank is turned. Set the counter at zero, turn the crank exactly 10 times and note the number of turns registered on the counter. If there is much of a difference in pulley diameters it will show up on the counter as over or under 10 turns. If the error in pulley diameter is only very slight, the counter will probably register accurately over so few turns. However, since even a slight error will be cumulative, it is well to try a hundred or more turns of the crank if 10 turns show up accurate. If the figures on the counter are less than the number turned by hand, it indicates the pulley on the counter is larger than the pulley on the polishing head. If the figures are more than the number turned by hand, the pulley on the counter is smaller than the polishing head pulley. You can reduce the diameter of either pulley by putting it in a lathe, if you have one or can secure the use of one, and turning the bottom of the pulley groove down. It is also possible to place a turn of narrow friction tape at the bottom of the pulley grooves to make the size correction.

After testing the counter and making the corrections if needed, make the holder for the magnet-wire spool as detailed in Fig. 5D. Fasten the holder to the base with two bolts and using nuts as in Fig. 8. If various width spools of wire are to be used, make the bar longer and drill several holes spaced to suit the spools. Allow space for the washers and spring compressed enough to supply some braking action on the spool so that when the winding is stopped, the spool will not spin around and tangle the wire.

Making Variable Speed Foot Control Switch

After completing the coil-winding machine itself, your next step is to make the variable



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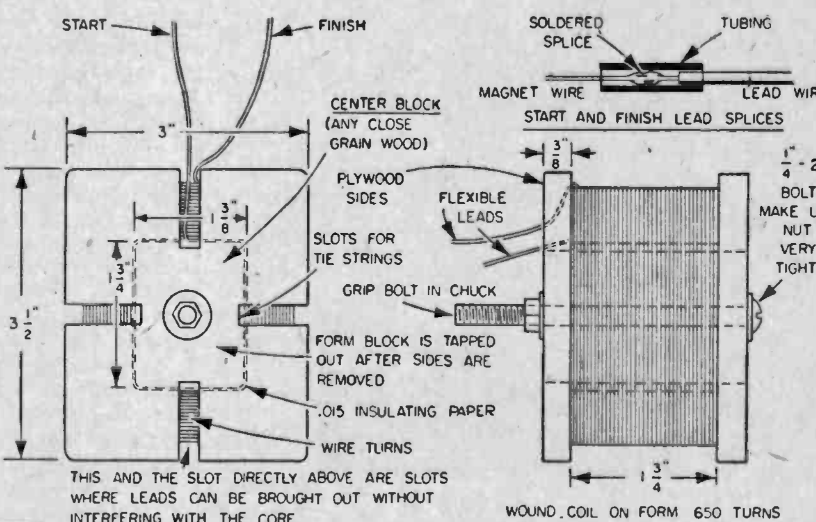
Left, completed foot switch showing pedal in up position, core in down position. Below, when foot pedal is depressed, core is lifted to up position.

10

speed, foot-control switch (Fig. 1). The variable speed foot-control switch consists of a coil and a stack of steel E-shaped laminations arranged so that the laminations can be raised and lowered in the coil (Figs. 9 and 10). The position of the laminations in the coil varies the reactance, which in turn causes a variation in the motor speed as required for winding various types of coils.

When the core is fully in the coil (Fig. 9), the reactance will be maximum and the power to the motor will be choked off to bring it to a virtual stop. On this position, the foot pedal is at its upper position and a switch arranged to be operated by the downward motion of the core will open the line to fully cut off power to the motor.



11 COIL AND WINDING FORM DETAILS

As the foot pedal is depressed (Fig. 10), the core is raised out of the coil giving a very smooth increase in motor speed until the pedal is nearly down to the base at which point the core is practically out of the coil and the motor is then running only on the impedance of the winding or nearly full speed. With further pressure on the pedal, a second switch is operated automatically to short out the coil and the motor then is directly on the line at full speed.

Start construction with the laminated core. Obtain an old radio power transformer which has laminations of approximately the size shown in Fig. 12. Disassemble the transformer and pile up a stack of the E-shaped laminations 1⅛ in. high. Clamp, drill and flush rivet the stack together to form a solid block as in Fig. 12.

The coil can be wound on the completed winding machine by using a temporary adjustable resistance, such as a rheostat or slide wire (Fig. 13), to limit the speed. First, make up a winding form (Fig. 11) with a center block 1⅜ x 1¾ x 1¾ in. long with a ¼-in. dia. hole through the center. Smooth the block well and slightly round the corners. Make the sides from ⅜-in. plywood and cut slots for the tie strings in the four sides of the block and the side pieces so that strings can be passed in under the coil. Apply a little wax to the form block after it is assembled to aid in getting the block out of the finished coil easily. Before winding the wire, place a turn of .015-in. insulating paper tightly around the block and fasten with cellophane tape. Using *Formvar* #22 wire, solder a #18 flexible insulated lead on the start end of the wire and wind 650 turns on the coil form. Solder a flexible insulated lead (Fig. 14), to the finish end. Use a short piece of spaghetti tubing over the splices for insulation. Wind the turns in a tight even manner, avoiding unnecessary crossing of turns. Be sure to bring the leads out of the slot in the form at one of the two narrow sides so as not to interfere with the core.

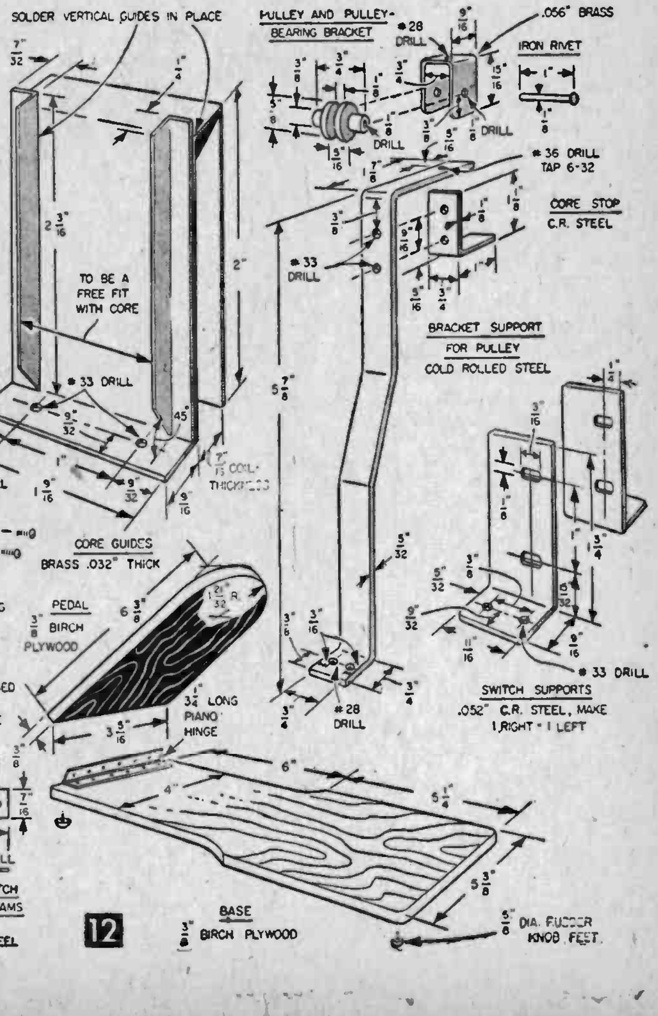
Bind the coil together with strings passed under the coil at four points and tightly tied (Fig. 15). Then remove the bolt and carefully tap the center block out.

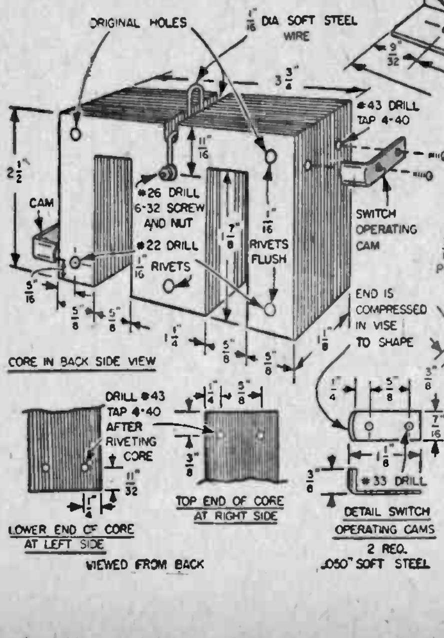
Insert the stacked core block into the coil to see if enough space exists for taping the coil and installation of the brass guide pieces and still allow the core to slide up and down freely. The coil can also be temporarily

MATERIALS LIST—FOOT CONTROL

All dimensions in inches

No.	Size and Description	Use
1	old power radio transformer having a core with laminations as detailed in a drawing	
2	microswitches, double-throw type with arms and rollers, Type HEPC (electronic supply stores)	
1¼ lbs	(approx) #22 Formex or Formvar magnet wire (try motor winding shops or Allied Radio, Chicago has it in 1 lb. spools. Purchase 2 spools and splice ends together.	
1 pc	⅜ x 5⅜ x 11¼ birch plywood	base
1 pc	⅜ x 3⁵⁄₁₆ x 6⅜ birch plywood	pedal
1 pc	3¼" long piano hinge	
1 pc	⁵⁄₃₂ x ¾ x 9 long cold rolled steel	bracket support
1 pc	about .056 thick x ⁹⁄₁₆ x 2⅞ sheet brass	pulley bearing bracket
2 pcs	about .032 thick x 1⁹⁄₁₆ x 5 sheet brass	make two core guides
1 pc	about .032 thick x ½ x 9 sheet brass	make 4 side guides
1 pc	⅛ x ¾ x about 2¼ cold rolled steel	make core stop
1 pc	¾ dia. x 1¼ long brass	turn to make pulley
1	⅛ dia. x 1 iron rivet	pulley shaft
1 pc	.052-.054 x ¹¹⁄₁₆ x 5 cold rolled steel	make supports for 2 switches
1 pc	⅛ dia. and 8 long, extra flexible steel cable, or use strong cord or small chain	bend to make eye for foot pedal
1 pc	¹⁄₁₆ dia. x 1 long steel rod (soft)	bend to make cable clamp for line cord
1 pc	¹⁄₃₂ x ⅝ x 2 soft sheet steel	
2 pcs	.050 x ⁷⁄₁₆ x 1⅝ soft steel	switch cams
4	⅝ dia. rubber knob feet with wood screws Allied Radio Cat. 44N764	under side of base
1 pc	#14-12 gage x 4 long soft iron wire	bend to make eye on top of core
1 pc	6¼ x 25 perforated sheet metal about .032 thick in any design to make enclosure around foot control parts	
	Misc. screws, nuts, washers, hook-up wire, paints, etc.	
1 pc	#18 two-wire vacuum-cleaner line cord. 5 ft. long.	





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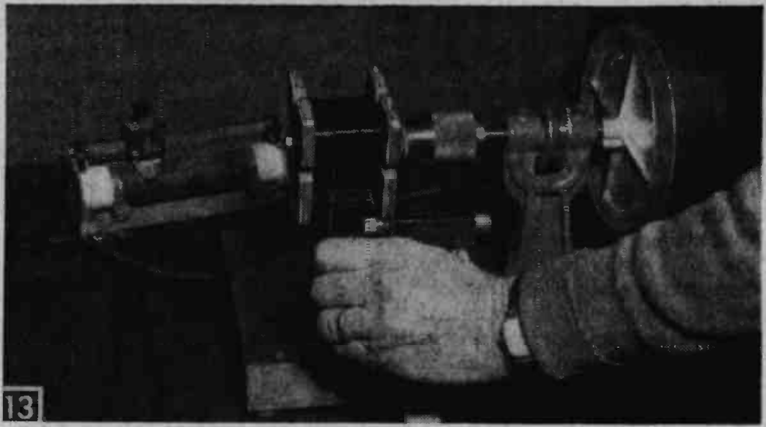
series connected in the motor circuit as a test for speed control at this time. In our case it was found that about 1⅛ in. of laminations brought the motor practically to a stop which is correct. Take care not to damage the wire insulation in this test. Now, tape the coil with varnished cambric tape or cotton tape shellacked after taping, pulling it tightly and cutting the strings as they are approached. Bind the end of the cambric tape with some cellophane tape. If the coil seemed a little thick for a good fit with the core, reinsert the slightly dressed down center block and clamp it in a vise as in Fig. 16 to compress it somewhat.

Next, make up the brass core guides (Fig. 12), that provide a wearing surface for the moving core and keep it in a vertical position. Bend the "U" sections of the guides to fit tightly over the coil sides. Before soldering vertical guide pieces to main sections, place main portions on coil and test for clearance by inserting the core into the coil (Fig. 17). Bend the vertical guides to the shape of a 90° angle, and holding them in place on each side of the core so that the core will slide freely, mark their position on the main portions of the core guides. Remove the core and guides from the coil and



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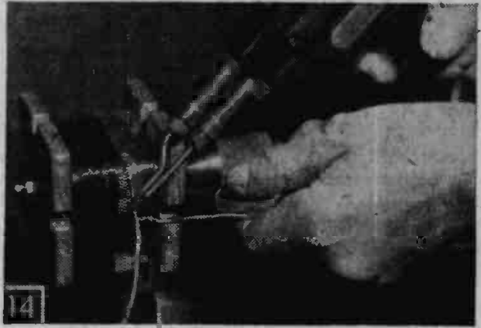
Winding machine is hooked up with variable resistance unit (shown in left background) to reduce speed of motor for winding reactor coil.



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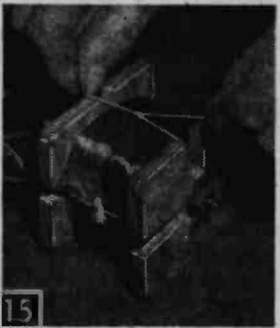

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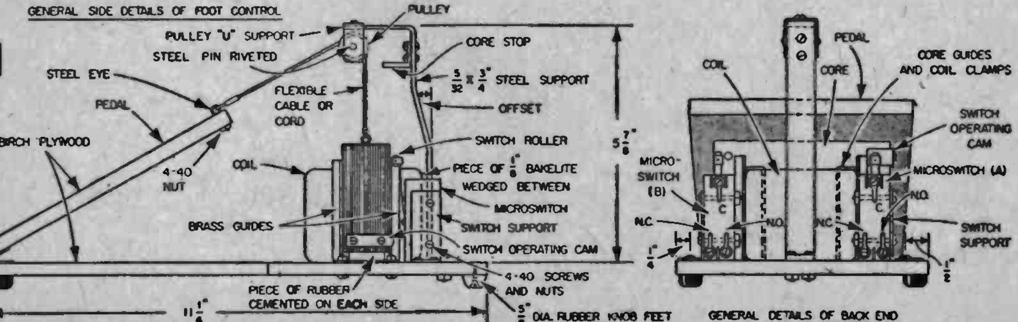
Left, at 650th turn solder a lead on end of coil wire, insulate the splice with a piece of spaghetti tubing and carry lead out slot at narrow side of form. Right, bind the coil together before removing it from the form.

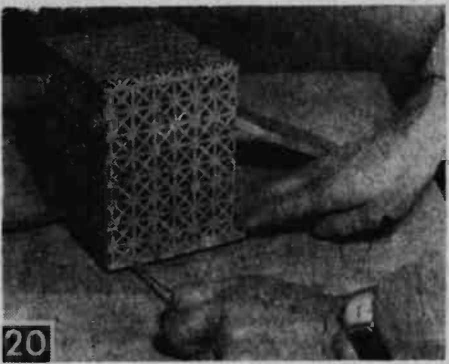
16

17

Left, if the coil is too thick for a proper fit with the core, compress it in a vise. Right, testing core to see that it slides freely up and down in coil.

18

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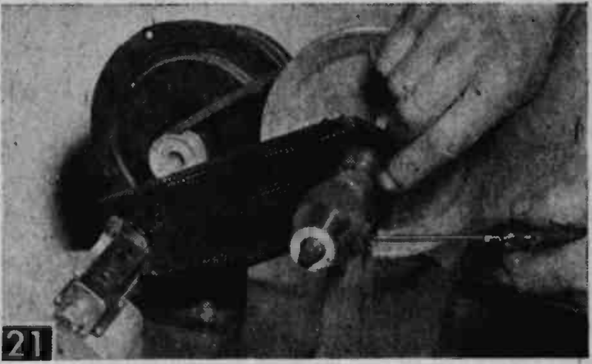
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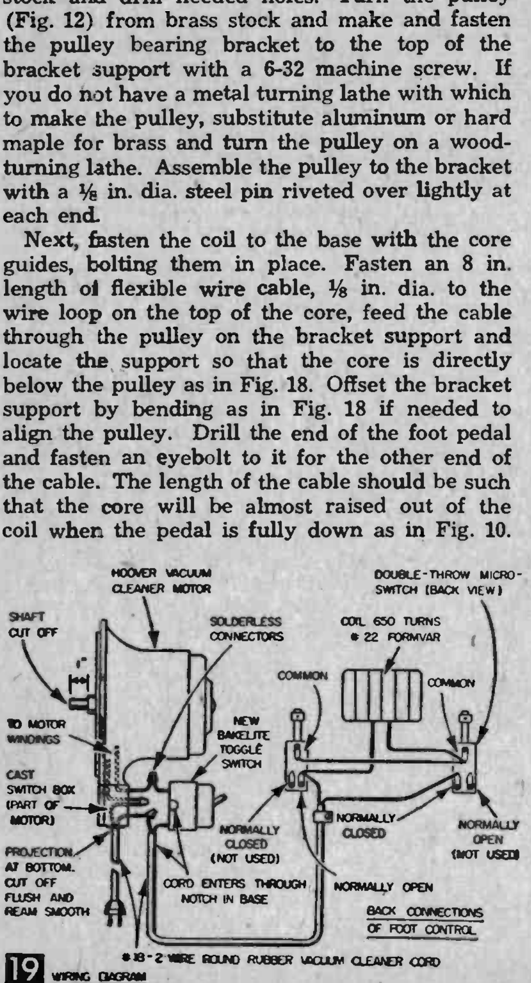
Left, fastening perforated metal enclosure to base with wood screws. Right, covering chain drive with guard.

solder the vertical guides to the core guides as in Fig. 12. With a sharp chisel, remove any excess solder that might interfere.

Make the base and pedal for the foot control as in Fig. 12 and fasten together with a piece of piano hinge. Bend up the bracket support core stop and switch supports from cold-rolled strip stock and drill needed holes. Turn the pulley (Fig. 12) from brass stock and make and fasten the pulley bearing bracket to the top of the bracket support with a 6-32 machine screw. If you do not have a metal turning lathe with which to make the pulley, substitute aluminum or hard maple for brass and turn the pulley on a wood-turning lathe. Assemble the pulley to the bracket with a 1/8 in. dia. steel pin riveted over lightly at each end.

Next, fasten the coil to the base with the core guides, bolting them in place. Fasten an 8 in. length of flexible wire cable, 1/8 in. dia. to the wire loop on the top of the core, feed the cable through the pulley on the bracket support and locate the support so that the core is directly below the pulley as in Fig. 18. Offset the bracket support by bending as in Fig. 18 if needed to align the pulley. Drill the end of the foot pedal and fasten an eyebolt to it for the other end of the cable. The length of the cable should be such that the core will be almost raised out of the coil when the pedal is fully down as in Fig. 10.



19 WIRING DIAGRAM

Fasten the core stop to the bracket support and cement pieces of rubber directly below each end of the core to serve as bumpers for the core.

Bolt two Microswitches to the switch supports and then fasten the supports to the base so that the rollers on the switches will bear lightly against the core but with actuating contacts not operated. To actuate the switches, make the operating cams (Fig. 12) and fasten to the core with 4-40 screws as in Fig. 12. Microswitch A, Fig. 18 cuts off the line current when the pedal is in the up position and core fully down. Microswitch B, Fig. 18 shorts out the coil when the core is in the up position so that the motor operates at top speed directly from the line.

Hook up the foot control switch to the coil-winder motor as shown in Fig. 19. Since the foot switch will be on the floor under the bench or table, make the cord extending from the foot switch to the motor switch about 5 ft. long. Bring this cord into the motor switch box through a notch provided in the base of the Bakelite switch that was substituted for the original motor switch.

To prevent the foot-switch mechanism from becoming damaged and yet provide ventilation make an enclosure of perforated sheet metal as in Fig. 20. Fasten the joining corners with rivets or sheet-metal screws and attach the lower edges to the base with #2 x 3/8 in. *rh* screws as in Fig. 20. Also make a perforated-metal guard (Fig. 21) if you are using a chain drive on the winding machine. Attach four rubber-knob feet to the bottom of the base to prevent slippage.

When winding coils with this machine be sure that the center bolt extending through the coil form is securely tightened so there is no chance of the form slipping on the bolt. Also securely tighten the chuck holding the bolt to prevent slippage at that point. Otherwise, the number of turns indicated on the counter will be in error.

Ionized Air Cloud for Super Hi Fi

1

As the heart of a radio hi-fi tweeter sound reproducer, Ionovac ion cell (indicated by pencil) is mounted in a simple cast- and sheet-metal shielding case (right). High-voltage, high frequency electricity, jiggered by electrical sound impulses from radio circuit or phono pickup, bombards air in Ionovac ion chamber, ionizing it and making it glow violet. Uncovered end of cell opens directly into the air (right and left) at base of the tweeter horn which is about 6 in. long, and 8 in. high at the bell. Upper and lower holes in bell lip take screws for cabinet mounting.

By JERRY SKELLY

TAKE your pick with the Ionovac, a sound-reproducing cell the size of a peanut shell. With it you can tune in superb hi-fi, clean hypodermic needles, age wine, and weld metal. Or other versions of the same type of cell might even be used to kill living tissue.

A tiny cloud of ionized air, glowing a jewel-like violet reproduces and modulates the sound in this small quartz cell. High-frequency electricity, modulated according to the sounds or signals fed into the Ionovac's circuit, ionizes the cloud, making it expand and contract to mechanically push sound waves out of the cell's open end.

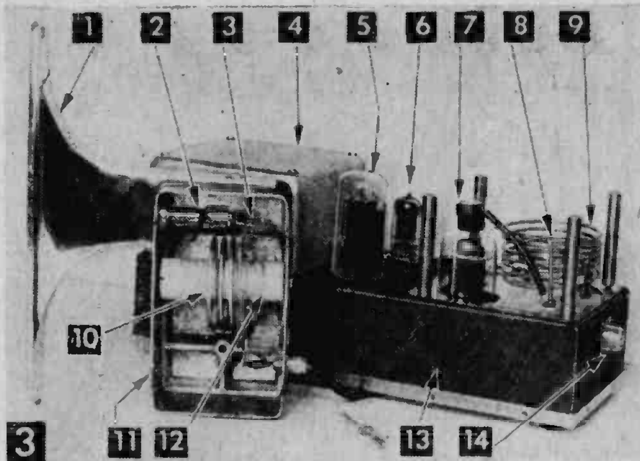
With the Ionovac, for the first time, ultrasonic ranges can be dialed at will instead of laboriously preset. Since no moving diaphragms or cones are used in the wasp-waisted unit, it is freed of the bonds these moving parts put on frequency response. And so not only does it reproduce audible sounds impeccably, but its notably smooth high response reaches well into the ultrasonic range.

2

In this hi-fi addict's Sherlock Holmesian closeup nothing goes unnoticed. Small point at top is one golden ionizing electrode lead. Small wire loop around quartz chamber's wasp waist is second ionizing electrode. Air cloud is ionized in long hollow end which narrows at waist to aperture the diameter of an automatic-pencil lead. Cloud is similar electrically to earth's ionosphere.

The first job for the Ionovac, built by DuKane Corp., St. Charles, Ill., will be as a new type of tweeter, or high frequency speaker, in radios and high fidelity phonograph systems (as a 50-cycle woofer, for example, its horn would have to be 28 ft. long). Hi-fi enthusiasts will cheer its wide response and its freedom from the sharp hills and valleys customary with cone and compression type tweeters (see Fig. 3).

Later, industry likely will be lining up to hire the sound cell. Since the Ionovac is an aperiodic device, that is, one which has no resonances and need not be used in a tuned condition



3

Full Ionovac layout for hi-fi tweeter assembly includes: (1) horn (2) ionizing cell (3) spring contact bracket (4) power transformer (5) rectifier tube (6) modulator tube (7) 6146 oscillator tube 20 mc (8) inner tank coil (9) outer tank coil (10) primary coil of step-up RF transformer (11) Ionovac shield can (12) secondary coil of step-up RF transformer (13) [whole unit] Ionovac power supply and oscillator (14) coaxial cable connector. Oscillator, acting as small-scale broadcasting station, sends modulated, high-frequency power to ion cell to reproduce sound impulses fed into it.

it will have many applications as a transducer to convert supersonic electrical energy into supersonic sound.

Already the little quartz cell is being considered for service in cleaning parts and garments of dust, shavings and soil. It may also be used in the supersonic aging of wines and liquors, the welding and soldering of hard-to-join metals; and the dispersion of smoke and other particles in the air.

Royal Dutch Airlines is now making totally blind touch-down landings with the Ionovac, using it to supplement aircraft radar at altitudes below 250 ft. where radar begins to lose accuracy.

Medical experiments are now being conducted to determine the usefulness of the Ionovac in the supersonic treatments of the symptoms of arthritis and bursitis. Other experimental studies are attempting to discover the effects of silent supersonic sound, radiated from the Ionovac, on various human and animal tissues. Already researchers suspect such a unit may have the useful, if also frightening, power to control our voluntary muscles. And both frightening and encouraging are the potentialities of larger ionized-air units for breaking down living cells. DuKane is planning ultrasonic-proof labs with built-in employee protection for testing larger ionization units.

The immediate forerunner of the Ionovac was the Ionophone, invented by Siegfried Klein in Paris about six years ago. While the Ionovac's basic operating principle is the same as the Ionophone's, the DuKane unit has better materials, a higher exciting frequency, and a six-fold increase in the sound power level.

Even before the Ionophone, there were many devices aimed at reproducing sound by using modulated expanding air. Thomas Edison worked on equipment aimed at doing the job with heated air.

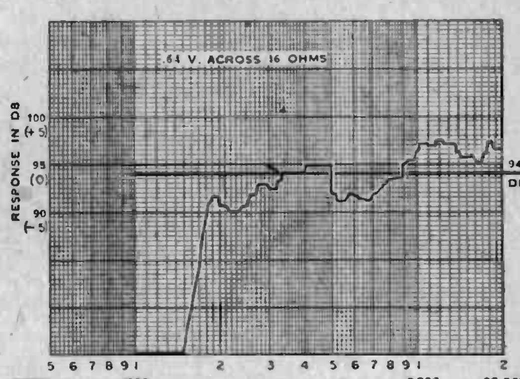
Between 1928 and 1931 there were at least five U.S. patents issued to inventors, including Lee DeForrest, for ionic speakers. Many of these were highly ingenious but in general they flunked acceptance because they didn't effectively radiate their sound waves in space and could not compete in efficiency with the moving-coil loud speaker, then coming into its heyday.

With the Post-World-War II increase of interest in high fidelity sound reproduction came a new demand for the distortion-free reproduction of treble sounds. Concerns for efficiency became secondary. Full frequency range in a single speaker was not necessarily required, and the moving-coil speakers' uneven high response began to strike listeners as more objectionable.

Against this background Klein developed his

IONOVAC FACTS

Response	3500 cps to 40,000 cps ± 5 db
Input voltage for full output	.64 V/16 ohms—94 db (average output from 3500-40,000+)
Input impedance	16 ohms
Level control	16 ohms T or L pad for balancing
Crossover point	3500 cps w/12 db per octave slope
Polar pattern	160° dispersion
Overall dim of unit	7½" deep, 9¼" high, 4" wide
Osc. freq.	20 Mc.
Tubes	1-5U4GA/GB, 1-12AU7, 1-6146
Overall dim of osc.-power supply	5" wide, 12¾" long, 5½" high
Power consumption	78 watts
Line voltage	115 V A.C., 60 cy. (105 or 125 volts w/taps)
Price	$135 to $150 (for transducer, horn, oscillator—marketed by Electro-Voice Corp., Buchanan, Mich.)

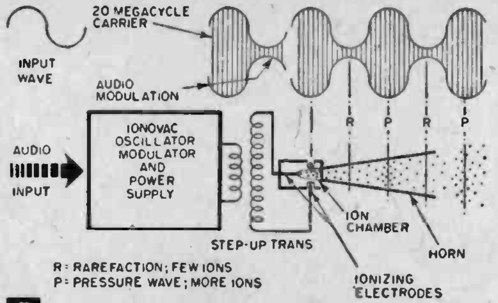


4

In this sample response curve for Ionovac hi-fi system, note relative freedom from very sharp hills and valleys customary with mechanically actuated cone-type speakers. Besides radio-phonograph applications, ionized-air system can be used as a variable generator of both audible and ultrasonic sound waves of 1000 to 1 million cycles.

Ionophone. Its main contribution in the history of ionic speakers was to locate the ion chamber at the throat of an efficient horn. Yet there were still problems of corona noise, low output, and interference with nearby TV and radio equipment.

After getting sole North American manufacturing licensing for the Ionophone in December, 1955, DuKane began its work of refining Klein's Ionophone and hired Klein himself to help with the job. Also racing to do the same perfecting work were the European licensees including Plessy, Ltd., in England; Audax in France; Telefunken, in Germany, and A.E.G. in Sweden. Although DuKane was the first to develop a workable unit, its findings will be shared with other firms through a pool agreement.



5 HOW IONOVAC WORKS

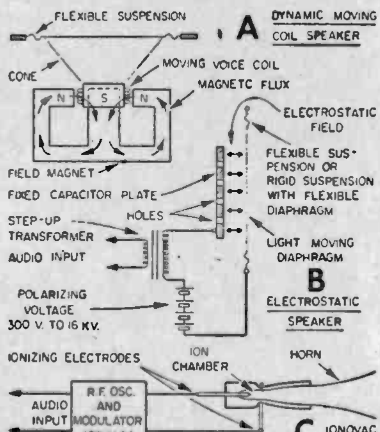
Diagram of Ionovac operation traces progress and reproduction of modulated sound waves from audio input (left) through oscillator and circuitry to ion chamber and finally out into the horn and room beyond. Note fewer ions where dipping waves show decreasing sound.

In operation, (Fig. 5) a low current electrical field of about 15,000 volts alternating at 20 megacycles is applied between the two discharge electrodes. This intense electrical field tends to strip electrons from the outer orbits of the gas atoms of the air in the chamber. By this process, called ionization, many of the gas atoms are left positively charged ions. Since these ions are of the same charge, they tend to repel each other and their increased activity increases the total mass of the molecules in the cell, creating a sound pressure within the ion chamber and emitting a violet light. The opening in one end of this quartz chamber leads directly into the throat of a horn which efficiently radiates the air-cloud sound pressure into the surrounding area.

The number of ions is modulated by modulating the 20 Mc field. This field is developed by a single 6146 tube used as a self-excited oscillator. The 6146 is arranged to be screen modulated by the amplified audio input. Only about 6/10 of a volt of audio is needed to get the Ionovac's full acoustic output. At peaks the oscillator is modulated only about 60% to minimize distortion.

As the audio signal rises, the modulated oscillator output increases. This rise in ionizing voltage boosts the number of ions available. The oscillation activity among the ions also increases, and the positive sound pressure wave which this action swells out spreads down the throat of the horn.

Then when the audio signal is modulating downwards the intensity of the ionizing field lessens. The number of ions is reduced and the sound pressure created at the throat of the horn is less than the moment before. This is heard as a negative sound pressure wave.



6 COMPARISON OF SPEAKER MOVEMENTS

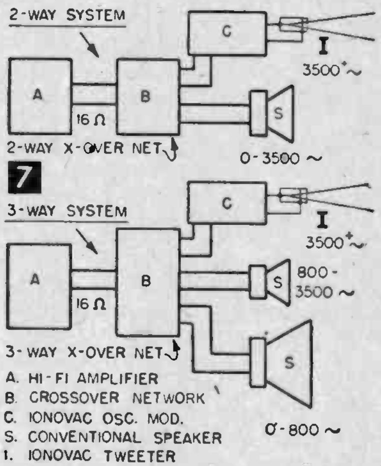


Fig. 6. Comparison of (A) moving coil loud speaker (B) electrostatic speaker (C) Ionovac, shows the much greater simplicity of the ion-cell's sound reproducing structure. Connecting to hi-fi layouts (Fig. 7) would not be difficult.

Sounds, of course, not violet lights and ions are what you want once you've settled down for an evening of Brahms or John Philip Sousa. The elimination of mechanically moving parts lets sound be reproduced clearly; frequency response is excellent. When used as a tweeter the Ionovac has a soft, almost silky sound. There are no metallic overtones or resonances in its high sounds. Tones, harmonics and transients up to the limit of hearing come through clearly.

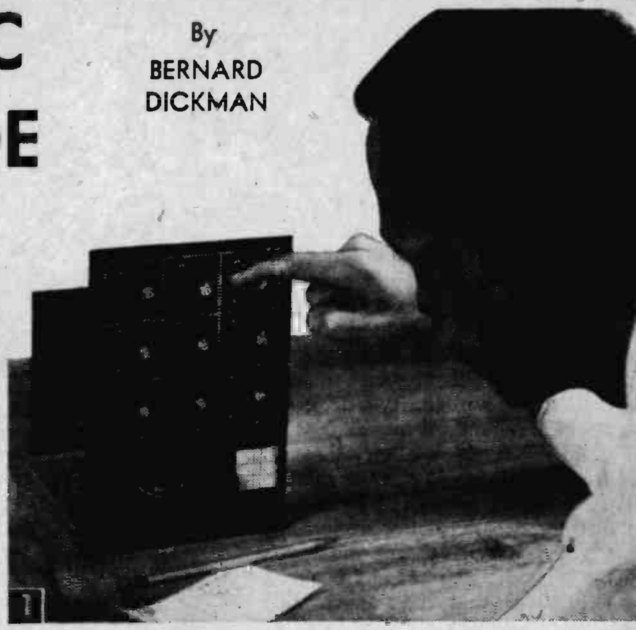
The output level of the Ionovac compares very favorably with that of other "super-tweeters." Good balance between treble, mid-range and bass tones should be possible in quality speaker units.

In the next few years inevitable competition between ionic speakers and electrostatic speakers should result in better units of both types.

In both audio and ultrasonic application, we stand to hear—or not hear—much more about the tiny, ionized cloud and the work it does.

ELECTRONIC TIC-TAC-TOE

By
BERNARD
DICKMAN

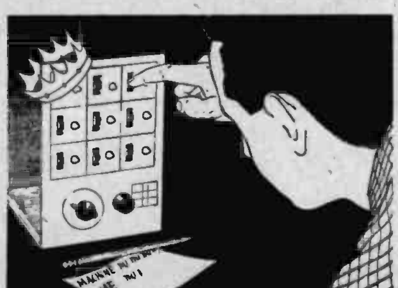


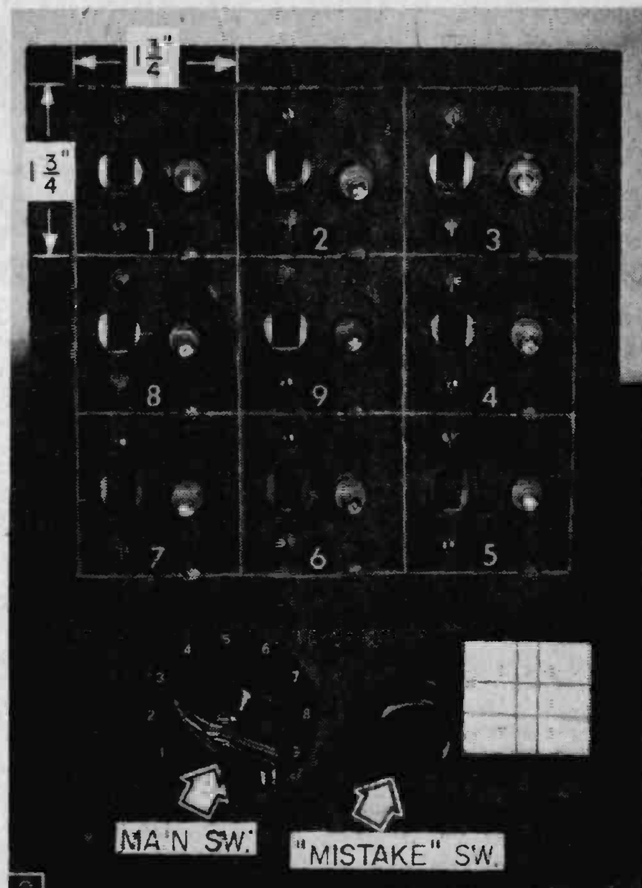
Man against Machine! And the odd thing is, the machine has to be handicapped in order to afford the man half a chance.

IT'S also spelled Ticktacktoe and also called Tit-Tat-Toe (in England, they call it Naughts and Crosses), but by whatever name it goes under, chances are you've played it—two horizontal lines, two vertical on a piece of paper. One player takes the naughts (0); the other, the crosses (X), and each takes his turn placing his symbol in one of the spaces on the paper until—either vertically, horizontally or diagonally—he has three crosses (or three naughts) in a row, or until it becomes impossible for either player to make such a combination. And, of course, while one player is attempting to place three of his symbols in a row, the other player—in addition to trying to do the same—must attempt to block his opponent. Actually, it's a fairly simple struggle of wits (with 15,120 possible combinations of moves). Simple enough, however, for an assortment of switches built into a panel to have mastered it.

The device in Fig. 1 contains those switches and, as originally built, a human being was doomed to a draw or worse in every encounter with the unit. (As modified, you and I now stand a chance of winning; but more of the modification later.) The "brains" of the device are two rotary switches. Its move-signaling apparatus consists of nine slide switches and nine GE222 flashlight bulbs powered by two 1½-v. 935C dry cells in series.

To construct this electronic Tic-Tac-Toe, first saw out, sand smooth and shellac a ¾-in. piece of pine or plywood 6 x 6 in. square. This is the block chassis of the unit. The front

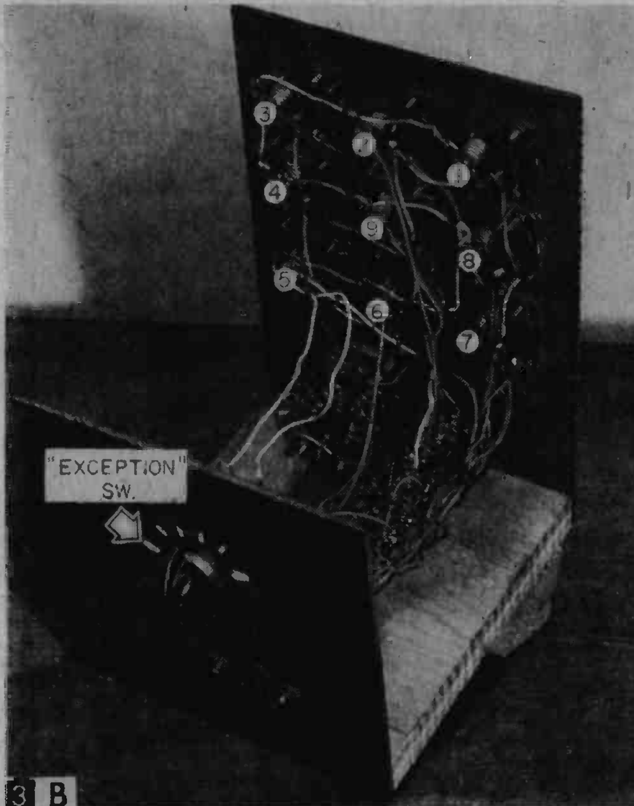




panel is made from ⅛-in. tempered hardboard to the dimensions given as shown in Fig. 2. Incise the square lines and fill them with white paint to make them stand out. The back panel is also ⅛-in. tempered hardboard, cut to a 6 x 6-in. square.

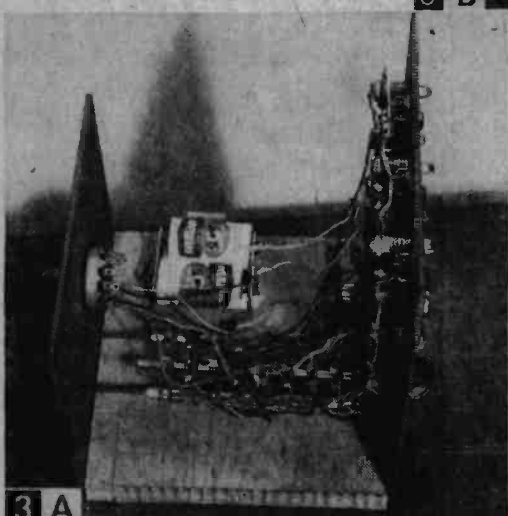
After cutting out chassis and panels, take the nine slide switches and paint white that area of the switch visible when it is turned on. Let dry and then install the slide switches and the nine bulb sockets, bending the Dialco 505 socket arms to a right angle (as shown in Fig. 3) for proper mounting on the front panel. Mount the nine-deck and the two-deck rotary switches and, using #20 wire or smaller, begin wiring. Wire as shown in Figs. 3 and 4, color-coding your wiring wherever possible to make any error tracing easier. In many cases, wiring on the deck switches can be stripped and brought directly from one terminal to the next.

The multi-gang, nine-deck, 10-position per deck rotary switch is the unit's main switch. The pole of each deck on this switch is connected to a slide switch (see Fig. 4A). Each of the nine other positions is wired into the circuit of one of the nine Tic-Tac-Toe squares.



3 B

Back of panel view of machine.



3 A

Either you or the machine can make the first move in a game. If you are going to make the first move select a square, turn the rotary switch to that number and press down the slide switch.

Machine's Turn First. If the machine is to make the first move, turn the rotary switch to the 10th position (which you can label "M" on the dial plate of the rotary switch). Then flick the slide switches until a bulb in the same square as a switch flicked lights: this is the machine's move. If you wish to modify the machine so that it makes its move automatically (without your flicking slide switches), add another phenolic deck section to the nine-deck switch and wire the 10th position of this deck directly to bulb nine, bypassing switch nine; the pole of this added deck goes directly to battery. With a 10th deck added, the machine will make its first move to the bulb of square nine automatically.

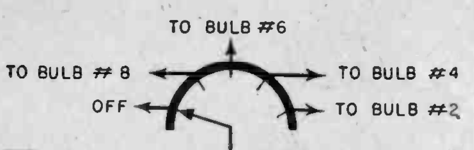
The single pole "off" plus four-position switch on the back panel is the "Exception" switch. The main circuit of the Tic-Tac-Toe is wired to reply

MATERIALS LIST—ELECTRONIC TIC-TAC-TOE

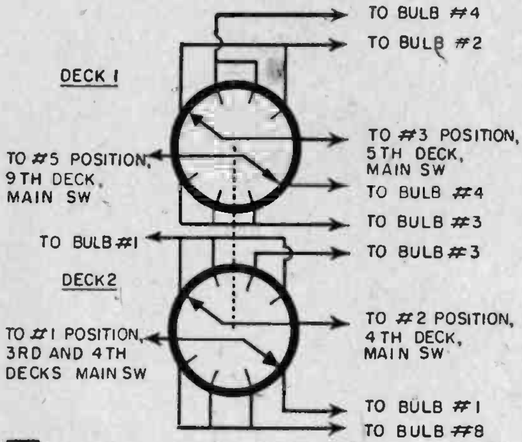
No.	Description
9	Non-shorting, one pole, 2-11* pos. per pole, phenolic sections (Allied 35 B 085).
1	Shaft (9 sections) and index (30°) assembly (Allied 35 B 094).
1	two gang, 4 pole, 4** pos. per pole, non-shorting, switch (Allied 34 B 257).
9	SPST slide switches (Allied 34 B 422).
9	miniature screw pilot light sockets with socket arms (Allied 52 E 410).
9	miniature screw lamps—GE222 (Allied 52 E 330).
1	non-shorting, one pole, 5 pos. switch (Allied 34 B 350).
1	wood chassis (see text)
2	1½-v. 935C dry cells.
	wire, solder, unmarked dial, dial plates

* Only 10 pos. needed

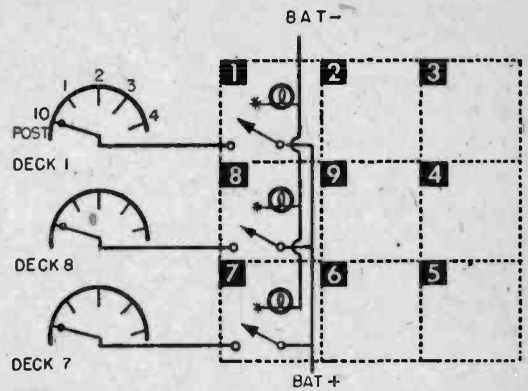
** Allied sw. is 5 pos.—one pos. not needed



4 B



4 C "MISTAKE" SWITCH



4 A BULB AND SLIDE SW SCHEMATIC (WIRING OF SLIDE SW # 2,3,4,5,6, AND 9 IS DONE IN THE SAME MANNER; SLIDE SW TO POLE ON ITS DECK AND TO PLUS OF BATTERY.

*AS SHOWN, ONE SIDE OF EACH BULB GOES TO MINUS SIDE OF BATTERY; THE OTHER SIDE OF EACH BULB IS WIRED AS FOLLOWS TO THE 9 DECK, 10 POSITION ROTARY SWITCH (POST IS #10 POSITION):

	DECK	POSITION		DECK	POSITION
1	3	2	6	7	3, 4, 5
	2	3, 4, 10,		5	7, 8, 10
	8	3,4, 5, 6, 7		2	9
	7	8	7	3	9
	9	9		6	1, 2, 3, 4, 5
2	3	7, 8		8	1, 2, 10
	1	3, 4, 10		5	6
	6	9		1	8
3	2	1, 5, 6, 7, 8	8	7*	1, 2, 10
	1	2		1	5, 6, 7
	5	4, 9		4	9
	4	5, 6, 10	9	1	1
	7	9		2	2
4	5	1, 2, 3,		3	3
	8	9		4	4
	3	5, 6, 10		5	5
5	4	1, 2, 3, 7, 8		6	6
	3	4		7	7
	7	6		8	8
	6	7, 8, 10		9*	10*
				10**	10**

POS. #10 IS MACHINE'S TURN.
* SEE TEXT: MACHINE'S TURN FIRST (NOT AUTOMATIC)
** SEE TEXT: MACHINE'S TURN FIRST (AUTOMATIC)

to logical moves. If you fail to play logically, it will occasionally happen that the machine will attempt to reply to such a move in a square already occupied. If this should occur—and such occasions are rare—flip the "Exception" switch to a different position. (If you have played in square 7, and need to use this switch, turn it directly to 4.)

The "Exception" switch is wired as shown in Fig. 4B. Its "exceptions" are for squares 8, 6, 4 and 2 for 1, 2, 3 and 4. For example, suppose you are occupying squares 1 and 7, the machine squares 8 and 9. Your *logical* move would be to square 4 to block the machine, but you move to square 6 instead. In such an instance, you would have to use the "Exception" switch.

The two-gang, two poles per gang, four positions per pole switch on the front panel (remove this switch's "off" position) is the "Mistake" switch. Without it, a player would be unable to win a game against the machine. It is wired as shown in Fig. 4C. Do not label the dial of this switch—so that you won't become familiar with the machine's mistakes—but occasionally flip it to a different position.

Extra mistakes can be introduced into the machine by modification of its circuitry. A three-deck, two poles per deck, six positions per pole switch, for example, would enable you to introduce six sets of mistakes into the machine's replies.

For the machine as wired in Fig. 4, however, the mistakes are: 1) your play—corner 3, machine's reply—1 to 8 (instead of 2); 2) your play—side 4, machine's reply—1 to 8 (instead of 2), 2 to 3 (instead of 1); 3) your play—center 9, machine's reply—5 to 4 (instead of 3); 4) your play—corner 5, machine's reply—2 to 3 (instead of 4).

"Your play" indicates your first move. For example, the perfect reply to your moving first into square 4, then into square 1 (as in the second example above) would be square 2; but instead of this move, the machine mistakenly replies in square 8—and thus allows you to retain some vestige of self-respect. But, then, if you should lose too often in spite of this modification to handicap the machine, remember—you built the device, and you have only yourself to blame.

1

Mostly for junior, this small record player has a minimum of circuit components compactly encased in a cigar box.

JUNIOR-SIZE RECORD PLAYER

By HOMER L. DAVIDSON

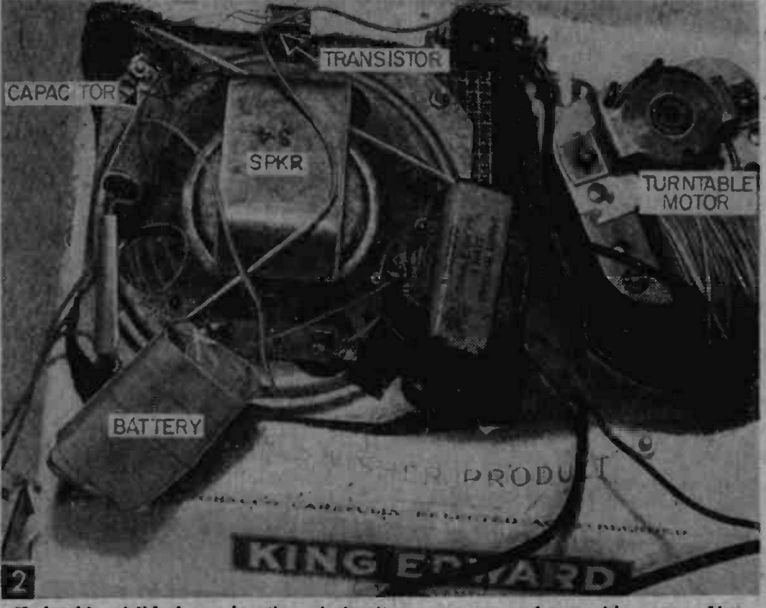
THOUGH it won't reproduce sound quite so faithfully as a $400 hi-fi radio-phonograph combination, this cigar box record player will deliver plenty of volume for the small one to play his favorite records by, and the quality of that volume is as good as that delivered by any one-tube phono.

A CK722 transistor, driven by an L12 crystal pickup, provides audio amplification, a 10 *mfd* capacitor isolates the pickup arm, the base return resistor is 220,000 ohms—a minimum of circuit components for the amplifier itself. The pickup arm (see Fig. 1) is a 1 x 11-in. piece of ¼-in. plywood fastened to a home-made, scrap-metal swivel, with the crystal cartridge bolted into place at the opposite end of the arm. Drill a hole at the bottom of the swivel's U-shape, insert a bolt through swivel and box, place a large washer top and bottom and then tighten the bolt's nut just enough so that the arm in the swivel swings freely. Then solder the nut to the bolt so that it will not loosen in use.

Wire as indicated in Fig. 3, connecting one side of the primary of a universal output transformer to the collector of the transistor, the center-tap to the resistor and back through the D.P.S.T. slide switch to the batteries.

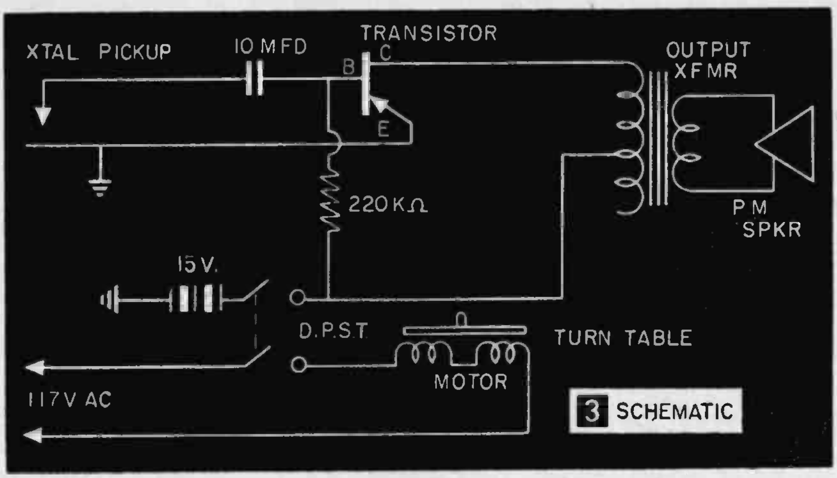
There is no special way that the turntable motor, battery, circuit components and speaker should be mounted inside the cigar box, but the layout shown in Fig. 2 works well. Cover the opening for the speaker in the lid of the cigar box with grille screen and cloth, and after the unit is completed, nail the lid tightly shut so that there will be no danger of a child investigating the house-line connections to the turntable and switch.

This small phono has no volume control and



2

Underside of lid shows location of circuit components and turntable motor. Line cord carrying house voltage enters through grommet in back of box.



3 SCHEMATIC

ordinarily its volume will not be disturbingly loud. But by changing the size of the 220K ohm resistor the volume and tone quality can be varied. Before experimenting with such a change, however, insert a 0 to 10 *ma* meter in series with the battery so that the transistor will not be damaged. The transistor should never pull over 5 *ma;* with the fixed value of resistance given in Fig. 3 and the Materials List, transistor current is slightly over 2 mills. Be sure to observe correct battery polarity.

MATERIALS LIST—JUNIOR-SIZE RECORD PLAYER

No.	Description	No.	Description
1	crystal pickup (L12 Astatic)	1	CK722 transistor (Raytheon)
1	10 mfd., 25 v. paper capacitor	1	D.P.S.T. slide switch
1	220,000 ohm, ½-watt resistor	1	78 rpm turntable
1	universal output transformer (Merit A2900)	1	4", permanent magnet speaker

Miscellaneous screws, nuts, bolts; 6' line cord; empty cigar box; grille screen and cloth; 1-15 v. battery.

BATTERIES FOR ELECTRONIC APPLICATIONS

This list contains all batteries in general use. Those not listed are special types not usually stocked by electronic supply shops. (Hearing aid type batteries are included, however, since many small radios use them.)

PORTABLE "A" BATTERIES

RCA Type	Volts	Size	Wt. Ea. Lbs.	Interchangeable with Burgess	Eveready
VS036	1	1 5/16x2 3/8"	6 oz.	2R	—
VS004	1½	2 5/8x2 5/8x4 1/16"	1	4F	742
VS073	1½	7/16x1 1/5"	2 oz.	—	—
VS236	1½	1 23/64x4 1/8"	7 oz.	—	—
VS069	1½	2 9/64x1 5/16x2 27/32"	¾	2D	720
VS072	4½	3 15/16x1 5/16x2 15/16"	1	D3	726
VS067	4½	4x1 3/8x4 1/8"	1	F3	736
VS009	6	1 5/8x2 5/8x4¼"	1½	F4P1	744
VS068	6	2 5/32x1 5/32x2 11/32"	¼	Z4	724
VS065	7½	2 5/16x2x3 1/16"	1¾	C5	717

PORTABLE "B" BATTERIES

RCA Type	Volts	Size	Wt. Ea. Lbs.	Burgess	Eveready
VS084	22½	1 1/64x5/8x1 25/32"	2 oz.	U15	412
VS085	30	1 1/64x5/8x2 17/32"	2 oz.	U20	413
VS013	45	3 9/16x1 13/16x5 1/2"	2	M30	482
VS014	45	3 7/16x2¼x4 9/16"	1¾	A30	—
VS015	45	3x2¼x4"	1½	230	738
VS055	45	2 21/32x31/32x3 11/16"	¾	XX30	455
VS016	67½	2 23/32x1 11/32x3¾"	1	XX45	467
VS216	67½	1 15/16x1x5 17/32"	1	—	—
VS217	75	1 7/8x1 15/32x6 1/2"	1	—	—
VS090	90	3 11/16x1 3/8x3¾"	1	N60	490

PORTABLE "AB" BATTERIES

RCA Type	Volts	Size	Wt. Ea. Lbs.	Burgess	Eveready
VS052	1½-61½	9 3/8x2 11/16x3 7/16"	4	4GA41	
				Philco	
				41A4G	
VS043	1½-90	5½x2 11/16x7 1/8"	5	5DA60	
VS054	1½-90	10x2 3/16x4 7/8"	5	6TA60	

PORTABLE "AB" BATTERIES (Cont.)

RCA Type	Volts	Size	Wt. Ea. Lbs.	Burgess	Eveready
				Ray-O-Vac	
				AB64	
VS064	1½-90	7¾x2 3/16x3 5/8"	3¾	Philco	
				P364	
				4TZ60	
VS050	6-7½-75	8 9/16x2 7/16x3 11/16"	4	T5Z50	
VS046	8-75	12 5/8x2¾x4 1/8"	8	G4B50	
				Zenith	
				Z675	
VS019	7½-9-90	9½x2 21/32x4 3/8"	6	F6A60	753
VS057	7½-9-90	9 3/8x2 3/16x3¾"	4	T5260	
				Philco	
				P361	
VS057W	7½-9-90	8 11/16x2 3/16x3¾"	4	—	756
VS119	7½-9-90	8¼x4½x13 7/8"	21½	Philco	
				P326	—
VS038	7½-63	8 5/8x2¾x4 1/16"	5	G5A42	—
VS047	9-90	13 5/8x2¾x4 9/16"	8	G6B60	
				Zenith	
				Z985	
VS058	9-90	9½x2 23/32x4 3/8"	5	FGA60P	
				Zenith	
				Z909	

INDUSTRIAL BATTERIES

RCA Type	Volts	Size	Wt. Ea. Lbs.	Burgess	Eveready
VS034	1½	37/64x2"	2 oz.	Z	915
VS106	1½	2 11/16x2 11/16x4 3/16"	1½	4FH	—
VS006S	1½	2 5/8x6 9/16"	2½	—	6
VS130	1½-3-4½	3 15/16x1 3/8x3"	1	2370BP	761T
VS029	1½-7½	3 13/16x7/8x3 1/8"	2	5156SC	778
VS028	4½	2 3/8x13/16x2 7/8"	½	5360	781
VS040S	6	2 11/16x2 11/16x4 3/16"	1¾	F4BP	—
VS102	22½	3 3/8x2 1/8x2¾"	1¼	4156	763
VS112	22½-45	4 1/8x2 5/8x5 7/16"	3¼	5308	762S

Batteries listed can be purchased at your local electronic supply shop or from the manufacturers: Burgess—The Burgess Battery Co., Dept. SM, Freeport, Ill. Eveready—National Carbon Co., Eveready Div., Dept. SM, 30 E. 42nd St. New York 17, N. Y. RCA—Radio Corp. of America, RCA Bldg., Dept. SM, 30 Rockefeller Plaza, New York 20, N. Y.

Tester for Dry Cells

By HAROLD P. STRAND

Reliable voltage tester for dry cells tests with or without load, before and after use

Right, this tester for dry cells quickly determines their condition. Readings are taken at both no load and with a resistance load. A good cell should test about .8 on this milliammeter at no load.

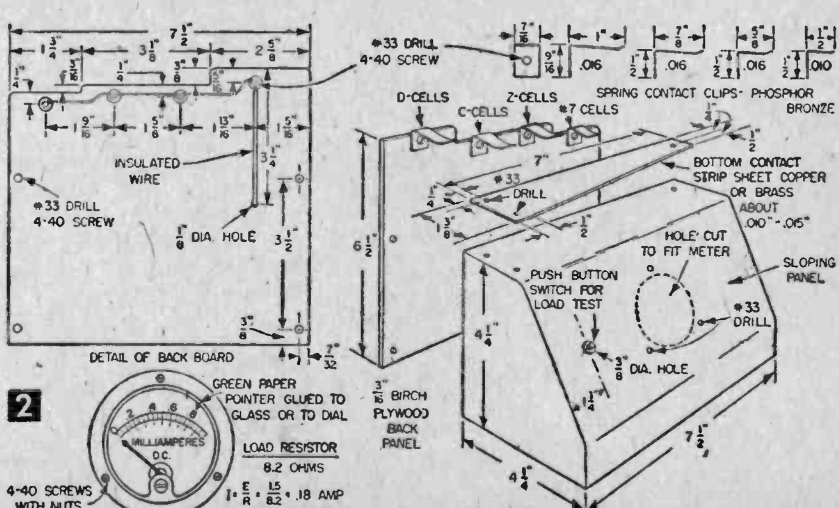
Below, pressing the button connects a resistor across the battery and in this case a severe voltage drop is shown, indicating a poor cell, since a good one only gives a drop of about 1 or 2 divisions on the meter. The milliammeter is serving as a voltage indicator, with a connected series resistance inside the cabinet.

1 B

1 A

IF YOU have ever received poor service from a newly-purchased dry cell, or your flashlight or flashgun refused to operate because of dead cells when you were far from a dealer, this project is for you. This handy tester (Fig. 1A), will prove invaluable for checking the voltage of the cells, with or without a load, before or after use. Some stores merely test cells before selling them to a customer by touching their contacts to spring clips to see if a small lamp lights. This is far from a satisfactory test as it does not determine the true condition of the cells.

Dry cells should give 1.5-1.55 volts when new, gradually falling to about 1.2 volts, at which voltage they may remain for quite some time. As current is delivered, this voltage falls



2

MATERIALS LIST—BATTERY CELL TESTER

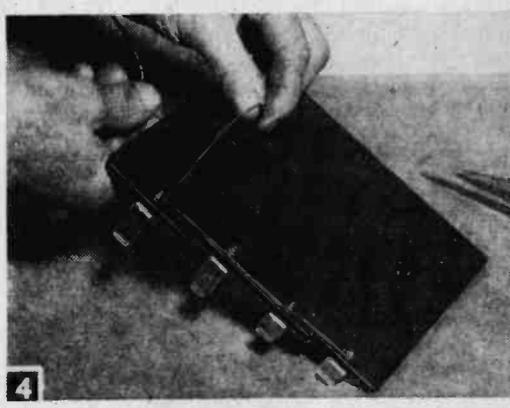
No.	Description	Use
1	metal cabinet, gray finish, sloping panel 4¼x4¼x7½" ICA #3906 Allied Radio Cat. #86P381, $1.72.	
1	2½" panel meter, 0-1 ma. d-c; or d-c voltmeter 0-3 volts. Allied Radio, 100-SM N. Western Ave., Chicago 80, Ill. or from surplus stores.	
1	push button, momentary contact switch for panel mounting. Switchcraft "Littel Switches" Type #201. #34B947 from Allied Radio. Can also use Grayhill Type 4001 or 23-1 switch, stocked by most supply stores and mail-order houses such as Allied Radio (#34B870 and #34B890 respectively.)	
1	2000 ohm, ½-watt carbon resistor (not needed if voltmeter is used).	
1	8.2 ohm, 1-watt carbon resistor	load resistor
1	two-terminal chassis terminal strip (or tie-point)	
1 pc	birch plywood 3/16x7x7½"	back panel
1 pc	sheet copper .015 x 1⅜ x 7"	bottom contact strip
1 pc	phosphor bronze or hard brass .016 x 7/16 x 4" (can be scrap from metal working shops or electrical equipment)	spring contact clips (D, C and Z cells)
1 pc	phosphor bronze or hard brass .010 x 7/16 x1" (see above)	spring contact clip (#7 cells)
14	4-40 roundhead plated machine screws with nuts Dull black paint, hook-up wire	

Use a circle cutter or similar tool in the drill press to make opening in metal cabinet to fit meter. Fix a wood block inside and clamp the piece securely.

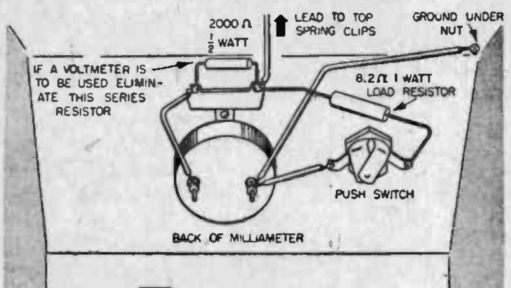
still further until a point is reached where they are no longer useful.

The meter used here (primarily because it is easily obtainable in surplus stores) is a 0-1 d-c milliammeter, with a 2000 ohm, ½-watt resistor in series which serves as a voltmeter. Since a fresh cell indicated exactly .8 on this meter, this reading was used as a voltage standard for good cells. If a d-c voltmeter is used (without the 2000 ohm, ½-watt resistor), a good cell will register about 1.5 volts.

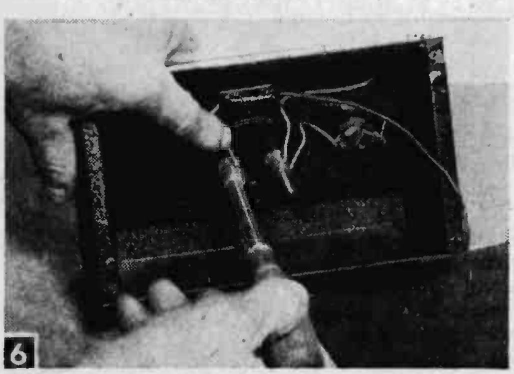
In operation, cells are placed one at a time under the spring clip that gives the proper spacing from the contact strip attached to top of cabinet. The cells accommodated by this tester are D, C, Z and No. 7, size designations used by Burgess and some other manufacturers. In general, these cells fit various flashlights including penlights and are used in flashgun equipment and in a number of laboratory and test equipment instruments.



Attach spring terminal clips loosely to back panel with short 4-40 screws and nuts, and wire clips together as shown. Carry the wire through a drilled hole to other side.



5 PICTORIAL DIAGRAM



Wire connections inside the cabinet are very simple, with two resistors required as shown.

The photoflash (D) cell shown in Fig. 1B shows about .7 on the meter or two divisions below the .8 standard for a good cell. An accurate voltmeter would show this value as about 1.4 volts. To find out if this cell is still usable, press the button at the left of the meter as shown in Fig. 1A. This places a load of 8.2 ohms across the battery. Take a quick reading and release push button immediately, since the load applied in this manner could run the cell down if applied for a prolonged period. With button depressed, the meter shows a drop to .45 on the scale, which indicates that the cell is in poor condition and should be discarded. In general, a drop of only one or two divisions on the scale is all that should be indicated for a usable cell.

Before placing cells in position on the tester, see that the bottom of the zinc cell is clean and the outer paper casing is up a short distance from the lower edge so that good contact with the copper strip will be assured.

First step in building tester is to cut out the large opening in the purchased metal cabinet for the meter (Figs. 2 and 3). Next, cut bottom contact strip from sheet copper, clean up the piece thoroughly with fine sandpaper and attach it to the top of the cabinet with 4-40 screws and nuts through drilled holes (Fig. 2). Also drill holes at the edge of the meter opening for attaching meter and a 3/8 in. dia. hole to the left of the meter opening for the push-button switch. Attach meter with 4-40 screws and nuts, insert push-switch and tighten nut on switch neck.

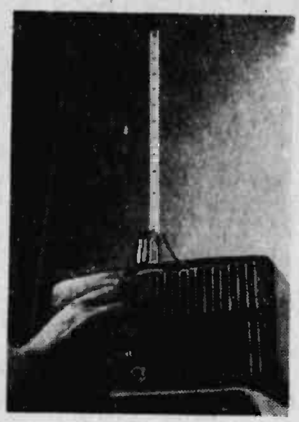
Cut back panel from a piece of 3/16 in. birch plywood, bakelite or hardboard (Fig. 2), and sand carefully. Drill holes as indicated and apply two coats of dull black enamel.

Form spring contact clips from phosphor bronze or hard brass and attach to back panel with 4-40 screws and nuts, with nuts loosely in place. Connect clips together at the back side with #20 insulated wire, bared for a length representing the spacing of the clips and attached under the 4-40 nuts. Carry the insulated portion of the wire through 1/8 in. dia. hole bored in panel to inside of cabinet (Fig. 4). Tighten screws to make firm contact with wire at back.

Complete wiring of components (Figs. 5 and 6), attaching a two-terminal strip under the nut of the top meter screw and connecting a 2000 ohm, 1/2-watt resistor across the terminals. Solder the wires going to these terminals in place. An 8.2 ohm, 1-watt load resistor connects from one side of the push-button switch to the terminal where the lead coming from the four contact clips is attached, which puts this resistor across the cells when the button is pressed. Attach the ground lead under one of the nuts used to secure the contact strip to cabinet.

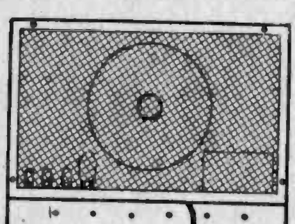
The final step is to attach the board to the back of the cabinet with 4-40 screws (Fig. 2) in holes drilled and tapped in the cabinet edge. Take a no-load reading on the completed tester, using a new fresh cell, and glue a pointer cut from green paper to glass or dial to indicate this standard for future readings.

Rule Doubles as Antenna



• A flexible steel rule, connected to the antenna lead of a small radio will improve reception in certain areas when used as a wand aerial. It may be extended to about 30 in. with stability and can be placed at the rear of the cabinet. A small alligator clamp or paper clip soldered to the lead from the set provides a handy removable connection.—R. L. Hay.

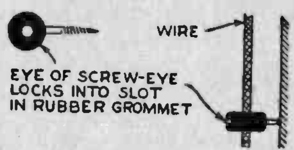
Ventilate Your TV Set



• Television sets develop a lot of heat and sometimes the only provision for ventilation is a series of holes punched in the back panel. Continued overheating can shorten the life of those costly television tubes.

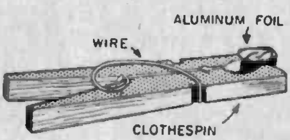
To get more ventilation, replace the panel with a simple frame covered with plastic screen such as is shown above.—W. H. McClay.

Stand-Off Insulators from Screw Eyes



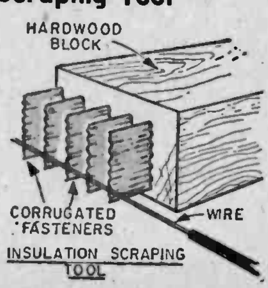
• Rubber grommets pressed into the eyes of screw-eyes make handy screw in stand-off insulators for wires in radio and electrical work. Make up a collection of variously sized insulators.—A. Trauffer.

Emergency Battery Clip



• If you run out of battery clips while doing an electrical project, make a substitute clip by wrapping aluminum foil around the tips of a spring-type clothespin. Wrap wire around foil.—J. Harvey.

Insulation Scraping Tool



• This simple and long-lasting tool is practical for scraping and cleaning insulated wire to make firm solder connections. To make it, simply drive several corrugated fasteners into the end of a hardwood block.—G. E. Hendrickson.

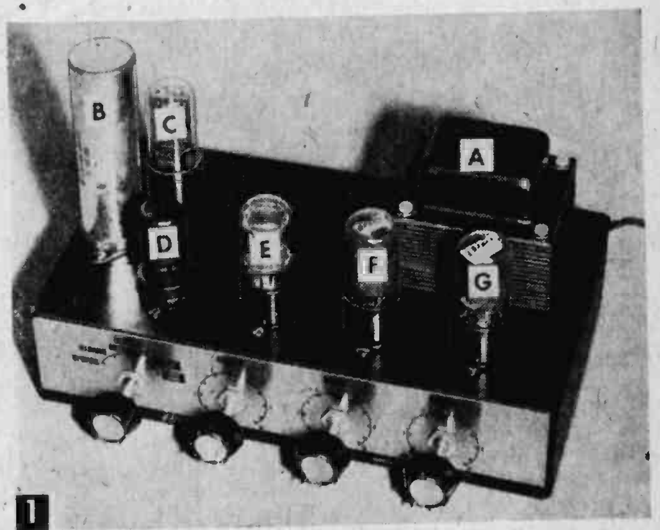
Get All the Sound You Pay for with This Fidelity Amplifier

FIDELITY AMPLIFIER SPECIFICATIONS

- Full range Bass and Treble controls
- Self-balancing phase-inverter system
- Beam power push-pull output with inverse feedback
- Multi-impedance output transformer
- Built-in pre-amplifier for magnetic and reluctance pickups
- FREQUENCY RESPONSE: ± 1.5 db. from 20-20,000 cps at 2 watt output
- DISTORTION: Less than 2% at 2 watts
- OUTPUT: Maximum 10 watts
- POWER REQUIREMENTS: 70 watts on 105-125v., 60 cy. line.

For quality sound reproduction, build this 10-watt, true-fidelity amplifier

By THOMAS A. BLANCHARD



1 Completed amplifier. Controls, left to right, are: Selector Switch, Volume, Bass, and Treble (line switch) controls. Escutcheon plate may be removed from chassis and mounted on cabinet if unit is enclosed. Parts shown are: A) power transformer; B) electrolytic capacitor; C) 5Y3GT rectifier; D) 6SC7 dual pre-amplifier; E) 6SLF interstage amplifier and phase inverter; F & G) 6V6 beam power push-pull output amplifiers.

HIGH-FIDELITY amplifiers bring out the best in present-day 33 and 45 *rpm* phonograph records. And a lot of "best" is built into these records. Phono pick-ups, and the right combination of speakers also add to the quality of sound reproduction, but these are packaged items that the audiophile should select himself.

This 10-watt amplifier (based on the Arkay brand A-12 Hi-Fi Kit), has all the features and the appearance of commercially made equipment and can be built in a few hours. Unlike many types of electronic apparatus, it does not require exacting circuit adjustments once wiring has been completed. If all connections have been made correctly, this amplifier is ready to go as soon as you connect a record player or radio tuner to the phono input jacks, and a PM speaker or speakers to the output terminals.

The pre-punched chassis measures 11¼ in. long, 6¼ in. wide, and 2¼ in. high. The top of the chassis is punched with six 1-in. holes for mounting five octal pin tube sockets, and a three-section electrolytic filter capacitor. A rectangular opening, 2¾ by 2-in. is provided for the power transformer.

Selector Switch, Volume, Bass, and Treble (line switch) controls mount on the front apron of the chassis (Fig. 1). The ⅜-in. mounting holes for them are spaced 2¼-in. apart, and located so that the escutcheon plate holes will coincide with them. The rear apron of the chassis contains four ⅜-in. holes, three of them for phono jacks and one for the line cord rubber grommet. The phono motor receptacle's size and shape will determine hole or slot size for it. The Na-ald receptacle shown in Fig. 3 fits the prepunched ⅜ by ¾-in. opening. The final chassis opening is a 2 by ½-in. slot on the rear apron of the chassis for the output terminal strip.

The first step in assembling the amplifier is to mount all screw-down components to the chassis. The power transformer comes with its own nuts and bolts. The nuts are removed, then used to bolt the unit securely to the chassis so that the transformer's laminations will not chatter when power is applied. Tube sockets are mounted with 6-32 x ¼-in. machine screws and nuts as are all other components except the phono jacks. For these, 4-40 x ⅜-in. screws and nuts are employed.

The advantage of using the saddle type tube

MATERIALS LIST—HI-FI AMPLIFIER

1	power transformer: 540V center-tapped @ 120 ma. rectifier fil. 5V @ 3 amps triode-pentode fil. 6.3V @ 3.5 amps (Stancor #8405)
1	push-pull audio output transformer. 10,000 ohm center-tapped primary. Secondary tapped at 4.8 and 16 ohms (Todd #1595 or Stancor #A-3304)
1	sheet metal chassis with panel cover. Size: 11¼x6¼x2¼ in.
1	2-pole, multi-position non-shorting selector switch (Mallory #3226J)
5	octal molded sockets (Amphenol #168-015 saddle type)
1	TTLTTT tie Strip (5 insulated tie point)
1	TL tie Strip (1 insulated tie point)
1	6 ft. fixture cord and plug
3	RCA type phono jacks
4	plastic knobs for ¼-in. shaft
1	escutcheon plate
3	ft. shielded single conductor lead
6	ft. plastic insulated #20 hook-up wire
1	AC receptacle
1	4-screw bakelite terminal strip
	TUBES
1	6SC7 Hi-Mu Twin Triode
1	6SL7GT Hi-Mu Twin Triode
2	6V6G7 Beam Power Amplifiers
1	5Y3GT Full Wave Rectifier
	RESISTORS
1	500K potentiometer with line switch (Treble Control)
2	500K potentiometer (Volume and Bass controls)
1	10 ohm, ½ watt composition resistor
1	100 ohm, ½ watt composition resistor
1	220 ohm, 5 watt, wire-wound resistor
1	2200 ohm, ½ watt composition resistor
1	22K, ½ watt composition resistor
2	47K, ½ watt composition resistors
1	47K, 1 watt composition resistor
2	100K, ½ watt composition resistors
6	220K ½ watt resistors
1	470K ½ watt resistors
1	3.3 megohm, ½ watt resistors
1	10 megohm, ½ watt resistor
1	5100 ohm, 2 watt composition resistor
	CAPACITORS
1	3-section electrolytic can capacitor. 10 mf., 400 DC wk. V./100 mf., 400 DC wk. V./80 mf., 350 DC wk. V. Alternates: Mallory FP378 or Sprague TVL3792
7	.05 or .047 mf., 400 DC wk. V. molded paper capacitors
1	.02 mf. 400 DC wk. V. molded paper capacitor
2	.0047 or .005 mf., 400 DC wk. V. molded paper capacitors
1	.006 mf., 400 DC wk. V. molded paper capacitor
2	.001 mf., 400 DC wk. V. molded paper capacitors
1	250 mmf. mica or ceramic capacitor
	HARDWARE
22	6-32x¼in. machine screws and nuts (for attaching sockets, mounting strips, etc.)
6	4-40x⅜ in. machine screws and nuts
1	#6 ground lug
1	⅜ in. rubber grommet
4	#6 self-tapping screws

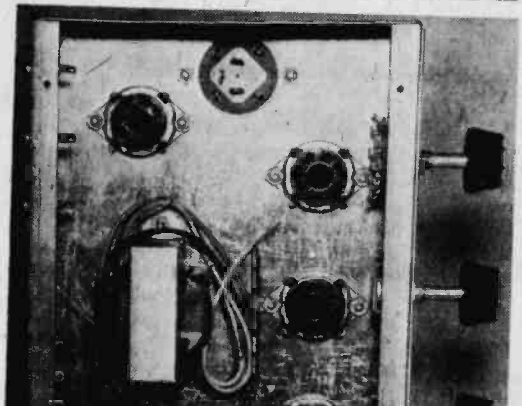
The complete Arkay Hi-Fi Amplifier Kit, containing all parts listed above, can be obtained from Rose Electronics, Inc., 76 Vesey St., New York 7, N. Y. The price is $22.95, plus postage on 12 lbs. to your zone.

sockets specified in the Materials List is that each socket has four grounding lugs in addition to its eight pin lugs. Thus, where a component returns to ground, there is always a ground lug handy—no need to drill holes for mounting individual lugs, or soldering leads to the stubborn chassis steel. Since the sockets do serve this dual purpose, they must be screwed down securely to a chassis whose underside is either bare metal or cadmium plated—it cannot be painted. Watch tube pin connections carefully. Mount all sockets so that the keyways face toward the controls on the front apron of the chassis. Since a number of components are clustered around the 6SL7GT socket, a tie-strip with five insulated lugs and mounting bracket is secured to the rear socket screw.

With basic components mounted (Fig. 2), begin wiring by connecting the power transformer and audio output transformer leads. The leads of these units are color-coded to identify the function of individual windings or taps. A printed key to the color coding comes with them.

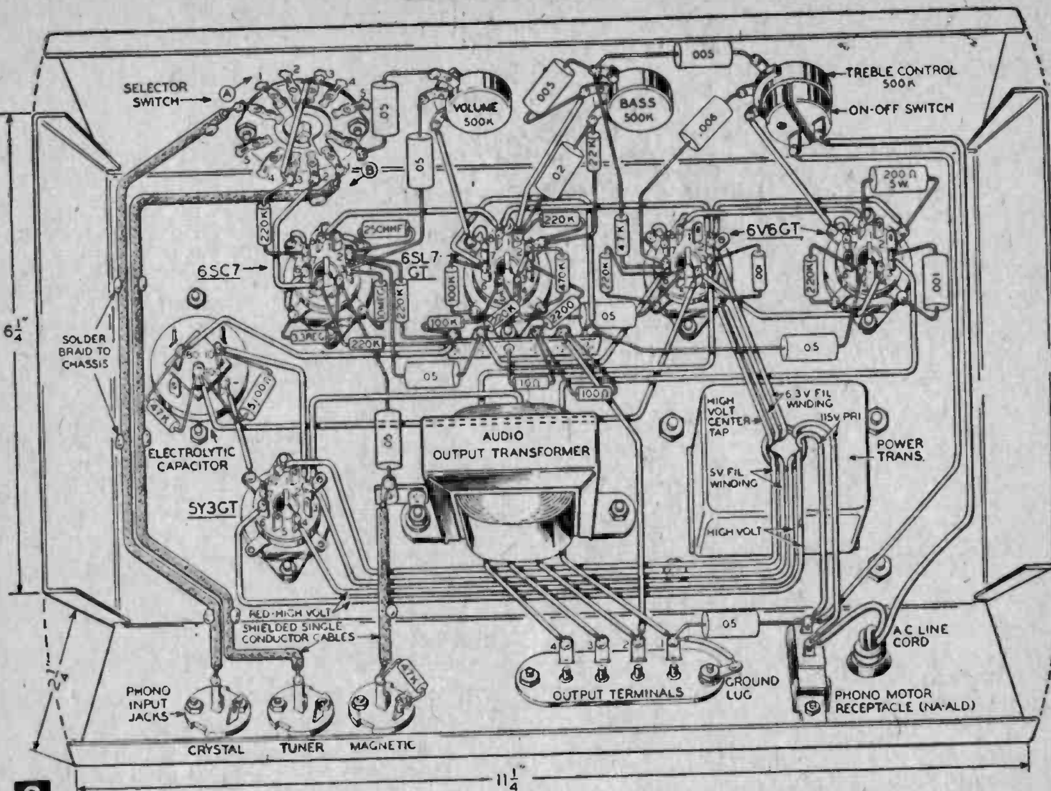
When wiring in capacitors and resistors, make doubly sure that you have the right value in the right place. It is easy to insert .005 mf. where .05 mf. belongs, or a 47K resistor where a 470K is called for. Many leads are drawn much longer in the Pictorial Wiring Diagram than you will want them in actual practice. And pigtail leads on new resistors and capacitors average 2-in. long, which is longer than you will ordinarily want them. Excess wire should, of course, be clipped off components before soldering into the circuit. Arrange long leads from transformer and circuitry that *are* long so that they lay close to the chassis. Figure 4 shows how the wiring may be done in actual practice.

You will find it most practical to insert all solid leads first, using #20 plastic covered hook-up wire. Although the wiring appears simple, the leads from the phono input jacks to the Selector Switch, and the wiring from the latter into the circuit, can be tricky, so be sure to proceed carefully.



2 Bottom view of chassis. Sockets, electrolytic capacitor, power transformer and controls are installed prior to wiring-in smaller components. Leads from output transformer (center) and power transformer (right) are wired in first.

Each phono jack carries a sensitive grid lead,



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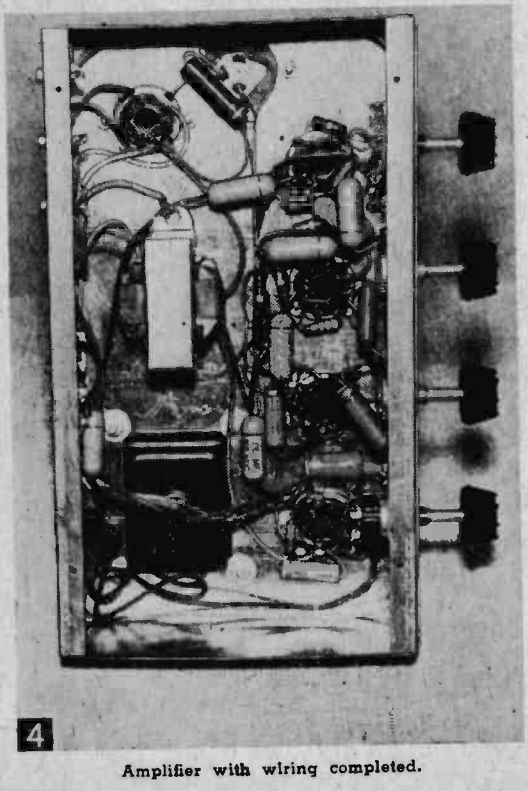

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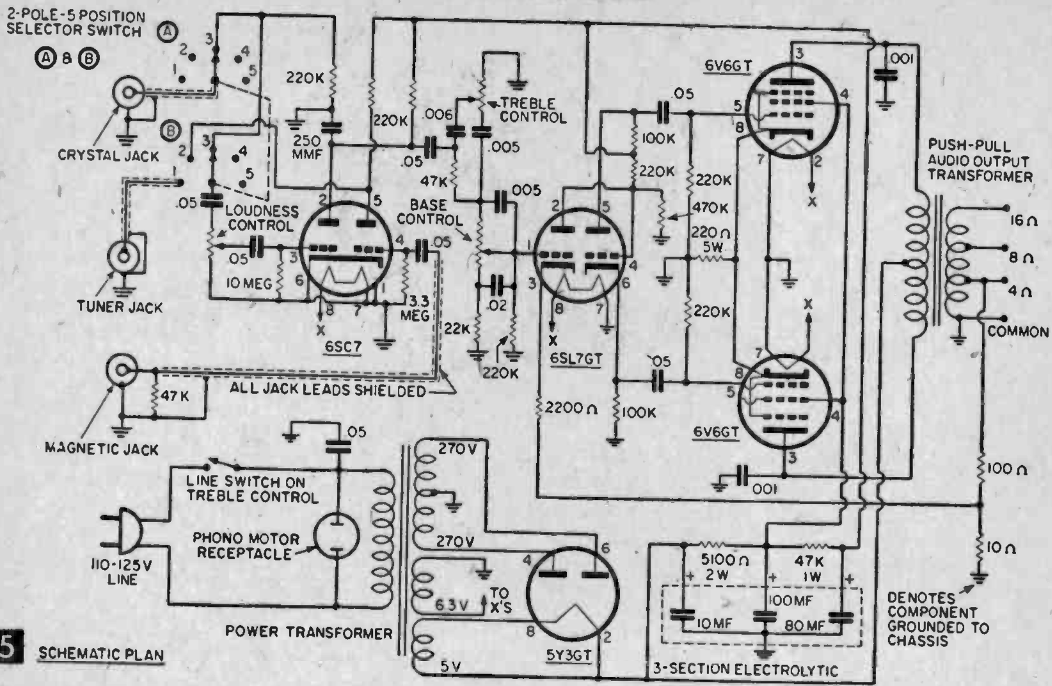
Amplifier with wiring completed.

and these leads must be shielded so that they won't pick up 60-cycle hum. The Arkay kit includes a supply of single conductor shielded wire for this wiring operation. The wire is like that used to connect an auto radio to its whip antenna. To install, measure off the length needed, then unravel the outer wire braid until about ½-in. of the inner wire's insulation is exposed. Now strip off just enough insulation to expose the center wire. Solder the inner wire to the center jack lug and terminate the opposite stripped end at its respective circuit point. Solder the outer braid to the chassis as indicated by black dots in Fig. 3. Be sure that none of the fine braid strands are accidentally left contacting the inner lead. While no harm will be done to the amplifier if they are, it will not work if any one of the input circuits is shorted by a stray strand of braid wire. Note that the smaller phono jack lugs next to the mounting screws are not visibly connected. They are self grounding when mounted to the metal chassis.

The purpose of the Selector Switch is to allow the amplifier to handle a crystal, magnetic or reluctance phono pick-up, as well as FM or AM radio tuners, with all three permanently plugged into the amplifier. Moreover, a separate pre-amplifier is not required for reluctance pick-ups. This is built right into this amplifier. In addition, where pick-up manufacturers supply instructions for installation of auxiliary equalizer networks (other than the conventional types already in-



5 SCHEMATIC PLAN

cluded here) spare lugs 4 and 5 of switch section A, and 4 and 5 of section B will accommodate these features. Note, too, that lugs 1 and 2 of switch section A are not used at any time.

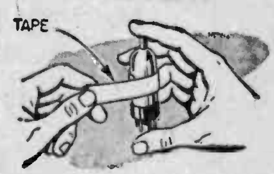
With wiring completed, the amplifier is ready for testing. Since the rectifier 5Y3GT has a 5-volt filament (see Fig. 5), don't mix it up with the 6.3-volt filament tubes which occupy the sockets in a row parallel to the control panel. Insert the 6.3-volt tubes into their sockets first. Viewing chassis from the front (Fig. 1) they are, left to right: 6SC7 metal dual preamplifier (D); 6SL7GT interstage amplifier and phase inverter (E); and two 6V6GT beam power push-pull output amplifiers (F & G). The 5Y3GT rectifier (C) is installed in the socket behind the electrolytic capacitor can.

A single speaker, or combination of speakers (with suitable cross-over network) may be attached to the output terminal strip. Viewed from the rear, the lefthand lug screw on this strip is *common*. Connect one speaker voice coil lead to this terminal. The other speaker lead is connected to the second lug screw from the left if the voice coil has 4 ohms resistance; to the third screw if the coil has 8 ohms; the fourth screw if it has 16 ohms.

If you have an automatic or manual record player, insert the motor cord in the amplifier's phono motor receptacle, connect pickup to appropriate phono jack, set Selector Switch to proper position, plug in the line cord and turn on power by rotating Treble Control.

All controls on the front panel are provided with ¼-in. shafts, 1-in. long. If you desire to leave the amplifier exposed, these shafts can be cut down to ⅜-in., giving a somewhat neater effect. On the other hand, if you plan to install the amplifier in a console later on, leave the shafts full length. The escutcheon plate, which has control designations, may be removed from the chassis by unscrewing the control mounting nuts. Holes in corners of control plate allow it to be attached to a console with #4 wood screws.

Keeping Tabs On Weak Tubes



• With do-it-yourself TV tube checkers installed in many large markets, drug stores and other convenient locations, it is easy for the average set owner to save most of his set upkeep by finding his own faulty tubes. Before testing your TV tubes, put a piece of adhesive tape on each tube, being careful not to cover the identification. Write the condition of each tube on the tape as it is checked. In this way you can keep track of weak "spares" that may get shuffled back into the circuit when a tube fails.—W. H. McClay.

Kink for Soldered Joints

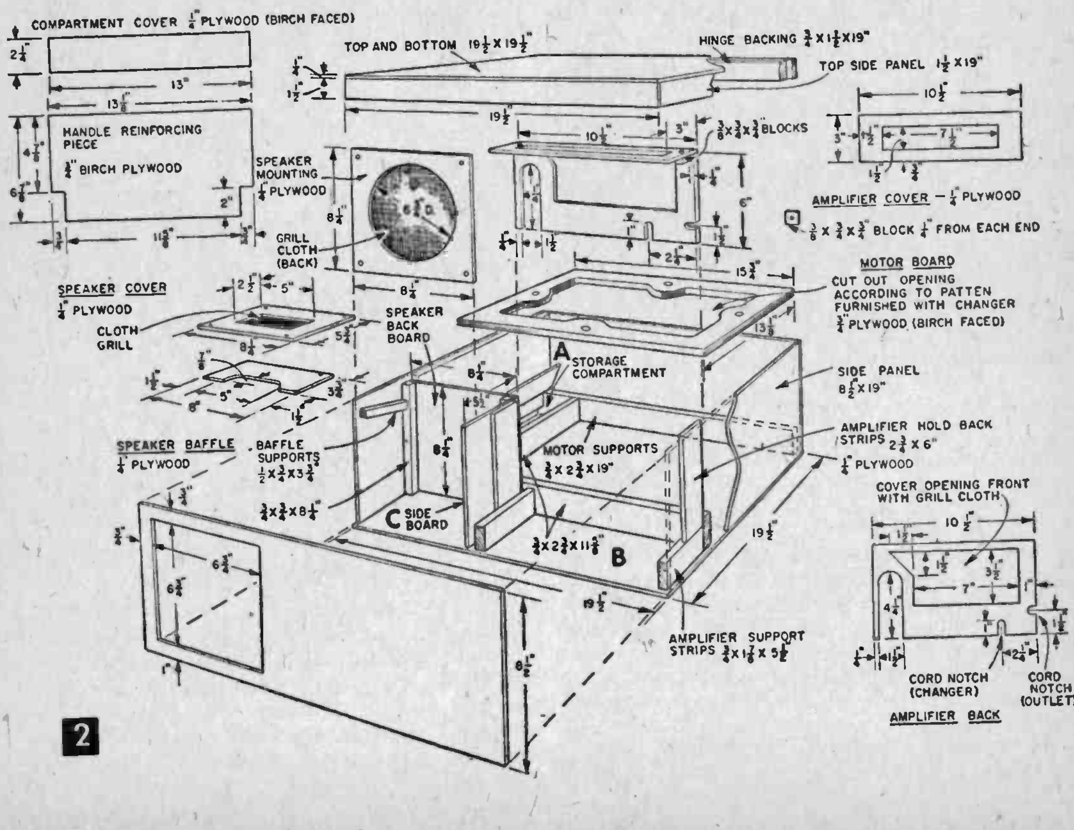
• When soldering wires and cables in a radio receiver, immediately after the iron is removed from the soldered joint, paint the joint with lacquer-thinner, using a small brush. The rosin flux will evaporate immediately, leaving a clean joint. Using this kink, a cold-soldered joint will immediately show up, preventing future trouble. —Herman R. Wallin.

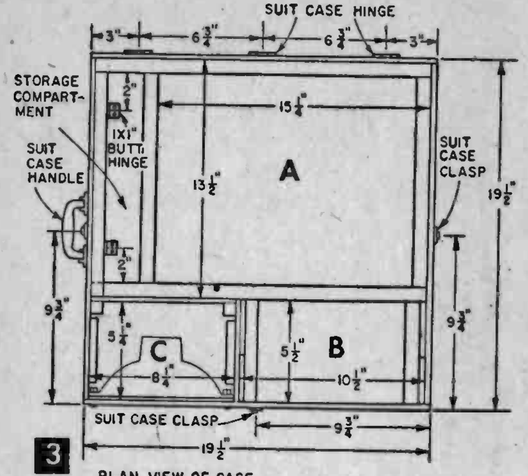
Portable Hi-Fi Record Player

By ELMA WALTNER

IF you like hi-fi, you'll appreciate this phonograph. Its portable, table-top size makes it possible to enjoy superb orthophonic listening in any room of the house, or outdoors wherever a cord for supplying current will reach or can be plugged in. The hi-fi components used in this portable phonograph are quite good, and relatively low in cost (the whole project, in fact, will run about $10 for cabinet materials, and roughly $100 for Hi-Fi components, depending on where you buy). You can't, of course, get perfect reproduction with any table top project, since the small size restricts both the tricks you can play with speakers, and the space you can use for sound-boarding layout. But we did find that cabinet resonance can be effectively damped out by a generous use of fiber glass insulation.

Be sure to cut the matching pieces for both the box walls and lids (Fig. 2) to length at the same time. This will give you an exact match, and a well fitting lid and box unit. The speaker open-





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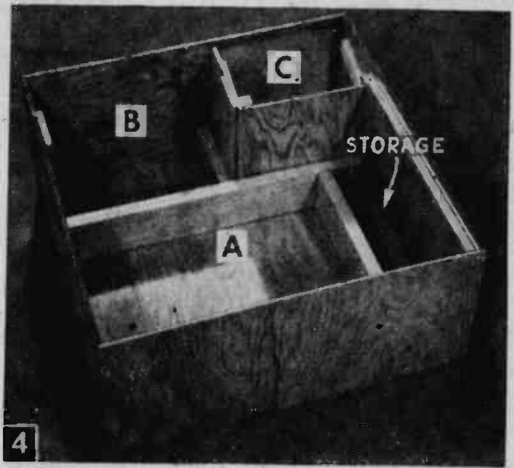
PLAN VIEW OF CASE



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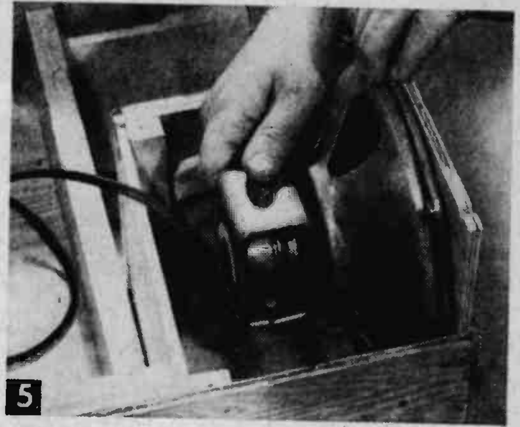

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After mounting speaker on its board, test fit by slipping it into speaker compartment.

MATERIALS LIST—PORTABLE HI-FI-RECORD PLAYER

No.	Size and Description	Use
For Cabinet:		
2 pcs	¼ x 19½ x 19½" plywood	case top and bottom
2 pcs	¼ x 8½ x 19" plywood	case ends
2 pcs	¼ x 8½ x 19½" plywood	case sides
2 pcs	¼ x 1½ x 19" plywood	lid ends
2 pcs	¼ x 1½ x 19½" plywood	lid front and back
1 pc	¼ x 3 x 10½" plywood	amplifier top
2 pcs	¾ x 1⅞ x 5½" solid stock	amplifier support
1 pc	¾ x 1½ x 19" solid stock	hinge backing
2 pcs	¼ x 2¾ x 6" plywood	amplifier holdback
1 pc	¼ x 6 x 10½" plywood	amplifier cover
2 pcs	⅜ x ¾ x ¾" solid stock	amplifier blocks
2 pcs	¾ x 2¾ x 19" solid stock	motor board support
1 pc	¾ x 2¾ x 11⅝" solid stock	motor board cross support
1 pc	¾ x 13⅛ x 15¾" birch-faced plywood	motor board
1 pc	¼ x 2¼ x 13" plywood	compartment cover
1 pc	¾ x 6⅞ x 13⅛" solid birch	handle reinforcement board
1 pc	¼ x 5¾ x 8¼" plywood	speaker cover
1 pc	¼ x 8¼ x 8¼" plywood	speaker mounting board
1 pc	¼ x 3¼ x 8" plywood	speaker baffle
2 pcs	½ x ¾ x 3½" solid stock	baffle board support
1 pc	¾ x ¾ x 8¼" solid stock	back, side and top support
1 pc	¼ x 5½ x 8¼" plywood	speaker side board
1 pc	¼ x 8¼ x 8½" plywood	speaker side board
1½ yds	54" wide plastic upholstery fabric with cloth back	(department or upholstery store)
⅔ yd	54" different color plastic upholstery with cloth back	(department or upholstery store)
15 x 15"	grille cloth (radio supply house)	
24 x 24"	fiber glass insulation (radio supply house)	

1 suitcase carrying handle, 2 suitcase bolts with safety clasps (2¾ x 1½"), 3 suitcase stop hinges, 1 surface suitcase lock (1¾ x 1¼"), 1 pair ¾" long brass box hinges

No. 8 oval head wood screws, 1¾" long (nickel finish); No. 4 rh nickel wood screws, ¾" long

For Record Player:

Amplifier—Grommes, Model LJ2

Speaker—Jensen Extended Range, 8", P8-SX

Changer—Gerrard, Model RC 80

Cartridge—GE RPX 050 (3-speed); or GE RPX061 (single play with diamond needle for microgroove; or GE RPX 040 (single play with sapphire needle for 78 rpm)

ing is cut in one of the 19½-in. long box pieces (C in Fig. 3). After dressing these cut parts, check the lid and box fit, and then assemble the box and lid with brads and glue.

Next cut the motor-board support strips (A in Fig. 3) and the cross motor-board support strip (which is the inner wall of the record changer spindle compartment) of ¾-in pine stock. Use countersunk flathead wood screws to hold the three strips in place in the bottom of the box.

The speaker compartment pieces are ¼-in. plywood except for the two corner supports which are strips of ¾-in. square pine stock, and the baffle board supports which are ½-in. stock (C in Fig. 3). Assemble the speaker compartment in the box with flathead wood screws.

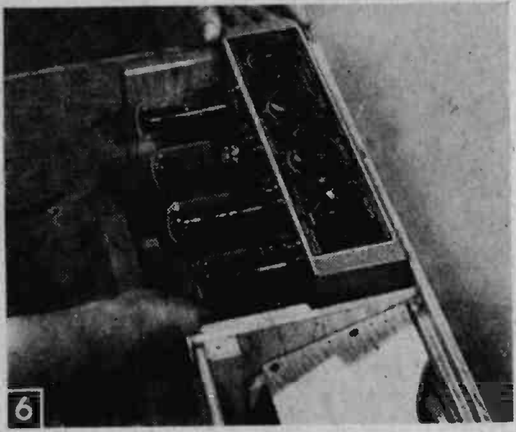
Cut the amplifier support strips from ¾-in. pine stock, and the amplifier hold-back strips of ¼-in. plywood. Fasten these in place with flathead wood screws.

Cut the speaker mounting board of ¼-in. plywood. Jigsaw out the circular speaker opening (Fig. 2) from ¼-in. plywood and mount the speaker on its board with flathead stove bolts, passing the bolts through holes drilled through the speaker board, then through the mounting holes in the speaker frame. Countersink for the stove bolt heads so they will be flush with the front of the speaker mounting board.

Slip the speaker, mounted on its board, into the speaker compartment to be sure it fits (Fig. 5). Fit the speaker baffle board (Fig. 2) down over the speaker and fasten to the slant baffle board support strips with small flathead wood screws (Fig. 6). After fitting the speaker in place to check the assembly, dis-assemble again, removing baffle board and speaker from the compartment.

Unscrew the nuts from the bolts holding speaker to speaker board and lift off the speaker, but leave stove bolts in place on speaker mounting board. Return speaker to its packing carton until you are ready for final assembly. Give front of speaker mounting board a coat of flat black paint.

Next, test fit the amplifier in place in its compartment (B in Fig. 3). Note that support strips on which amplifier rests, also hold amplifier up flush with the top of the box, at the same time creating a compartment below the amplifier for the plugs and cords that connect amplifier to speaker and changer. Test fit both the amplifier back board and amplifier cover board in place. Then disassemble amplifier cover and back board, lift out amplifier and return it to its shipping carton.



6

Trying out fit of amplifier in its compartment. Baffle board in place over speaker.

The motor board (Fig. 2) is cut from ¾-in. birch stock. Test fit the board on its support strips. The cross support strip forming the inner wall of changer spindle compartment, extends about ¼ in. beyond edge of motor board, and the compartment cover projects over this extension. Drill holes through motor board so it may be screwed to support strips at the four corners. Then remove motor board from box and jigsaw out an opening in its center to match the mounting diagram furnished with your record changer.

8

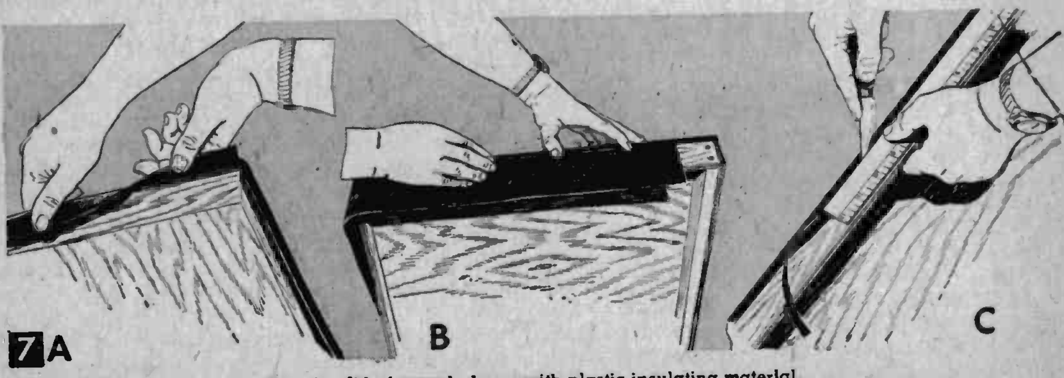
Attaching fiber glass insulation to insides of speaker compartment with stapler-tacker. Insulation on sides extends only up to baffle board supports.

Cut the handle reinforcing board (Fig. 2) of ¾-in. birch stock and fasten to box side with wood screws screwed through from outside box. Also locate two screws to engage the board at the edge where it fits into the corner of the box.

Cut the changer spindle compartment cover of ¼-in. birch-faced plywood (Fig. 2). Also cut two 2¼-in. lengths of ¾-in. square stock and glue these to the motor board support strips under the cover. These blocks hold the compartment cover up flush with the motor board. Hinge this cover to handle support board with brass hinges.

For covering the box, buy plastic upholstery material with a fabric back. Cut a 20½-in. square piece for the box bottom. Spread a good grade of liquid glue evenly on the bottom of the box. Lay the covering square on the bottom so that the material extends ½ in. beyond the bottom on all four sides. Then smooth and roll the upholstery material to the wood for a good bond.

Notch out the four corners as shown where they extend beyond the bottom, then glue material to four sides of box, making sure corners



7A B C

Covering lid of record player with plastic insulating material.

come together. Before glue hardens completely, use a straight edge ruler and razor blade or sharp pointed knife to trim material to a straight edge around the four box sides.

Cut the material for covering the box sides in strips wide enough to extend ¾ in. beyond top edge of box when it is fitted against cut edge of covering material glued to box sides. Spread glue on one side at a time and fit and roll the edge of the covering material snugly against the glued-on material. Repeat this procedure around all four sides of the box. Miter the corners and bring covering material over top edges and down against the inside of the box. On the section faced by the birch handle reinforcing board, however, glue covering only over the top plywood edge of the board.

When glue has set but is still tacky, again use straight edge razor to cut a clean edge on the covering material. Line inside of box with a contrasting plastic material, running the lining down to top of the motor board support strips. The birch handle reinforcing board, and the inside of the amplifier and speaker compartments are all left unlined. Cover and line the lid as you did the box (Fig. 7).

Also cover the speaker and amplifier cover boards with the material that is used for lining the case, carrying the covering material over both

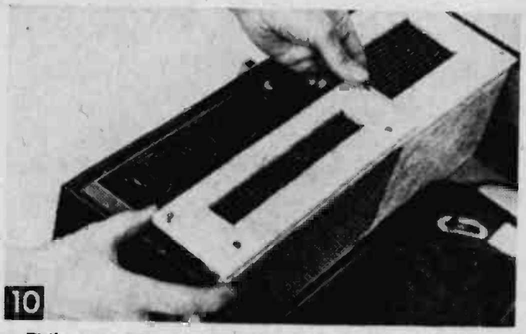
9

Placing changer, mounted on the motor board, down onto motor board support strips.

the outside edges of the board and the inside edges of the cutout holes, and gluing it so it laps over onto the back about ¼ in. You'll have to miter the corners, of course. Cut pieces of plastic grille cloth and fasten to the back of the boards to cover the openings, using either screen cloth staples or a regular tacker-stapler fitted with wire staples. Cut a piece of grille cloth the same size as the speaker mounting board. After making sure stove bolts used for mounting speaker are in place, lay the cloth over the opening and fasten to the front side of the board with screen staples or wire staples.

Glue a piece of the plastic used for the lining, to the amplifier back board. Cut out the oblong opening but leave plastic covering material over the upright opening. Tack a piece of grille cloth, with raw edges folded under, to the *outside* of the opening. (The amplifier tubes, which give off considerable heat, would be too close to grille cloth fastened to the inside).

Finish motor board, compartment cover and handle reinforcing board with several coats of shellac or other preferred finish. Allow to dry, then wax. Attach handle to outside of case (Fig. 2) using screws that drive nearly through box and handle reinforcing board. Fit lid in place and attach three safety clasp suitcase-type fasteners,



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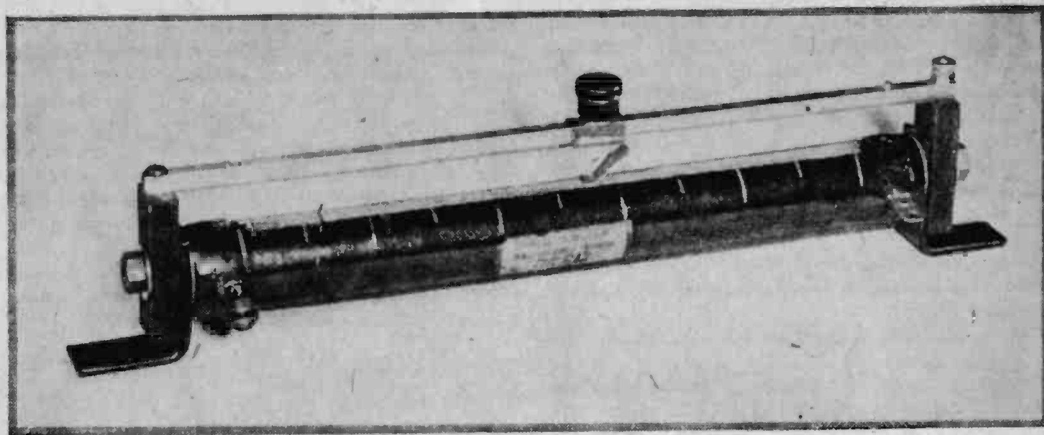
Fitting amplifier compartment back and cover in place. Below is the finished record player.

centering them on the front and two sides of the record player where the lid meets the base. Hinge the fourth side of the lid to the box using three evenly spaced stop hinges.

Fasten pieces of spun fiber glass acoustic insulation to the bottom, back and sides (below the baffle board supports) of the speaker compartment with a stapler-tacker (Fig. 8). Mount the speaker on the back of the speaker mounting board and draw up the stove bolt nuts until they are so tight the speaker will not vibrate during playing. Slip mounted speaker into its compartment and fasten speaker board to box frame with four nickel plated, roundhead machine screws passed through matching holes in the box and speaker mounting board. Draw nuts tight against back of speaker mounting board to eliminate vibration. Fasten baffle board and then speaker compartment cover in place.

Set changer, mounted on its motor board, into its compartment on the motor board support strips (Fig. 9). Tighten the screws at the four corners of the motor board to secure it to the support strips.

Make the wiring connections from changer to amplifier and amplifier to speaker. Cord passes through a hole cut in the wall between the two compartments. Instructions for making these connections come with the amplifier. Slip amplifier into its compartment with the wires in the open space beneath the amplifier. Slip amplifier compartment back board into place, then fit cover into position (Fig. 10) and screw down. The outlet plug cord is carried over the top of the box for playing and fitted around the changer when the box is closed for carrying. Spare equipment is stored in the spindle compartment.



The finished slide wire resistor. This one has a value of 5000 ohms, 200 watts, .2 amperes.

Try Making Slide Wire Resistors

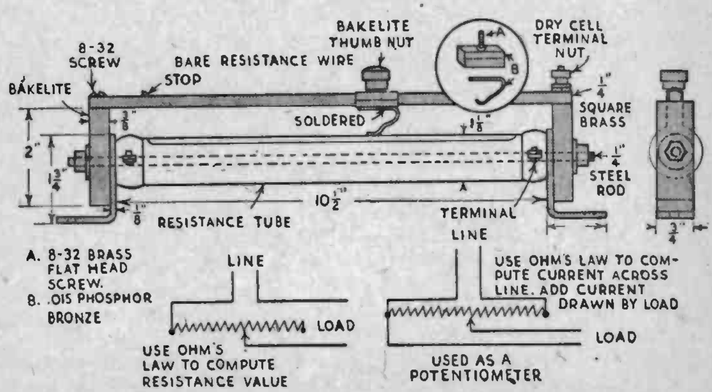
These are just what you need when you are adjusting voltage or creating special loads during testing operations

By HAROLD P. STRAND

The complete parts of the slide wire resistor are shown on the bench ready for assembly. The sliding piece has been made and the phosphor bronze contact spring is shown here being soldered in place.

HAVING an assortment of slide wire resistors on hand for electrical or radio testing is a great advantage. Technicians all use them for adjusting voltage and creating special loads on apparatus they are testing or developing. It is quite simple to make a good resistor of this sort from a tubular adjustable resistor, or one that is equipped with an adjusting band. These can be purchased in most any radio supply store and many of them are included in surplus equipment. The advantage of a slide wire resistor is that the resistance can be adjustable in very gradual steps by simply sliding the movable unit along the wire to the point desired.

In selecting resistance tubes for this job, remember that two factors are involved—resistance and current carrying capacity. For example, a resistor may have a resistance of 500 ohms, but be able to carry but .2 amperes. If 1 ampere were the value of the current in the circuit, this resistor would quickly overheat and burn out. Therefore, we must provide an assortment of resistances with various cur-



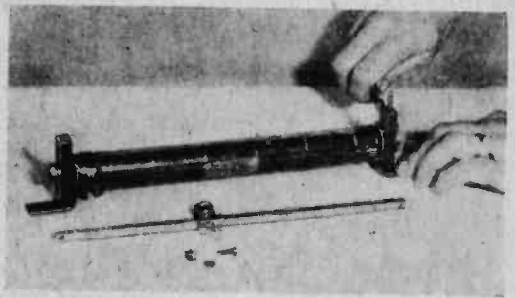
rent values, so as to be able to supply one within the limits of the demand. Generally speaking, those of high resistance and low current capacity will be comparatively small tubes, both in length and diameter, and the wire with which they are wound will be of small size. As the current value goes up, larger wire is required and in order to get the specified resistance on the tube, the latter will have to be both longer and somewhat greater in diameter.

In estimating the required amount of resistance for a given case, Ohm's Law is usually employed—$R = \frac{E}{I}$, meaning that resistance equals the voltage divided by the current. Suppose, for example, that the voltage is 110 and .5 ampere is the current desired in the circuit, how much resistance will be required? Dividing 110 by .5 = 220 ohms. Therefore, if a resistance of 220 ohms is connected in series on 110 volts, .5 amperes will flow in the circuit. This tells us that a slide wire resistor of at least 220 ohms (preferably a little more to allow for top adjustment) which is capable of carrying .5 amperes, will be required.

On the other hand suppose that we want to know how much current will flow in the circuit, if a resistance of some value is connected in. Ohm's Law is again employed—$I = \frac{E}{R}$, or dividing the voltage by the resistance, gives us the current value. On this basis, as an example, if a resistance of 150 ohms is used on 110 volts, the current will be .733. Again, when selecting the resistance to be used, make sure it will carry at least this current value, and preferably more so it will run cooler. These resistance tubes can be had in a large variety of values in both resistance and current. They are also often rated in watts, which shows the watt limit that can be dissipated without damage. Watt values are found by the formula I^2R (the current squared times the resistance). For example, in the previous problem with 110 volts and .5 amperes as known values, .5 times .5 equals .25 multiplied by 220 ohms equals 55 watts. Therefore, in this particular case, the resistor must be rated at 55 watts or better.

To get down to making these slide wires, note that the photos and drawings show all necessary steps. The resistor illustrated is rated at 5000 ohms and 0.2 amperes, 200 watts. It is a tube about 10½ inches long and 1⅛ inch in diameter. A ¼ inch steel rod is cut 12¼ inches long and threaded at both ends for ¼ inch-20. Two steel brackets are also made as indicated in the drawing and photos. The rod passes through drilled holes in these brackets and pieces of ⅜ inch bakelite, which also have holes drilled to receive the rod, are made and fitted as shown. With the aid of two ¼ inch nuts and washers, the assembly is tightly clamped together. If cup shaped or recessed washers are supplied with the tube, these are used in the open ends to center the rod and make a better job of it.

The slide rod is made from a piece of ¼ inch square brass rod, drilled at the ends to receive an 8/32 screw at one end and a threaded stud, also 8/32, at the other end. These are used in tapped holes in the ends of the Bakelite pieces. Stops are made on the slide rod so the movable unit cannot go beyond the bared section of the wire. These are 6/32 screws fitted in tapped holes in the rod, with their heads cut off. An 8/32 nut and thumb nut from a dry cell are fitted to the threaded stud, so as to form a convenient terminal post for attachment of the lead wire.



Assembly of the resistor is simple. A nut on each end of the tie rod clamps parts together. Final job is to place square rod in position and secure it with a screw and binding post nuts.

The sliding member is made by taking some thin phosphor bronze and bending it up in the form of a square tube around the rod as a guide. The seam is soldered as shown in one of the photos. A piece of the same material is also used as the wiping spring contact, which is also soldered in place to the square tube. The final job is to solder a flat head 8/32 brass screw to the top center of the tube. Screw an insulated thumb nut or binding post terminal on the screw. Tension on the wire should be positive at every point but should not have excessive pressure, which might damage the fine wires.

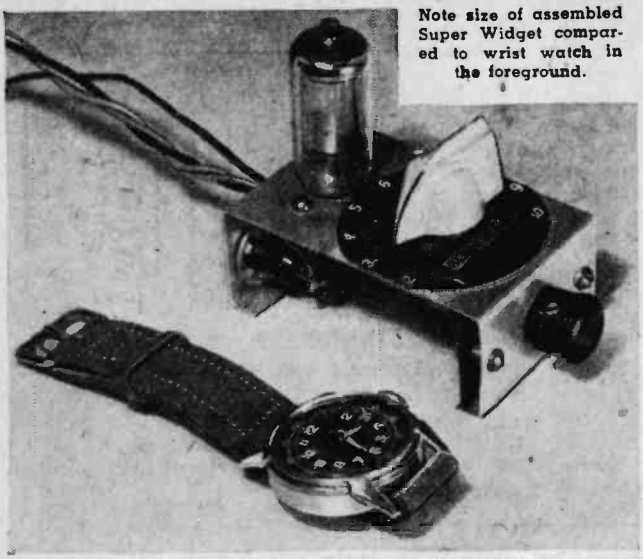
Only one end of the resistance will be used, unless the slide wire is to be used as a potentiometer, in which case both ends will be in use. It is a simple matter to either solder or fit suitable terminal posts through the holes for attachment of the leads.

These finished slide wire resistors can be made more stable on the bench, by attaching pieces of ¼ inch hard asbestos board under the brackets.

Dimensions given in the drawings and some details shown will have to be modified according to the size of the unit under construction. However, the method of converting them will be the same and if carefully done, the result will be well worth the trouble.

Cut Power Interference

• Erect your radio aerial at right angles to telephone and power lines in order to eliminate interference or static.—I. M. Fenn.



Note size of assembled Super Widget compared to wrist watch in the foreground.

SUPER WIDGET

Want to build a pep-packed pocket set? Here is a simple yet powerful circuit for a one-tube radio that's easy to build, easy to listen to, and easy on the pocketbook

By T. A. BLANCHARD

FOR THE radio experimenter who wants to try his hand at something simple yet exciting, the *Super Widget is it!* The *Super Widget* has been designed along straight-forward lines, but our pictorial wiring plan is arranged so that the builder may install the set in a cigarette case, plastic compact, or any other small, non-metallic case. The result is a truly powerful and selective pocket set.

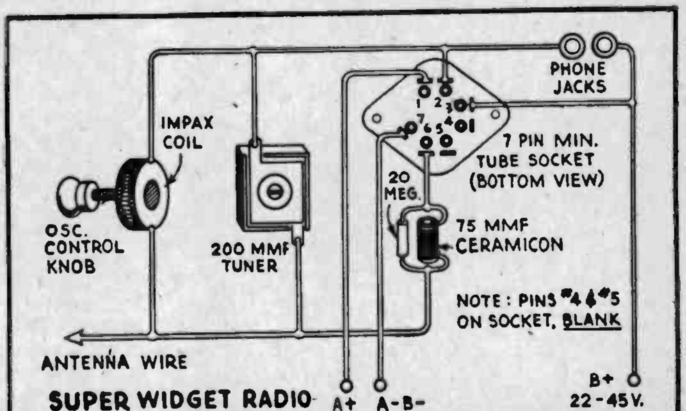
Only six radio components are used. The circuit employs the super-regenerating system working around a tiny Impax coil. This coil is about the size of a dime, and 1/8 in. thick. By means of a vernier adjustment knob, the set builds up a remarkable amount of sensitivity and power without any of the usual objections to super-regenerating circuits such as lack of sensitivity, continuous oscillation, whistles, howls, etc. The knob control on the Impax coil serves as both sensitivity and volume control and is free of critical adjustment and noise, as is often the case where potentiometers and condensers are used to control feedback.

To conserve space, a compression type capacitor is used as tuning control. The capacitor has a maximum capacity of about 200 mmf, and when used with the Impax coil, covers the entire broadcast band. As compression capacitors are ordinarily adjusted with a screwdriver, we attached a 1/4 in. bushing to the screw so that it could be fitted with a small Bakelite knob. Three complete revolutions of the knob cover the broadcast band. The components list is completed with a 20 megohm resistor and 75 mmf. Ceramicon capacitor in the grid circuit. A midget electron tube, a type 1T4 pentode, is used in the compact hookup. The original model was assembled on a simple aluminum chassis 1 3/4 in. wide, 2 3/4 in. long and 1 in. high.

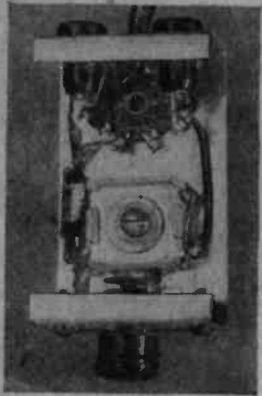
The *Super Widget* obtains power from a 22 1/2 or 45 volt midget B battery or an ultra-compact Minimax 30 volt cell. An ordinary penlight cell provides 1 1/2 volt for the tube filament. The antenna lead is soldered in to the circuit. We used a 3 ft. length of thin hook-up wire. Bringing this wire within close

MATERIALS LIST—SUPER WIDGET

- 1 200 mmf. compression type capacitator
- 1 75 mmf. Ceramicon fixed capacitor
- 1 20 megohm, 1/4 watt resistor
- 1 Impax BC band coil assembly
- 1 7-pin miniature tube socket
- 2 phone jacks
- 2 Bakelite knobs
- 1 Type 1T4 Pentode tube



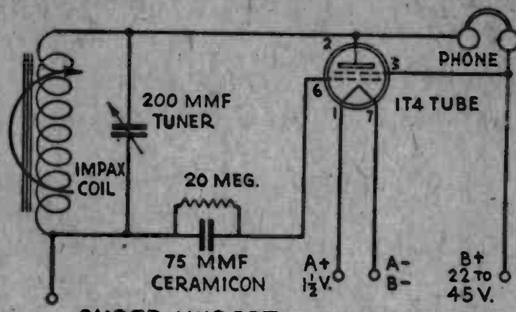
SUPER WIDGET RADIO PICTURE PLAN



Note tuning capacitor (center) and above it, tube sockets and phone jacks.

range of a telephone or other metallic object gave ample pick - up. Greater signal strength may be obtained by connecting a ground wire to the A-B connection on the set.

This unique circuit offers numerous design possibilities. Earphone reception is bell-clear and plenty loud. We suggest that the headphones used* with this set have a 2000 ohm impedance. With the proper output transformer a regular hearing-aid receiver works fine.

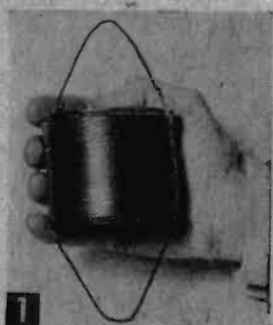


SUPER WIDGET - SCHEMATIC PLAN

In many locations good loudspeaker volume may be expected. This is particularly true if you are located in the vicinity of high-powered radio stations.

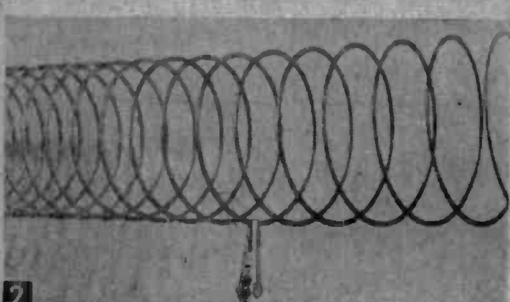
Portable Coil Antenna

• Those amusing metal coils that "walk" down the steps make handy portable antennas for standard broadcast and/or short-wave receivers. Simply hang the coil from the ceiling to the floor, or stretch it across the room, and when you want to take it down it will snap back into a neat and compact unit.



1

Slinky (Fig. 1) consists of 70 ft of copper-plated metal band about 3/32 in. wide. The coil is about 3 in. wide and stands about 2¼ in. high.



2

Fasten a hanger on each end of the coil using short lengths of wire or cord twisted or tied to end loops, so you can hang the coil from hooks or nails.

An alligator clip and a length of wire connect the coil, hung from the ceiling, to your receiver's antenna post. These coils are made of copper-coated spring-steel, and one cost me 85¢ in a dime store.—ARTHUR TRAUFFER.

Weather-Resistant Antenna Coating

• Despite the use of non-rusting elements for outdoor TV antennas, they deteriorate rapidly under exposure to the weather, with such results as pitted contacts at the transmission-line insulator connections and cracked insulators which cause signal losses. Extend the life of your outdoor antenna with a weather-resistant coating obtained by applying a clear plastic spray such as *Krylon Crystal Clear*. After the antenna has been assembled but before it is mounted on the mast, spray reflector, crossarm mast-section, the twin-lead section which extends from the insulator to the first stand-off insulator, the stand-off insulator, bolts, nuts and other important terminals.

The Care of Electric Soldering Irons

1

An assortment of irons; ratings range from 20 to 135 watts. All have universal shaped tips, or chisel points, except the gun-type (right center) which has a shorted turn, alloy-wire tip. Dual-rated for 100-135 watts, the gun-type iron is designed for instant-heat electronics work. The pencil iron (lower right) is for use in cramped quarters.

MOST home handymen have an investment in one or more soldering irons. Properly used and cared for, an iron will give long years of dependable, efficient service. Improperly used and cared for, it will give weak and imperfect soldered joints and will soon be valueless as a tool. In other words, it pays to take care of your soldering irons.

Often, a large iron can do a small job; a small iron can never do a large job. Figure 1 shows a variety of irons; Table A gives the uses to which the different sizes of irons are usually put. In addition to using the proper size iron on a job—an iron that will generate and transmit enough heat to insure a good joint—you should remember that it is the tip of the iron that transmits the heat and that, unless the tip is kept properly "tinned," an oxidized crust will form that will impede the flow of heat to the work.

To tin an iron, first see that the tip is smooth and free from pits. If necessary, use a file to recondition the four faces. Then apply solder to the tip (Fig. 2), just before it reaches maximum heat. Rosin-core solder is best for this purpose as it eliminates the necessity of using an external flux.

When using the iron, watch the tinning on the tip. If it becomes discolored, dip it into clean water and instantly withdraw it. This will not only expose the bright tin, but also restore the iron to a safe temperature if the discoloration is due to overheating. Tinning may also be cleaned by rubbing the iron on steel wool (Fig. 3); and overheating may be remedied by disconnecting the iron briefly when necessary.

When you're through using an iron, wipe it clean with an oily cloth. This will help prevent corrosion. Never use sal ammoniac (ammonium chloride) to clean a tip; it spreads rapidly and will corrode the rest of the iron. It may also be deposited on the work when doing electrical or electronic soldering and later cause trouble.

Don't abuse your iron by hammering or prying with it. Don't forge the tip; use a file, or grind it, to restore its shape. And don't kink its cord sharply, yank it, twist it, or drag it. A good

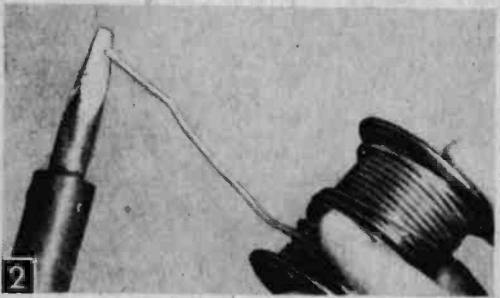
TABLE A SOLDERING IRON

Type	Watt Rating	Length	Weight	Use
Pencil	20-35	7- 8 in.	3¼-8 oz.	Quick heat for short intervals; Small wire soldering in crowded places
Conventional	40-75	9-12 in.	8 oz.-1 lb.	General light work (radio or jewelry soldering)
Conventional	85-100	10-13 in.	10 oz.-1¼ lbs.	Common type household and general purpose iron; also for appliance repairs
Conventional	150	11-13 in.	12 oz.-1½ lbs.	Same as above, but for slightly heavier work
Conventional	200	12-14 in.	1-2 lbs.	Used in shops for medium heavy jobs and in homes for heavy tasks
Conventional	300	12-15 in.	2-3 lbs.	Factory production soldering and any very large surface soldering
Gun	100-135	10-12 in.	1½-2 lbs.	Where quick heating is required
Gun	200	10-12 in.	2-2½ lbs.	Where quick heating is required
Gun	200-250	10-12 in.	2-2½ lbs.	Where quick heating is required, also permits soldering wires directly to large surface (such as radio chassis)

way to protect the cord of an iron is to wind a plastic spiral cover around the end nearest the iron's handle, the end most flexed. Such covers are available at hardware and variety stores.

If the heating element of your iron burns out, obtain a replacement unit from the manufacturer or at a hardware store and make the installation yourself. To remove the defective element from a conventional type iron, slip the handle back on the cord, after loosening it from the metal barrel, and remove the cord wires and the wire leads to the heating element from beneath the threaded screws in the fiber support. Remove the tip (by loosening the set screw) and drive out the small drift pin in the end section of the barrel. The end section then pulls out, complete with heating element, porcelain insulator and lead-in wires attached (Fig. 4). Reverse the removal procedure to install the new element.

In taking care of the gun-type iron, its tip should also, of course, be kept well tinned. With such guns, overheating should be strictly avoided. Since this type of iron heats in about five seconds there is no need to leave it turned on when not immediately in use. With the dual heat gun type models, the higher ranges should be used as little as possible to prevent overheating of tip and transformer.—H. Leeper.



2

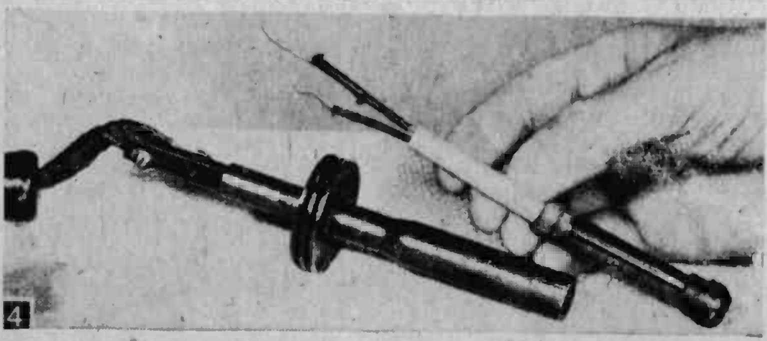
3

LEFT

On a new iron, or with an old iron where the tinning has burned off, tin to clear copper on all four iron faces with flux and solder. Rosin-core solder is used here.

RIGHT

A wad of steel wool forced inside solder spool is useful for tip cleaning while working.

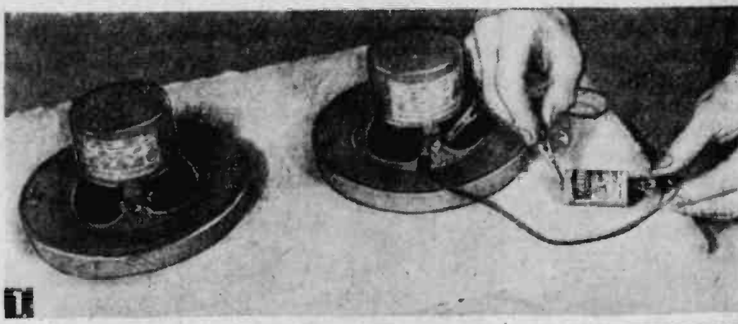


4

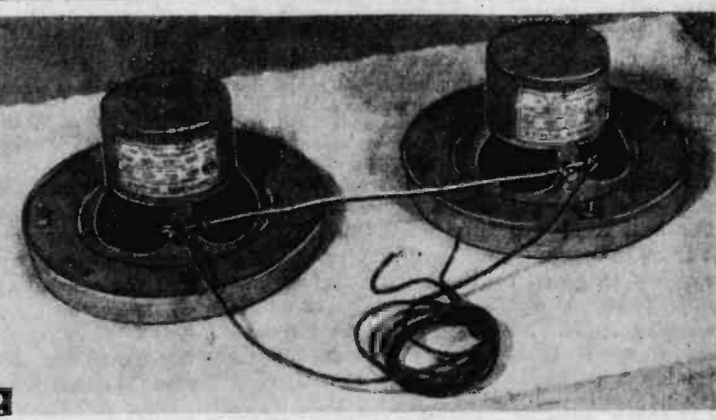
BOTTOM

Conventional iron disassembled for installation of new heating element. With irons in which the tips are held in place with a set screw, regular loosening of the screw and removal of tip for cleaning of the shank will prevent sticking and insure good heat conduction from element to tip.

Twin Speakers Improve Fidelity



1



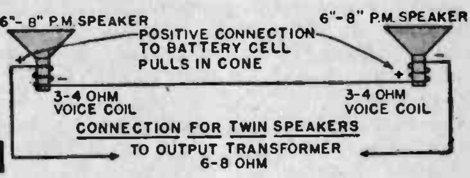
2

IF YOU have twin 6 or 8 in. P.M. type speakers, it's an easy job to connect them in series at their voice coils, and their combined performance will sound very much like one expensive speaker of twice the diameter. The two-speaker combination will, in fact, reproduce any audio signal with less distortion. Costwise, the two small 6 in. P.M. speakers cost about the same as one large 12 in. speaker.

To connect the small speakers in series, first mount them on a single baffle of suitable size (preferably of ½ in. insulating board).

The important thing to consider when connecting the voice coils is their correct polarity with respect to the operation of the cones. They must work in phase, that is, both cones must be pulled in and pushed out together, on each impulse of the signal, or vibrate together, rather than have one pull in and the other push out. To do this, use a flashlight cell and 2 clip leads to test the operation of each cone (Fig. 1). With the positive, (top of cell) connected to a certain voice coil terminal, the cone will be pulled in. If you reverse the battery polarity, the cone will be pushed out. Mark the terminal used when the cone is pulled in with positive polarity on that terminal. Do the same thing to the other speaker. It is now a simple job to connect the two voice coils in series (Figs. 2 and 3), connecting a positive to a negative. Solder on long leads for connection to the output transformer. Then double-check by attaching the battery to the long leads, and make sure that both cones pull in and push out together, with a reversal of the battery leads. The two speakers will now operate as a single unit, each taking half the power output, which doubles the capacity of a single speaker of the same size.

For good bass reception, speakers should have a rather flexible cone mounting, since bass is at the lower frequencies where the maximum cone movement is evident. Many speakers will be found with very stiff working cones, easily determined by gently pushing in at the center with a finger. Such speakers work all right at the higher frequencies, but may lack good bass response. In the past, speakers were made with a flexible leather mounting ring at the edges of the cone to improve the bass. The two shown in Figs. 1 and 2 have bellows-like construction at the edge, rather than the usual direct mounting to the frame, to provide a more flexible operation of the cones.

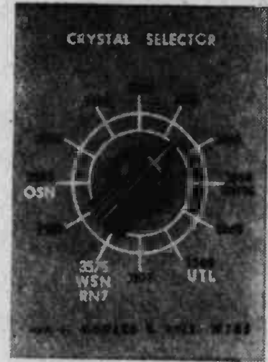


3

For good fidelity choose a good quality output transformer of generous size, since a cheap, small transformer will often fail to cover the wide frequency band of the signals delivered to it, if the full range of the musical scale is desired. The transformer must also match the rated load resistance of the amplifier output tube or tubes in the circuit, to the voice coil impedance. For example, a 6V6 with 250 volts on the plate requires 5000 ohms load resistance. Using the twin speakers, each with a 3-4 ohm voice coil, this becomes 6-8 ohms in series. Thus, you must match 5000 ohms to 6-8 ohms on the secondary of the transformer.—HAROLD P. STRAND.

How to Apply Small Decals

IT HAS now become common practice to put the professional touch on experimenter-made amplifiers, record players, other hi-fi equipment, amateur radio apparatus, etc., by using decalcomania transfer labels. Tweezers are recommended by most manufacturers for handling the individual words and letters, but you'll have much more success, using a tiny paint brush of the variety found in children's water color boxes—the smaller, the better.



Both black and white decals were used here, the most frequently used frequencies on this selector appearing in white.

For best results in applying decals, first lay out *all* of your supplies and materials so that you are ready to go to work without interruption. You will need, in addition to the book or sheets of decals themselves, a small pair of scissors with which to cut out the various words and letters; a small shallow dish or pan; (the cover from a glass jar works well) a small paint brush; and a soft, lint-free cloth.

Locate the word or letter you are going to use from the sheet, then carefully clip it out with the scissors, taking care to stay very close to the lettering so that a small spot of decal from the next letter does not mar the finished work. Drop this word or letter in the shallow water container and let it float while you look up and cut out the next word or letter. About 30 seconds in the water is enough for the average manufacturer's decals, although a full minute in water will do no harm. Sometimes it will be found that the decal will separate from the paper in the water and float free. When this happens, lift the decal itself from the water, using the point of the art brush and picking it up *only* at one end. (Picking it up in the middle will result in its curling around itself.) If the decal has not separated from the paper backing (good, dry decals will not), then pick up the word or letter —paper backing and all—with the tip of the brush and lay it in approximate position on the surface to which it is to be applied. Drop it about half an inch above or below, or a little more than the equivalent of its own length to one side, not over the final position it will occupy. This, too, is somewhat contrary to manufacturer's suggestions, but makes for far easier handling. Then (again in disagreement with printed instructions) do *not* attempt to pull the paper out from beneath the decal. Instead, take the pointed handle of the brush and gently "tease" the decal from the paper—after first providing a moistened path for it to follow to its final position by means of the brush and a little water. Use the pointed handle of the brush to push the decal into its proper position, re-wetting it slightly if it moves with difficulty. Don't attempt to float it in with an excess of water, particularly when it is to be located adjacent to other recently placed decals.

When you have positioned the word or letter in its final position, carefully pat it lightly with a lint-free cloth and, after absorbing the excess water, press it firmly into the surface with the cloth. Then leave it alone and proceed with the next word or letter.

When placing the larger dial scales and similar circular patterns, note that most of the better decal makers provide a "plus" sign in the exact center of the circle. In cutting out this decal do *not* cut out the inside of the circular area, but preserve the plus mark in its printed position. Before soaking the decal in water, place it in proper position and, using a prick punch or similar tool, puncture the exact intersection of the horizontal and vertical lines of the plus sign so that the mark is transferred to the surface of whatever the decal is to appear on. This will enable exact centering of the circular design when applied. (The plus mark is usually concealed behind a knob or dial anyway.)

Once you have completed lettering your panel or cabinet or other piece of gear, set it aside for a full 24 hours. Meanwhile, provide yourself with a small can of a high-grade lacquer. I have experimented with dozens of different brand names of various "clear" lacquers with varying degrees of success. For best all-round results, use "SYNALAC" clear white lacquer (made by W. P. Fuller Co.).

The first coat will dry hard within 20 minutes and then a second light coat should be applied. If the decals will be subject to rubbing fingers or other hard usage, a third, and thicker coat will also be needed and sometimes as many as five coats in all.—HOWARD S. PYLE.

Answers to Electronics Numbers Quiz On Page 58

1) c—CK705
2) b—1X2
3) c—4:3
4) b—3¾" and 7½"
5) a (and c)—60 c.p.s. (and .06 kilocycles)
6) TV channels VHF (a) and UHF (b)
7) a—40 (40 parts tin to 60 parts lead)
8) b—60
9) c—746
10) Record player speeds
11) c—6 Megacycles
12) b—6 Megacycles

WHITE'S RADIO LOG

An up-to-date broadcasting directory
AM, FM, TV and Short-Wave Stations

Vol. 35 No. 1

QUICK REFERENCE INDEX

History of White's Radio Log

White's Radio Log was founded in Providence, R. I., by Charles DeWitt White as an extension of his earlier publishing activities which, in turn, were a continuation of the business established by his father: the publication of city directories, street guides and municipal tax guides.

In the early days of broadcasting, the compilation of a list of operating stations and their frequencies was no simple task. Prior to the Dill-White Radio Act of 1927, if a feed merchant, auto dealer, barber or undertaker wanted to advertise his wares or services, he had only to select a frequency and go on the air. A great many experimenters and business men did just that.

Nevertheless, Mr. White's directory publishing experience had convinced him that he could successfully assemble a radio log, and in 1924 he justified this conviction with *The Rhode Island Radio Call Book*, following this shortly after with *White's Triple List of Radio Broadcasting Stations*.

In 1927 the two publications were merged, nation-wide distribution was established and in ensuing years related publications, such as *Sponsored Radio Programs, Radio Announcer's Guide, Short-Wave Schedule Guide* and a special Canadian edition of the *Log* (which had had its title shortened to the one it bears today), were also issued.

The *Log* itself reached a combined circulation of well over 1,000,000 copies at one time, in 1929-31 was distributed as the *Enna Jettick Radio Log* (to promote the sale of shoes), in 1938-39 was distributed as the *General Electric Radio Log* (to promote General Electric's "sensational 1939 receivers with push-button tuning").

The Fall-Winter number of the 1927 *Log* listed 701 U.S. Stations. Most powerful were WEAF (now WRCA), N.Y., with 50,000 watts, KDKA, Pittsburgh, WGY, Schenectady, and WJZ (now WABC), N. Y., each with 30,000 watts; WGN-WLIB, Chicago, with 15,000 watts; and Boston's WBZ, also with 15,000. Five stations listed (one a Junior High School in Norfolk, Va.) operated on a mighty 5 watts, more than 100 stations had outputs of less than 100 watts.

The current *Log* cross-indexes over 3000 U.S. standard-broadcast (AM) stations, separately lists U.S. frequency-modulation (FM) and television stations, has a complete compilation of Canadian broadcasters and, in addition, has a comprehensive world-wide roster of short-wave stations.

With the success of his *Log*, Charles DeWitt White (a direct descendant of Peregrine White, the first child born on the Mayflower's historic crossing and bearer of the name of another illustrious ancestor, DeWitt Clinton) disposed of his city directory and street guide interests and transferred his editorial operations to Bronxville, N. Y., a suburb of New York City, where he could remain in close touch with the broadcasting industry. On April 6, 1957, having only recently completed revising and updating the 34th consecutive year of his *Log*, Mr. White died in his sleep. He was 76 years old.

Charles DeWitt White's daughter and heir, Mrs. W. R. Washburn, has sold all rights in and to the *Log* to Science and Mechanics Publishing Co., and entrusted us with continuing her father's work. This we are proud to do, beginning with the present edition, Vol. 35, No. 1, of *White's Radio Log*.

V. D. Angerman
Publisher
Science and Mechanics

United States

Standard Broadcast (AM) Broadcasting Stations Listed Alphabetically by Call Letters

C.L., call letters; Kc., frequency in kilocycles (for watt power of station, see list arranged by frequency, p. 169)

C.L.	Location	Kc.
DYBU	Cebu, P.I.	1260
DZPI	Manila, P.I.	800
DZRH	Manila, P.I.	710
KAAA	Kingman, Ariz.	1230
KABC	Los Angeles, Calif.	790
KABI	Ketchikan, Alaska	580
KABR	Aberdeen, S. Dak.	1220
KACT	Andrews, Tex.	1360
KADA	Ada, Okla.	1230
KAFA	Colo. Sprgs., Colo.	1460
KAFP	Petaluma, Calif.	1490
KAFY	Bakersfield, Calif.	550
KAGH	Crossett, Ark.	1340
KAGT	Anacortes, Wash.	1340
KAGR	Yuba City, Calif.	1450
KAHU	Waipahu, Hawaii	920
KAIM	Kaimuki, Hawaii	870
KAKC	Tulsa, Okla.	970
KAKE	Wichita, Kan.	1240
KALB	Alexandria, La.	580
KALE	Richland, Wash.	960
KALG	Alamogordo, N.Mex.	1230
KALI	Pasadena, Calif.	1430
KALL	Salt Lake City, Utah	910
KALM	Thayer, Mo.	1290
KALT	Atlanta, Tex.	900
KALV	Alva, Okla.	1430
KAMD	Camden, Ark.	910
KAMO	Rogers, Ark.	1390
KAMP	El Centro, Calif.	1430
KAMQ	Amarillo, Tex.	1010
KANA	Anaconda, Mont.	1230
KAND	Corsicana, Tex.	1340
KANE	New Iberia, La.	1240
KANI	Oahu, Hawaii	1150
KANN	Sinton, Tex.	1590
KANO	Anoka, Minn.	1470
KANS	Wichita, Kan.	1480
KANV	Shreveport, La.	1050
KAOK	Lake Charles, La.	1400
KAPA	Raymond, Wash.	1340
KAPB	Marksville, La.	1370
KAPK	Minden, La.	1240
KARE	Atchison, Kan.	1470
KARK	Little Rock, Ark.	920
KARM	Fresno, Calif.	1430
KART	Jerome, Idaho	1400
KARY	Prosser, Wash.	1310
KASA	Elk City, Okla.	1240
KASH	Eugene, Ore.	1600
KASI	Ames, Iowa	1430
KASL	Newcastle, Wyo.	1240
KASM	Albany, Minn.	1150
KAST	Astoria, Ore.	1370
KATE	Albert Lea, Minn.	1450
KATI	Casper, Wyo.	1400
KATL	Miles City, Mont.	1340
KATO	Reno, Nev.	1340
KATR	Corpus Christi, Tex.	1030
KATY	San Luis Obispo, Cal.	1340
KATZ	St. Louis, Mo.	1600
KAUS	Austin, Minn.	1480
KAVE	Carlsbad, N.Mex.	1240
KAVL	Lancaster, Calif.	1340
KAVR	Apple Valley, Calif.	960
KAWL	York, Neb.	1370
KAWT	Douglas, Ariz.	1450
KAYE	Puyallup, Wash.	1450
KAYL	Storm Lake, Iowa	990
KAYO	Seattle, Wash.	1150
KAYS	Hays, Kans.	1400
KAYT	Rupert, Idaho	970
KBAB	El Cajon, Calif.	910
KBAL	San Saba, Tex.	1410
KBAM	Longview, Wash.	1220
KBAR	Burley, Idaho	1230
KBBA	Benton, Ark.	690
KBBS	Buffalo, Wyo.	1450
KBCH	Oceanlake, Oreg.	1400
KBEC	Waxahachie, Tex.	1390
KBEE	Modesto, Calif.	970
KBEL	Idabel, Okla.	1240
KBEN	Carrizo Sprgs., Tex.	1450
KBHM	Branson, Mo.	1220
KBHS	Hot Springs, Ark.	590
KBIA	Columbia, Mo.	1580
KBIF	Centerville, Calif.	900
KBIG	Avalon, Calif.	740
KBIM	Roswell, N.Mex.	910
KBIS	Bakersfield, Calif.	970
KBIX	Muskogee, Okla.	1490
KBIZ	Ottumwa, Iowa	1240
KBKO	Portland, Oreg.	1290
KBKR	Baker, Oreg.	1490
KBKW	Aberdeen, Wash.	1450
KBLA	Burbank, Calif.	1490
KBLF	Red Bluff, Calif.	1490
KBLI	Blackfoot, Idaho	1490
KBLO	Hot Springs, Ark.	1470
KBMI	Henderson, Nev.	1400
KBMN	Bozeman, Mont.	1230
KBMO	Benson, Minn.	1290
KBMW	Breckinrdg., Minn.	1450
KBMX	Coalinga, Calif.	1470
KBMY	Billings, Mont.	1240
KBND	Bend, Oreg.	1110
KBNZ	LaJunta, Colo.	1400
KBOA	Kennett, Mo.	830
KBOE	Oskaloosa, Iowa	740
KBOI	Boise, Idaho	950
KBOK	Malvern, Ark.	1310
KBOL	Boulder, Colo.	1490
KBOM	Mandan, N.Dak.	1270
KBON	Omaha, Nebr.	1490
KBOP	Pleasanton, Tex.	1380
KBOR	Brownsville, Tex.	1600
KBOW	Butte, Mont.	1490
KBOY	Medford, Oreg.	730
KBPS	Portland, Oreg.	1450
KBRC	Mt. Vernon, Wash.	1430
KBRK	Brookings, S.Dak.	1430
KBRL	McCook, Nebr.	1300
KBRO	Bremerton, Wash.	1490
KBRS	Springdale, Ark.	1340
KBRZ	Freeport, Texas	1460
KBSF	Springhill, La.	1460
KBST	Big Spring, Tex.	1490
KBTA	Batesville, Ark.	1340
KBTK	Missoula, Mont.	1340
KBTM	Jonesboro, Ark.	1230
KBTN	Neosho, Mo.	1420
KBTO	El Dorado, Kans.	1360
KBUC	Corona, Calif.	1370
KBUD	Athens, Tex.	1410
KBUH	Brigham City, Utah	800
KBUN	Bemidji, Minn.	1450
KBUR	Burlington, Iowa	1490
KBUS	Mexia, Tex.	1590
KBVM	Lancaster, Calif.	1380
KBWD	Brownwood, Tex.	1380
KBYE	Okla. City, Okla.	890
KBYR	Anchorage, Alaska	1270
KBZY	Salem, Oreg.	1490
KCAL	Redlands, Calif.	1410
KCAP	Helena, Mont.	1340
KCBC	Des Moines, Iowa	1390
KCBD	Lubbock, Tex.	1590
KCBQ	San Diego, Calif.	1170
KCBS	San Fran., Calif.	740
KCCO	Lawton, Okla.	1050
KCCT	Corpus Christi, Tex.	1150
KCFH	Cuero, Tex.	1600
KCHA	Charles City, Iowa	1580
KCHE	Cherokee, Iowa	1440
KCHI	Chillicothe, Mo.	1010
KCHJ	Delano, Calif.	1010
KCHR	Charleston, Mo.	1350
KCHS	Truth or Consequences, New Mexico	1400
KCHV	Coachella, Calif.	970
KCID	Caldwell, Idaho	1490
KCIJ	Shreveport, La.	980
KCIL	Houma, La.	1490
KCIM	Carroll, Iowa	1380
KCJB	Minot, N.Dak.	910
KCKN	Kansas City, Kans.	1340
KCKY	Coolidge, Ariz.	1150
KCLA	Pine Bluff, Ark.	1400
KCLE	Cleburne, Tex.	1120
KCLF	Clifton, Ariz.	1400
KCLN	Clinton, Iowa	1390
KCLO	Leavenworth, Kans.	1410
KCLS	Flagstaff, Ariz.	600
KCLV	Clovis, N.Mex.	1240
KCLW	Hamilton, Tex.	900
KVLX	Colfax, Wash.	1450
KCMC	Texarkana, Tex.	1230
KCMJ	Palm Sprgs., Calif.	1340
KCMO	Kansas City, Mo.	810
KCNA	Tucson, Ariz.	580
KCNC	Ft. Worth, Tex.	870
KCNI	Broken Bow, Nebr.	1280
KCNO	Alturas, Calif.	570
KCNY	San Marcos, Tex.	1470
KCOB	Newton, Iowa	1280
KCOG	Centerville, Iowa	1400
KCOH	Houston, Tex.	1430
KCOK	Tulare, Calif.	1270
KCOL	Ft. Collins, Colo.	1410
KCOM	Sioux City, Iowa	620
KCON	Conway, Ark.	1230
KCOR	San Antonio, Tex.	1350
KCOW	Alliance, Nebr.	1400
KCOY	Santa Maria, Calif.	1400
KCRA	Sacramento, Calif.	1320
KCRB	Chanute, Kans.	1460
KCRC	Enid, Okla.	1390
KCRE	Crescent City, Calif.	1240
KCRG	Cedar Rapids, Iowa	1600
KCRS	Midland, Tex.	550
KCRT	Trinidad, Colo.	1240
KCRV	Caruthersville, Mo.	1370
KCSB	San Bernardino, Calif.	1350
KCSR	Chadron, Nebr.	1450
KCTG	Springfield, Oreg.	1400
KCTI	Gonzales, Tex.	1450
KCTX	Childress, Tex.	1510
KCUE	Red Wing, Minn.	1250
KCUL	Fort Worth, Tex.	1540
KCVL	Colville, Wash.	1480
KCVR	Lodi, Calif.	1570
KCYL	Lampasas, Tex.	1450
KDAC	Ft. Bragg, Calif.	1230
KDAL	Duluth, Minn.	610
KDAN	Eureka, Calif.	790
KDAV	Lubbock, Tex.	580
KDAY	Santa Monica, Calif.	1580
KDB	Santa Barbara, Calif.	1490
KDBC	Mansfield, La.	1360
KDBS	Alexandria, La.	1410
KDOD	Dumas, Tex.	800
KDEC	Decorah, Iowa	1240
KDEF	Albuquerque, N.Mex.	1150
KDBM	Dillon, Mont.	800
KDEN	Denver, Colo.	1340
KDES	Palm Sprgs., Calif.	920
KDET	Center, Tex.	930
KDEX	Dexter, Mo.	1590
KDHL	Faribault, Minn.	920
KDIA	Auburn, Calif.	1490
KDIO	Ortonville, Minn.	1350
KDIX	Dickinson, N.Dak.	1230
KDJI	Holbrook, Ariz.	1270
KDKA	Pittsburgh, Pa.	1020
KDKD	Clinton, Mo.	1280
KDLA	DeRidder, La.	1010
KDLK	Del Rio, Tex.	1230
KDLM	Detroit Lakes, Minn.	1340
KDLR	Devils Lake, N.Dak.	1240
KDMA	Montevideo, Minn.	1450
KDMO	Carthage, Mo.	1490
KDMS	El Dorado, Ark.	1290
KDNT	Denton, Tex.	1440
KDOK	Tyler, Tex.	1330
KDON	Salinas, Calif.	1460
KDQN	DeQueen, Ark.	1390
KDRO	Sedalia, Mo.	1490
KDRS	Paragould, Ark.	1490
KDSJ	Deadwood, S.Dak.	980
KDSN	Denison, Iowa	1580
KDSX	Denison, Tex.	950
KDTA	Delta, Colo.	1400
KDTH	Dubuque, Iowa	1370
KDUB	Lubbock, Tex.	1340
KDUZ	Hutchinson, Minn.	1260
KDWT	Stamford, Tex.	1400
KDYL	Salt Lake City, Utah	1320
KDZA	Pueblo, Colo.	1230
KEAN	Brownwood, Tex.	1240
KEBE	Jacksonville, Tex.	1400
KECC	Pittsburg, Calif.	990
KECK	Odessa, Tex.	920
KEED	Springfield, Oreg.	1050
KEEN	San Jose, Calif.	1370
KEEP	Twin Falls, Idaho	1450
KELA	Centralia, Wash.	1470
KELD	El Dorado, Ark.	1400
KELO	Sioux Falls, S.Dak.	1320
KELK	Elko, Nev.	1240
KELP	El Paso, Tex.	920
KELT	Electra, Tex.	1050
KENA	Mena, Ark.	1450
KENE	Toppenish, Wash.	1490
KENI	Anchorage, Alaska	550
KENL	Arcata, Calif.	1340
KENM	Portales, N.Mex.	1450
KENO	Las Vegas, Nev.	1460
KENS	San Antonio, Tex.	680
KENT	Shreveport, La.	1550
KEOK	Fort Dodge, Iowa	540
KEPR	Kennewick, Wash.	610
KERB	Kermit, Tex.	600
KERC	Eastland, Tex.	1590
KERG	Eugene, Oreg.	1280
KERN	Bakersfield, Calif.	1410
KERV	Kerrville, Tex.	1230
KEUE	Minneapolis, Minn.	1440
KEUN	Eunice, La.	1490
KEVA	Shamrock, Tex.	1580
KEVL	White Castle, La.	1590
KEVT	Tucson, Ariz.	690
KEX	Portland, Oreg.	1190
KEXO	Grand Junc., Colo.	1230
KEXX	San Antonio, Tex.	1250
KEYE	Perryton, Tex.	1400
KEYJ	Jamestown, N.Dak.	1400
KEYS	Corpus Christi, Tex.	1440
KEYY	Pocatello, Idaho	1240
KEYZ	Williston, N.Dak.	1450
KFAB	Omaha, Nebr.	1110
KFAC	Los Angeles, Calif.	1330
KFAD	Fairfield, Iowa	1570
KFAL	Fulton, Mo.	900
KFAM	St. Cloud, Minn.	1450
KFAR	Fairbanks, Alaska	660
KFBB	Great Falls, Mont.	1310
KFBC	Cheyenne, Wyo.	1240
KFBI	Wichita, Kans.	1070
KFBK	Sacramento, Calif.	1530
KFDA	Amarillo, Tex.	1440
KFDM	Beaumont, Tex.	560
KFDR	Grand Coulee, Wash.	1400
KFDX	Wichita Falls, Tex.	990
KFEL	Pueblo, Colo.	970
KFEQ	St. Joseph, Mo.	680
KFFA	Helena, Ark.	1360
KFGO	Fargo, N.Dak.	790
KFGQ	Boone, Iowa	1260
KFGR	Forest Grove, Oreg.	1570
KFGT	Fremont, Nebr.	1340M
KFH	Wichita, Kans.	1330
KFI	Los Angeles, Calif.	640
KFIR	North Bend, Oreg.	1340
KFIV	Modesto, Calif.	1360
KFIZ	Fond du Lac, Wis.	1450
KFJB	Marshalltown, Iowa	1230
KFJI	Klamath Falls, Oreg.	1150
KFJM	Grand Forks, N.Dak.	1440
KFJZ	Ft. Worth, Tex.	1270
KFKA	Greeley, Colo.	1310
KFKU	Lawrence, Kans.	1250
KFLD	Floydada, Tex.	900
KFLW	Klamath Falls, Oreg.	1450
KFLY	Corvallis, Oreg.	1240
KFMA	Davenport, Iowa	1580
KFMB	San Diego, Calif.	540
KFMJ	Tulsa, Okla.	1050
KFML	Denver, Colo.	1390
KFMO	Flat River, Mo.	1240
KFNF	Shenandoah, Iowa	920
KFNV	Ferriday, La.	1600
KFNW	Fargo, N.Dak.	900
KFOR	Lincoln, Nebr.	1240
KFOX	Long Beach, Calif.	1280
KFPW	Ft. Smith, Ark.	1230
KFQD	Anchorage, Alaska	730
KFRB	Fairbanks, Alaska	900
KFRC	San Francisco, Calif.	610
KFRD	Rosenberg, Tex.	980
KFRE	Fresno, Calif.	940
KFRM	Kansas City, Mo.	550
KFRO	Longview, Tex.	1370
KFRU	Columbia, Mo.	1400
KFSA	Ft. Smith, Ark.	950
KFSB	Joplin, Mo.	1310
KFSC	Denver, Colo.	1220
KFSD	San Diego, Calif.	600
KFSG	Los Angeles, Calif.	1150
KFST	Ft. Stockton, Tex.	860
KFTM	Ft. Morgan, Colo.	1400
KFTV	Paris, Tex.	1250
KFUN	Las Vegas, N.Mex.	1230
KFUO	St. Louis, Mo.	850
KFVS	Cape Girardeau, Mo.	960
KFWB	Los Angeles, Calif.	980
KFXD	Nampa, Idaho	580
KFXM	San Bernardino, Calif.	590
KFYN	Bonham, Tex.	1420
KFYO	Lubbock, Tex.	790
KFYR	Bismarck, N.Dak.	550
KGA	Spokane, Wash.	1510
KGAF	Gainesville, Tex.	1580
KGAK	Gallup, N.Mex.	1330
KGAL	Lebanon, Oreg.	920
KGAY	Salem, Oreg.	1430
KGB	San Diego, Calif.	1360
KGBT	Harlingen, Tex.	1530
KGBX	Springfield, Mo.	1260
KGCX	Sidney, Mont.	1480
KGDE	Fergus Falls, Minn.	1250
KGDN	Edmonds, Wash.	630
KGEE	Bakersfield, Calif.	1230
KGEK	Sterling, Colo.	1230
KGEM	Boise, Idaho	1140
KGEN	Tulare, Calif.	1370
KGER	Long Beach, Calif.	1390
KGEZ	Kalispell, Mont.	600
KGFF	Shawnee, Okla.	1450
KGFJ	Los Angeles, Calif.	1230
KGFL	Roswell, N.Mex.	1400
KGFW	Kearney, Nebr.	1340
KGFX	Pierre, S.Dak.	630
KGGF	Coffeyville, Kans.	690
KGGM	Albuquerque, N.Mex.	610
KGHF	Pueblo, Colo.	1350
KGHI	Little Rock, Ark.	1250
KGHL	Billings, Mont.	790
KGHM	Brookfield, Mo.	1470
KGIB	Bremerton, Wash.	1540
KGIL	San Fernando, Calif.	1260
KGIW	Alamosa, Colo.	1450
KGKB	Tyler, Tex.	1490
KGKL	San Angelo, Tex.	960
KGKO	Dallas, Tex.	1480
KGLC	Miami, Okla.	910
KGLN	Glenwood Sprgs., Colo.	980
KGLO	Mason City, Iowa	1300
KGLU	Safford, Ariz.	1480
KGMB	Honolulu, Hawaii	590
KGMC	Englewood, Colo.	1150
KGMO	Cape Girardeau, Mo.	1220
KGMS	Sacramento, Calif.	1380
KGNB	New Braunfels, Tex.	1420
KGNC	Amarillo, Tex.	710
KGNO	Dodge City, Kans.	1370
KGO	San Francisco, Calif.	810
KGOL	Golden, Colo.	1250
KGON	Oregon City, Oreg.	1520
KGOS	Torrington, Wyo.	1490
KGRH	Fayetteville, Ark.	1450
KGRI	Henderson, Tex.	1000
KGRO	Gresham, Oreg.	1230
KGRT	Las Cruces, N.Mex.	570
KGST	Fresno, Calif.	1600
KGU	Honolulu, Hawaii	760
KGVL	Greenville, Tex.	1400
KGVO	Missoula, Mont.	1290
KGW	Portland, Oreg.	620
KGWA	Enid, Okla.	960
KGY	Olympia, Wash.	1240
KGYN	Guymon, Okla.	1220

C.L.	Location	Kc.
KGYW	Vallejo, Calif.	1190
KHAM	Albuquerque, N.Mex.	1580
KHAS	Hastings, Nebr.	1230
KHBC	Hilo, Hawaii	970
KHBG	Okmulgee, Okla.	1240
KHBM	Monticello, Ark.	1430
KHBR	Hillsboro, Tex.	1560
KHCD	Clifton, Ariz.	1450
KHEM	Big Springs, Tex.	1270
KHEN	Henryetta, Okla.	1590
KHEY	El Paso, Tex.	690
KHIL	Brighton-Fort Lupton, Colorado	800
KHIT	Walla Walla, Wash.	1320
KHEP	Phoenix, Ariz.	1280
KHFS	Vancouver, Wash.	1150
KHJ	Los Angeles, Calif.	930
KHMO	Hannibal, Mo.	1070
KHOB	Hobbs, N.Mex.	1280
KHON	Honolulu, T.H.	1380
KHOZ	Harrison, Ark.	1240
KHQ	Spokane, Wash.	590
KHSL	Chico, Calif.	1290
KHUB	Watsonville, Calif.	1340
KHUM	Eureka, Calif.	980
KHUZ	Borger, Tex.	1490
KHVH	Honolulu, Hawaii	1040
KIBE	Palo Alto, Calif.	1220
KIBH	Seward, Alaska	1340
KIBL	Beeville, Tex.	1490
KIBS	Bishop, Calif.	1230
KICA	Clovis, N.Mex.	980
KICD	Spencer, Iowa	1240
KICK	Springfield, Mo.	1340
KICO	Calexico, Calif.	1490
KID	Idaho Falls, Idaho	590
KIDD	Monterey, Calif.	630
KIDO	Boise, Idaho	630
KIEM	Eureka, Calif.	1480
KIEV	Glendale, Calif.	870
KIFI	Idaho Falls, Idaho	1060
KIFN	Phoenix, Ariz.	860
KIFW	Sitka, Alaska	1230
KIHN	Hugo, Okla.	1340
KIHO	Sioux Falls, S.Dak.	1270
KIHR	Hood River, Oreg.	1340
KIJV	Huron, S.Dak.	1340
KIKS	Sulphur, La.	1310
KIKI	Honolulu, Hawaii	830
KILL	Lubbock, Tex.	1460
KILO	Grand Forks, N.Dak.	1060
KILT	Houston, Tex.	610
KIMA	Yakima, Wash.	1460
KIMO	Independence, Mo.	1510
KIMN	Denver, Colo.	950
KIMP	Mt. Pleasant, Tex.	960
KIND	Independence, Kans.	1010
KINE	Kingsville, Tex.	1330
KING	Seattle, Wash.	1090
KINY	Juneau, Alaska	800
KIOA	Des Moines, Iowa	940
KIOX	Bay City, Tex.	1270
KIPA	Hilo, Hawaii	1110
KIRK	Kirksville, Mo.	1450
KIRO	Seattle, Wash.	710
KISD	Sioux Falls, S.Dak.	1230
KIST	Santa Barbara, Calif.	1340
KIT	Yakima, Wash.	1280
KITE	San Antonio, Tex.	930
KITI	Chehalis, Wash.	1420
KITN	Olympia, Wash.	1440
KITO	San Bernardino, Calif.	1290
KIUL	Garden City, Kans.	1240
KIUN	Pecos, Tex.	1400
KIUP	Durango, Colo.	930
KIVY	Crockett, Tex.	1290
KIWW	San Antonio, Tex.	1540
KIXL	Dallas, Tex.	1040
KIXX	Provo, Utah	1400
KIYI	Shelby, Mont.	1150
KJAM	Vernal, Utah	1340
KJAN	Atlantic, Iowa	1220
KJAY	Topeka, Kans.	1440
KJBC	Midland, Tex.	1150
KJBS	San Francisco, Calif.	1100
KJCF	Festus, Mo.	1010
KJCK	Junction City, Kans.	1420
KJEF	Jennings, La.	1290
KJET	Beaumont, Tex.	1380
KJFJ	Webster City, Iowa	1570
KJLT	North Platte, Nebr.	970
KJNO	Juneau, Alaska	630
KJOE	Shreveport, La.	1480
KJOY	Stockton, Calif.	1280
KJR	Seattle, Wash.	950
KJRG	Newton, Kans.	950
KJSK	Columbus, Nebr.	920
KJUN	Redmond, Oreg.	1240
KKIN	Visalia, Calif.	1400
KKOG	Ogden, Utah	730
KLAC	Los Angeles, Calif.	570
KLAD	Klamath Falls, Oreg.	900
KLAK	Lakewood, Colo.	1600
KLAM	Cordova, Alaska	1450
KLAS	Las Vegas, Nev.	1010
KLBM	La Grande, Oreg.	1450
KLCB	Libby, Mont.	1230
KLCN	Blytheville, Ark.	910
KLCO	Poteau, Okla.	1280
KLEA	Lovington, N.Mex.	630
KLEC	Jonesville, La.	1480
KLEE	Ottumwa, Iowa	1480
KLEM	LeMars, Iowa	1410
KLEN	Killeen, Tex.	1050
KLER	Lewiston, Idaho	1300
KLEX	Lexington, Mo.	1570
KLFT	Golden Meadow, La.	1600
KLGA	Algona, Iowa	1600
KLGR	Redwood Falls, Minn.	1490
KLIC	Monroe, La.	1230
KLIF	Dallas, Tex.	1190
KLIK	Jefferson City, Mo.	950
KLIL	Estherville, Iowa	1340
KLIN	Lincoln, Nebr.	1400
KLIR	Denver, Colo.	990
KLIX	Twin Falls, Idaho	1310
KLIZ	Brainerd, Minn.	1380
KLKC	Parsons, Kans.	1540
KLLA	Leesville, La.	1570
KLMO	Longmont, Colo.	1050
KLMR	Lamar, Colo.	920
KLMS	Lincoln, Nebr.	1480
KLMX	Clayton, N.Mex.	1450
KLO	Ogden, Utah	1430
KLOG	Kelso, Wash.	1490
KLOH	Pipestone, Minn.	1050
KLOK	San Jose, Calif.	1170
KLOO	Corvallis, Oreg.	1340
KLOS	Albuquerque, N.Mex.	1450
KLOU	Lake Charles, La.	1580
KLOV	Loveland, Colo.	1570
KLPM	Minot, N.Dak.	1390
KLPR	Okla. City, Okla.	1140
KLPW	Union, Mo.	1220
KLRA	Little Rock, Ark.	1010
KLRS	Mountain Grove, Mo.	1360
KLTF	Little Falls, Minn.	960
KLTI	Longview, Tex.	1280
KLTR	Blackwell, Okla.	1580
KLTZ	Glasgow, Mont.	1240
KLUB	Salt Lake City, Utah	570
KLUE	Shreveport, La.	1300
KLUF	Galveston, Tex.	1400
KLUK	Evanston, Wyo.	1240
KLUV	Haynesville, La.	1580
KLVC	Leadville, Colo.	1230
KLVL	Pasadena, Tex.	1480
KLVT	Levelland, Tex.	1230
KLWN	Lawrence, Kans.	1320
KLWT	Lebanon, Mo.	1230
KLX	Oakland, Calif.	910
KLYN	Amarillo, Tex.	940
KLZ	Denver, Colo.	560
KMA	Shenandoah, Iowa	960
KMAC	San Antonio, Tex.	630
KMAE	McKinney, Tex.	1600
KMAK	Fresno, Calif.	1340
KMAN	Manhattan, Kans.	1350
KMAP	Bakersfield, Calif.	1490
KMAR	Winnsboro, La.	1570
KMBC	Kansas City, Mo.	980
KMBL	Junction, Tex.	1450
KMBY	Monterey, Calif.	1240
KMCM	McMinnville, Oreg.	1260
KMCO	Conroe, Tex.	900
KMDO	Ft. Scott, Kans.	1600
KMED	Medford, Oreg.	1440
KMEL	Wenatchee, Wash.	1340
KMHL	Marshall, Minn.	1400
KMHT	Marshall, Tex.	1450
KMIL	Cameron, Tex.	1330
KMIN	Grants, N.M.	980
KMJ	Fresno, Calif.	580
KLB	Monroe, La.	1440
KMLW	Marlin, Tex.	1010
KMMJ	Grand Island, Nebr.	750
KMMO	Marshall, Mo.	1300
KMNS	Sioux City, Iowa	620
KMO	Tacoma, Wash.	1360
KMON	Great Falls, Mont.	560
KMOR	Oroville, Calif.	1340
KMOX	St. Louis, Mo.	1120
KMPC	Los Angeles, Calif.	710
KMRC	Morgan City, La.	1430
KMRS	Morris, Minn.	1570
KMUL	Muleshoe, Tex.	1380
KMUR	Murray, Utah	1230
KMUS	Muskogee, Okla.	1380
KMVI	Wailuku, T. H.	550
KMYC	Marysville, Calif.	1410
KMYR	Denver, Colo.	710
KNAF	Fredericksburg, Tex.	1340
KNAK	Salt Lake City, Utah	1280
KNAL	Victoria, Tex.	1410
KNBC	San Francisco, Calif.	680
KNBX	Kirkland, Wash.	1050
KNBY	Newport, Ark.	730
KNCK	Concordia, Kans.	1390
KNCM	Moberly, Mo.	1230
KNCO	Garden City, Kans.	1050
KNDC	Hettinger, N.Dak.	1490
KNDY	Marysville, Kans.	1570
KNEA	Jonesboro, Ark.	970
KNEB	Scottsbluff, Nebr.	960
KNED	McAlester, Okla.	1150
KNEL	Brady, Tex.	1490
KNEM	Nevada, Mo.	1240
KNET	Palestine, Tex.	1450
KNEU	Provo, Utah	1450
KNEW	Spokane, Wash.	790
KNEX	McPherson, Kans.	1540
KNGS	Hanford, Calif.	620
KNIM	Maryville, Mo.	1580
KNLR	N. Little Rock, Ark.	1380
KNOC	Natchitoches, La.	1450
KNOE	Monroe, La.	1390
KNOG	Nogales, Ariz.	1340
KNOK	Ft. Worth, Tex.	970
KNOR	Norman, Okla.	1400
KNOW	Austin, Tex.	1490
KNOX	Grand Forks, N.Dak.	1310
KNPT	Newport, Ore.	1310
KNUJ	New Ulm, Minn.	860
KNUZ	Houston, Tex.	1230
KNWS	Waterloo, Iowa	1090
KNX	Los Angeles, Calif.	1070
KOA	Denver, Colo.	850
KOAC	Corvallis, Oreg.	550
KOAL	Price, Utah	1230
KOAM	Pittsburg, Kans.	860
KOB	Albuquerque, N.Mex.	770
KOBE	Las Cruces, N.Mex.	1450
KOBY	San Francisco, Calif.	1550
KOCA	Kilgore, Tex.	1240
KOCS	Ontario, Calif.	1510
KOCY	Oklahoma City, Okla.	1340
KODE	Joplin, Mo.	1230
KODI	Cody, Wyo.	1400
KODL	The Dalles, Oreg.	1440
KODY	North Platte, Nebr.	1240
KOEL	Oelwein, Iowa	950
KOFA	Yuma, Ariz.	1240
KOFE	Pullman, Wash.	1150
KOFI	Kalispell, Mont.	980
KOFO	Ottawa, Kans.	1220
KOGA	Ogallala, Nebr.	930
KOGT	Orange, Tex.	1600
KOH	Reno, Nev.	630
KOHU	Hermiston, Oreg.	1570
KOIL	Omaha, Nebr.	1290
KOIN	Portland, Oreg.	970
KOJM	Havre, Mont.	610
KOKO	Warrensburg, Mo.	1450
KOKX	Keokuk, Iowa	1310
KOL	Seattle, Wash.	1300
KOLE	Port Arthur, Tex.	1340
KOLJ	Quanah, Tex.	1150
KOLO	Reno, Nev.	920
KOLS	Pryor, Okla.	1570
KOLT	Scottsbluff, Nebr.	1320
KOLY	Mobridge, S.Dak.	1300
KOMA	Okla. City, Okla.	1520
KOMB	Cottage Grove, Oreg.	1400
KOME	Tulsa, Okla.	1300
KOMO	Seattle, Wash.	1000
KOMW	Omak, Wash.	680
KONE	Reno, Nev.	1450
KONI	Phoenix, Ariz.	1400
KONO	San Antonio, Tex.	860
KONP	Port Angeles, Wash.	1450
KOOK	Billings, Mont.	970
KOOL	Phoenix, Ariz.	960
KOOS	Coos Bay, Oreg.	630
KOLD	Tucson, Ariz.	1450
KOPR	Butte, Mont.	550
KOPY	Alice, Tex.	1070
KORA	Bryan, Tex.	1240
KORC	Mineral Wells, Tex.	1140
KORD	Pasco, Wash.	910
KORE	Eugene, Oreg.	1450
KORK	Las Vegas, Nev.	1340
KORN	Mitchell, S.Dak.	1490
KORT	Grangeville, Idaho	1230
KOKY	Little Rock, Ark.	1440
KOSA	Odessa, Tex.	1230
KOSE	Osceola, Ark.	860
KOSF	Nacogdoches, Tex.	1230
KOSI	Aurora, Colo.	1430
KOSY	Texarkana, Ark.	790
KOTA	Rapid City, S.Dak.	1380
KOTN	Pine Bluff, Ark.	1490
KOTS	Deming, N.M.	1230
KOVC	Valley City, N.Dak.	1490
KOVE	Lander, Wyo.	1330
KOVO	Provo, Utah	960
KOWB	Laramie, Wyo.	1340
KOWH	Omaha, Nebr.	660
KOWL	Bijou, Calif.	1490
KOXR	Ornard, Calif.	910
KOY	Phoenix, Ariz.	550
KOYL	Odessa, Tex.	1310
KOYN	Billings, Mont.	910
KOZE	Lewiston, Idaho	950
KOZY	Grand Rapids, Minn.	1490
KPAC	Port Arthur, Tex.	1250
KPAK	Minden, La.	1240
KPAL	Palm Springs, Calif.	1450
KPAM	Portland, Oreg.	1410
KPAN	Hereford, Tex.	860
KPAS	Banning, Calif.	1490
KPAT	Pampa, Tex.	1230
KPBM	Carlsbad, N.Mex.	740
KPDN	Pampa, Tex.	1340
KPDQ	Portland, Oreg.	800
KPEP	San Angelo, Tex.	1420
KPET	Lamesa, Tex.	690
KPHO	Phoenix, Ariz.	910
KPIG	Cedar Rapids, Iowa	1450
KPIN	Casa Grande, Ariz.	1260
KPKW	Pasco, Wash.	1340
KPLC	Lake Charles, La.	1470
KPLK	Dallas, Oreg.	1460
KPMC	Bakersfield, Calif.	1560
KPOA	Honolulu, T.H.	630
KPOC	Pocahontas, Ark.	1420
KPOF	Denver, Colo.	910
KPOJ	Portland, Oreg.	1330
KPOK	Scottsdale, Ariz.	1440
KPOL	Los Angeles, Calif.	1540
KPOO	San Francisco, Calif.	1010
KPOP	Los Angeles, Calif.	1020
KPOW	Powell, Wyo.	1260
KPPC	Pasadena, Calif.	1240
KPQ	Wenatchee, Wash.	560
KPRC	Houston, Tex.	950
KPRK	Livingston, Mont.	1340
KPRL	Paso Robles, Calif.	1230
KPRO	Riverside, Calif.	1440
KPRS	Kansas City, Mo.	1590
KPST	Preston, Idaho	1340
KPTL	Carson City, Nev.	1400
KPUG	Bellingham, Wash.	1170
KQIK	Lakeview, Oreg.	1230
KQUE	Albuquerque, N.Mex.	920
KQV	Pittsburgh, Pa.	1410
KRAI	Craig, Colo.	550
KRAK	Stockton, Calif.	1140
KRAL	Rawlins, Wyo.	1240
KRAM	Las Vegas, Nev.	920
KRAY	Amarillo, Tex.	1360
KRBA	Lufkin, Tex.	1340
KRBC	Abilene, Tex.	1470
KRBI	St. Peter, Minn.	1310
KRBO	Las Vegas, Nev.	1050
KRCK	Ridgecrest, Calif.	1360
KRCO	Prineville, Oreg.	690
KRCT	Baytown, Tex.	650
KRDG	Redding, Calif.	1230
KRDO	Colo. Springs, Colo.	1240
KRDU	Dinuba, Calif.	1240
KRE	Berkeley, Calif.	1400
KREH	Oakdale, La.	900
KREI	Farmington, Mo.	800
KREL	Baytown, Tex.	1360
KREM	Spokane, Wash.	970
KREO	Indio, Calif.	1400
KRES	St. Joseph, Mo.	1550
KREW	Sunnyside, Wash.	1230
KREX	Grand Junc., Colo.	920
KRFC	Rocky Ford, Colo.	1320
KRFO	Owatonna, Minn.	1390
KRGV	Weslasco, Tex.	1290
KRGI	Grand Island, Neb.	1430
KRHD	Duncan, Okla.	1350
KRIB	Mason City, Iowa	1490
KRIC	Beaumont, Tex.	1450
KRIG	Odessa, Tex.	1410
KRIO	McAllen, Tex.	910
KRIS	Corpus Christi, Tex.	1360
KRIV	Camas, Wash.	1480
KRIZ	Phoenix, Ariz.	1230
KRPF	Miles City, Mont.	1340
KRKD	Los Angeles, Calif.	1150
KRKO	Everett, Wash.	1380
KRKS	Ridgecrest, Calif.	1240
KRLC	Lewiston, Idaho	1350
KRLD	Dallas, Tex.	1080
KRLN	Canon City, Colo.	1400
KRLW	Walnut Ridge, Ark.	1320
KRMD	Shreveport, La.	1340
KRMG	Tulsa, Okla.	740
KRMO	Monett, Mo.	990
KRMS	Osage Beach, Mo.	1150
KRMW	The Dalles, Oreg.	1300
KRNO	San Bernardino, Calif.	1240
KRNR	Roseburg, Oreg.	1490
KRNT	Des Moines, Iowa	1350
KRNY	Kearney, Nebr.	1460
KROC	Rochester, Minn.	1340
KROD	El Paso, Tex.	600
KROF	Abbeville, La.	960
KROG	Sonora, Calif.	1450
KROP	Brawley, Calif.	1300
KROS	Clinton, Iowa	1340
KROW	Oakland, Calif.	960
KROX	Crookston, Minn.	1260
KROY	Sacramento, Calif.	1240
KRPL	Moscow, Idaho	1400
KRRV	Sherman, Tex.	910
KRSC	Seattle, Wash.	1150
KRSD	Rapid City, S.Dak.	1340
KRSL	Russell, Kans.	990
KRSN	Los Alamos, N.Mex.	1490
KRTN	Raton, N.Mex.	1490
KRTR	Thermopolis, Wyo.	1490
KRUN	Ballinger, Tex.	1400
KRUS	Ruston, La.	1490
KRVN	Lexington, Nebr.	1010
KRUX	Glendale, Ariz.	1340
KRWS	Post, Tex.	1370
KRXK	Rexburg, Idaho	1230
KRXL	Roseburg, Oreg.	1240
KSAC	Manhattan, Kans.	580
KSAL	Salina, Kans.	1150
KSAM	Huntsville, Tex.	1490
KSAN	San Francisco, Calif.	1450
KSBW	Salinas, Calif.	1380
KSCB	Liberal, Kans.	1270
KSCJ	Sioux City, Iowa	1360
KSCO	Santa Cruz, Calif.	1080
KSD	St. Louis, Mo.	550
KSDA	Redding, Calif.	1400
KSDO	San Diego, Calif.	1130
KSDN	Aberdeen, S.Dak.	930
KSEI	Pocatello, Idaho	930
KSEK	Pittsburg, Kans.	1340
KSEL	Lubbock, Tex.	950
KSEM	Moses Lake, Wash.	1450
KSEO	Durant, Okla.	750
KSET	El Paso, Tex.	1340
KSEW	Sitka, Alaska	1400
KSEY	Seymour, Tex.	1230
KSFA	Nacogdoches, Tex.	860
KSFE	Needles, Calif.	1340
KSFO	San Francisco, Calif.	560
KSFT	Trinidad, Colo.	1280
KSGA	Redmond, Oreg.	1240
KSGM	Ste. Genevieve, Mo.	980
KSIB	Creston, Iowa	1520
KSID	Sidney, Nebr.	1340
KSIG	Crowley, La.	1450
KSIJ	Gladewater, Tex.	1320
KSIL	Silver City, N.Mex.	1340
KSIM	Sikeston, Mo.	1400
KSIS	Sedalia, Mo.	1050
KSIW	Woodward, Okla.	1450
KSIX	Corpus Christi, Tex.	1230
KSJB	Jamestown, N.Dak.	600
KSJO	San Jose, Calif.	1590

C.L.	Location	Kc.
KSJV	Sanger, Calif.	900
KSKY	Dallas, Tex.	660
KSL	Salt Lake City, Utah	1160
KSLM	Salem, Oreg.	1390
KSLO	Opelousas, La.	1230
KSLR	Oceanside, Calif.	1230
KSMA	Santa Maria, Calif.	1340
KSML	Seminole, Tex.	1250
KSMN	Mason City, Iowa	1010
KSMO	Salem, Mo.	1340
KSNY	Snyder, Tex.	1450
KSO	Des Moines, Iowa	1460
KSOK	Arkansas City, Kans.	1280
KSON	San Diego, Calif.	1240
KSOO	Sioux Falls, S.Dak.	1140
KSOP	Salt Lake City, Utah	1370
KSPA	Santa Paula, Calif.	1400
KSPI	Stillwater, Okla.	780
KSPR	Casper, Wyo.	1470
KSPT	Sandpoint, Idaho	1400
KSRO	Santa Rosa, Calif.	1350
KSRV	Ontario, Oreg.	1380
KSST	Sulphur Springs, Tex.	1230
KSTA	Coleman, Tex.	1000
KSTB	Breckenridge, Tex.	1430
KSTL	St. Louis, Mo.	690
KSTN	Stockton, Calif.	1420
KSTP	St. Paul, Minn.	1500
KSTT	Davenport, Iowa	1170
KSTV	Stephenville, Tex.	1510
KSUB	Cedar City, Utah	590
KSUE	Susanville, Calif.	1240
KSUM	Fairmont, Minn.	1370
KSUN	Bisbee, Ariz.	1230
KSVC	Richfield, Utah	980
KSVP	Artesia, N.Mex.	990
KSWA	Graham, Tex.	1330
KSWI	Council Bluffs, Iowa	1560
KSWO	Lawton, Okla.	1380
KSWS	Roswell, N.Mex.	1230
KSYC	Yreka, Calif.	1490
KTAC	Tacoma, Wash.	850
KTAE	Taylor, Tex.	1260
KTAN	Sherman, Tex.	1500
KTAR	Phoenix, Ariz.	620
KTAT	Frederick, Okla.	1570
KTBB	Tyler, Tex.	600
KTBC	Austin, Tex.	590
KTBS	Shreveport, La.	710
KTCB	Malden, Mo.	1470
KTCS	Fort Smith, Ark.	1410
KTED	Laguna Beach, Calif.	1520
KTEL	Walla Walla, Wash.	1490
KTEM	Temple, Tex.	1400
KTER	Terrell, Tex.	1570
KTFI	Twin Falls, Idaho	1270
KTFS	Texarkana, Tex.	1400
KTFY	Brownfield, Tex.	1300
KTHE	Thermopolis, Wyo.	1240
KTHS	Little Rock, Ark.	1090
KTHT	Houston, Tex.	790
KTIB	Thibodaux, La.	630
KTIL	Tillamook, Oreg.	1240
KTIM	San Rafael, Calif.	1510
KTIP	Porterville, Calif.	1450
KTIS	Minneapolis, Minn.	900
KTIX	Seattle, Wash.	1590
KTJS	Hobart, Okla.	1420
KTKN	Ketchikan, Alaska	930
KTKR	Taft, Calif.	1310
KTKT	Tucson, Ariz.	990
KTLD	Tullulah, La.	1360
KTLN	Denver, Colo.	1280
KTLO	Mtn. Home, Ark.	1490
KTLU	Rusk, Tex.	1580
KTLW	Texas City, Tex.	920
KTMC	McAlester, Okla.	1400
KTML	Marked Tree, Ark.	1580
KTMS	Santa Barbara, Calif.	1250
KTNC	Falls City, Nebr.	1230
KTNM	Tucumcari, N.Mex.	1400
KTNT	Tacoma, Wash.	1400
KTOE	Mankato, Minn.	1420
KTOH	Lihue, Hawaii	1490
KTOK	Oklahoma City, Okla.	1000
KTOO	Henderson, Nev.	1280
KTOP	Topeka, Kans.	1490
KTOW	Oklahoma City, Okla.	800
KTRB	Modesto, Calif.	860
KTRC	Santa Fe, N.Mex.	1400
KTRE	Lufkin, Tex.	1420
KTRF	Thief River Falls, Minn.	1230
KTRH	Houston, Tex.	740
KTRI	Sioux City, Iowa	1470
KTRM	Beaumont, Tex.	990
KTRN	Wichita Falls, Tex.	1290
KTRY	Bastrop, La.	730
KTSA	San Antonio, Tex.	550
KTSM	El Paso, Tex.	1380
KTTN	Trenton, Mo.	1600
KTTR	Rolla, Mo.	1490
KTTS	Springfield, Mo.	1400
KTUC	Tucson, Ariz.	1400
KTUE	Tulia, Tex.	1260
KUDU	Ventura, Calif.	1590
KTUL	Lookout Mountain, Oklahoma	1430
KTUR	Turlock, Calif.	1390
KTUT	Tooele, Utah	990
KTW	Seattle, Wash.	1250
KTXC	Big Spring, Tex.	1400
KTXJ	Jasper, Tex.	1350
KTXL	San Angelo, Tex.	1340

C.L.	Location	Kc.
KTXN	Austin, Tex.	1370
KTYL	Mesa, Ariz.	1310
KUBA	Yuba City, Calif.	1600
KUBC	Montrose, Colo.	1260
KUBE	Pendleton, Oreg.	1050
KUDI	Great Falls, Mont.	1450
KUDL	Kansas City, Mo.	1380
KUDU	Ventura, Calif.	1590
KUEN	Wenatchee, Wash.	1410
KUGN	Eugene, Oreg.	590
KUIK	Hillsboro, Oreg.	1360
KUIN	Grants Pass, Oreg.	1340
KUJ	Walla Walla, Wash.	1420
KUKI	Ukiah, Calif.	1400
KULA	Honolulu, T.H.	690
KULE	Ephrata, Wash.	730
KULP	El Campo, Tex.	1390
KUMA	Pendleton, Oreg.	1290
KUNO	Corpus Christi, Tex.	1400
KUOA	Siloam Springs, Ark.	1290
KUOM	Minneapolis, Minn.	770
KURV	Edinburg, Tex.	710
KUSD	Vermillion, S.Dak.	690
KUSH	Cushing, Okla.	1600
KUSN	St. Joseph, Mo.	1270
KUTI	Yakima, Wash.	980
KUVR	Holdredge, Nebr.	1380
KUZN	W. Monroe, La.	1310
KVAN	Vancouver, Wash.	910
KVAS	Astoria, Oreg.	1230
KVBC	Farmington, N.Mex.	1240
KVCL	Winnfield, La.	1270
KVCV	Redding, Calif.	600
KVEC	San Luis Obispo, Calif.	920
KVEN	Ventura, Calif.	1450
KVER	Albuquerque, N.Mex.	1340
KVET	Austin, Tex.	1300
KVFC	Cortez, Colo.	740
KVFD	Ft. Dodge, Iowa	1400
KVGB	Great Bend, Kans.	1590
KVHL	Homer, La.	1320
KVI	Seattle, Wash.	570
KVIC	Victoria, Tex.	1340
KVIM	New Iberia, La.	1360
KVIN	Vinita, Okla.	1470
KVKM	Monahans, Tex.	1340
KVLB	Cleveland, Tex.	1410
KVLC	Little Rock, Ark.	1050
KVLF	Alpine, Tex.	1240
KVLH	Pauls Valley, Okla.	1470
KVMA	Magnolia, Ark.	630
KVNA	Flagstaff, Ariz.	690
KVNC	Colorado City, Tex.	1320
KVNC	Winslow, Ariz.	1010
KVNI	Coeur d'Alene, Idaho	1240
KVNU	Logan, Utah	610
KVOA	Tucson, Ariz.	1290
KVOB	Alexandria, La.	970
KVOC	Casper, Wyo.	1230
KVOD	Denver, Colo.	630
KVOE	Emporia, Kans.	1400
KVOG	Ogden, Utah	1490
KVOL	Lafayette, La.	1330
KVOM	Morrilton, Ark.	800
KVON	Napa, Calif.	1440
KVOO	Tulsa, Okla.	1170
KVOP	Plainview, Tex.	1400
KVOR	Colo. Springs, Colo.	1300
KVOS	Bellingham, Wash.	790
KVOU	Uvalde, Tex.	1400
KVOW	Littlefield, Tex.	1490
KVOX	Moorhead, Minn.	1280
KVOY	Yuma, Ariz.	1400
KVOZ	Laredo, Tex.	1240
KVPI	Ville Platte, La.	1050
KVRC	Arkadelphia, Ark.	1240
KVRH	Salida, Colo.	1340
KVRS	Rock Springs, Wyo.	1360
KVSA	McGehee, Ark.	1220
KVSF	Santa Fe, N.Mex.	1260
KVSM	San Mateo, Calif.	1050
KVSO	Ardmore, Okla.	1240
KVWC	Vernon, Tex.	1490
KVWM	Show Low, Ariz.	1050
KVWO	Cheyenne, Wyo.	1370
KWAD	Wadena, Minn.	920
KWAK	Stuttgart, Ark.	1240
KWAL	Wallace, Idaho	620
KWAT	Watertown, S.Dak.	950
KWBB	Wichita, Kans.	1410
KWBE	Beatrice, Nebr.	1450
KWBG	Boone, Iowa	1590
KWBR	Oakland, Calif.	1310
KWBY	Colo. Sprgs., Colo.	740
KWBW	Hutchinson, Kans.	1450
KWCB	Searcy, Ark.	1410
KWCO	Chickasha, Okla.	1560
KWDM	Des Moines, Iowa	1150
KWEI	Weiser, Idaho	1240
KWED	Seguin, Tex.	1580
KWEM	Memphis, Tenn.	990
KWEW	Hobbs, N.Mex.	1480
KWFC	Hot Springs, Ark.	1350
KWFR	San Angelo, Tex.	1260
KWFT	Wichita Falls, Tex.	620
KWG	Stockton, Calif.	1230
KWGB	Goodland, Kans.	730
KWHI	Brenham, Tex.	1280
KWHK	Hutchinson, Kans.	1260
KWHN	Fort Smith, Ark.	1320
KWHO	Salt Lake City, Utah	860
KWHW	Altus, Okla.	1450
KWIC	Salt Lake City, Utah	1570
KWIK	Pocatello, Idaho	1440
KWIL	Albany, Oreg.	790
KWIN	Ashland, Oreg.	1400
KWIZ	Santa Ana, Calif.	1480
KWJB	Globe, Ariz.	1240

C.L.	Location	Kc.
KWJC	Natchitoches, La.	1450
KWJJ	Portland, Oreg.	1080
KWIP	Merced, Calif.	1580
KWIQ	Moses Lake, Wash.	1260
KWK	St. Louis, Mo.	1380
KWKC	Abilene, Tex.	1340
KWKS	Shreveport, La.	1130
KWKW	Pasadena, Calif.	1300
KWLC	Decorah, Iowa	1240
KWLK	Longview, Wash.	1400
KWLM	Willmar, Minn.	1340
KWNA	Winnemucca, Nev.	1400
KWNO	Winona, Minn.	1230
KWOA	Worthington, Minn.	730
KWOC	Poplar Bluff, Mo.	930
KWOE	Clinton, Okla.	1320
KWON	Bartlesville, Okla.	1400
KWOR	Worland, Wyo.	1340
KWOS	Jefferson City, Mo.	1240
KWOW	Pomona, Calif.	1600
KWPC	Muscatine, Iowa	860
KWPM	West Plains, Mo.	1450
KWRC	Pendleton, Oreg.	1240
KWRD	Henderson, Tex.	1470
KWRE	Warrenton, Mo.	730
KWRF	Warren, Ark.	860
KWRL	Riverton, Wyo.	1450
KWRN	Reno, Nev.	1230
KWRO	Coquille, Oreg.	1450
KWRT	Boonville, Mo.	1370
KWRW	Guthrie, Okla.	1490
KWSC	Pullman, Wash.	1250
KWSD	Mt. Shasta, Calif.	1340
KWSH	Wewoka-Seminole, Oklahoma	1260
KWSK	Pratt, Kans.	1570
KWSO	Wasco, Calif.	1050
KWTC	Barstow, Calif.	1230
KWTO	Springfield, Mo.	560
KWTX	Waco, Tex.	1230
KWWB	Walla Walla, Wash.	1490
KWWL	Waterloo, Iowa	1330
KWYN	Wynne, Ark.	1400
KWYO	Sheridan, Wyo.	1410
KXA	Seattle, Wash.	770
KXAR	Hope, Ark.	1490
KXEL	Waterloo, Iowa	1540
KXEO	Mexico, Mo.	1340
KXGI	Ft. Madison, Iowa	1360
KXGN	Glendive, Mont.	1400
KXIC	Iowa City, Iowa	800
KXIT	Dalhart, Tex.	1410
KXJK	Forrest City, Ark.	950
KXL	Portland, Oreg.	750
KXLA	Pasadena, Calif.	1110
KXLE	Ellensburg, Wash.	1240
KXLF	Butte, Mont.	1370
KXLJ	Helena, Mont.	1240
KXLK	Great Falls, Mont.	1400
KXLL	Missoula, Mont.	1450
KXLO	Lewiston, Mont.	1230
KXLQ	Bozeman, Mont.	1450
KXLR	Little Rock, Ark.	1150
KXLW	Clayton, Mo.	1320
KXLY	Spokane, Wash.	920
KXO	El Centro, Calif.	1230
KXOA	Sacramento, Calif.	1470
KXOB	Stockton, Calif.	1280
KXOC	Chico, Calif.	1060
KXOK	St. Louis, Mo.	630
KXOL	Ft. Worth, Tex.	1360
KXOX	Sweetwater, Tex.	1240
KXRA	Alexandria, Minn.	1490
KXRJ	Russellville, Ark.	1490
KXRN	Renton, Wash.	910
KXRO	Aberdeen, Wash.	1320
KXRX	San Jose, Calif.	1500
KXXX	Colby, Kans.	790
KXYZ	Houston, Tex.	1320
KYA	San Francisco, Calif.	1260
KYAK	Yakima, Wash.	1390
KYCA	Prescott, Ariz.	1490
KYJC	Medford, Oreg.	1230
KYME	Boise, Idaho	740
KYNO	Fresno, Calif.	1300
KYNG	Coos Bay, Oreg.	1420
KYNT	Yankton, S.Dak.	1450
KYOK	Houston, Tex.	1590
KYOR	Blythe, Calif.	1450
KYOS	Merced, Calif.	1480
KYOU	Greeley, Colo.	1450
KYSM	Mankato, Minn.	1230
KYTE	Pocatello, Idaho	1290
KYUM	Yuma, Ariz.	560
KYW	Cleveland, Ohio	1100
KZEE	Weatherford, Tex.	1220
KZIP	Amarillo, Tex.	1310
KZUN	Opportunity, Wash.	1270
WAAA	Winston-Salem, N.C.	980
WAAB	Worcester, Mass.	1440
WAAF	Chicago, Ill.	950
WAAG	Adel, Ga.	1470
WAAT	Newark, N.J.	970
WABA	Aquadilla, P.Rico	850
WABB	Mobile, Ala.	1480
WABC	New York, N.Y.	770
WABG	Greenwood, Miss.	960
WABI	Bangor, Maine	910
WABJ	Adrian, Mich.	1490
WABL	Amite, La.	1570
WABM	Houlton, Maine	1340
WABO	Waynesboro, Miss.	990
WABR	Winter Park, Fla.	1440
WABV	Abbeville, S.C.	1590
WABY	Albany, N.Y.	1400
WABZ	Albemarle, N.C.	1010
WACA	Camden, S.C.	1590
WACB	Kittanning, Pa.	1380

C.L.	Location	Kc.
WACE	Chicopee, Mass.	730
WACL	Waycross, Ga.	570
WACO	Waco, Tex.	1460
WACR	Columbus, Miss.	1050
WADC	Akron, Ohio	1350
WADE	Wadesboro, N.C.	1210
WADK	Newport, R.I.	1540
WADP	Kane, Pa.	960
WADS	Ansonia, Conn.	690
WAEB	Allentown, Pa.	790
WAEL	Mayaguez, P.Rico	600
WAEW	Crossville, Tenn.	1330
WAGA	Atlanta, Ga.	590
WAGC	Chattanooga, Tenn.	1560
WAGF	Dothan, Ala.	1320
WAGG	Franklin, Tenn.	950
WAGM	Presque Isle, Maine	1450
WAGN	Menominee, Mich.	1340
WAGR	Lumberton, N.C.	1480
WAGS	Bishopville, S.C.	1380
WAHR	Miami Beach, Fla.	1490
WAIL	Baton Rouge, La.	1460
WAIM	Anderson, S.C.	1230
WAIN	Columbia, Ky.	1270
WAIP	Prichard, Ala.	1270
WAIR	Winston-Salem, N.C.	1340
WAIT	Chicago, Ill.	820
WAJF	Decatur, Ala.	1490
WAJR	Morgantown, W.Va.	1230
WAKE	Atlanta, Ga.	1340
WAKN	Aiken, S.C.	990
WAKR	Akron, Ohio	1590
WAKU	Latrobe, Pa.	1570
WALA	Mobile, Ala.	1410
WALB	Albany, Ga.	1590
WALD	Walterboro, S.C.	1220
WALE	Fall River, Mass.	1400
WALK	Patchogue, N.Y.	1370
WALL	Middletown, N.Y.	1340
WALM	Albion, Mich.	1260
WALT	Tampa, Fla.	1110
WALY	Herkimer, N.Y.	1420
WAMD	Aberdeen, Md.	970
WAMI	Opp, Ala.	860
WAML	Laurel, Miss.	1340
WAMM	Flint, Mich.	1420
WAMO	Homestead, Pa.	860
WAMS	Wilmington, Del.	1380
WAMW	Washington, Ind.	1580
WAMY	Amory, Miss.	1580
WANA	Anniston, Ala.	1490
WANB	Waynesburg, Pa.	1580
WAND	Canton, Ohio	900
WANE	Ft. Wayne, Ind.	1450
WANN	Annapolis, Md.	1190
WANS	Anderson, S.C.	1280
WANT	Richmond, Va.	990
WAOK	Atlanta, Ga.	1380
WAOV	Vincennes, Ind.	1450
WAPA	San Juan, P.R.	680
WAPF	McComb, Miss.	980
WAPG	Arcadia, Fla.	1480
WAPI	Birmingham, Ala.	1070
WAPL	Appleton, Wis.	1570
WAPO	Chattanooga, Tenn.	1150
WAPX	Montgomery, Ala.	1600
WARA	Attleboro, Mass.	1320
WARB	Covington, La.	730
WARD	Johnstown, Pa.	1490
WARE	Ware, Mass.	1250
WARK	Hagerstown, Md.	1490
WARL	Arlington, Va.	780
WARM	Scranton, Pa.	590
WARN	Ft. Pierce, Fla.	1330
WARU	Peru, Ind.	1600
WASA	Havre de Grace, Md.	1330
WASK	Lafayette, Ind.	1450
WATA	Boone, N.C.	1450
WATC	Gaylord, Mich.	900
WATE	Knoxville, Tenn.	620
WATG	Ashland, Ohio	1340
WATH	Athens, Ohio	970
WATK	Antigo, Wis.	900
WATM	Atmore, Ala.	1590
WATN	Watertown, N.Y.	1240
WATO	Oak Ridge, Tenn.	1490
WATR	Waterbury, Conn.	1320
WATS	Sayre, Pa.	960
WATT	Cadillac, Mich.	1240
WATW	Ashland, Wis.	1400
WATZ	Alpena, Mich.	1450
WAUD	Auburn, Ala.	1230
WAUG	Augusta, Ga.	1050
WAUX	Waukesha, Wis.	1510
WAVE	Louisville, Ky.	970
WAVI	Dayton, Ohio	1210
WAVL	Apollo, Pa.	910
WAVN	Stillwater, Minn.	1220
WAVU	Albertville, Ala.	630
WAVZ	New Haven, Conn.	1300
WAWZ	Zarephath, N.J.	1380
WAYB	Waynesboro, Va.	1490
WAYE	Dundalk, Md.	860
WAYN	Rockingham, N.C.	900
WAYS	Charlotte, N.C.	610
WAYX	Waycross, Ga.	1230
WAYZ	Waynesboro, Pa.	1380
WAZF	Yazoo City, Miss.	1230
WAZL	Hazelton, Pa.	1490
WBAA	West Lafayette, Ind.	920
WBAC	Cleveland, Tenn.	1340
WBAL	Baltimore, Md.	1090
WBAM	Montgomery, Ala.	740
WBAP	Ft. Worth, Tex.	570, 820
WBAR	Bartow, Fla.	1460
WBAT	Marion, Ind.	1400
WBAX	Wilkes-Barre, Pa.	1240
WBAW	Barnwell, S.C.	740

C.L.	Location	Kc.
WBAY	Green Bay, Wis.	1360
WBBA	Pittsfield, Ill.	1580
WBBB	Burlington, N.C.	920
WBBC	Flint, Mich.	1330
WBBF	Rochester, N.Y.	950
WBBI	Abingdon, Va.	1230
WBBL	Richmond, Va.	1480
WBBM	Chicago, Ill.	780
WBBN	Perry, Ga.	980
WBBO	Forest City, N.C.	780
WBBQ	Augusta, Ga.	1340
WBBW	Youngstown, Ohio	1240
WBBZ	Ponca City, Okla.	1230
WBCA	Bay Minette, Ala.	1150
WBCK	Battle Creek, Mich.	930
WBCM	Bay City, Mich.	1440
WBCO	Bessemer, Ala.	1450
WBCR	Christiansburg, Va.	1260
WBCU	Union, S.C.	1460
WBEC	Pittsfield, Mass.	1420
WBEE	Harvey, Ill.	1570
WBEJ	Elizabethton, Tenn.	1240
WBEL	Beloit, Wis.	1380
WBEN	Buffalo, N.Y.	930
WBET	Brockton, Mass.	1460
WBEU	Beaufort, S.C.	960
WBEV	Beaver Dam, Wis.	1430
WBEX	Chillicothe, Ohio	1490
WBFC	Fremont, Mich.	1490
WBFD	Bedford, Pa.	1310
WBGC	Chipley, Fla.	1240
WBGR	Jesup, Ga.	1370
WBHB	Fitzgerald, Ga.	1240
WBHF	Cartersville, Ga.	1450
WBHP	Huntsville, Ala.	1230
WBIA	Augusta, Ga.	1230
WBIE	Marietta, Ga.	1050
WBIG	Greensboro, N.C.	1470
WBIP	Booneville, Miss.	1400
WBIR	Knoxville, Tenn.	1240
WBIS	Bristol, Conn.	1440
WBIW	Bedford, Ind.	1340
WBIZ	Eau Claire, Wis.	1400
WBKH	Hattiesburg, Miss.	950
WBKV	West Bend, Wis.	1470
WBLA	Elizabethtown, N.C.	1450
WBLE	Batesville, Miss.	1290
WBLJ	Dalton, Ga.	1230
WBLK	Clarksburg, W.Va.	1400
WBLR	Batesburg, S.C.	1430
WBLT	Bedford, Va.	1350
WBLU	Salem, Va.	1480
WBLY	Springfield, Ohio	1600
WBMA	Beaufort, N.C.	1400
WBMC	McMinnville, Tenn.	960
WBMD	Baltimore, Md.	750
WBML	Macon, Ga.	1240
WBMS	Boston, Mass.	1090
WBNL	Boonville, Ind.	1540
WBNS	Columbus, Ohio	1460
WBNX	New York, N.Y.	1380
WBNY	Buffalo, N.Y.	1400
WBOB	Galax, Va.	1360
WBOC	Salisbury, Md.	960
WBOF	Virginia Beach, Va.	1600
WBOK	New Orleans, La.	800
WBOP	Pensacola, Fla.	980
WBOS	Brookline, Mass.	1600
WBOW	Terre Haute, Ind.	1230
WBPZ	Lock Haven, Pa.	1230
WBRB	Mt. Clemens, Mich.	1430
WBRC	Birmingham, Ala.	960
WBRE	Wilkes-Barre, Pa.	1340
WBRG	Lynchburg, Va.	1050
WBRK	Pittsfield, Mass.	1340
WBRM	Marion, N.C.	1250
WBRN	Big Rapids, Mich.	1460
WBRO	Waynesboro, Ga.	1310
WBRT	Bardstown, Ky.	1320
WBRV	Boonville, N.Y.	900
WBRX	Berwick, Pa.	1280
WBRY	Waterbury, Conn.	1590
WBSC	Bennetsville, S.C.	1550
WBSE	Hillsdale, Mich.	1340
WBSM	New Bedford, Mass.	1420
WBSR	Pensacola, Fla.	1450
WBT	Charlotte, N.C.	1110
WBTA	Batavia, N.Y.	1490
WBTH	Williamson, W.Va.	1400
WBTM	Danville, Va.	1330
WBTN	Bennington, Vt.	1370
WBTO	Linton, Ind.	1600
WBUD	Trenton, N.J.	1260
WBUT	Butler, Pa.	1050
WBUX	Doylestown, Pa.	1570
WBUY	Lexington, N.C.	1440
WBVL	Barboursville, Ky.	950
WBVP	Beaver Falls, Pa.	1230
WBYS	Canton, Ill.	1560
WBZ	Boston, Mass.	1030
WBZA	Springfield, Mass.	1030
WCAE	Pittsburgh, Pa.	1250
WCAL	Northfield, Minn.	770
WCAM	Camden, N.J.	1310
WCAO	Baltimore, Md.	600
WCAP	Lowell, Mass.	980
WCAR	Detroit, Mich.	1130
WCAS	Gadsden, Ala.	570
WCAT	Orange, Mass.	1390
WCAU	Philadelphia, Pa.	1210
WCAW	Charleston, W.Va.	1300
WCAX	Burlington, Vt.	620
WCAZ	Carthage, Ill.	990
WCBA	Corning, N.Y.	1350
WCBC	Anderson, Ind.	1470
WCBD	Chicago, Ill.	820
WCBG	Chambersburg, Pa.	1590
WCBI	Columbus, Miss.	550
WCBL	Benton, Ky.	1290
WCBM	Baltimore, Md.	680
WCBS	New York, N.Y.	880
WCBT	Roanoke Rapids, N.C.	1230
WCBY	Cheboygan, Mich.	1240
WCCC	Hartford, Conn.	1290
WCCM	Lawrence, Mass.	800
WCCO	Minneapolis, Minn.	830
WCCP	Savannah, Ga.	1450
WCDL	Carbondale, Pa.	1440
WCDJ	Edenton, N.C.	1260
WCDT	Winchester, Tenn.	1340
WCEC	Rocky Mount, N.C.	810
WCED	DuBois, Pa.	1420
WCEH	Hawkinsville, Ga.	610
WCEM	Cambridge, Md.	1240
WCEN	Mt. Pleasant, Mich.	1150
WCER	Charlotte, Mich.	1390
WCFL	Chicago, Ill.	1000
WCGA	Calhoun, Ga.	900
WCGC	Belmont, N.C.	1270
WCHA	Chambersburg, Pa.	800
WCHB	Inkster, Mich.	1440
WCHF	Chippewa Falls, Wis.	1150
WCHI	Chillicothe, Ohio	1350
WCHJ	Brookhaven, Miss.	1470
WCHK	Canton, Ga.	1290
WCHO	Washington Court House, Ohio	1250
WCHL	Chapel Hill, N.C.	1360
WCHN	Norwich, N.Y.	970
WCHS	Charleston, W.Va.	580
WCHV	Charlottesville, Va.	1260
WCIL	Carbondale, Ill.	1020
WCIN	Cincinnati, Ohio	1480
WCJU	Columbia, Miss.	1450
WCKB	Dunn, N.C.	780
WCKI	Greer, S.C.	1300
WCKR	Miami, Fla.	610
WCKY	Cincinnati, Ohio	1530
WCLA	Colonial Hgts., Va.	1290
WCLB	Camilla, Ga.	1220
WCLD	Cleveland, Miss.	1490
WCLG	Morgantown, W.Va.	1300
WCLI	Corning, N.Y.	1450
WCLO	Janesville, Wis.	1230
WCLS	Columbus, Ga.	1580
WCLT	Newark, Ohio	1430
WCMA	Corinth, Miss.	1230
WCMB	Harrisburg-Lemoyne, Pennsylvania	1460
WCMC	Wildwood, N.J.	1230
WCME	Brunswick, Maine	900
WCMI	Ashland, Ky.	1340
WCMN	Arecibo, P.R.	1280
WCMS	Norfolk, Va.	1050
WCMW	Canton, Ohio	1060
WCMY	Ottawa, Ill.	1430
WCNB	Connersville, Ind.	1580
WCNC	Elizabeth City, N.C.	1240
WCNH	Quincy, Fla.	1230
WCNR	Bloomsburg, Pa.	930
WCNT	Centralia, Ill.	1210
WCNU	Crestview, Fla.	1010
WCNX	Middletown, Conn.	1150
WCOA	Pensacola, Fla.	1370
WCOC	Meridian, Miss.	910
WCOG	Greensboro, N.C.	1320
WCOH	Newnan, Ga.	1400
WCOJ	Coatesville, Pa.	1420
WCOL	Columbus, Ohio	1230
WCOM	Parkersburg, W.Va.	1230
WCON	Cornelia, Ga.	1450
WCOP	Boston, Mass.	1150
WCOR	Lebanon, Tenn.	900
WCOS	Columbia, S.C.	1400
WCOU	Lewiston, Maine	1240
WCOV	Montgomery, Ala.	1170
WCOW	Sparta, Wis.	1290
WCPA	Clearfield, Pa.	900
WCPC	Houston, Miss.	1320
WCPH	Etowah, Tenn.	1220
WCPM	Cumberland, Ky.	1490
WCPO	Cincinnati, Ohio	1230
WCPS	Tarboro, N.C.	760
WCRA	Effingham, Ill.	1090
WCRB	Waltham, Mass.	1330
WCRE	Cheraw, S.C.	1420
WCRI	Scottsboro, Ala.	1050
WCRK	Morristown, Tenn.	1450
WCRL	Oneonta, Ala.	1570
WCRO	Johnstown, Pa.	1230
WCRS	Greenwood, S.C.	1450
WCRT	Birmingham, Ala.	1260
WCRV	Washington, N.J.	1580
WCRW	Chicago, Ill.	1240
WCSC	Charleston, S.C.	1390
WCSH	Portland, Maine	970
WCSI	Columbus, Ind.	1010
WCSS	Amsterdam, N.Y.	1490
WCTA	Andalusia, Ala.	920
WCTC	New Brunswick, N.J.	1450
WCTT	Corbin, Ky.	680
WCUE	Akron, Ohio	1150
WCUM	Cumberland, Md.	1230
WCVA	Culpeper, Va.	1490
WCVI	Connellsville, Pa.	1340
WCVS	Springfield, Ill.	1450
WCYB	Bristol, Va.	690
WCYN	Cynthiana, Ky.	1400
WDAD	Indiana, Pa.	1450
WDAE	Tampa, Fla.	1250
WDAF	Kansas City, Mo.	610
WDAK	Columbus, Ga.	1340
WDAN	Danville, Ill.	1490
WDAS	Philadelphia, Pa.	1480
WDAY	Fargo, N. Dak.	970
WDBC	Escanaba, Mich.	680
WDBF	Delray Beach, Fla.	1420
WDBJ	Roanoke, Va.	960
WDBL	Springfield, Tenn.	1430
WDBO	Orlando, Fla.	580
WDBQ	Dubuque, Iowa	1490
WDCF	Dade City, Fla.	1350
WDCL	Tarpon Sprgs., Fla.	1470
WDDT	Greenville, Miss.	900
WDDY	Gloucester, Va.	1420
WDEB	Gulfport, Miss.	1390
WDEC	Americus, Ga.	1290
WDEF	Chattanooga, Tenn.	1370
WDEH	Sweetwater, Tenn.	800
WDEL	Wilmington, Del.	1150
WDEV	Waterbury, Vt.	550
WDGY	Minneapolis, Minn.	1130
WDHL	Bradenton, Fla.	1490
WDIA	Memphis, Tenn.	1070
WDIG	Dothan, Ala.	1450
WDIX	Orangeburg, S.C.	1450
WDKD	Kingstree, S.C.	1310
WDKN	Dickson, Tenn.	1260
WDLA	Walton, N.Y.	1270
WDLB	Marshfield, Wis.	1450
WDLC	Port Jervis, N.Y.	1490
WDLP	Panama City, Fla.	590
WDMF	Buford, Ga.	1460
WDMG	Douglas, Ga.	860
WDMJ	Marquette, Mich.	1320
WDNC	Durham, N.C.	620
WDNE	Elkins, W.Va.	1240
WDOB	Canton, Miss.	1370
WDOD	Chattanooga, Tenn.	1310
WDOK	Cleveland, Ohio	1260
WDON	Wheaton, Md.	1540
WDOR	Sturgeon Bay, Wis.	910
WDOS	Oneonta, N.Y.	730
WDOT	Burlington, Va.	1400
WDOV	Dover, Del.	1410
WDQN	DuQuoin, Ill.	1580
WDRC	Hartford, Conn.	1360
WDRF	Chester, Pa.	1590
WDSC	Dillon, S.C.	800
WDSG	Dyersburg, Tenn.	1450
WDSM	Superior, Wis.	710
WDSP	DeFuniak Springs, Florida	1280
WDSR	Lake City, Fla.	1340
WDSU	New Orleans, La.	1280
WDTV	St. John, V.I.	1190
WDUN	Gainesville, Ga.	1240
WDUX	Waupaca, Wis.	800
WDUZ	Green Bay, Wis.	1400
WDVA	Danville, Va.	1250
WDVH	Gainesville, Fla.	980
WDVM	Pocomoke City, Md.	540
WDWD	Dawson, Ga.	990
WDWS	Champaign, Ill.	1400
WDXB	Chattanooga, Tenn.	1450
WDXE	Lawrenceburg, Tenn.	1370
WDXI	Jackson, Tenn.	1310
WDXL	Lexington, Tenn.	1490
WDXN	Clarksville, Tenn.	540
WDZ	Decatur, Ill.	1050
WEAB	Greer, S.C.	800
WEAM	Arlington, Va.	1390
WEAN	Providence, R.I.	790
WEAR	Pensacola, Fla.	1230
WEAS	Decatur, Ga.	1010
WEAT	W. Palm Beach, Fla.	850
WEAU	Washington, Wis.	790
WEAV	Plattsburg, N.Y.	960
WEAW	Evanston, Ill.	1330
WEBB	Dundalk, Md.	1360
WEBC	Duluth, Minn.	560
WEBJ	Brewton, Ala.	1240
WEBQ	Harrisburg, Ill.	1240
WEBR	Buffalo, N.Y.	970
WEBY	Milton, Fla.	1330
WEDC	Chicago, Ill.	1240
WEDO	McKeesport, Pa.	810
WEDR	Birmingham, Ala.	1220
WEEB	Southern Pines, N.C.	990
WEED	Rocky Mount, N.C.	1390
WEEI	Boston, Mass.	590
WEEK	Peoria, Ill.	1350
WEEU	Reading, Pa.	850
WEEX	Easton, Pa.	1230
WEGA	Newton, Miss.	1410
WEGO	Concord, N.C.	1410
WEHH	Elmira Heights-Horseheads, N. Y.	1590
WEIC	Charleston, Ill.	1270
WEIM	Fitchburg, Mass.	1280
WEIR	Weirton, W.Va.	1430
WEJL	Scranton, Pa.	630
WEKR	Fayetteville, Tenn.	1240
WEKY	Richmond, Ky.	1340
WEKZ	Monroe, Wis.	1260
WELC	Welch, W.Va.	1150
WELD	Fisher, W.Va.	690
WELI	New Haven, Conn.	960
WELK	Charlottesville, Va.	1010
WELL	Battle Creek, Mich.	1400
WELM	Elmira, N.Y.	1400
WELO	Tupelo, Miss.	580
WELP	Easley, S.C.	1360
WELR	Roanoke, Ala.	1360
WELS	Kinston, N.C.	1010
WELY	Ely, Minn.	1450
WEMB	Erwin, Tenn.	1420
WEMP	Milwaukee, Wis.	1250
WENA	Bayamon, P.R.	1560
WENC	Whiteville, N.C.	1220
WEND	Baton Rouge, La.	1380
WENE	Endicot, N.Y.	1430
WENK	Union City, Tenn.	1240
WENT	Gloversville, N.Y.	1340
WENY	Elmira, N.Y.	1230
WEOA	Evansville, Ind.	1400
WEOK	Poughkeepsie, N.Y.	1390
WEOL	Elyria, Ohio	930
WEPG	S. Pittsburgh, Tenn.	910
WEPM	Martinsburg, W.Va.	1340
WERC	Erie, Pa.	1260
WERD	Atlanta, Ga.	860
WERE	Cleveland, Ohio	1300
WERH	Hamilton, Ala.	970
WERI	Westerly, R.I.	1230
WESA	Charleroi, Pa.	940
WESB	Bradford, Pa.	1490
WESC	Greenville, S.C.	860
WESK	Escanaba, Mich.	1490
WESO	Southbridge, Mass.	970
WEST	Easton, Pa.	1400
WESX	Salem, Mass.	1230
WETB	Johnson City, Tenn.	790
WETO	Gadsden, Ala.	930
WETU	Wetumpka, Ala.	1570
WETZ	New Martinsville, West Virginia	1330
WEVA	Emporia, Va.	860
WEVD	New York, N.Y.	1330
WEVE	Eveleth, Minn.	1340
WEW	St. Louis, Mo.	770
WEWO	Laurinburg, N.C.	1080
WEXL	Royal Oak, Mich.	1340
WEYE	Sanford, N.C.	1290
WEZB	Homewood, Ala.	1320
WFAA	Dallas, Tex.	570, 820
WFAH	Alliance, Ohio	1310
WFAR	Farrell, Pa.	1470
WFAS	White Plains, N.Y.	1230
WFAU	Augusta, Me.	1340
WFAX	Falls Church, Va.	1220
WFBC	Greenville, S.C.	1330
WFBF	Fernandina Bch., Fla.	1570
WFBG	Altoona, Pa.	1340
WFBL	Syracuse, N.Y.	1390
WFBM	Indianapolis, Ind.	1260
WFBR	Baltimore, Md.	1300
WFBS	Ft. Walton Bch., Fla.	950
WFCB	Dunkirk, N.Y.	1410
WFCR	Fairfax, Va.	1310
WFDF	Flint, Mich.	910
WFEA	Manchester, N.Y.	1370
WFEB	Sylacauga, Ala.	1340
WFEC	Miami, Fla.	1220
WFGM	Fitchburg, Mass.	1580
WFGN	Gaffney, S.C.	1570
WFHG	Bristol, Va.	980
WFHK	Pell City, Ala.	1430
WFHR	Wis. Rapids, Wis.	1340
WFIG	Sumter, S.C.	1290
WFIL	Philadelphia, Pa.	560
WFIN	Findlay, Ohio	1330
WFIS	Fountain Inn, S.C.	1600
WFIW	Fairfield, Ill.	1390
WFKN	Franklin, Ky.	1220
WFKY	Frankfort, Ky.	1490
WFLA	Tampa, Fla.	970
WFLB	Fayetteville, N.C.	1490
WFLO	Farmville, Va.	870
WFLR	Dundee, N.Y.	1570
WFLW	Monticello, Ky.	1570
WFMC	Goldsboro, N.C.	730
WFMD	Frederick, Md.	930
WFMH	Cullman, Ala.	1460
WFMJ	Youngstown, Ohio	1390
WFMO	Fairmont, N.C.	860
WFMW	Madisonville, Ky.	730
WFNC	Fayetteville, N.C.	1390
WFNM	DeFuniak Springs, Florida	1460
WFNS	Burlington, N.C.	1150
WFOB	Fosteria, Ohio	1430
WFOM	Marietta, Ga.	1230
WFOR	Hattiesburg, Miss.	1400
WFOX	Milwaukee, Wis.	860
WFOY	St. Augustine, Fla.	1240
WFPA	Fort Payne, Ala.	1400
WFPG	Atlantic City, N.J.	1450
WFPM	Fort Valley, Ga.	1150
WFPR	Hammond, La.	1400
WFRC	Reidsville, N.C.	1600
WFRL	Freeport, Ill.	1570
WFRM	Coudersport, Pa.	600
WFRO	Fremont, Ohio	900
WFRP	Savannah, Ga.	1230
WFRX	West Frankfort, Ill.	1300
WFSC	Franklin, N.C.	1050
WFST	Caribou, Maine	600
WFTC	Kinston, N.C.	960
WFTG	London, Ky.	1400
WFTL	Ft. Lauderdale, Fla.	1400
WFTM	Maysville, Ky.	1240
WFTR	Front Royal, Va.	1450
WFTW	Ft. Walton, Fla.	1260
WFUL	Fulton, Ky.	1270
WFUN	Huntsville, Ala.	1450
WFUR	Grand Rapids, Mich.	1570
WFVA	Fredericksburg, Va.	1230
WFVG	Fuquay Sprgs., N.C.	1460
WFWL	Camden, Tenn.	1220
WFYC	Alma, Mich.	1280
WGAA	Cedartown, Ga.	1340
WGAC	Augusta, Ga.	580
WGAD	Gadsden, Ala.	1350
WGAF	Valdosta, Ga.	910
WGAI	Elizabeth City, N.C.	560
WGAK	Gallup, N.Mex.	1330
WGAL	Lancaster, Pa.	1490

C.L.	Location	Kc.
WGAN	Portland, Maine	560
WGAP	Maryville, Tenn.	1400
WGAR	Cleveland, Ohio	1220
WGAU	Athens, Ga.	1340
WGAW	Gardner, Mass.	1340
WGAY	Silver Spring, Md.	1050
WGBA	Columbus, Ga.	1270
WGBB	Freeport, N.Y.	1240
WGBF	Evansville, Ind.	1280
WGBG	Greensboro, N.C.	1400
WGBI	Scranton, Pa.	910
WGBR	Goldsboro, N.C.	1150
WGBS	Miami, Fla.	710
WGCB	Red Lion, Pa.	1440
WGCO	Chester, S.C.	1490
WGCM	Gulfport, Miss.	1240
WGEA	Geneva, Ala.	1150
WGEE	Indianapolis, Ind.	1590
WGEM	Quincy, Ill.	1440
WGES	Chicago, Ill.	1390
WBET	Gettysburg, Pa.	1450
WGEZ	Beloit, Wis.	1490
WGFG	Kalamazoo, Mich.	1360
WGFS	Covington, Ga.	1430
WGGA	Gainesville, Ga.	550
WGGG	Gainesville, Fla.	1230
WGGH	Marion, Ill.	1150
WGH	Newport News, Va.	1310
WGHM	Skowegan, Maine	1150
WGHN	Grd. Haven, Mich.	1370
WGIG	Brunswick, Ga.	1440
WGIL	Galesburg, Ill.	1400
WGIR	Manchester, N.H.	610
WGIV	Charlotte, N.C.	1600
WGKA	Atlanta, Ga.	1600
WGKV	Charleston, W.Va.	1300
WGL	Fort Wayne, Ind.	1250
WGLC	Centreville, Miss.	1580
WGMA	Hollywood, Fla.	1320
WGMS	Washington, D.C.	570
WGN	Chicago, Ill.	720
WGNC	Wilmington, N.C.	1340
WGNS	Murfreesboro, Tenn.	1450
WGNY	Newburgh, N.Y.	1220
WGOL	Goldsboro, N.C.	1300
WGOV	Valdosta, Ga.	950
WGPA	Bethlehem, Pa.	1100
WGPC	Albany, Ga.	1450
WGR	Buffalo, N.Y.	550
WGRA	Cairo, Ga.	790
WGRC	Louisville, Ky.	790
WGRD	Grand Rapids, Mich.	1410
WGRF	Aguadella, P.R.	1340
WGRM	Greenwood, Miss.	1240
WGRV	Greeneville, Tenn.	1340
WGRY	Gary, Ind.	1370
WGSA	Savannah, Ga.	1400
WGSM	Huntington, N.Y.	740
WGST	Atlanta, Ga.	920
WGSV	Guntersville, Ala.	1270
WGSW	Greenwood, S.C.	1350
WGTA	Summerville, Ga.	950
WGTC	Greenville, N.C.	1590
WGTL	Kannapolis, N.C.	870
WGTM	Wilson, N.C.	590
WGTN	Georgetown, S.C.	1400
WGTO	Haines City, Fla.	540
WGUY	Bangor, Maine	1230
WGVA	Geneva, N.Y.	1240
WGVM	Greenville, Miss.	1260
WGWC	Selma, Ala.	1340
WGWR	Asheboro, N.C.	1260
WGY	Schenectady, N.Y.	810
WGYV	Greenville, Ala.	1380
WHA	Madison, Wis.	970
WHAB	Baxley, Ga.	1260
WHAI	Greenfield, Mass.	1240
WHAK	Rogers City, Mich.	960
WHAL	Shelbyville, Tenn.	1400
WHAM	Rochester, N.Y.	1180
WHAN	Charleston, S.C.	1340
WHAP	Hopewell, Va.	1340
WHAR	Clarksburg, W.Va.	1340
WHAS	Louisville, Ky.	840
WHAT	Philadelphia, Pa.	1340
WHAV	Haverhill, Mass.	1490
WHAW	Weston, W.Va.	1450
WHAY	New Britain, Conn.	910
WHAZ	Troy, N.Y.	1330
WHB	Kansas City, Mo.	710
WHBB	Selma, Ala.	1490
WHBC	Canton, Ohio	1480
WHBF	Rock Island, Ill.	1270
WHBG	Harrisonburg, Va.	1360
WHBI	Newark, N.J.	1280
WHBL	Sheboygan, Wis.	1330
WHBN	Harrodsburg, Ky.	1420
WHBO	Tampa, Fla.	1050
WHBQ	Memphis, Tenn.	560
WHBS	Huntsville, Ala.	1550
WHBT	Harriman, Tenn.	1230
WHBU	Anderson, Ind.	1240
WHBY	Appleton, Wis.	1230
WHCC	Waynesville, N.C.	1400
WHCO	Sparta, Ill.	1230
WHCU	Ithaca, N.Y.	870
WHDF	Houghton, Mich.	1400
WHDH	Boston, Mass.	850
WHDL	Olean, N.Y.	1450
WHDM	McKenzie, Tenn.	1440
WHEB	Portsmouth, N.H.	750
WHEC	Rochester, N.Y.	1460
WHED	Washington, N.C.	1340
WHEN	Syracuse, N.Y.	620
WHEE	Martinsville, Va.	1370

C.L.	Location	Kc.
WHER	Memphis, Tenn.	1430
WHFB	Benton Harbor, Mich.	1060
WHFC	Cicero, Ill.	1450
WHGB	Harrisburg, Pa.	1400
WHGR	Houghton L., Mich.	1290
WHHH	Warren, Ohio	1440
WHHY	Montgomery, Ala.	1440
WHHM	Memphis, Tenn.	1340
WHIE	Griffin, Ga.	1320
WHIL	Medford, Mass.	1430
WHIM	E. Providence, R.I.	1110
WHIN	Gallatin, Tenn.	1010
WHIO	Dayton, Ohio	1290
WHIP	Mooresville, N.C.	1350
WHIR	Danville, Ky.	1230
WHIS	Bluefield, W.Va.	1440
WHIT	New Bern, N.C.	1450
WHIZ	Zanesville, Ohio	1240
WHJB	Greensburg, Pa.	620
WHJC	Matewan, W.Va.	1360
WHK	Cleveland, Ohio	1420
WHKK	Akron, Ohio	640
WHKP	Hendersonville, N.C.	1450
WHKY	Hickory, N.C.	1290
WHLB	Virginia, Minn.	1400
WHLD	Niagara Falls, N.Y.	1270
WHLF	South Boston, Va.	1400
WHLI	Hempstead, N.Y.	1100
WHLL	Wheeling, W.Va.	1600
WHLM	Bloomsburg, Pa.	550
WHLN	Harlan, Ky.	1280
WHLP	Centerville, Tenn.	1570
WHLS	Port Huron, Mich.	1450
WHMA	Anniston, Ala.	1450
WHMI	Howell, Mich.	1350
WHMP	Northampton, Mass.	1400
WHNC	Henderson, N.C.	890
WHNY	McComb, Miss.	1250
WHO	Des Moines, Iowa	1040
WHOA	San Juan, P.R.	1400
WHOC	Philadelphia, Miss.	1490
WHOK	Lancaster, Ohio	1320
WHOL	Allentown, Pa.	1230
WHOM	New York, N.Y.	1480
WHOO	Orlando, Fla.	990
WHOP	Hopkinsville, Ky.	1230
WHOS	Decatur, Ala.	800
WHOT	Campbell, Ohio	1570
WHOW	Clinton, Ill.	1520
WHP	Harrisburg, Pa.	580
WHPB	Belton, S.C.	1390
WHPE	High Point, N.C.	1070
WHRT	Hartselle, Ala.	860
WHRV	Ann Arbor, Mich.	1600
WHSC	Hartsville, S.C.	1450
WHSY	Hattiesburg, Miss.	1230
WHTB	Talledega, Ala.	1230
WHTN	Huntington, W.Va.	800
WHUB	Cookeville, Tenn.	1400
WHUC	Hudson, N.Y.	1230
WHUM	Reading, Pa.	1240
WHUN	Huntington, Pa.	1150
WHVF	Wausau, Wis.	1230
WHVH	Henderson, N.C.	1450
WHVR	Hanover, Pa.	1280
WHWB	Rutland, Vt.	1000
WHWL	Nanticoke, Pa.	730
WHXY	Bogalusa, La.	920
WHYL	Carlisle, Pa.	960
WHYN	Springfield, Mass.	560
WIAC	San Juan, P.R.	580
WIAM	Williamston, N.C.	900
WIBA	Madison, Wis.	1310
WIBB	Macon, Ga.	1280
WIBC	Indianapolis, Ind.	1070
WIBG	Philadelphia, Pa.	990
WIBK	Knoxville, Tenn.	800
WIBM	Jackson, Mich.	1450
WIBR	Baton Rouge, La.	1300
WIBS	Santurce, P.R.	740
WIBU	Poynette, Wis.	1240
WIBV	Belleville, Ill.	1260
WIBW	Topeka, Kans.	580
WIBX	Utica, N.Y.	950
WICA	Ashtabula, Ohio	970
WICC	Bridgeport, Conn.	600
WICE	Providence, R.I.	1290
WICH	Norwich, Conn.	1310
WICK	Scranton, Pa.	1400
WICO	Salisbury, Md.	1320
WICY	Malone, N.Y.	1490
WIDE	Biddeford, Maine	1400
WIEL	Elizabethtown, Ky.	1400
WIFM	Elkin, N.C.	1540
WIGM	Medford, Wis.	1490
WIKB	Iron River, Mich.	1230
WIKC	Bogalusa, La.	1490
WIKE	Newport, Vt.	1490
WIKK	Erie, Pa.	1330
WIKY	Evansville, Ind.	820
WIL	St. Louis, Mo.	1430
WILD	Birmingham, Ala.	850
WILE	Cambridge, Ohio	1270
WILK	Wilkes-Barre, Pa.	980
WILL	Urbana, Ill.	580
WILM	Wilmington, Del.	1450
WILO	Frankfort, Ind.	1570
WILS	Lansing, Mich.	1320
WILY	Pittsburgh, Pa.	1080
WIMA	Lima, Ohio	1150
WIMO	Winder, Ga.	1300
WIMS	Michigan City, Ind.	1420
WINA	Charlottesville, Va.	1400
WINC	Winchester, Va.	1400
WIND	Chicago, Ill.	560
WING	Dayton, Ohio	1410
WINI	Murphysboro, Ill.	1420
WINK	Fort Myers, Fla.	1240

C.L.	Location	Kc.
WINN	Louisville, Ky.	1240
WINR	Binghamton, N.Y.	680
WINS	New York, N.Y.	1010
WINX	Rockville, Md.	1600
WINZ	Miami, Fla.	940
WIOO	Sanford, Fla.	1360
WIOK	Tampa, Fla.	1150
WION	Ionia, Mich.	1430
WIOU	Kokomo, Ind.	1350
WIP	Philadelphia, Pa.	610
WIPA	Annapolis, Md.	810
WIPR	San Juan, P.R.	940
WIPS	Ticonderoga, N.Y.	1250
WIRA	Fort Pierce, Fla.	1400
WIRB	Enterprise, Ala.	1230
WIRC	Hickory, N.C.	630
WIRE	Indianapolis, Ind.	1430
WISK	St. Paul, Minn.	1590
WIRJ	Humboldt, Tenn.	740
WIRK	W. Palm Beach, Fla.	1290
WIRL	Peoria, Ill.	1290
WIRO	Ironton, Ohio	1230
WIRY	Plattsburg, N.Y.	1340
WIS	Columbia, S.C.	560
WISC	Madison, Wis.	1480
WISE	Asheville, N.C.	1310
WISH	Indianapolis, Ind.	1310
WISK	St. Paul, Minn.	1590
WISL	Shamokin, Pa.	1480
WISN	Milwaukee, Wis.	1150
WISO	Ponce, P.R.	1260
WISP	Kinston, N.C.	1230
WISR	Butler, Pa.	680
WIST	Charlotte, N.C.	930
WITA	San Juan, P.R.	1140
WITH	Baltimore, Md.	1230
WITY	Danville, Ill.	980
WITZ	Jasper, Ind.	990
WIVI	Christiansted, V.I.	1230
WIVK	Knoxville, Tenn.	860
WIVV	Vieques, P.R.	1370
WIVY	Jacksonville, Fla.	1050
WIZE	Springfield, Ohio	1340
WIZZ	Streator, Ill.	1250
WJAC	Johnstown, Pa.	1400
WJAG	Norfolk, Nebr.	780
WJAK	Jackson, Tenn.	1460
WJAM	Marion, Ala.	1310
WJAN	Spartanburg, S.C.	1400
WJAR	Providence, R.I.	920
WJAS	Pittsburgh, Pa.	1320
WIPC	Lake Wales, Fla.	1280
WIPR	Santurce, P.R.	940
WJAT	Swainsboro, Ga.	800
WJAX	Jacksonville, Fla.	930
WJAY	Mullins, S.C.	1280
WJAZ	Albany, Ga.	1050
WJBB	Haleyville, Ala.	1230
WJBC	Bloomington, Ill.	1230
WJBD	Salem, Ill.	1350
WJBK	Detroit, Mich.	1500
WJBO	Baton Rouge, La.	1150
WJBS	DeLand, Fla.	1490
WJBW	New Orleans, La.	1230
WJCD	Seymour, Ind.	1390
WPCM	Sebring, Fla.	1340
WJDA	Quincy, Mass.	1300
WJDB	Thomasville, Ala.	630
WJDX	Jackson, Miss.	620
WJEF	Grand Rapids, Mich.	1230
WJEH	Gallipolis, Ohio	990
WJEJ	Hagerstown, Md.	1240
WJEM	Valdosta, Ga.	1150
WJER	Dover, Ohio	1450
WJET	Erie, Pa.	1400
WJGD	Columbia, Tenn.	1280
WJHB	Talladega, Ala.	1580
WJHL	Johnson City, Tenn.	910
WJHO	Opelika, Ala.	1400
WJHP	Jacksonville, Fla.	1320
WJIG	Tullahoma, Tenn.	740
WJIM	Lansing, Mich.	1240
WJIV	Savannah, Ga.	900
WJJD	Chicago, Ill.	1160
WJJL	Niagara Falls, N.Y.	1440
WJJM	Lewisburg, Tenn.	1490
WJKO	Springfield, Mass.	1600
WJLB	Detroit, Mich.	1400
WJLD	Homewood, Ala.	1400
WJLK	Asbury Park, N.J.	1310
WJLS	Beckley, W.Va.	560
WJMA	Orange, Va.	1340
WJMB	Brookhaven, Miss.	1340
WJMC	Rice Lake, Wis.	1240
WJMJ	Philadelphia, Pa.	1540
WJMO	Cleveland, Ohio	1540
WJMR	New Orleans, La.	990
WJMS	Ironwood, Mich.	630
WJMW	Athens, Ala.	730
WJMX	Florence, S.C.	970
WJNC	Jacksonville, N.C.	1240
WJNO	W. Palm Beach, Fla.	1230
WJOB	Hammond, Ind.	1230
WJOC	Jamestown, N.Y.	1340
WJOE	Ward Ridge, Fla.	1570
WJOI	Florence, Ala.	1340
WJOL	Joliet, Ill.	1340
WJON	St. Cloud, Minn.	1240
WJOT	Lake City, S.C.	1260
WJOY	Burlington, Vt.	1230
WJPA	Washington, Pa.	1450
WJPD	Ishpeming, Mich.	1240
WJPF	Herrin, Ill.	1340
WJPG	Green Bay, Wis.	1440
WJPR	Greenville, Miss.	1330
WJPS	Evansville, Ind.	1330
WJQS	Jackson, Miss.	1400
WJR	Detroit, Mich.	760

C.L.	Location	Kc.
WJRD	Tuscaloosa, Ala.	1150
WJSB	Crestview, Fla.	1050
WJTN	Jamestown, N.Y.	1240
WJUN	Mexico, Pa.	1220
WJVA	South Bend, Ind.	1580
WJW	Cleveland, Ohio	850
WJWG	Conway, N.H.	1050
WJWL	Georgetown, Del.	900
WJWS	South Hill, Va.	1370
WJXN	Jackson, Miss.	1450
WJZM	Clarksville, Tenn.	1400
WKAB	Mobile, Ala.	840
WKAI	Macomb, Ill.	1510
WKAL	Rome, N.Y.	1450
WKAM	Goshen, Ind.	1460
WKAN	Kankakee, Ill.	1320
WKAP	Allentown, Pa.	1320
WKAQ	San Juan, P.R.	580
WKAR	East Lansing, Mich.	870
WKAT	Miami Beach, Fla.	1360
WKAY	Glasgow, Ky.	1490
WKBC	N. Wilkesboro, N.C.	810
WKBH	La Crosse, Wis.	1410
WKBI	St. Mary's, Pa.	1400
WKBJ	Milan, Tenn.	1600
WKBL	Covington, Tenn.	1250
WKBN	Youngstown, Ohio	570
WKBO	Harrisburg, Pa.	1230
WKBR	Manchester, N.H.	1240
WKBV	Richmond, Ind.	1490
WKBW	Buffalo, N.Y.	1520
WKBZ	Muskegon, Mich.	850
WKCT	Bowling Green, Ky.	930
WKDA	Nashville, Tenn.	1240
WKDK	Newberry, S.C.	1240
WKDL	Clarksdale, Miss.	1600
WKDN	Camden, N.J.	800
WKEI	Kewanee, Ill.	1450
WKEU	Griffin, Ga.	1450
WKEY	Covington, Va.	1340
WKGN	Knoxville, Tenn.	1340
WKHM	Jackson, Mich.	970
WKIC	Hazard, Ky.	1430
WKID	Urbana, Ill.	1580
WKIK	Leonardtown, Md.	1370
WKIN	Kingsport, Tenn.	1320
WKIP	Poughkeepsie, N.Y.	1450
WKIT	Mineola, N.Y.	1520
WKIX	Raleigh, N.C.	850
WKJB	Mayaguez, P.R.	710
WKJG	Fort Wayne, Ind.	1380
WKKO	Cocoa, Fla.	860
WKLA	Ludington, Mich.	1450
WKLC	St. Albans, W.Va.	1300
WKLE	Washington, Ga.	1370
WKLF	Clanton, Ala.	980
WKLK	Cloquet, Minn.	1230
WKLM	Wilmington, N.C.	980
WKLO	Louisville, Ky.	1080
WKLV	Blackstone, Va.	1440
WKLX	Paris, Ky.	1440
WKLY	Hartwell, Ga.	980
WKLZ	Kalamazoo, Mich.	1470
WKMC	Roaring Sprgs., Pa.	1370
WKMF	Flint, Mich.	1470
WKMH	Dearborn, Mich.	1310
WKMI	Kalamazoo, Mich.	1360
WKMT	Kings Mtn., N.C.	1220
WKNA	Charleston, W.Va.	950
WKNB	Bownemont, Conn.	840
WKNE	Keene, N.H.	1290
WKNX	Saginaw, Mich.	1210
WKNY	Kingston, N.Y.	1490
WKOA	Hopkinsville, Ky.	1480
WKOK	Sunbury, Pa.	1240
WKOP	Binghamton, N.Y.	1360
WKOV	Wellston, Ohio	1570
WKOW	Madison, Wis.	1070
WKOX	Framingham, Mass.	1190
WKOY	Bluefield, W.Va.	1240
WKOZ	Kosciusko, Miss.	1350
WKPA	New Kensington, Pa.	1150
WKPT	Kingsport, Tenn.	1400
WKRC	Cincinnati, Ohio	550
WKRG	Mobile, Ala.	710
WKRM	Columbia, Tenn.	1340
WKRO	Cairo, Ill.	1490
WKRS	Waukegan, Ill.	1220
WKRT	Cortland, N.Y.	920
WKRZ	Oil City, Pa.	1340
WKSB	Milford, Del.	930
WKSR	Pulaski, Tenn.	1420
WKST	New Castle, Pa.	1280
WKTG	Thomasville, Ga.	730
WKTL	Kendallville, Ind.	1570
WKTM	Mayfield, Ky.	1050
WKTQ	South Paris, Maine	1450
WKTY	LaCrosse, Wis.	580
WKUL	Cullman, Ala.	1340
WKVA	Lewistown, Pa.	920
WKVM	San Juan, P.R.	810
WKWF	Key West, Fla.	1600
WKWK	Wheeling, W.Va.	1400
WKXL	Concord, N.H.	1450
WKXV	Knoxville, Tenn.	900
WKXY	Sarasota, Fla.	930
WKY	Oklahoma City, Okla.	930
WKYB	Paducah, Ky.	570
WKYR	Keyser, W.Va.	1270
WKYW	Louisville, Ky.	900
WKZO	Kalamazoo, Mich.	590
WLAC	Nashville, Tenn.	1510
WLAD	Danbury, Conn.	800
WLAF	LaFollette, Tenn.	1450
WLAG	La Grange, Ga.	1240
WLAK	Lakeland, Fla.	1430
WLAM	Lewiston, Maine	1470
WLAN	Lancaster, Pa.	1390

C.L.	Location	Kc.
WLAP	Lexington, Ky.	630
WLAQ	Rome, Ga.	1410
WLAR	Athens, Tenn.	1450
WLAT	Conway, S.C.	1330
WLAU	Laurel, Miss.	1490
WLAV	Grand Rapids, Mich.	1340
WLAY	Muscle Shoals, Ala.	1450
WLBA	Gainesville, Ga.	1580
WLBB	Carrollton, Ga.	1100
WLBC	Muncie, Ind.	1340
WLBE	Leesburg, Fla.	790
WLBG	Laurens, S.C.	860
WLBH	Mattoon, Ill.	1170
WLBJ	Bowling Green, Ky.	1410
WLBK	DeKalb, Ill.	1360
WLBL	Auburndale, Wis.	930
WLBN	Lebanon, Ky.	1590
WLBR	Lebanon, Pa.	1270
WLBS	Birmingham, Ala.	900
WLBZ	Bangor, Maine	620
WLCK	Campbellsville, Ky.	1450
WLCM	Lancaster, S.C.	1360
WLCO	Eustis, Fla.	1240
WLCR	Torrington, Conn.	990
WLCS	Baton Rouge, La.	910
WLDB	Atlantic City, N.J.	1490
WLDL	LaCrosse, Wis.	1490
WLDS	Jacksonville, Ill.	1180
WLDY	Ladysmith, Wis.	1340
WLEA	Hornell, N.Y.	1480
WLEC	Sandusky, Ohio	1450
WLEE	Richmond, Va.	1480
WLEO	Ponce, P.R.	1170
WLET	Toccoa, Ga.	1420
WLEU	Erie, Pa.	1450
WLEW	Bad Axe, Mich.	1340
WLEX	Lexington, Ky.	1300
WLFA	Lafayette, Ga.	1590
WLFH	Little Falls, N.Y.	1230
WLIB	New York, N.Y.	1190
WLIK	Newport, Tenn.	1270
WLIL	Lenoir, Tenn.	730
WLIP	Kenosha, Wis.	1050
WLIS	Old Saybrook, Conn.	1420
WLIV	Livingston, Tenn.	920
WLLH	Lowell, Mass.	1400
WLLY	Richmond, Va.	1320
WLMJ	Jackson, Ohio	1280
WLNA	Peekskill, N.Y.	1420
WLNH	Laconia, N.H.	1350
WLOA	Braddock, Pa.	1550
WLOB	Portland, Maine	1310
WLOE	Leaksville, N.C.	1490
WLOF	Orlando, Fla.	950
WLOG	Logan, W.Va.	1230
WLOH	Princeton, W.Va.	1490
WLOI	LaPorte, Ind.	1540
WLOK	Memphis, Tenn.	1480
WLOL	Minneapolis, Minn.	1330
WLON	Lincolnton, N.C.	1050
WLOS	Asheville, N.C.	1380
WLOU	Louisville, Ky.	1350
WLOW	Portsmouth, Va.	1400
WLOX	Biloxi, Miss.	1490
WLPM	Suffolk, Va.	1450
WLPO	LaSalle, Ill.	1220
WLRP	New Albany, Ind.	1570
WLS	Chicago, Ill.	890
WLSD	Big Stone Gap, Va.	1220
WLSE	Wallace, N.C.	1400
WLSH	Lansford, Pa.	1410
WLSI	Pikesville, Ky.	900
WLSM	Louisville, Miss.	1270
WLSV	Wellsville, N.Y.	790
WLTC	Gastonia, N.C.	1370
WLTR	Bloomsburg, Pa.	690
WLVA	Lynchburg, Va.	590
WLW	Cincinnati, Ohio	700
WLYC	Williamsport, Pa.	1050
WLYN	Lynn, Mass.	1360
WMAB	Munising, Mich.	1400
WMAF	Madison, Fla.	1230
WMAG	Forest, Miss.	860
WMAJ	State College, Pa.	1450
WMAK	Nashville, Tenn.	1300
WMAL	Washington, D.C.	630
WMAM	Marinette, Wis.	570
WMAN	Mansfield, Ohio	1400
WMAP	Monroe, N.C.	1060
WMAQ	Chicago, Ill.	670
WMAS	Springfield, Mass.	1450
WMAX	Grand Rapids, Mich.	1480
WMAY	Springfield, Ill.	970
WMAZ	Macon, Ga.	940
WMBC	Macon, Miss.	1400
WMBD	Peoria, Ill.	1470
WMBG	Richmond, Va.	1380
WMBH	Joplin, Mo.	1450
WMBI	Chicago, Ill.	1110
WMBL	Morehead City, N.C.	740
WMBM	Miami Beach, Fla.	800
WMBN	Petoskey, Mich.	1340
WMBO	Auburn, N.Y.	1340
WMBR	Jacksonville, Fla.	1460
WMBS	Uniontown, Pa.	590
WMC	Memphis, Tenn.	790
WMCA	New York, N.Y.	570
WMCD	Welch, W.Va.	1340
WMCH	Church Hill, Tenn.	1260
WMCK	McKeesport, Pa.	1360
WMCW	Harvard, Ill.	1600
WMDC	Hoylehurst, Miss.	1220
WMDD	Fajardo, P.R.	1490
WMDN	Midland, Mich.	1490
WMEG	Eau Gallie, Fla.	920
WMEN	Tallahassee, Fla.	1330
WMEV	Marion, Va.	1010
WMEX	Boston, Mass.	1510

C.L.	Location	Kc.
WMFC	Monroeville, Ala.	1360
WMFD	Wilmington, N.C.	630
WMFG	Hibbing, Minn.	1240
WMFJ	Daytona Beach, Fla.	1450
WMFR	High Point, N.C.	1230
WMFS	Chattanooga, Tenn.	1260
WMGA	Moultrie, Ga.	1400
WMGE	Madison, Ga.	1250
WMGM	New York, N.Y.	1050
WMGR	Bainbridge, Ga.	930
WMGW	Meadville, Pa.	1490
WMGY	Montgomery, Ala.	800
WMIC	Monroe, Mich.	560
WMID	Atlantic City, N.J.	1340
WMIE	Miami, Fla.	1140
WMIK	Middlesboro, Ky.	560
WMIL	Milwaukee, Wis.	1290
WMIN	Mpls.-St. Paul, Minn.	1400
WMIS	Natchez, Miss.	1240
WMIQ	Iron Mountain, Mich.	1450
WMIX	Mt. Vernon, Ill.	940
WMJM	Cordele, Ga.	1490
WMLF	Pineville, Ky.	1230
WMLP	Milton, Pa.	1570
WMLS	Sylacauga, Ala.	1290
WMLT	Dublin, Ga.	1330
WMLY	Millville, N.J.	1440
WMMB	Melbourne, Fla.	1240
WMMH	Marshall, N.C.	1460
WMMN	Fairmont, W.Va.	920
WMMT	McMinnville, Tenn.	1230
WMMW	Meriden, Conn.	1470
WMNA	Gretna, Va.	730
WMNB	No. Adams, Mass.	1230
WMNC	Morganton, N.C.	1430
WMNE	Menomonie, Wis.	1360
WMNS	Olean, N.Y.	1360
WMOA	Marietta, Ohio	1490
WMOD	Moundsville, W.Va.	1370
WMOG	Brunswick, Ga.	1490
WMOH	Hamilton, Ohio	1450
WMOK	Metropolis, Ill.	920
WMON	Montgomery, W.Va.	790
WMOO	Milford, Mass.	1490
WMOP	Ocala, Fla.	900
WMOR	Morehead, Ky.	1330
WMOU	Berlin, N.H.	1230
WMOX	Meridian, Miss.	1240
WMOZ	Mobile, Ala.	960
WMPA	Aberdeen, Miss.	1240
WMPC	Lapeer, Mich.	1230
WMPL	Hancock, Mich.	920
WMPM	Smithfield, N.C.	1270
WMPS	Memphis, Tenn.	680
WMRB	Greenville, S.C.	1490
WMRE	Monroe, Ga.	1490
WMRF	Lewistown, Pa.	1490
WMRI	Marion, Ind.	860
WMRN	Marion, Ohio	1490
WMRO	Aurora, Ill.	1280
WMRP	Flint, Mich.	1570
WMRY	New Orleans, La.	600
WMSA	Massena, N.Y.	1340
WMSC	Columbia, S.C.	1320
WMSL	Decatur, Ala.	1400
WMSN	Raleigh, N.C.	570
WMT	Cedar Rapids, Iowa	600
WMTA	Central City, Ky.	1380
WMTC	Vancleve, Ky.	730
WMTE	Manistee, Mich.	1340
WMTM	Moultrie, Ga.	1300
WMTR	Morristown, N.J.	1250
WMTS	Murfreesboro, Tenn.	860
WMUR	Manchester, N.H.	610
WMUS	Muskegon, Mich.	1090
WMUU	Greenville, S.C.	1260
WMVA	Martinsville, Va.	1450
WMVG	Milledgeville, Ga.	1450
WMVO	Mt. Vernon, Ohio	1300
WMYB	Myrtle Beach, S.C.	1450
WMYR	Ft. Myers, Fla.	1410
WNAB	Bridgeport, Conn.	1450
WNAC	Lawrence, Mass.	680
WNAD	Norman, Okla.	640
WNAE	Warren, Pa.	1310
WNAG	Grenada, Miss.	1400
WNAH	Nashville, Tenn.	1360
WNAM	Neenah, Wis.	1280
WNAR	Norristown, Pa.	1110
WNAT	Natchez, Miss.	1450
WNAU	New Albany, Miss.	1470
WNAV	Annapolis, Md.	1430
WNAW	North Adams, Mass.	860
WNAX	Yankton, S.Dak.	570
WNBF	Binghamton, N.Y.	1290
WNBH	New Bedford, Mass.	1340
WNBP	Newburyport, Mass.	1470
WNBS	Murray, Ky.	1340
WNBT	Wellsboro, Pa.	1490
WNBZ	Saranac Lake, N.Y.	1240
WNCA	Siler City, N.C.	1570
WNCC	Barnesboro, Pa.	950
WNDB	Daytona Beach, Fla.	1150
WNDR	Syracuse, N.Y.	1260
WNDU	South Bend, Ind.	1490
WNEB	Worcester, Mass.	1230
WNEG	Taccoa, Ga.	1320
WNER	Live Oak, Fla.	1250
WNES	Central City, Ky.	1600
WNEW	New York, N.Y.	1130
WNEX	Macon, Ga.	1400
WNGO	Mayfield, Ky.	1320
WNHC	New Haven, Conn.	1340
WNIA	Cheektowaga, N.Y.	1230
WNIL	Niles, Mich.	1290
WNIX	Springfield, Va.	1480
WNJR	Newark, N.J.	1430
WNKY	Neon, Ky.	1450

C.L.	Location	Kc.
WNLA	Indianola, Miss.	1380
WNLC	New London, Conn.	1490
WNLK	Norwalk, Conn.	1350
WNMP	Evanston, Ill.	1590
WNNC	Newton, N.C.	1230
WNNJ	Newton, N.J.	1360
WNNT	Warsaw, Va.	690
WNOE	New Orleans, La.	1060
WNOG	Naples, Fla.	1270
WNOK	Columbia, S.C.	1230
WNOP	Newport, Ky.	740
WNOR	Norfolk, Va.	1230
WNOS	High Point, N.C.	1590
WNOW	York, Pa.	1250
WNOX	Knoxville, Tenn.	990
WNPT	Tuscaloosa, Ala.	1280
WNRC	New Rochelle, N.Y.	1460
WNRG	Grundy, Va.	1250
WNRI	Woonsocket, R.I.	1380
WNRV	Narrows, Va.	990
WNTM	Vero Beach, Fla.	1370
WNVA	Norton, Va.	1350
WNYC	New York, N.Y.	830
WNXT	Portsmouth, Ohio	1260
WOAI	San Antonio, Tex.	1200
WOAP	Owosso, Mich.	1080
WOAY	Oak Hill, W.Va.	860
WOBS	Jacksonville, Fla.	1360
WOBT	Rhinelander, Wis.	1240
WOC	Davenport, Iowa	1420
WOCB	W. Yarmouth, Mass.	1240
WOCH	North Vernon, Ind.	1460
WOHI	E. Liverpool, Ohio	1490
WOHO	Toledo, Ohio	1470
WOHP	Bellefontaine, Ohio	1390
WOHS	Shelby, N.C.	730
WOI	Ames, Iowa	640
WOIC	Columbia, S.C.	1470
WOKE	Oak Ridge, Tenn.	1290
WOKK	Meridian, Miss.	1450
WOKJ	Jackson, Miss.	1590
WOKO	Albany, N.Y.	1460
WOKW	Sturgeon Bay, Wis.	1260
WOKY	Milwaukee, Wis.	920
WOKZ	Alton, Ill.	1570
WOL	Washington, D.C.	1450
WOLF	Syracuse, N.Y.	1490
WOLS	Florence, S.C.	1230
WOMI	Owensboro, Ky.	1490
WOMT	Manitowoc, Wis.	1240
WOND	Pleasantville, N.J.	1400
WONE	Dayton, Ohio	980
WONG	Oneida, N.Y.	1600
WONN	Lakeland, Fla.	1230
WONW	Defiance, Ohio	1280
WOOD	Grand Rapids, Mich.	1300
WOOF	Dothan, Ala.	580
WOOK	Washington, D.C.	1340
WOOO	Deland, Fla.	1310
WOOW	New Bern, N.C.	1490
WOPA	Oak Park, Ill.	1490
WOPI	Bristol, Tenn.	1490
WOR	New York, N.Y.	710
WORA	Mayaguez, P.R.	1150
WORC	Worcester, Mass.	1310
WORD	Spartanburg, S.C.	910
WORK	York, Pa.	1350
WORL	Boston, Mass.	950
WORM	Savannah, Tenn.	1010
WORX	Madison, Ind.	1270
WORZ	Orlando, Fla.	740
WOSA	Wausau, Wis.	550
WOSC	Fulton, N.Y.	1300
WOSH	Oshkosh, Wis.	1490
WOSU	Columbus, Ohio	820
WOTR	Corry, Pa.	1370
WOTW	Nashua, N.H.	900
WOV	New York, N.Y.	1280
WOW	Omaha, Nebr.	590
WOWL	Florence, Ala.	1240
WOWO	Ft. Wayne, Ind.	1190
WOXF	Oxford, N.C.	1340
WOZK	Ozark, Ala.	900
WPAB	Ponce, P.R.	550
WPAC	Patchogue, N.Y.	1580
WPAD	Paducah, Ky.	1450
WPAG	Ann Arbor, Mich.	1050
WPAL	Charleston, S.C.	730
WPAM	Pottsville, Pa.	1450
WPAQ	Mount Airy, N.C.	740
WPAR	Parkersburg, W.Va.	1450
WPAT	Paterson, N.J.	930
WPAW	Pawtucket, R.I.	550
WPAX	Thomasville, Ga.	1240
WPAY	Portsmouth, Ohio	1400
WPAZ	Pottstown, Pa.	1370
WPBB	Jackson, Ala.	1290
WPBC	Minneapolis, Minn.	980
WPCF	Panama City, Fla.	1400
WPCO	Mt. Vernon, Ind.	1590
WPCT	Putnam, Conn.	1350
WPDM	Potsdam, N.Y.	1470
WPDQ	Jacksonville, Fla.	600
WPDR	Portage, Wis.	1350
WPDX	Clarksburg, W.Va.	750
WPEL	Montrose, Pa.	1250
WPEN	Philadelphia, Pa.	950
WPEO	Peoria, Ill.	1020
WPEP	Taunton, Mass.	1570
WPET	Greensboro, N.C.	950
WPFA	Pensacola, Fla.	790
WPFB	Middletown, Ohio	910
WPFD	Darlington, S.C.	1350
WPFP	Park Falls, Wis.	1450
WPGC	Bradbury Hghts., Md.	1580
WPGW	Portland, Ind.	1440
WPHB	Philipsburg, Pa.	1260
WPHE	Prairie du Chien, Wis.	980

C.L.	Location	Kc.
WPIC	Sharon, Pa.	790
WPID	Piedmont, Ala.	1280
WPIK	Alexandria, Va.	730
WPIN	St. Petersburg, Fla.	680
WPIT	Pittsburgh, Pa.	730
WPKE	Pikeville, Ky.	1240
WPKO	Waverly, Ohio	1380
WPKY	Princeton, Ky.	1580
WPLA	Plant City, Fla.	910
WPLH	Huntington, W.Va.	1470
WPLI	Jackson, Tenn.	1490
WPLM	Plymouth, Mass.	1390
WPLY	Plymouth, Wis.	1420
WPME	Punxsutawney, Pa.	1540
WPMP	Pascagoula, Miss.	1580
WPNF	Brevard, N.C.	1240
WPNX	Phenix City, Ala.	1270
WPON	Pontiac, Mich.	1460
WPOP	Hartford, Conn.	1410
WPOR	Portland, Maine	1490
WPOW	Brooklyn, N.Y.	1330
WPPA	Pottsville, Pa.	1360
WPRA	Mayaguez, P.R.	990
WPRC	Lincoln, Ill.	1370
WPRT	Prestonsburg, Ky.	1270
WPRO	Providence, R.I.	630
WPRP	Ponce, P.R.	910
WPRS	Paris, Ill.	1440
WPRY	Perry, Fla.	1400
WPTF	Raleigh, N.C.	680
WPTR	Albany, N.Y.	1540
WPTS	Pittston, Pa.	1540
WPTW	Piqua, Ohio	1570
WPTX	Lexington Pk., Md.	920
WPUV	Pulaski, Va.	1580
WPVL	Painesville, Ohio	1460
WQAM	Miami, Fla.	560
WQBC	Vicksburg, Miss.	1420
WQIK	Jacksonville, Fla.	1280
WQOK	Greenville, S.C.	1440
WQSN	Charleston, S.C.	1450
WQUA	Moline, Ill.	1230
WQXI	Atlanta, Ga.	790
WQXR	New York, N.Y.	1560
WQXT	Palm Beach, Fla.	1340
WRAC	Racine, Wis.	1460
WRAD	Radford, Va.	1460
WRAG	Carrollton, Ala.	590
WRAJ	Anna, Ill.	1440
WRAK	Williamsport, Pa.	1400
WRAL	Raleigh, N.C.	1240
WRAP	Norfolk, Va.	850
WRAW	Reading, Pa.	1340
WRAY	Princeton, Ind.	1250
WRBC	Jackson, Miss.	1300
WRBL	Columbus, Ga.	1420
WRC	Washington, D.C.	980
WRCA	New York, N.Y.	660
WRCD	Dalton, Ga.	1430
WRCO	Richland, Wis.	1450
WRCS	Ahoskie, N.C.	970
WRCV	Philadelphia, Pa.	1060N
WRDB	Reedsburg, Wis.	1400
WRDL	Caguas, P.R.	1450
WRDO	Augusta, Maine	1400
WRDW	Augusta, Ga.	1480
WREB	Holyoke, Mass.	930
WREC	Memphis, Tenn.	600
WREL	Lexington, Va.	1450
WREN	Topeka, Kans.	1250
WREV	Reidsville, N.C.	1220
WREX	Duluth, Minn.	1080
WRFC	Athens, Ga.	960
WRFD	Worthington, Ohio	880
WRFS	Alexander City, Ala.	1050
WRFW	Eau Claire, Wis.	1050
WRGA	Rome, Ga.	1470
WRGS	Rogersville, Tenn.	1370
WRHC	Jacksonville, Fla.	1400
WRHI	Rock Hill, S.C.	1340
WRIA	Caguas, P.R.	1450
WRIB	Providence, R.I.	1220
WRIC	Richlands, Va.	540
WRIO	Rio Piedras, P.R.	1320
WRIS	Roanoke, Va.	1410
WRIT	Milwaukee, Wis.	1340
WRIV	Riverhead, N.Y.	1390
WRJN	Racine, Wis.	1400
WRJW	Picayune, Miss.	1320
WRKD	Rockland, Maine	1450
WRKE	Roanoke, Va.	910
WRKH	Rockwood, Tenn.	580
WRLD	Lanitt, Ala.	1490
WRMA	Montgomery, Ala.	950
WRMN	Elgin, Ill.	1410
WRNL	Richmond, Va.	910
WRNO	Orangeburg, S.C.	1150
WRNY	Rochester, N.Y.	680
WROB	West Point, Miss.	1450
WROD	Daytona Beach, Fla.	1340
WROK	Rockford, Ill.	1440
WROM	Rome, Ga.	710
WRON	Ronceverte, W.Va.	1400
WROS	Scottsboro, Ala.	1330
WROV	Roanoke, Va.	1240
WROW	Albany, N.Y.	590
WROX	Clarksdale, Miss.	1450
WROY	Carmi, Ill.	1460
WRPB	Warner Robbins, Ga.	1350
WRR	Dallas, Tex.	1310
WRRF	Washington, N.C.	930
WRRR	Rockford, Ill.	1330
WRRZ	Clinton, N.C.	880
WRSW	Warsaw, Ind.	1480
WRTA	Altoona, Pa.	1240

C.L.	Location	Kc.
WRUF	Gainesville, Fla.	850
WRUM	Rumford, Maine	790
WRUN	Utica, N.Y.	1150
WRUS	Russellville, Ky.	800
WRVA	Richmond, Va.	1140
WRVK	Mt. Vernon, Ky.	1460
WRWB	Kissimmee, Fla.	1220
WRWJ	Selma, Ala.	1570
WRXO	Roxboro, N.C.	1430
WRYO	Rochester, Pa.	1050
WSAC	Radcliff, Ky.	1470
WSAI	Cincinnati, Ohio	1360
WSAJ	Grove City, Pa.	1340
WSAL	Logansport, Ind.	1230
WSAM	Saginaw, Mich.	1400
WSAN	Allentown, Pa.	1470
WSAR	Portsmouth, Va.	1350
WSAR	Fall River, Mass.	1480
WSAT	nr. Salisbury, N.C.	1280
WSAU	Wausau, Wis.	1400
WSAV	Savannah, Ga.	630
WSAY	Rochester, N.Y.	1370
WSAZ	Huntington, W.Va.	930
WSB	Atlanta, Ga.	750
WSBA	York, Pa.	910
WSBB	New Smyrna Beach, Florida	1230
WSBC	Chicago, Ill.	1240
WSBS	Gt. Barrington, Mass.	860
WSBT	South Bend, Ind.	960
WSCR	Scranton, Pa.	1320
WSDC	Marine City, Mich.	1590
WSDR	Sterling, Ill.	1240
WSEV	Sevierville, Tenn.	930
WSFB	Quitman, Ga.	1490
WSFC	Somerset, Ky.	1240
WSFT	Thomaston, Ga.	1220
WSGA	Ephrata, Pa.	1310
WSGC	Elberton, Ga.	1400
WSGN	Birmingham, Ala.	610
WSGW	Saginaw, Mich.	790
WSHE	Sheboygan, Wis.	950
WSIC	Statesville, N.C.	1400
WSID	Baltimore, Md.	1010
WSIG	Mount Jackson, Va.	790
WSIP	Paintsville, Ky.	1490
WSIR	Winter Haven, Fla.	1490
WSIV	Pekin, Ill.	1140
WSIX	Nashville, Tenn.	980
WSJM	St. Joseph, Mich.	1400
WSJS	Winston-Salem, N.C.	600
WSKB	Miami, Fla.	1450
WSKI	Montpelier-Barre, Vt.	1240
WSKN	Saugerties, N.Y.	920
WSKY	Asheville, N.C.	1280
WSLB	Ogdensburg, N.Y.	1400
WSLI	Jackson, Miss.	930
WSLM	Salem, Ind.	1220
WSLS	Roanoke, Va.	610
WSM	Nashville, Tenn.	650
WSMB	New Orleans, La.	1350
WSMI	Litchfield, Ill.	1540
WSMT	Sparta, Tenn.	1050
WSNJ	nr. Bridgeton, N.J.	1240
WSNT	Sandersville, Ga.	1490
WSNW	Seneca Twnshp., S.C.	1150
WSNY	Schenectady, N.Y.	1240
WSOC	Charlotte, N.C.	1240
WSOK	Nashville, Tenn.	1470
WSON	Henderson, Ky.	860
WSOO	Slt. Ste. Marie, Mich.	1230
WSOY	Decatur, Ill.	1340
WSPA	Spartanburg, S.C.	950
WSPB	Sarasota, Fla.	1450

C.L.	Location	Kc.
WSPC	Anniston, Ala.	1390
WSPD	Toledo, Ohio	1370
WSPN	Saratoga Sprgs., N.Y.	900
WSPR	Springfield, Mass.	1270
WSRC	Durham, N.C.	1410
WSRS	Cleveland Hgts., Ohio	1490
WSRW	Hillsboro, Ohio	1590
WSSB	Durham, N.C.	1490
WSSC	Sumter, S.C.	1340
WSSO	Starkville, Miss.	1230
WSSV	Petersburg, Va.	1240
WSTA	Charlotte Amalie, Virgin Islands	1340
WSTC	Stamford, Conn.	1400
WSTK	Woodstock, Va.	1230
WSTL	Eminence, Ky.	1600
WSTN	St. Augustine, Fla.	1420
WSTP	Salisbury, N.C.	1490
WSTR	Sturgis, Mich.	1230
WSTU	Stuart, Fla.	1450
WSTV	Steubenville, Ohio	1340
WSUH	Oxford, Miss.	1420
WSUI	Iowa City, Iowa	910
WSUN	St. Petersburg, Fla.	620
WSUX	Seaford, Del.	1280
WSVA	Harrisonburg, Va.	550
WSVS	Crewe, Va.	800
WSWN	Belle Glade, Fla.	900
WSWW	Platteville, Wis.	1590
WSYB	Rutland, Vt.	1380
WSYD	Mt. Airy, N.C.	1300
WSYR	Syracuse, N.Y.	570
WTAB	Tabor City, N.C.	1370
WTAC	Flint, Mich.	600
WTAD	Quincy, Ill.	930
WTAG	Worcester, Mass.	580
WTAL	Tallahassee, Fla.	1270
WTAM	Decatur, Ga.	970
WTAN	Clearwater, Fla.	1340
WTAO	Cambridge, Mass.	740
WTAQ	LaGrange, Ill.	1300
WTAR	Norfolk, Va.	790
WTAW	College Sta., Tex.	1150
WTAX	Springfield, Ill.	1240
WTAY	Robinson, Ill.	1570
WTBC	Tuscaloosa, Ala.	1230
WTBF	Troy, Ala.	970
WTBO	Cumberland, Md.	1450
WTCB	Flomaton, Ala.	990
WTCD	Campbellsville, Ky.	1450
WTCH	Shawano, Wis.	960
WTCJ	Tell City, Ind.	1230
WTCM	Traverse City, Mich.	1400
WTCN	Minneapolis, Minn.	1280
WTCR	Ashland, Ky.	1420
WTCS	Fairmont, W.Va.	1490
WTCW	Whitesburg, Ky.	920
WTEL	Philadelphia, Pa.	860
WTHI	Terre Haute, Ind.	1480
WTIC	Hartford, Conn.	1080
WTIK	Durham, N.C.	1310
WTIL	Mayaguez, P.R.	1300
WTIM	Taylorville, Ill.	1410
WTIP	Charleston, W.Va.	1240
WTIX	New Orleans, La.	1450
WTJH	East Point, Ga.	1260
WTJS	Jackson, Tenn.	1390
WTKM	Ft. Atkinson, Wis.	1540
WTKO	Ithaca, N.Y.	1470
WTLB	Utica, N.Y.	1310
WTLG	Bowling Green, Ohio	730
WTMA	Charleston, S.C.	1250
WTMC	Ocala, Fla.	1290
WTMJ	Milwaukee, Wis.	620

C.L.	Location	Kc.
WTMV	E. St. Louis, Ill.	1490
WTNC	Thomasville, N.C.	790
WTND	Orangeburg, S.C.	920
WTNJ	Trenton, N.J.	1300
WTNS	Coshocton, Ohio	1560
WTNT	Tallahassee, Fla.	1450
WTOB	Winston-Salem, N.C.	1380
WTOC	Savannah, Ga.	1290
WTOD	Toledo, Ohio	1560
WTOE	Spruce Pine, N.C.	1470
WTOL	Toledo, Ohio	1230
WTON	Staunton, Va.	1240
WTOP	Washington, D.C.	1500
WTOR	Torrington, Conn.	1490
WTOW	Towson, Md.	1570
WTPR	Paris, Tenn.	710
WTPS	New Orleans, La.	940
WTRA	Latrobe, Pa.	1480
WTRB	Ripley, Tenn.	1570
WTRC	Elkhart, Ind.	1340
WTRL	Bradenton, Fla.	1490
WTRN	Tyrone, Pa.	1290
WTRO	Dyersburg, Tenn.	1330
WTRP	LaGrange, Ga.	620
WTRR	Sanford, Fla.	1440
WTRU	Muskegon, Mich.	1600
WTRW	Two Rivers, Wis.	1590
WTRX	Bellaire, Ohio	1290
WTRY	Troy, N.Y.	980
WTSA	Brattleboro, Vt.	1450
WTSB	Lumberton, N.C.	1340
WTSL	Hanover-Lebanon, New Hampshire	1400
WTSN	Dover, N.H.	1270
WTSP	St. Petersburg, Fla.	1380
WTSV	Claremont, N.H.	1230
WTTH	Port Huron, Mich.	1380
WTTL	Madisonville, Ky.	1310
WTTM	Trenton, N.J.	920
WTTN	Watertown, Wis.	1580
WTTR	Westminster, Md.	1470
WTTS	Bloomington, Ind.	1370
WTTT	Coral Gables, Fla.	1490
WTUC	Union City, Tenn.	1580
WTUP	Tupelo, Miss.	1380
WTUS	Tuskegee, Ala.	580
WTUX	Wilmington, Del.	1290
WTVB	Coldwater, Mich.	1590
WTVL	Waterville, Maine	1490
WTVN	Columbia, Ohio	610
WTWA	Thomson, Ga.	1240
WTWB	Auburndale, Fla.	1570
WTWN	St. Johnsbury, Vt.	1340
WTWT	Stevens Pt., Wis.	1010
WTXL	W. Spgfd., Mass.	1490
WTYC	Rock Hill, S.C.	1150
WTYN	Tryon, N.C.	1580
WTYS	Marianna, Fla.	1340
WULA	Eufaula, Ala.	1240
WUSJ	Lockport, N.Y.	1340
WUST	Bethesda, Maine	1120
WVAM	Altoona, Pa.	1430
WVCG	Coral Gables, Fla.	1070
WVCH	Chester, Pa.	740
WVDA	Boston, Mass.	1260
WVEC	Hampton, Va.	1490
WVET	Rochester, N.Y.	1280
WVIM	Vicksburg, Miss.	1490
WVIP	Mt. Kisco, N.Y.	1310
WVJP	Caguas, P.R.	1110
WVJS	Owensboro, Ky.	1420
WVKO	Columbus, Ohio	1580
WVLK	Lexington, Ky.	590
WVLN	Olney, Ill.	740

C.L.	Location	Kc.
WVMC	Mt. Carmel, Ill.	1360
WVMI	Biloxi, Miss.	570
WVNA	Tuscumbia, Ala.	1590
WVNJ	Newark, N.J.	620
WVOK	Birmingham, Ala.	690
WVOP	Vidalia, Ga.	970
WVOS	Liberty, N.Y.	1240
WVOT	Wilson, N.C.	1420
WVOW	Logan, W.Va.	1290
WVPD	Stroudsburg, Pa.	840
WVSC	Somerset, Pa.	990
WVVW	Grafton, W.Va.	1260
WWBC	Bay City, Mich.	1250
WWBZ	Vineland, N.J.	1360
WWCA	Gary, Ind.	1270
WWCC	Bremen, Ga.	1440
WWCO	Waterbury, Conn.	1240
WWDC	Washington, D.C.	1260
WWEZ	New Orleans, La.	690
WWGP	Sanford, N.C.	1050
WWGS	Tifton, Ga.	1340
WWHG	Hornell, N.Y.	1320
WWIL	Ft. Lauderdale, Fla.	1580
WWIN	Baltimore, Md.	1400
WWIT	Canton, N.C.	970
WWJ	Detroit, Mich.	950
WWKY	Winchester, Ky.	1380
WWL	New Orleans, La.	870
WWNC	Asheville, N.C.	570
WWNF	Fayetteville, N.C.	1230
WWNH	Rochester, N.H.	930
WWNR	Beckley, W.Va.	620
WWNS	Statesboro, Ga.	1240
WWNY	Watertown, N.Y.	790
WWOC	Manitowoc, Wis.	980
WWOD	Lynchburg, Va.	1390
WWOK	Charlotte, N.C.	1480
WWOL	Buffalo, N.Y.	1120
WWON	Woonsocket, R.I.	1240
WWPA	Williamsport, Pa.	1340
WWPF	Palatka, Fla.	1260
WWRI	W. Warwick, R.I.	1450
WWRL	Woodside, N.Y.	1600
WWSC	Glen Falls, N.Y.	1450
WWSR	St. Albans, Vt.	1420
WWST	Wooster, Ohio	960
WWSW	Pittsburgh, Pa.	970
WWTB	Tampa, Fla.	1300
WWVA	Wheeling, W.Va.	1170
WWWB	Jasper, Ala.	1360
WWWF	Fayette, Ala.	990
WWWR	Russellville, Ala.	920
WWWW	Rio Piedras, P.R.	1520
WWXL	Manchester, Ky.	1580
WWYO	Pineville, W.Va.	970
WXAL	Demopolis, Ala.	1400
WXGI	Richmond, Va.	950
WXLW	Indianapolis, Ind.	950
WXOK	Baton Rouge, La.	1260
WXRA	Kenmore, N.Y.	1080
WXRF	Guayama, P.R.	1590
WXYZ	Detroit, Mich.	1270
WYCL	York, S.C.	1580
WYUO	Newport News, Va.	1270
WYSR	Franklin, Va.	1250
WYTI	Rocky Mount, Va.	1570
WYVE	Wytheville, Va.	1280
WYZE	Atlanta, Ga.	1480
WZIP	Covington, Ky.	1050
WZKY	Albemarle, N.Dak.	1580
WZOB	Ft. Payne, Ala.	1250
WZRD	Jacksonville Beach, Florida	1010
WZYX	Cowan, Tenn.	1440

Canadian

Amplitude-Modulation (AM) Broadcasting Stations Listed Alphabetically by Call Letters

C.L., call letters; Kc., frequency in kilocycles (for watt power of station, see list arranged by frequency, p. 169)

C.L.	Location	Kc.
CBA	Sackville, N.B.	1070
CBAF	Moncton, N.B.	1300
CBE	Windsor, Ont.	1550
CBF	Montreal, Que.	690
CBG	Gander, Nfld.	1450
CBH	Halifax, N.S.	1330
CBI	Sydney, N.S.	1140
CBJ	Chicoutimi, Que.	1580
CBK	Regina, Sask.	540
CBL	Toronto, Ont.	740
CBM	Montreal, Que.	940
CBN	St. John's, Nfld.	640
CBO	Ottawa, Ont.	910
CBT	Grand Falls, Nfld.	990
CBU	Vancouver, B.C.	690
CBV	Quebec, Que.	980
CBW	Winnipeg, Man.	990
CBX	Edmonton, Alta.	1010
CBXA	Edmonton, Alta.	740
CBY	Corner Brook, Nfld.	790
CFAB	Windsor, N.S.	1450
CFAC	Calgary, Alta.	960
CFAM	Altona, Man.	1290
CFAR	Flin Flon, Man.	590
CFBC	Saint John, N.B.	930
CFCF	Montreal, Que.	600
CFCH	North Bay, Ont.	600

C.L.	Location	Kc.
CFCL	Timmins, Ont.	580
CFCN	Calgary, Alta.	1060
CFCO	Chatham, Ont.	630
CFCW	Camrose, Alta.	1230
CFCY	Charlottetown, P.E.I.	630
CFDA	Victoriaville, Que.	1380
CFGP	Grande Prairie, Alta.	1050
CFGR	Gravelbourg, Sask.	1230
CFGT	St. Joseph d'Alma, Que.	1270
CFJB	Brampton, Ont.	1090
CFJC	Kamloops, B.C.	910
CFJR	Brockville, Ont.	1450
CFNB	Fredericton, N.B.	550
CFNS	Saskatoon, Sask.	1170
CFOB	Fort Frances, Ont.	800
CFOR	Orillia, Ont.	1570
CFOS	Owen Sound, Ont.	1470
CFPA	Port Arthur, Ont.	1230
CFPL	London, Ont.	980
CFPR	Prince Rupert, B.C.	1240
CFQC	Saskatoon, Sask.	600
CFRA	Ottawa, Ont.	560
CFRB	Toronto, Ont.	1010
CFRC	Kingston, Ont.	1490
CFRG	Gravelbourg, Sask.	710
CFRN	Edmonton, Alta.	1260
CFRS	Simcoe, Ont.	1560
CFRY	Portage la Prairie, Man.	1570
CFSL	Weyburn, Sask.	1340
CFUN	Vancouver, B.C.	1410

C.L.	Location	Kc.
CHAB	Moose Jaw, Sask.	800
CHAD	Amos, Que.	1340
CHAT	Medicine Hat, Alta.	1270
CHEO	Edmonton, Alta.	1080
CHEF	Granby, Que.	1450
CHEX	Peterborough, Ont.	1430
CHFA	Edmonton, Alta.	680
CHGB	St. Anne de la Pocatiere, Que.	1350
CHLN	Three Rivers, Que.	550
CHLO	St. Thomas, Ont.	680
CHLP	Montreal, Que.	1410
CHLT	Sherbrooke, Que.	900
CHML	Hamilton, Ont.	900
CHNC	New Carlisle, Que.	610
CHNO	Sudbury, Ont.	900
CHNS	Halifax, N.S.	960
CHOK	Sarnia, Ont.	1070
CHOV	Pembroke, Ont.	1350
CHRC	Quebec, Que.	800
CHRD	Drummondville, Que.	1340
CHRL	Roberval, Que.	910
CHRS	St. Jean, Que.	1090
CHSJ	Saint John, N.B.	1150
CHUB	Nanaimo, B.C.	1570
CHUM	Toronto, Ont.	1050
CHVC	Niagara Falls, Ont.	1600
CHWK	Chilliwack, B.C.	1270
CHWO	Oakville, Ont.	1250
CJAD	Montreal, Que.	800
CJAT	Trail, B.C.	610

C.L.	Location	Kc.
CJAV	Port Alberni, B.C.	1240
CJBC	Toronto, Ont.	860
CJBQ	Belleville, Ont.	800
CJBR	Rimouski, Que.	900
CJCA	Edmonton, Alta.	930
CJCB	Sydney, N.S.	1270
CJCH	Halifax, N.S.	920
CJCS	Stratford, Ont.	1240
CJDC	Dawson Creek, B.C.	1350
CJEM	Edmundston, N.B.	570
CJET	Smiths Falls, Ont.	1070
CJFP	Riviere du Loup, Que.	1400
CJFX	Antigonish, N.S.	580
CJGX	Yorkton, Sask.	940
CJIB	Vernon, B.C.	940
CJIC	Sault Ste. Marie, Ont.	1490
CJKL	Kirkland Lake, Ont.	560
CJLS	Yarmouth, N.S.	1340
CJMS	Montreal, Que.	1280
CJMT	Chicoutimi, Que.	1450
CJNB	N. Battleford, Sask.	1460
CJOB	Winnipeg, Man.	1340
CJOC	Lethbridge, Alta.	1220
CJON	St. John's, Nfld.	930
CJOR	Vancouver, B.C.	600
CJOY	Guelph, Ont.	1450
CJQC	Quebec, Que.	1340
CJRH	Richmond Hill, Ont.	1300
CJRL	Kenora, Ont.	1220
CJRW	Summerside, P.E.I.	1240
CJSO	Sorel, Que.	1320

C.L.	Location	Kc.
CJSP	Leamington, Ont.	710
CJVI	Victoria, B.C.	900
CKAC	Montreal, Que.	730
CKBB	Barrie, Ont.	1230
CKBC	Bathurst, N.B.	1400
CKBI	Prince Albert, Sask.	900
CKBL	Matane, Que.	1250
CKBM	Montmagny, Que.	1490
CKBW	Bridgewater, N.S.	1000
CKCH	Hull, Que.	970
CKCK	Regina, Sask.	620
CKCL	Truro, N.S.	600
CKCR	Kitchener, Ont.	1490
CKCV	Quebec, Que.	1280
CKCW	Moncton, N.B.	1220
CKCY	Sault Ste. Marie, Ont.	1400
CKDA	Victoria, B.C.	1280
CKDM	Dauphin, Man.	1050
CKEC	New Glasgow, N.S.	1230
CKEN	Kentville, N.S.	1350
CKEY	Toronto, Ont.	580
CKFH	Toronto, Ont.	1400
CKGB	Timmins, Ont.	680
CKGR	Galt, Ont.	1110
CKJL	St. Jerome, Que.	900
CKLB	Oshawa, Ont.	1350
CKLC	Kingston, Ont.	1380
CKLD	Thetford Mines, Que.	1230
CKLG	N. Vancouver, B.C.	1070
CKLN	Nelson, B.C.	1240
CKLS	LaSarre, Que.	1240
CKLW	Windsor, Ont.	800
CKLY	Lindsay, Ont.	910
CKMR	Newcastle, N.B.	790
CKMX	Gorse Crown, Nfld.	600
CKNB	Campbellton, N.B.	950
CKNW	New Westminster, British Columbia	1320
CKNX	Wingham, Ont.	920
CKOC	Hamilton, Ont.	1150
CKOK	Penticton, B.C.	800
CKOM	Saskatoon, Sask.	1420
CKOT	Tillsonburg, Ont.	1510
CKOV	Kelowna, B.C.	630
CKOX	Woodstock, Ont.	1340
CKOY	Ottawa, Ont.	1310
CKPC	Brantford, Ont.	1380
CKPG	Prince George, B.C.	550
CKPR	Fort William, Ont.	580
CKRB	Ville St. Georges, Que.	1400
CKRC	Winnipeg, Man.	630
CKRD	Red Deer, Alta.	850
CKRM	Regina, Sask.	980
CKRN	Rouyn, Que.	1400
CKRS	Jonquiere, Que.	590
CKSA	Lloydminster, Alta.	1150
CKSB	St. Boniface, Man.	1250
CKSF	Cornwall, Ont.	1230
CKSL	London, Ont.	1290
CKSM	Shawinigan Falls, Quebec	1220
CKSO	Sudbury, Ont.	790
CKSW	Swift Current, Sask.	1400
CKTB	St. Catharines, Ont.	620
CKTR	Three Rivers, Que.	1350
CKTS	Sherbrooke, Que.	1240
CKUA	Edmonton, Alta.	580
CKVD	Val d'Or, Que.	1230
CKVL	Verdun, Que.	850
CKVM	Ville Marie, Que.	710
CKWS	Kingston, Ont.	960
CKWX	Vancouver, B.C.	980
CKX	Brandon, Man.	1150
CKXL	Calgary, Alta.	1140
CKY	Winnipeg, Man.	580
CKYL	Peace River, Alta.	630
VOAR	St. John's, Nfld.	1230
VOCM	St. John's, Nfld.	590
VOWR	St. John's, Nfld.	800

United States and Canadian

Amplitude-Modulation (AM) Broadcasting Stations Grouped by Frequency; U.S. stations listed alphabetically by location within groups, Canadian stations precede U.S.

Abbreviations: Kc., frequency in kilocycles; W.P., watt power—Wave length is given in meters (all AM stations broadcasting at a higher frequency than 1600 Kc. are listed under Short-Wave Stations, see p. 184 and p. 186)

Kc. — Wave Length — W.P.

540—555.5

CBK	Regina, Sask.	5000
KFMB	San Diego, Calif.	5000
WGTO	Haines City, Fla.	10000
KEOK	Ft. Dodge, Iowa	1000
WDVM	Pocomoke City, Md.	500
WDXN	Clarksville, Tenn.	250
WRIC	Richlands, Va.	1000

550—545.1

CFNB	Fredericton, N.B.	5000
CHLN	Three Rivers, Que.	5000
CKPG	Pr. George, B.C.	250
KENI	Anchorage, Alaska	5000
KOY	Phoenix, Ariz.	1000
KAFY	Bakersfield, Calif.	1000
KRAI	Craig, Colo.	1000
WGGA	Gainesville, Ga.	5000
WHYN	Springfield, Mass.	1000
WCBI	Columbus, Miss.	1000
KOPR	Butte, Mont.	5000
KFRM	Kansas City, Mo.	5000
KSD	St. Louis, Mo.	5000
WGR	Buffalo, N.Y.	5000
KFYR	Bismarck, N.Dak.	5000
WKRC	Cincinnati, Ohio	5000
KOAC	Corvallis, Oreg.	5000
WHLM	Bloomsburg, Pa.	500
WPAB	Ponce, P.R.	5000
WPAW	Pawtucket, R.I.	1000
KMVI	Wailuku, T.H.	1000
KCRS	Midland, Tex.	5000
KTSA	San Antonio, Tex.	5000
WDEV	Waterbury, Vt.	1000
WSVA	Harrisburg, Va.	5000
WOSA	Wausau, Wis.	5000

560—535.4

CFRA	Ottawa, Ont.	1000
CJKL	Kirkland Lake, Ont.	5000
WOOF	Dothan, Ala.	5000
KYUM	Yuma, Ariz.	1000
KSFO	San Fran., Calif.	5000
KLZ	Denver, Colo.	5000
WQAM	Miami, Fla.	5000
WIND	Chicago, Ill.	5000
WMIK	Middlesboro, Ky.	500
WGAN	Portland, Maine	5000
WHYN	Springfield, Mass.	1000
WMIC	Monroe, Mich.	500
WEBC	Duluth, Minn.	5000
KWTO	Springfield, Mo.	5000
KMON	Great Falls, Mont.	5000
WGAI	Elizabeth City, N.C.	1000
WFIL	Philadelphia, Pa.	5000
WIS	Columbia, S.C.	5000
WHBQ	Memphis, Tenn.	5000
KFDM	Beaumont, Tex.	5000
KPQ	Wenatchee, Wash.	5000
WJLS	Beckley, W.Va.	5000

570—526.0

CJEM	Edmundston, N.B.	1000
WCAS	Gadsden, Ala.	1000
KCNO	Alturas, Calif.	1000
KLAC	Los Angeles, Calif.	5000
WGMS	Washington, D.C.	5000
WACL	Waycross, Ga.	1000
WKYB	Paducah, Ky.	1000
WVMI	Biloxi, Miss.	1000
KGRT	Los Cruces, N.Mex.	1000
WMCA	New York, N.Y.	5000
WSYR	Syracuse, N.Y.	5000
WWNC	Asheville, N.C.	5000
WMSN	Raleigh, N.C.	500
WKBN	Youngstown, Ohio	5000
WNAX	Yankton, S.Dak.	5000
WFAA	Dallas, Tex.	5000
WBAP	Ft. Worth, Tex.	5000
KLUB	Salt Lake City, Utah	5000
KVI	Seattle, Wash.	5000
WMAM	Marinette, Wis.	250

580—516.9

CFCL	Timmins, Ont.	1000
CJFX	Antigonish, N.S.	5000
CKEY	Toronto, Ont.	5000
CKPR	Ft. William, Ont.	1000
CKUA	Edmonton, Alta.	1000
CKY	Winnipeg, Man.	5000
WTUS	Tuskegee, Ala.	500
KABI	Ketchikan, Alaska	1000
KCNA	Tucson, Ariz.	5000
KMJ	Fresno, Calif.	5000
WDBO	Orlando, Fla.	5000
WGAC	Augusta, Ga.	1000
KFXD	Nampa, Idaho	5000
WILL	Urbana, Ill.	5000
KSAC	Manhattan, Kans.	500
WIBW	Topeka, Kans.	5000
KALB	Alexandria, La.	5000
WTAG	Worcester, Mass.	5000
WELO	Tupelo, Miss.	1000
WHP	Harrisburg, Pa.	5000
WIAC	San Juan, P.R.	5000
WKAQ	San Juan, P.R.	5000
WRKH	Rockwood, Tenn.	500
KDAV	Lubbock, Tex.	500
WCHS	Charleston, W.Va.	5000
WKTY	LaCrosse, Wis.	1000

590—508.2

CFAR	FlinFlon, Man.	1000
CKRS	Jonquiere, Que.	1000
COCM	St. Johns, N.F.	1000
WRAG	Carrollton, Ala.	1000
KBHS	Hot Springs, Ark.	500
KFXM	San Bernardino, Cal.	5000
WDLP	Panama City, Fla.	1000
WAGA	Atlanta, Ga.	5000
KGMB	Honolulu, Hawaii	5000
KID	Idaho Falls, Idaho	5000
WVLK	Lexington, Ky.	1000
WEEI	Boston, Mass.	5000
WKZO	Kalamazoo, Mich.	5000
WOW	Omaha, Nebr.	5000
WROW	Albany, N.Y.	5000
WGTM	Wilson, N.C.	5000
KUGN	Eugene, Oreg.	5000
WARM	Scranton, Pa.	5000
WMBS	Uniontown, Pa.	1000
KTBC	Austin, Tex.	1000
KTBB	Tyler, Tex.	1000
KSUB	Cedar City, Utah	1000
WLVA	Lynchburg, Va.	1000
KHQ	Spokane, Wash.	5000

600—499.7

CFCF	Montreal, Que.	5000
CFCH	North Bay, Ont.	1000
CFQC	Saskatoon, Sask.	5000
CJOR	Vancouver, B.C.	5000
CKCL	Truro, N.S.	1000
KCLS	Flagstaff, Ariz.	5000
KVCV	Redding, Calif.	1000
KFSD	San Diego, Calif.	5000
WICC	Bridgeport, Conn.	500
WPDQ	Jacksonville, Fla.	5000
WMT	Cedar Rapids, Iowa	5000
WFST	Caribou, Maine	1000
WCAO	Baltimore, Md.	5000
WTAC	Flint, Mich.	1000
KGEZ	Kalispell, Mont.	2000
WMRY	New Orleans, La.	1000
WSJS	Winston-Salem, N.C.	5000
KSJB	Jamestown, N.D.	5000
WFRM	Coudersport, Pa.	1000
WAEL	Mayaguez, P.R.	1000
WREC	Memphis, Tenn.	5000
KROD	El Paso, Tex.	5000
KERB	Kermit, Tex.	1000
KTBB	Tyler, Tex.	1000

610—491.5

CHNC	New Carlisle, Que.	5000
CJAT	Trail, B.C.	1000
WSGN	Birmingham, Ala.	1000
KFRC	San Francisco, Calif.	5000
WCKR	Miami, Fla.	2000
WCEH	Hawkinsville, Ga.	500
KESE	Iowa Falls, Iowa	250
KDAL	Duluth, Minn.	5000
WDAF	Kansas City, Mo.	5000
KOJM	Havre, Mont.	1000
WGIR	Manchester, N.M.	5000
KGGM	Albuquerque, N.Mex.	5000
WAYS	Charlotte, N.C.	5000
WTVN	Columbus, Ohio	5000
WIP	Philadelphia, Pa.	5000
KILT	Houston, Tex.	5000
KVNU	Logan, Utah	1000
WSLS	Roanoke, Va.	5000
KEPR	Kennewick, Wash.	5000

620—483.6

CKCK	Regina, Sask.	5000
CKTB	St. Katharine, Ont.	1000
KTAR	Phoenix, Ariz.	5000
KNGS	Hanford, Calif.	1000
WSUN	St. Petersburg, Fla.	5000
WTRP	LaGrange, Ga.	1000
KWAL	Wallace, Idaho	1000
KCOM	Sioux City, Iowa	1000
KMNS	Sioux City, Iowa	1000
WLBZ	Bangor, Maine	5000
WJDX	Jackson, Miss.	5000
WRBC	Jackson, Miss.	5000
WVNJ	Newark, N.J.	5000
WHEN	Syracuse, N.Y.	5000
WDNC	Durham, N.C.	5000
KGW	Portland, Oreg.	5000
WHJB	Greensburg, Pa.	1000
WKAQ	San Juan, P.R.	5000
WATE	Knoxville, Tenn.	5000
KWFT	Wichita Falls, Tex.	5000
WCAX	Burlington, Vt.	5000
WWNR	Beckley, W.Va.	1000
WTMJ	Milwaukee, Wis.	5000

630—475.9

CFCO	Chatham, Ont.	1000
CFCY	Charlottetown, P.E.I.	5000
CKRC	Winnipeg, Man.	5000
CKOV	Kelowna, B.C.	1000
CKYL	Peace River, Alta.	1000
WAVU	Albertville, Ala.	1000
WJDB	Thomasville, Ala.	1000
KJND	Juneau, Alaska	1000
KVMA	Magnolia, Ark.	1000
KIDD	Monterey, Calif.	1000
KVOD	Denver, Colo.	5000
WMAL	Washington, D.C.	5000
WSAV	Savannah, Ga.	5000
KIDO	Boise, Idaho	5000
WLAP	Lexington, Ky.	5000
KTIB	Thibodaux, La.	500
WJMS	Ironwood, Mich.	1000
KXOK	St. Louis, Mo.	5000
KOH	Reno, Nev.	5000
KLEA	Lovington, N.Mex.	500
WIRC	Hickory, N.C.	1000
WMFD	Wilmington, N.C.	1000
KOOS	Coos Bay, Oreg.	1000
WEJL	Scranton, Pa.	500
WPRO	Providence, R.I.	5000
KGFX	Pierre, S.Dak.	200
KPOA	Honolulu, T.H.	5000
KMAC	San Antonio, Tex.	5000
KGDN	Edmunds, Wash.	1000

640—468.5

CBN	St. John's, N.F.	10000
KFI	Los Angeles, Calif.	50000
WOI	Ames, Iowa	5000
WHKK	Akron, Ohio	1000
WNAD	Norman, Okla.	1000

650—461.3

WSM	Nashville, Tenn.	50000
KRCT	Baytown, Pa.	250

660—454.3

KFAR	Fairbanks, Alaska	10000
KOWH	Omaha, Nebr.	500
WRCA	New York, N.Y.	50000
WESC	Greenville, S.C.	5000
KSKY	Dallas, Tex.	1000

670—447.5

WMAQ	Chicago, Ill.	50000

680—440.9

CHFA	Edmonton, Alta.	5000
CHLO	St. Thomas, Ont.	1000
CKGB	Timmins, Ont.	5000
KNBC	San Fran., Calif.	50000
WPIN	St. Petersburg, Fla.	1000
WCTT	Corbin, Ky.	1000
WCBM	Baltimore, Md.	10000
WNAC	Lawrence, Mass.	50000
WDBC	Escanaba, Mich.	1000
KFEQ	St. Joseph, Mo.	5000
WINR	Binghamton, N.Y.	1000
WRNY	Rochester, N.Y.	250
WPTF	Raleigh, N.C.	50000
WISR	Butler, Pa.	250
WAPA	San Juan, P.Rico.	10000
WMPS	Memphis, Tenn.	10000
KENS	San Antonio, Tex.	50000
KOMW	Omak, Wash.	1000

690—434.5

CBU	Vancouver, B.C.	10000
CBF	Montreal, Que.	50000
KVNA	Flagstaff, Ariz.	1000
WVDK	Birmingham, Ala.	50000
KEVT	Tucson, Ariz.	250
KBBA	Benton, Ark.	250
WADS	Ansonia, Conn.	500

Kc. Wave Length		W.P.
(690-434.5)		
KGGF	Coffeyville, Kans.	10000
WWEZ	New Orleans, La.	5000
KSTL	St. Louis, Mo.	1000
KRCO	Prineville, Oreg.	1000
WLTR	Bloomsburg, Pa.	1000
KUSD	Vermillion, S.Dak.	1000
KULA	Honolulu, T.H.	10000
KHEY	El Paso, Tex.	10000
KPET	Lamesa, Tex.	250
WCYB	Bristol, Va.	10000
WNNT	Warsaw, Va.	250
WELD	Fisher, W.Va.	500

700—428.3

WLW	Cincinnati, Ohio	50000

710—422.3

CJSP	Leamington, Ont.	250
CFRG	Gravelbourg, Sask.	5000
CKVM	Ville Marie, Que.	1000
WKRG	Mobile, Ala.	1000
KMPC	Los Angeles, Calif.	50000
KMYR	Denver, Colo.	5000
WGBS	Miami, Fla.	50000
WROM	Rome, Ga.	1000
KTBS	Shreveport, La.	10000
WHB	Kansas City, Mo.	10000
WOR	New York, N.Y.	50000
DZRH	Manila, P.I.	10000
WKJB	Mayaguez, P.Rico	1000
WTPR	Paris, Tenn.	250
KGNC	Amarillo, Tex.	10000
KURV	Edinburg, Tex.	250
KIRO	Seattle, Wash.	50000
WDSM	Superior, Wis.	5000
KFBC	Cheyenne, Wyo.	10000

720—416.4

WGN	Chicago, Ill.	50000

730—410.7

CKAC	Montreal, Que.	10000
KFQD	Anchorage, Alaska	10000
WJMW	Athens, Ala.	1000
KNBY	Newport, Ark.	1000
WKTG	Thomasville, Ga.	1000
KWGB	Goodland, Kans.	1000
WFMW	Madisonville, Ky.	250
WMTC	Vancleve, Ky.	1000
KTRY	Bastrop, La.	250
WARB	Covington, La.	250
WACE	Chicopee, Mass.	1000
KWRE	Warrenton, Mo.	500
KWOA	Worthington, Minn.	1000
WDOS	Oneonta, N.Y.	500
WFMC	Goldsboro, N.C.	1000
WDHS	Shelby, N.C.	1000
WTLG	Bowling Green, Ohio	250
KBOY	Medford, Oreg.	1000
WHWL	Nanticoke, Pa.	1000
WPIT	Pittsburgh, Pa.	1000
WPAL	Charleston, S.C.	1000
WLIL	Lenoir, Tenn.	1000
KBCS	Grand Prairie, Tex.	500
KKOG	Ogden, Utah	1000
WPIK	Alexandria, Va.	1000
WMNA	Gretna, Va.	1000
KULE	Ephrata, Wash.	1000

740—405.2

CBXA	Edmonton, Alta.	250
CBL	Toronto, Ont.	50000
WBAM	Montgomery, Ala.	50000
KBIG	Avalon, Calif.	10000
KCBS	San Francisco, Calif.	50000
KWBY	Colo. Sprgs., Colo.	250
KVFC	Cortez, Colo.	1000
KYME	Boise, Idaho	500
WORZ	Orlando, Fla.	5000
WNOP	Newport, Ky.	1000
WVLN	Olney, Ill.	250
KBOE	Oskaloosa, Iowa	250
WTAO	Cambridge, Mass.	250
KPBM	Carlsbad, N.Mex.	1000
WGSM	Huntington, N.Y.	1000
WMBL	Morehead City, N.C.	1000
WPAQ	Mount Airy, N.C.	10000
KRMG	Tulsa, Okla.	50000
WVCH	Chester, Pa.	1000
WIBS	Santurce, P.Rico	10000
WBAW	Barnwell, S.C.	500
WIRJ	Humbolt, Tenn.	250
WJIG	Tullahoma, Tenn.	250
KTRH	Houston, Tex.	50000

750—399.8

WSB	Atlanta, Ga.	50000
WBMD	Baltimore, Md.	1000
KMMJ	Grand Island, Neb.	1000
KSEO	Durant, Okla.	250
KXL	Portland, Oreg.	10000
WHEB	Portsmouth, N.H.	1000
WPDX	Clarksburg, W.Va.	1000

760—394.5

KGU	Honolulu, Hawaii	2500
WJR	Detroit, Mich.	50000
WCPS	Tarboro, N.C.	1000

770—389.4

KUOM	Minneapolis, Minn.	5000
WCAL	Northfield, Minn.	5000
WEW	St. Louis, Mo.	1000
KOB	Albuquerque, N. Mex.	50000
WABC	New York, N.Y.	50000
WJZ	New York, N.Y.	50000
KXA	Seattle, Wash.	1000

780—384.4

WBBM	Chicago, Ill.	50000
WJAG	Norfolk, Neb.	1000
WCKB	Dunn, N.C.	1000
WBBO	Forest City, N.C.	1000
KSPI	Stillwater, Okla.	250
WARL	Arlington, Va.	1000

790—379.5

CBY	Corner Brook, N.F.	1000
CKMR	Newcastle, N.B.	1000
CKSO	Sudbury, Ont.	5000
KOSY	Texarkana, Ark.	1000
KDAN	Eureka, Calif.	5000
KABC	Los Angeles, Calif.	5000
WLBE	Leesburg, Fla.	1000
WPFA	Pensacola, Fla.	1000
WQXI	Atlanta, Ga.	5000
WGRA	Cairo, Ga.	1000
KXXX	Colby, Kans.	5000
WGRC	Louisville, Ky.	5000
WRUM	Rumford, Me.	1000
WSGW	Saginaw, Mich.	1000
KGHL	Billings, Mont.	5000
WWNY	Watertown, N.Y.	1000
WLSV	Wellsville, N.Y.	500
WTNC	Thomasville, N.C.	1000
KFGO	Fargo, N.Dak.	5000
KWIL	Albany, Oreg.	1000
WAEB	Allentown, Pa.	1000
WPIC	Sharon, Pa.	1000
WEAN	Providence, R.I.	5000
WETB	Johnson City, Tenn.	1000
WMC	Memphis, Tenn.	5000
KTHT	Houston, Tex.	5000
KFYO	Lubbock, Tex.	5000
WSIG	Mount Jackson, Va.	1000
WTAR	Norfolk, Va.	5000
KVOS	Bellingham, Wash.	1000
KNEW	Spokane, Wash.	5000
WMON	Montgomery, W.Va.	1000
WEAU	Washington, Wis.	5000

800—374.8

CHAB	Moose Jaw, Sask.	5000
CKOK	Penticton, B.C.	1000
CFOB	Ft. Frances, Ont.	1000
CHRC	Quebec, Que.	5000
CJAD	Montreal, Que.	10000
CKLW	Windsor, Ont.	50000
VOWR	St. Johns, N.F.	1000
WHOS	Decatur, Ala.	1000
WMGY	Montgomery, Ala.	1000
KINY	Juneau, Alas.	5000
KVOM	Morrilton, Ark.	250
KHIL	Ft. Lupton, Colo.	500
WLAD	Danbury, Conn.	250
WMBM	Miami Beach, Fla.	1000
WJAT	Swainsboro, Ga.	1000
KDBM	Dillon, Mont.	1000
KXIC	Iowa City, Iowa	1000
WRUS	Russellville, Ky.	1000
WBOK	New Orleans, La.	1000
WCCM	Lawrence, Mass.	1000
KREI	Farmington, Mo.	1000
WKDN	Camden, N.J.	1000
KTOW	Okla. City, Okla.	250
KPDQ	Portland, Oreg.	1000
WCHA	Chambersburg, Pa.	1000
DZPI	Manila, P.I.	10000
WOSC	Dillon, S.C.	1000
WEAB	Greer, S.C.	250
WIBK	Knoxville, Tenn.	1000
WDEH	Sweetwater, Tenn.	500
KOOO	Dumas, Tex.	250
KBUH	Brigham City Utah	250
WSVS	Crewe, Va.	1000
WHTN	Huntington, W.Va.	1000
WDUX	Waupaca, Wis.	1000

810—370.2

KGO	San Francisco, Calif.	50000
WIPA	Annapolis, Md.	250
KCMO	Kansas City, Mo.	50000
WGY	Schenectady, N.Y.	50000
WKBC	N.Wilkesboro, N.C.	1000
WCEC	Rocky Mount, N.C.	1000
WEDO	McKeesport, Pa.	1000
WKVM	San Juan, P.R.	25000
KIKI	Honolulu, Hawaii	1000

820—365.6

WAIT	Chicago, Ill.	5000
WCBD	Chicago, Ill.	5000
WIKY	Evansville, Ind.	250
WOSU	Columbus, Ohio	5000
WFAA	Dallas, Tex.	50000
WBAP	Ft. Worth, Tex.	50000

830—361.2

KIKI	Honolulu, Hawaii	250
WCCO	Minneapolis, Minn.	50000
KBOA	Kennett, Mo.	1000
WNYC	New York, N.Y.	1000

840—356.9

WKAB	Mobile, Ala.	1000
WKNB	Bownemont, Conn.	1000
WHAS	Louisville, Ky.	50000
WVPD	Stroudsburg, Pa.	250

850—352.7

CKVL	Verdun, Que.	10000
CKRD	Red Deer, Alta.	1000
WILD	Birmingham, Ala.	10000
KOA	Denver, Colo.	50000
WRUF	Gainesville, Fla.	5000
WEAT	W. Palm Beach, Fla.	1000
KILA	Hilo, Hawaii	1000
WHDH	Boston, Mass.	50000
WKBZ	Muskegon, Mich.	5000
KFUO	St. Louis, Mo.	5000
WKIX	Raleigh, N.C.	10000
WJW	Cleveland, Ohio	5000
WEEU	Reading, Pa.	1000
WABA	Aguadilla, P.R.	500
WRAP	Norfolk, Va.	1000
KTAC	Tacoma, Wash.	1000

860—348.6

CJBC	Toronto, Ont.	50000
WHRT	Hartselle, Ala.	250
WAMI	Opp, Ala.	1000
KIFN	Phoenix, Ariz.	1000
KOSE	Osceola, Ark.	1000
KWRF	Warren, Ark.	250
KTRB	Modesto, Calif.	10000
WKKO	Cocoa, Fla.	1000
WERD	Atlanta, Ga.	10000
WDMG	Douglas, Ga.	5000
KWPC	Muscatine, Iowa	250
WMRI	Marion, Ind.	250
KOAM	Pittsburg, Kans.	10000
WSON	Henderson, Ky.	500
WAYE	Dundalk, Md.	500
WSBS	Gt. Barrington, Mass.	250
WNAW	N. Adams, Mass.	250
KNUJ	New Ulm, Minn.	1000
WMAG	Forest, Miss.	500
WFMO	Fairmont, N.C.	1000
WAMO	Homestead, Pa.	250
WTEL	Philadelphia, Pa.	250
WLBG	Laurens, S.C.	250
WIVK	Knoxville, Tenn.	1000
WMTS	Murfreesboro, Tenn.	250
KFST	Ft. Stockton, Tex.	250
KPAN	Hereford, Tex.	250
KSFA	Nacogdoches, Tex.	1000
KONO	San Antonio, Tex.	5000
KWHO	Salt Lake City, Utah	1000
WEVA	Emporia, Va.	1000
WOAY	Oak Hill, W.Va.	10000
WFOX	Milwaukee, Wis.	250

870—344.6

KIEV	Glendale, Calif.	250
KAIM	Kaimuki, Hawaii	1000
WWL	New Orleans, La.	50000
WKAR	E. Lansing, Mich.	5000
WHCU	Ithaca, N.Y.	1000
WGTL	Kannapolis, N.C.	1000
KCNC	Ft. Worth, Tex.	250
WFLO	Farmville, Va.	1000

880—340.7

WCBS	New York, N.Y.	50000
WRRZ	Clinton, N.C.	1000
WRFD	Worthington, Ohio	5000

890—336.9

WLS	Chicago, Ill.	50000
WHNC	Henderson, N.C.	1000
KBYE	Okla. City, Okla.	1000

900—333.1

CHLT	Sherbrooke, Que.	1000
CHML	Hamilton, Ont.	5000
CHNO	Sudbury, Ont.	1000
CJBR	Rimouski, Que.	10000
CKJL	St. Jerome, Que.	1000
CJVI	Victoria, B.C.	5000
CKBI	Prince Albert, Sask.	10000
CJGX	Yorkton, Sask.	10000
WLBS	Birmingham, Ala.	1000
WOZK	Ozark, Ala.	1000
KFRB	Fairbanks, Alaska	10000
KBIF	Centerville, Calif.	1000
KSJV	Sanger, Calif.	1000
WJWL	Georgetown, Del.	10000
WSWN	Belle Glade, Fla.	1000
WMOP	Ocala, Fla.	1000
WCGA	Calhoun, Ga.	1000
WJIV	Savannah, Ga.	1000
WKYW	Louisville, Ky.	1000
WLSI	Pikesville, Ky.	1000
KREH	Oakdale, La.	250
WCME	Brunswick, Maine	500
WATC	Gaylord, Mich.	1000
KTIS	Minneapolis, Minn.	1000
KFAL	Fulton, Mo.	1000
WDDT	Greenville, Miss.	1000
WOTW	Nashua, N.H.	1000
WSPN	Saratoga Sprgs., N.Y.	250
WBRV	Boonville, N.Y.	500
WAYN	Rockingham, N.C.	1000
WIAM	Williamston, N.C.	1000
KFNW	Fargo, N.Dak.	1000
WAND	Canton, Ohio	500
WFRO	Fremont, Ohio	500
KLAD	Klamath Falls, Oreg.	1000
WCPA	Clearfield, Pa.	1000
WKXV	Knoxville, Tenn.	1000
WCDR	Lebanon, Tenn.	250
KALT	Atlanta, Tex.	1000
KCLW	Hamilton, Tex.	250
KFLD	Floydada, Tex.	250
KMCO	Conroe, Tex.	500
WATK	Antigo, Wis.	250

910—329.5

CKLY	Lindsay, Ont.	1000
CBO	Ottawa, Ont.	5000
CFJC	Kamloops, B.C.	1000
CHRL	Roberval, Que.	1000
KLCN	Blytheville, Ark.	5000
KAMD	Camden, Ark.	1000
KOXR	Oxnard, Calif.	1000
KPHO	Phoenix, Ariz.	5000
KBAB	El Cajon, Calif.	1000
KLX	Oakland, Calif.	5000
KPOF	nr. Denver, Colo.	1000
WHAY	New Britain, Conn.	5000
WPLA	Plant City, Fla.	1000
WGAF	Valdosta, Ga.	5000
WSUI	Iowa City, Iowa	5000
WLCS	Baton Rouge, La.	1000
WABI	Bangor, Maine	5000
WFDF	Flint, Mich.	1000
WCOC	Meridian, Miss.	1000
KOYN	Billings, Mont.	1000
KBIM	Roswell, N.Mex.	5000
WLAS	Jacksonville, N.C.	1000
KCJB	Minot, N.Dak.	1000
WPFB	Middletown, Ohio	1000
KGLC	Miami, Okla.	1000
WAVL	Apollo, Pa.	1000
WGBI	Scranton, Pa.	1000
WSBA	York, Pa.	1000
WPRP	Ponca, P.R.	5000
WORD	Spartanburg, S.C.	1000
WJHL	Johnson City, Tenn.	1000
WEPG	S. Pittsburgh, Tenn	500
KRIO	McAllen, Tex.	1000
KRRV	Sherman, Tex.	1000
WRNL	Richmond, Va.	5000
KALL	Salt Lake City, Utah	1000
WRKE	Roanoke, Va.	1000
KORD	Pasco, Wash.	500
KXRN	Renton, Wash.	1000
KVAN	Vancouver, Wash.	1000
WDOR	Sturgeon Bay, Wis.	500

920—325.9

CJCH	Halifax, N.S.	5000
CKNX	Wingham, Ont.	1000
WCTA	Adalusia, Ala.	1000
WWWR	Russellville, Ala.	1000
KARK	Little Rock, Ark.	5000
KIUP	Durango, Colo.	5000
KREX	Grd. Junc., Colo.	5000
WMEG	Eau Gallie, Fla.	500
WSKN	Saugerties, N.Y.	1000
KVEC	San Luis Obispo, Cal.	500
KLMR	Lamar, Colo.	1000
WGST	Atlanta, Ga.	1000
KAHU	Waiphau, Hawaii	1000
WMOK	Metropolis, Ill.	1000
WBAA	W. Lafayette, Ind.	1000
KFNF	Shenandoah, Iowa	500
WTCW	Whitesburg, Ky.	1000
WHXY	Bogalusa, La.	1000
WPTX	Lexington Pk., Md.	500
WMPL	Hancock, Mich.	1000
KDHL	Faribault, Minn.	1000
KWAD	Wadena, Minn.	1000
KJSK	Columbus, Nebr.	1000
KRAM	Las Vegas, Nev.	1000
KOLO	Reno, Nev.	1000
KQUE	Albuquerque, N.Mex.	1000
WTTM	Trenton, N.J.	1000
WKRT	Cortland, N.Y.	1000
WBBB	Burlington, N.C.	5000
KGIL	Lebanon, Oreg.	1000
WKVA	Lewiston, Pa.	1000
WJAR	Providence, R.I.	5000
WTND	Orangeburg, S.C.	1000
WLIV	Livingston, Tenn.	1000
KELP	El Paso, Tex.	1000
KECK	Odessa, Tex.	1000
KTLW	Texas City, Tex.	1000
KXLY	Spokane, Wash.	5000
WMMN	Fairmont, W.Va.	5000
WOKY	Milwaukee, Wis.	5000

930—322.4

CFBC	Saint John, N.B.	5000
CJCA	Edmonton, Alta.	5000
CJON	St. John's, N.F.	5000
WETO	Gadsden, Ala.	1000
KTKN	Ketchikan, Alaska	1000
KHJ	Los Angeles, Calif.	5000
WKSB	Milford, Del.	500
WJAX	Jacksonville, Fla.	5000
WKXY	Sarasota, Fla.	1000
WMGR	Bainbridge, Ga.	5000
KSEI	Pocatello, Idaho	5000
WTAD	Quincy, Ill.	5000
WKCT	Bowling Green, Ky.	1000
WFMD	Frederick, Md.	1000
WREB	Holyoke, Mass.	500
WBCK	Battle Creek, Mich.	1000
WSLI	Jackson, Miss.	5000

Kc. Wave Length W.P.

KWOC	Poplar Bluff, Mo.	1000
KOGA	Ogallala, Nebr.	500
WPAT	Paterson, N.J.	5000
WBEN	Buffalo, N.Y.	5000
WWNH	Rochester, N.H.	5000
WIST	Charlotte, N.C.	5000
WRRF	Washington, N.C.	5000
WEOL	Elyria, Ohio	1000
WKY	Oklahoma City, Okla.	5000
WCNR	Bloomsburg, Pa.	1000
KSON	Aberdeen, S.D.	1000
WSEV	Sevierville, Tenn.	5000
KOET	Center, Tex.	1000
KITE	San Antonio, Tex.	1000
WSAZ	Huntington, W.Va.	5000
WLBL	Auburndale, Wis.	5000

940—319.0

CBM	Montreal, Que.	50000
CJGX	Yorkton, Sask.	10000
CJIB	Vernon, B.C.	1000
KFRE	Fresno, Calif.	50000
WINZ	Miami, Fla.	50000
WMAZ	Macon, Ga.	10000
WMIX	Mt. Vernon, Ill.	1000
KIOA	Des Moines, Iowa	10000
WTPS	New Orleans, La.	1000
WESA	Charleroi, Pa.	250
WIPR	San Juan, P.R.	10000
KLYN	Amarillo, Tex.	1000

950—315.6

CKNB	Campbellton, N.B.	1000
WRMA	Montgomery, Ala.	1000
KXJK	Forrest City, Ark.	5000
KFSA	Ft. Smith, Ark.	1000
KIMN	Denver, Colo.	5000
WFBS	Ft. Walton Bch., Fla.	1000
WLOF	Orlando, Fla.	5000
WGTA	Summerville, Ga.	1000
WGOV	Valdosta, Ga.	5000
KBOI	Boise, Idaho	5000
KOZE	Lewiston, Idaho	500
WAAF	Chicago, Ill.	1000
WXLW	Indianapolis, Ind.	5000
KOEL	Oelwein, Iowa	1000
KJRG	Newton, Kans.	500
WBVL	Barboursville, Ky.	1000
WORL	Boston, Mass.	5000
WWJ	Detroit, Mich.	5000
WBKH	Hattiesburg, Miss.	5000
KLIK	Jefferson City, Mo.	5000
WBBF	Rochester, N.Y.	1000
WIBX	Utica, N.Y.	5000
WPET	Greensboro, N.C.	500
WNCC	Barnesboro, Pa.	500
WPEN	Philadelphia, Pa.	5000
WSPA	Spartanburg, S.C.	5000
KWAT	Watertown, S.Dak.	1000
WAGG	Franklin, Tenn.	1000
KOSX	Denison, Tex.	500
KPRC	Houston, Tex.	5000
KSEL	Lubbock, Tex.	1000
WXGI	Richmond, Va.	1000
KJR	Seattle, Wash.	5000
WKNA	Charleston, W.Va.	5000
WSHE	Sheboygan, Wis.	500

960—312.3

CFAC	Calgary, Alta.	5000
CHNS	Halifax, N.S.	5000
CKWS	Kingston, Ont.	5000
WBRC	Birmingham, Ala.	5000
WMOZ	Mobile, Ala.	1000
KOOL	Phoenix, Ariz.	5000
KAVR	Apple Valley, Calif.	5000
KROW	Oakland, Calif.	5000
WELI	New Haven, Conn.	5000
WRFC	Athens, Ga.	5000
WSBT	South Bend, Ind.	5000
KMA	Shenandoah, Iowa	5000
KROF	Abbeville, La.	1000
WBOC	Salisbury, Md.	5000
WHAK	Rogers City, Mich.	5000
KLTF	Little Falls, Minn.	500
WABG	Greenwood, Miss.	1000
KFVS	Cape Girardeau, Mo.	1000
KNEB	Scottsbluff, Nebr.	1000
WEAV	Plattsburg, N.Y.	5000
WFTC	Kinston, N.C.	5000
WWST	Wooster, Ohio	1000
KGWA	Enid, Okla.	1000
WHYL	Carlisle, Pa.	1000
WADP	Kane, Pa.	500
WATS	Sayre, Pa.	1000
WBEU	Beaufort, S.C.	1000
WBMC	McMinnville, Tenn.	500
KIMP	Mt. Pleasant, Tex.	1000
KGKL	San Angelo, Tex.	1000
KOVO	Provo, Utah	5000
WDBJ	Roanoke, Va.	5000
KALE	Richland, Wash.	1000
WTCH	Shawano, Wis.	1000

970—309.1

CKCH	Hull, Que.	5000
WERH	Hamilton, Ala.	5000
WTBF	Troy, Ala.	5000
KNEA	Jonesboro, Ark.	1000
KCHV	Coachella, Calif.	1000
KBIS	Bakersfield, Calif.	1000
KBEE	Modesto, Calif.	1000
KFEL	Pueblo, Colo.	1000
WFLA	Tampa, Fla.	5000
WTAM	Decatur, Ga.	1000
WVOP	Vidalia, Ga.	5000
KAYT	Rupert, Idaho	1000
KHBC	Hilo, Hawaii	1000
WMAY	Springfield, Ill.	1000
WAVE	Louisville, Ky.	5000
KVOB	Alexandria, La.	1000
WCSH	Portland, Maine	5000
WAMD	Aberdeen, Md.	500
WESO	Southbridge, Mass.	1000
WKHM	Jackson, Mich.	1000
KOOK	Billings, Mont.	5000
KJLT	No. Platte, Nebr.	5000
WAAT	Newark, N.J.	5000
WEBR	Buffalo, N.Y.	5000
WCHN	Norwich, N.Y.	500
WRCS	Ahoskie, N.C.	1000
WWIT	Canton, N.C.	1000
WDAY	Fargo, N.Dak.	5000
WICA	Ashtabula, Ohio	5000
WATH	Athens, Ohio	1000
KAKC	Tulsa, Okla.	1000
KOIN	Portland, Oreg.	5000
WWSW	Pittsburgh, Pa.	5000
WJMX	Florence, S.C.	5000
KNOK	Ft. Worth, Tex.	1000
KREM	Spokane, Wash.	5000
WWYO	Pineville, W.Va.	1000
WHA	Madison, Wis.	5000

980—305.9

CFPL	London, Ont.	5000
CBV	Quebec, Que.	5000
CKRM	Regina, Sask.	5000
CKWX	Vancouver, B.C.	5000
WKLF	Clanton, Ala.	1000
KHUM	Eureka, Calif.	5000
KFWB	Los Angeles, Calif.	5000
KGLN	Glenwood Sprgs., Colo.	1000
WRC	Washington, D.C.	5000
WDVH	Gainesville, Fla.	5000
WBOP	Pensacola, Fla.	500
WKLY	Hartwell, Ga.	1000
WBBN	Perry, Ga.	500
WITY	Danville, Ill.	1000
KCIJ	Shreveport, La.	5000
WPBC	Minneapolis, Minn.	1000
WAPF	McComb, Miss.	1000
KSGM	Ste. Genevieve, Mo.	500
WCAP	Lowell, Mass.	1000
KOFI	Kalispell, Mont.	1000
KICA	Clovis, N.Mex.	1000
KMIN	Grants, N.Mex.	1000
WTRY	Troy, N.Y.	5000
WKLM	Wilmington, N.C.	500
WAAA	Win.-Salem, N.C.	1000
WONE	Dayton, Ohio	5000
WILK	Wilkes-Barre, Pa.	5000
KDSJ	Deadwood, S.Dak.	1000
WSIX	Nashville, Tenn.	5000
KFRO	Rosenberg, Tex.	1000
KSVC	Richfield, Utah	1000
WFHG	Bristol, Va.	5000
KUTI	Yakima, Wash.	1000
WPHE	Prairie du Chien, Wis.	500
WWOC	Manitowoc, Wis.	1000

990—302.8

CBW	Winnipeg, Man.	50000
CBT	Grand Falls, N.F.	1000
WWWF	Fayette, Ala.	1000
WTCB	Flomaton, Ala.	500
KTKT	Tucson, Ariz.	10000
KECC	Pittsburg, Calif.	5000
KLIR	Denver, Colo.	1000
WLCR	Torrington, Conn.	1000
WHOO	Orlando, Fla.	10000
WOWD	Dawson, Ga.	1000
WCAZ	Carthage, Ill.	1000
WITZ	Jasper, Ind.	1000
KRSL	Russell, Kans.	250
WJMR	New Orleans, La.	250
KAYL	Storm Lake, La.	250
WABO	Waynesboro, Miss.	250
KRMO	Monett, Mo.	250
KSVP	Artesia, N.Mex.	1000
WEEB	Southern Pines, N.C.	1000
WJEH	Gallipolis, Ohio	1000
WTIG	Massillon, Ohio	250
WIBG	Philadelphia, Pa.	10000
WVSC	Somerset, Pa.	250
WPRA	Mayaguez, P.R.	10000
WAKN	Aiken, S.C.	1000
WNOX	Knoxville, Tenn.	10000
KWEM	Memphis, Tenn.	1000
KTRM	Beaumont, Tex.	5000
KENN	Kenedy, Tex.	250
KFDX	Wich. Falls, Tex.	10000
KTUT	Tooele, Utah	1000
WNRV	Narrows, Va.	1000
WANT	Richmond, Va.	1000
WKLJ	Sparta, Wis.	250

1000—299.8

CKBW	Bridgewater, N.S.	1000
WCFL	Chicago, Ill.	50000
KTOK	Okla. City, Okla.	5000
KSTA	Coleman, Tex.	250
KGRI	Henderson, Tex.	250
WHWB	Rutland, Vt.	1000
KOMO	Seattle, Wash.	50000

1010—296.9

CBX	Edmonton, Alta.	50000
CFRB	Toronto, Ont.	50000
KVNC	Winslow, Ariz.	1000
KLRA	Little Rock, Ark.	5000
KCHJ	Delano, Calif.	5000
KPOO	San Fran., Calif.	1000
WCNU	Crestview, Fla.	1000
WZRO	Jacksonville Beach, Florida	1000
WEAS	Decatur, Ga.	50000
WCSI	Columbus, Ind.	500
KSMN	Mason City, Iowa	1000
KINO	Independence, Kans.	250
KOLA	DeRidder, La.	1000
WSID	Baltimore, Md.	1000
KCHI	Chillicothe, Mo.	250
KJCF	Festus, Mo.	250
KRVN	Lexington, Nebr.	25000
KLAS	Las Vegas, Nev.	5000
WINS	New York, N.Y.	50000
WABZ	Albemarle, N.C.	1000
WELS	Kinston, N.C.	1000
WHIN	Gallatin, Tenn.	1000
WORM	Savannah, Tenn.	250
KAMQ	Amarillo, Tex.	5000
KMLW	Marlin, Tex.	250
WELK	Charlottesville, Va.	1000
WMEV	Marion, Va.	1000
WTWT	Stevens Pt., Wis.	250

1020—293.9

KPOP	Los Angeles, Calif.	10000
WCIL	Carbondale, Ill.	1000
WPEO	Peoria, Ill.	1000
KDKA	Pittsburgh, Pa.	50000

1030—291.1

WBZ	Boston, Mass.	50000
WBZA	Springfield, Mass.	1000
KATR	Corpus Christi, Tex.	50000

1040—288.3

KHVH	Honolulu, Hawaii	5000
WHO	Des Moines, Iowa	50000
KIXL	Dallas, Tex.	1000

1050—285.5

CFGP	Grand Prairie, Alta.	5000
CKDM	Dauphin, Man.	1000
CHUM	Toronto, Ont.	2500
WRFS	Alexander City, Ala.	1000
WCRI	Scottsboro, Ala.	250
KVWM	Show Low, Ariz.	250
KVLC	Little Rock, Ark.	1000
KVSM	San Mateo, Calif.	1000
KWSO	Wasco, Calif.	1000
KLMO	Longmont, Colo.	250
WJSB	Crestview, Fla.	1000
WIVY	Jacksonville, Fla.	1000
WHBO	Tampa, Fla.	250
WJAZ	Albany, Ga.	1000
WAUG	Augusta, Ga.	1000
WBIE	Marietta, Ga.	500
KNCO	Garden City, Kans.	1000
WZIP	Covington, Ky.	250
WKTM	Mayfield, Ky.	1000
WDZ	Decatur, Ill.	1000
KANV	Shreveport, La.	250
KVPI	Ville Platte, La.	250
WGAY	Silver Sprg., Md.	1000
WPAG	Ann Arbor, Mich.	1000
KLOH	Pipestone, Minn.	1000
WACR	Columbus, Miss.	1000
KSIS	Sedalia, Mo.	1000
KRBO	Las Vegas, Nev.	500
WJWG	Conway, N.H.	1000
WMGM	New York, N.Y.	50000
WLON	Lincolnton, N.C.	1000
WFSC	Franklin, N.C.	500
WWGP	Sanford, N.C.	1000
KCCO	Lawton, Okla.	250
KFMJ	Tulsa, Okla.	1000
KUBE	Pendleton, Oreg.	1000
KEED	Springfield, Oreg.	1000
WBUT	Butler, Pa.	250
WRYO	Rochester, Pa.	250
WLYC	Williamsport, Pa.	1000
WSMT	Sparta, Tenn.	1000
KELT	Electra, Tex.	250
KLEN	Killeen, Tex.	250
WBRG	Lynchburg, Va.	1000
WCMS	Norfolk, Va.	1000
KNBX	Kirkland, Wash.	1000
WCEF	Parkersburg, W.Va.	1000
WRFW	Eau Claire, Wis.	1000
WLIP	Kenosha, Wis.	250
KWIV	Douglas, Wyo.	250

1060—282.8

CFCN	Calgary, Alta.	10000
KXOC	Chico, Calif.	10000
KIFI	Idaho Falls, Idaho	250
WNOE	New Orleans, La.	50000
WHFB	Benton Harbor, Mich.	1000
WMAP	Monroe, N.C.	250
KILD	Grand Forks, N.Dak.	5000
WCMW	Canton, Ohio	1000
WRCV	Philadelphia, Pa.	50000

1070—280.2

CBA	Sackville, N.B.	50000
CKLG	N. Vancouver, B.C.	1000
CHOK	Sarnia, Ont.	5000
CJET	Smiths Falls, Ont.	1000
WAPI	Birmingham, Ala.	10000
KNX	Los Angeles, Calif.	50000
WVCG	Coral Gables, Fla.	1000
WIBC	Indianapolis, Ind.	50000
KFBI	Wichita, Kans.	10000
KHMO	Hannibal, Mo.	5000
WHPE	High Point, N.C.	1000
WDIA	Memphis, Tenn.	50000
KOPY	Alice, Tex.	1000
WKOW	Madison, Wis.	10000

1080—277.6

CHED	Edmonton, Alta.	1000
KSCO	Santa Cruz, Calif.	1000
WTIC	Hartford, Conn.	50000
WKLO	Louisville, Ky.	5000
WOAP	Owosso, Mich.	250
WREX	Duluth, Minn.	10000
WXRA	Kenmore, N.Y.	1000
WEWO	Laurinburg, N.C.	1000
KWJJ	Portland, Oreg.	10000
WILY	Pittsburgh, Pa.	1000
KRLD	Dallas, Tex.	50000

1090—275.1

CFJB	Brampton, Ont.	250
CHRS	St. Jean, Que.	1000
KTHS	Little Rock, Ark.	50000
WCRA	Effingham, Ill.	250
KNWS	Waterloo, Iowa	1000
WBMS	Boston, Mass.	1000
WBAL	Baltimore, Md.	50000
WMUS	Muskegon, Mich.	1000
KING	Seattle, Wash.	50000

1100—272.6

KJBS	San Francisco, Calif.	1000
WLBB	Carrollton, Ga.	250
WHLI	Hempstead, N.Y.	250
KYW	Cleveland, Ohio	50000
WGPA	Bethlehem, Pa.	250

1110—270.1

CKGR	Galt, Ont.	250
KXLA	Pasadena, Calif.	10000
WALT	Tampa, Fla.	1000
WMBI	Chicago, Ill.	5000
KFAB	Omaha, Nebr.	50000
WBT	Charlotte, N.C.	50000
KBND	Bend, Oreg.	1000
WNAR	Norristown, Pa.	500
WVJP	Caguas, P.R.	250
WHIM	Providence, R.I.	1000
KIPA	Hilo, T.Hawaii	1000

1120—267.7

WUST	Bethesda, Md.	250
KMOX	St. Louis, Mo.	50000
WWOL	Buffalo, N.Y.	1000
KCLE	Cleburne, Tex.	250

1130—265.3

KSDO	San Diego, Calif.	5000
KWKH	Shreveport, La.	50000
WCAR	Detroit, Mich.	10000
WDGY	Minneapolis, Minn.	50000
WNEW	New York, N.Y.	50000

1140—263.0

CKXL	Calgary, Alta.	1000
KRAK	Stockton, Calif.	5000
WMIE	Miami, Fla.	10000
KGEM	Boise, Idaho	10000
WSIV	Pekin, Ill.	1000
KLPR	Oklahoma City, Okla.	1000
WITA	San Juan, P.R.	500
KSOO	Sioux Falls, S.Dak.	10000
KORC	Mineral Wells, Tex.	250
WRVA	Richmond, Va.	50000

1150—260.7

CKSA	Lloydminster, Alta.	1000
CHSJ	Saint John, N.B.	5000
CKOC	Hamilton, Ont.	5000
CKX	Brandon, Man.	1000
WBCA	Bay Minette, Ala.	1000
WGEA	Geneva, Ala.	1000
WJRD	Tuscaloosa, Ala.	5000
KCKY	Coolidge, Ariz.	1000
KXLR	Little Rock, Ark.	1000
KFSG	Los Angeles, Calif.	5000
KRKD	Los Angeles, Calif.	5000
KGMC	Englewood, Colo.	1000
WCNX	Middletown, Conn.	500
WDEL	Wilmington, Del.	5000
WNDB	Daytona Bch., Fla.	1000
WIOK	Tampa, Fla.	1000
WFPM	Fort Valley, Ga.	1000
WJEM	Valdosta, Ga.	1000
KANI	Oahu, Hawaii	1000
WGGH	Marion, Ill.	5000
KWDM	Des Moines, Iowa	1000
KSAL	Salina, Kans.	5000
WLOC	Mumfordville, Ky.	1000
WJBO	Baton Rouge, La.	5000
WGHM	Skowhegan, Maine	1000
WCOP	Boston, Mass.	5000
WCEN	Mt. Pleasant, Mich.	1000
KASM	Albany, Minn.	500
KRMS	Osage Beach, Mo.	1000

Kc. Wave Length W.P.

(1150—260.7)
KIYI Shelby, Mont. 1000
KDEF Albuquerque, N.Mex. 1000
WRUN Utica, N.Y. 5000
WFNS Burlington, N.C. 1000
WGBR Goldsboro, N.C. 5000
WCUE Akron, Ohio 1000
WIMA Lima, Ohio 1000
KNED McAlester, Okla. 1000
KFJI Klamath Falls, Oreg. 5000
WHUN Huntington, Pa. 1000
WKPA New Kensington, Pa. 250
WORA Mayaguez, P.R. 5000
WTYC Rock Hill, S.C. 1000
WRNO Orangeburg, S.C. 500
WSNW Seneca Township, South Carolina 1000
WAPO Chattanooga, Tenn. 1000
WTAW College Station, Tex. 1000
KCCT Corpus Christi, Tex. 1000
KJBC Midland, Tex. 1000
KOLJ Quanah, Tex. 500
KRSC Seattle, Wash. 5000
WELC Welch, W.Va. 1000
KOFE Pullman, Wash. 1000
KAYO Seattle, Wash. 5000
KHFS Vancouver, Wash. 1000
WCHF Chippewa Falls, Wis. 5000
WISN Milwaukee, Wis. 5000

1160—258.5

WJJD Chicago, Ill. 50000
KSL Salt Lake City, Utah 50000

1170—256.3

CFNS Saskatoon, Sask. 1000
WCOV Montgomery, Ala. 10000
KCBQ San Diego, Calif. 5000
KLOK San Jose, Calif. 5000
WLBH Mattoon, Ill. 250
KSTT Davenport, Iowa 1000
KVOO Tulsa, Okla. 50000
WLED Ponce, P.R. 250
KPUG Bellingham, Wash. 1000
WWVA Wheeling, W.Va. 50000

1180—254.1

WLDS Jacksonville, Ill. 1000
WHAM Rochester, N.Y. 50000

1190—252.0

KGYW Vallejo, Calif. 250
WOWO Ft. Wayne, Ind. 50000
WANN Annapolis, Md. 1000
WKOX Fram'gham, Mass. 1000
WLIB New York, N.Y. 1000
KEX Portland, Oreg. 50000
WDTV St. John, V.I. 1000
KLIF Dallas, Tex. 50000

1200—249.9

WOAI San Antonio, Tex. 50000

1210—247.8

WCNT Centralia, Ill. 1000
WKNX Saginaw, Mich. 1000
WADE Wadesboro, N.C. 1000
WAVI Dayton, Ohio 250
WCAU Philadelphia, Pa. 50000

1220—245.8

CJOC Lethbridge, Alta. 10000
CJRL Kenora, Ont. 1000
CKEC New Glasgow, N.S. 250
CKCW Moncton, N.B. 10000
CKSM Shawinigan Falls, Quebec 1000
WEDR Birmingham, Ala. 1000
KVSA McGehee, Ark. 1000
KIBE Palo Alto, Calif. 1000
KFSC Denver, Colo. 1000
WRWB Kissimmee, Fla. 250
WFEC Miami, Fla. 250
WCLB Camilla, Ga. 1000
WSFT Thomaston, Ga. 250
WLPO LaSalle, Ill. 1000
WKRS Waukegan, Ill. 1000
WSLM Salem, Ind. 1000
KJAN Atlantic, Iowa 250
KOFO Ottawa, Kans. 250
WFKN Franklin, Ky. 250
WAVN Stillwater, Minn. 250
WMDC Hazlehurst, Miss. 250
KBHM Branson, Mo. 250
KGMO Cape Girardeau, Mo. 250
KLPW Union, Mo. 250
WGNY Newburgh, N.Y. 1000
WKMT Kings Mtn., N.C. 1000
WREV Reidsville, N.C. 250
WENC Whiteville, N.C. 1000
WGAR Cleveland, Ohio 50000
KGYN Guymon, Okla. 1000
WJUN Mexico, Pa. 250
WRIB Providence, R.I. 1000
WALD Walterboro, S.C. 1000
KABR Aberdeen, S.Dak. 250
WFWL Camden, Tenn. 250
WCPH Etowah, Tenn. 1000
KZEE Weatherford, Tex. 250
WLSD Big Stone Gap, Va. 1000

Kc. Wave Length W.P.

WFAX Falls Church, Va. 500
KBAM Longview, Wash. 1000

1230—243.8

CFCW Camrose, Alta. 250
CFGR Gravelbourg, Sask. 250
CKBB Barrie, Ont. 250
CJBQ Belleville, Ont. 250
CFPA Port Arthur, Ont. 250
CKLD Thetford Mines, Que. 250
VOAR St. John's, Nfld. 100
CKSF Cornwall, Ont. 250
CKVD Val D'Or, Que. 100
WAUD Auburn, Ala. 250
WIRB Enterprise, Ala. 250
WJBB Haleyville, Ala. 250
WBHP Huntsville, Ala. 250
WHTB Talladega, Ala. 250
WTBC Tuscaloosa, Ala. 250
KIFW Sitka, Alaska 250
KSUN Bisbee, Ariz. 250
KAAA Kingman, Ariz. 1000
KRIZ Phoenix, Ariz. 250
KCON Conway, Ark. 250
KFPW Ft. Smith, Ark. 250
KBTM Jonesboro, Ark. 250
KGEE Bakersfield, Calif. 250
KWTC Barstow, Calif. 250
KIBS Bishop, Calif. 250
KXO El Centro, Calif. 250
KDAC Ft. Bragg, Calif. 250
KGFJ Los Angeles, Calif. 250
KSLR Oceanside, Calif. 500
KPRL Paso Robles, Calif. 250
KRDG Redding, Calif. 250
KWG Stockton, Calif. 250
KEXD Grand Junc., Colo. 250
KLVC Leadville, Colo. 250
KDZA Pueblo, Colo. 250
KGEK Sterling, Colo. 250
WGGG Gainesville, Fla. 250
WONN Lakeland, Fla. 250
WMAF Madison, Fla. 250
WSBB New Smyrna Bch., Fla. 250
WEAR Pensacola, Fla. 250
WCNH Quincy, Fla. 250
WJNO W. Palm Beach, Fla. 250
WDEC Americus, Ga. 250
WBLJ Dalton, Ga. 250
WFDM Marietta, Ga. 250
WFRP Savannah, Ga. 250
WAYX Waycross, Ga. 250
KBAR Burley, Idaho 250
KORT Grangeville, Idaho 250
KRXK Rexburg, Idaho 250
WJBC Bloomington, Ill. 250
WQUA Moline, Ill. 250
WHCO Sparta, Ill. 250
WJOB Hammond, Ind. 250
WSAL Logansport, Ind. 250
WTCJ Tell City, Ind. 250
WBOW Terre Haute, Ind. 250
KFJB Marshalltown, Iowa 250
WHIR Danville, Ky. 250
WHOP Hopkinsville, Ky. 250
WMLF Pineville, Ky. 250
KLIC Monroe, La. 250
WJBW New Orleans, La. 250
KSLO Opelousas, La. 250
WGUY Bangor, Maine 250
WITH Baltimore, Md. 250
WCUM Cumberland, Md. 250
WMNB No. Adams, Mass. 250
WNEB Worcester, Mass. 250
WESX Salem, Mass. 250
WJEF Grand Rapids, Mich. 250
WIKB Iron River, Mich. 250
WMPC Lapeer, Mich. 250
WSOO Slt. Ste. Marie, Mich. 250
WSTR Sturgis, Mich. 250
WKLK Cloquet, Minn. 250
KYSM Mankato, Minn. 250
KTRF Thief Riv. Flls., Minn. 250
KWNO Winona, Minn. 250
WCMA Corinth, Miss. 250
WHSY Hattiesburg, Miss. 250
WSSO Starkville, Miss. 250
WAZF Yazoo City, Miss. 250
KODE Joplin, Mo. 250
KLWT Lebanon, Mo. 250
KNCM Moberly, Mo. 250
KANA Anaconda, Mont. 250
KBMN Bozeman, Mont. 250
KXLO Lewiston, Mont. 250
KLCB Libby, Mont. 250
KTNC Falls City, Nebr. 100
KHAS Hastings, Nebr. 250
KELY Ely, Nev. 250
KWRN Reno, Nev. 250
WMOU Berlin, N.H. 250
WTSV Claremont, N.H. 250
WGMC Wildwood, N.J. 250
KALG Alamogordo, N.Mex. 250
KOTS Deming, N.Mex. 250
KFUN Las Vegas, N.Mex. 250
KSWS Roswell, N.Mex. 250
WNIA Cheektonaga, N.Y. 250
WENY Elmira, N.Y. 250
WHUC Hudson, N.Y. 250
WLFH Little Falls, N.Y. 250
WFAS White Plains, N.Y. 250
WSKY Asheville, N.C. 250
WFNC Fayetteville, N.C. 250
WMFR High Point, N.C. 250
WISP Kinston, N.C. 250
WNNC Newton, N.C. 250
WCBT Roanoke Rap., N.C. 250

Kc. Wave Length W.P.

KDIX Dickinson, N.Dak. 250
WCPO Cincinnati, Ohio 250
WCOL Columbus, Ohio 250
WIRO Ironton, Ohio 250
WTOL Toledo, Ohio 250
KADA N. of Ada, Okla. 250
WBBZ Ponca City, Okla. 250
KVAS Astoria, Oreg. 250
KGRO Gresham, Oreg. 100
KYJC Medford, Oreg. 250
KQIK Lakeview, Oreg. 250
WHDL Allentown, Pa. 250
WBVP Beaver Falls, Pa. 250
WEEX Easton, Pa. 250
WKBO Harrisburg, Pa. 250
WCRO Johnstown, Pa. 250
WBPZ Lock Haven, Pa. 250
WERI Westerly, R.I. 250
WAIM Anderson, S.C. 250
WNOK Columbia, S.C. 250
WOLS Florence, S.C. 250
KISD Sioux Falls, S.Dak. 250
WHBT Harriman, Tenn. 250
WMMT McMinnville, Tenn. 250
KSIX Corpus Christi, Tex. 250
KDLK Del Rio, Tex. 250
KNUZ Houston, Tex. 250
KERV Kerrville, Tex. 250
KLVT Levelland, Tex. 250
KOSF Nacogdoches, Tex. 250
KOSA Odessa, Tex. 250
KPAT Pampa, Tex. 250
KSEY Seymour, Tex. 250
KCMC Texarkana, Tex. 250
KSST Sulphur Sprgs., Tex. 250
KWTX Waco, Tex. 250
KMUR Murray, Utah 250
KOAL Price, Utah 250
WJOY Burlington, Vt. 250
WBBI Abingdon, Va. 250
WFVA Fredericksburg, Va. 250
WNOR Norfolk, Va. 250
WIVI Christiansted, V.I. 250
KQTY Everett, Wash. 250
KREW Sunnyside, Wash. 250
WLOG Logan, W.Va. 250
WAJR Morgantown, W.Va. 250
WCOM Parkersburg, W.Va. 250
WHBY Appleton, Wis. 250
WCLD Janesville, Wis. 250
WHVF Wausau, Wis. 250
KVOC Casper, Wyo. 250

1240—241.8

CFPR Prince Rupert, B.C. 250
CJAV Port Alberni, B.C. 250
CJCS Stratford, Ont. 250
CJRW Summerside, P.E.I. 250
CKLN Nelson, B.C. 250
CKLS LaSarre, Que. 250
CKTS Sherbrooke, Que. 250
WEBJ Brewton, Ala. 250
WULA Eufaula, Ala. 250
WOWL Florence, Ala. 250
WCOV Montgomery, Ala. 250
KWJB So. of Globe, Ariz. 250
KOFA Yuma, Ariz. 250
KVRC Arkadelphia, Ark. 250
KAGH Crossett, Ark. 250
KHOZ Harrison, Ark. 250
KWAK Stuttgart, Ark. 250
KRDU Dinuba, Calif. 250
KMBY Monterey, Calif. 250
KPPC Pasadena, Calif. 100
KRKS Ridgecrest, Calif. 250
KROY Sacramento, Calif. 250
KRNO San Bernardino, Calif. 250
KSON San Diego, Calif. 250
KSUE Susanville, Calif. 250
KRDO Colo. Sprgs., Colo. 250
KCRT Trinidad, Colo. 250
WWCO Waterbury, Conn. 250
WBGO Chipley, Fla. 250
WMMB Melbourne, Fla. 250
WLCO Eustis, Fla. 250
WINK Fort Myers, Fla. 250
WFOY St. Augustine, Fla. 250
WBHB Fitzgerald, Ga. 250
WDUN Gainesville, Ga. 250
WLAG LaGrange, Ga. 250
WBML Macon, Ga. 250
WWNS Statesboro, Ga. 250
WPAX Thomasville, Ga. 250
WTWA Thomson, Ga. 250
KVNI Coeur d'Alene, Idaho 250
KEYY Pocatello, Idaho 250
KWEI Weiser, Idaho 250
WCRW Chicago, Ill. 100
WEDC Chicago, Ill. 250
WSBC Chicago, Ill. 250
WEBQ Harrisburg, Ill. 250
WTAX Springfield, Ill. 250
WSDR Sterling, Ill. 250
WHBU Anderson, Ind. 250
KDEC Decorah, Iowa 250
KWLC Decorah, Iowa 250
KBIZ Ottumwa, Iowa 250
KICD Spencer, Iowa 250
KIUL Garden City, Kans. 250
KAKE Wichita, Kans. 250
WINN Louisville, Ky. 250
WFTM Maysville, Ky. 250
WPKE Pikeville, Ky. 250
WSFC Somerset, Ky. 250
KAPK Minden, La. 100
KANE New Iberia, La. 250
WCOU Lewiston, Maine 250

Kc. Wave Length W.P.

WCEM Cambridge, Md. 250
WJEJ Hagerstown, Md. 250
WHAI Greenfield, Mass. 250
WOCB W. Yarmouth, Mass. 250
WATT Cadillac, Mich. 250
WCBY Cheboygan, Mich. 250
WJPD Ishpeming, Mich. 250
WJIM Lansing, Mich. 250
WMFG Hibbing, Minn. 250
WJON St. Cloud, Minn. 250
WMPA Aberdeen, Miss. 250
WGRM Greenwood, Miss. 250
WGCM Gulfport, Miss. 250
WMOX Meridian, Miss. 250
WMIS Natchez, Miss. 250
KFMO Flat River, Mo. 250
KWOS Jefferson City, Mo. 250
KNEM Nevada, Mo. 250
KBMY Billings, Mont. 250
KLTZ Glasgow, Mont. 250
KXLJ Helena, Mont. 250
KFOR Lincoln, Nebr. 250
KODY North Platte, Nebr. 250
KELK Elko, Nev. 250
WKBR Manchester, N.H. 250
WSNJ Bridgeton, N.J. 250
KAVE Carlsbad, N.Mex. 250
KCLV Clovis, N.Mex. 250
KVBC Farmington, N.Mex. 250
WGBB Freeport, N.Y. 250
WGVA Geneva, N.Y. 250
WJTN Jamestown, N.Y. 250
WVOS Liberty, N.Y. 250
WNBZ Saranac Lake, N.Y. 250
WSNY Schenectady, N.Y. 250
WATN Watertown, N.Y. 250
WPNF Brevard, N.C. 250
WSOC Charlotte, N.C. 250
WCNC Elizabeth City, N.C. 250
WJNC Jacksonville, N.C. 250
WRAL Raleigh, N.C. 250
KDLR Devils Lake, N.Dak. 250
WBBW Youngstown, Ohio 250
WHIZ Zanesville, Ohio 250
KVSO Ardmore, Okla. 250
KASA Elk City, Okla. 250
KBEL Idabel, Okla. 250
KHBG Okmulgee, Okla. 250
KFLX Corvallis, Oreg. 1000
KWRC Pendleton, Oreg. 250
KTIL Tillamook, Oreg. 250
KJUN Redmond, Oreg. 250
KSGA Redmond, Oreg. 250
KRXL Roseburg, Oreg. 250
WRTA Altoona, Pa. 250
WHUM Reading, Pa. 250
WKOK Sunbury, Pa. 250
WBAX Wilkes-Barre, Pa. 250
WWON Woonsocket, R.I. 250
WKDK Newberry, S.C. 250
WBEJ Elizabethton, Tenn. 250
WEKR Fayetteville, Tenn. 250
WBIR Knoxville, Tenn. 250
WKDA Nashville, Tenn. 250
WENK Union City, Tenn. 250
KVLF Alpine, Tex. 250
KEAN Brownwood, Tex. 100
KORA Bryan, Tex. 250
KOCA Kilgore, Tex. 250
KVOZ Laredo, Tex. 250
KXOX Sweetwater, Tex. 250
WSKI Montpelier, Vt. 250
WSSV Petersburg, Va. 250
WROV Roanoke, Va. 250
WTON Staunton, Va. 250
KXLE Ellensburgh, Wash. 250
KGY Olympia, Wash. 250
WKOY Bluefield, W.Va. 250
WTIP Charleston, W.Va. 250
WDNE Elkins, W.Va. 250
WOMT Manitowoc, Wis. 250
WIBU Poynette, Wis. 250
WOBT Rhinelander, Wis. 250
WJMC Rice Lake, Wis. 250
KFBC Cheyenne, Wyo. 10000
KLUK Evanston, Wyo. 250
KASL Newcastle, Wyo. 250
KRAL Rawlins, Wyo. 250
KTHE Thermopolis, Wyo. 250

1250—239.9

CHWO Oakville, Ont. 1000
CKBL Matane, Que. 5000
CKSB St. Boniface, Man. 1000
WZOB Ft. Payne, Ala. 1000
KGHI Little Rock, Ark. 500
KTMS Santa Barbara, Calif. 1000
KGDL Golden, Colo. 1000
WNER Live Oak, Fla. 1000
WDAE Tampa, Fla. 5000
WMGE Madison, Ga. 1000
WIZZ Streator, Ill. 500
WGL Ft. Wayne, Ind. 1000
WRAY Princeton, Ind. 1000
KFKU Lawrence, Kans. 1000
WREN Topeka, Kans. 5000
WARE Ware, Mass. 1000
WWBC Bay City, Mich. 1000
KGDE Fergus Falls, Minn. 1000
KCUE Red Wing, Minn. 1000
WHNY McComb, Miss. 250
WSKB McComb, Miss. 250
WMTR Morristown, N.J. 1000
WIPS Ticonderoga, N.Y. 500
WBRM Marion, N.C. 1000
WCHO Washington Court House, Ohio 500

Kc.	Wave Length	W.P.
WPEL	Montrose, Pa.	1000
WCAE	Pittsburgh, Pa.	5000
WNOW	York, Pa.	1000
WTMA	Charleston, S.C.	5000
WKBL	Covington, Tenn.	1000
KFTX	Paris, Tex.	500
KPAC	Port Arthur, Tex.	5000
KEXX	San Antonio, Tex.	500
KSML	Seminole, Tex.	1000
WDVA	Danville, Va.	5000
WYSR	Franklin, Va.	1000
WNRG	Grundy, Va.	1000
KWSC	Pullman, Wash.	5000
KTW	Seattle, Wash.	1000
WEMP	Milwaukee, Wis.	5000

1260—238.0

CFRN	Edmonton, Alta.	5000
DYBU	Cebu, P.I.	1000
WCRT	Birmingham, Ala.	1000
KPIN	Casa Grande, Ariz.	1000
KGIL	San Fernando, Calif.	1000
KYA	San Francisco, Calif.	1000
KUBC	Montrose, Colo.	1000
WWDC	Washington, D.C.	5000
WFTW	Fort Walton, Fla.	1000
WWPF	Palatka, Fla.	1000
WHAB	Baxley, Ga.	5000
WTJH	East Point, Ga.	5000
WIBV	Belleville, Ill.	1000
WFBM	Indianapolis, Ind.	5000
KFGQ	Boone, Iowa	250
KWHK	Hutchinson, Kans.	1000
WXOK	Baton Rouge, La.	1000
WVDA	Boston, Mass.	5000
WALM	Albion, Mich.	1000
KROX	Crookston, Minn.	1000
KDUZ	Hutchinson, Minn.	1000
WGVM	Greenville, Miss.	1000
KGBX	Springfield, Mo.	5000
WBUD	Trenton, N.J.	5000
KVSF	Santa Fe, N.Mex.	1000
WNDR	Syracuse, N.Y.	5000
WGWR	Asheboro, N.C.	1000
WCDJ	Edenton, N.C.	1000
WDOK	Cleveland, Ohio	5000
WNXT	Portsmouth, Ohio	5000
KWSH	Wewoka-Seminole, Oklahoma	1000
KMCM	McMinnville, Oreg.	1000
WERC	Erie, Pa.	5000
WPHB	Philipsburg, Pa.	1000
WISO	Ponce, P.R.	1000
WMUU	Greenville, S.C.	1000
WJOT	Lake City, S.C.	1000
WMFS	Chattanooga, Tenn.	1000
WMCH	Church Hill, Tenn.	1000
WDKN	Dickson, Tenn.	1000
KBLP	Falfurrias, Tex.	500
KWFR	San Angelo, Tex.	1000
KTUE	Tulia, Tex.	1000
KTAE	Taylor, Tex.	1000
WCHV	Charlottesville, Va.	5000
WBCR	Christiansburg, Va.	1000
KWIQ	Moses Lake, Wash.	1000
WVVW	Grafton, W.Va.	500
WEKZ	Monroe, Wis.	1000
WOKW	Sturgeon Bay, Wis.	1000
KPOW	Powell, Wyo.	5000

1270—236.1

CHAT	Medicine Hat, Alta.	1000
CHWK	Chilliwack, B.C.	1000
CJCB	Sydney, N.S.	5000
CFGT	St. Joseph d'Alma, Quebec	1000
WGSV	Guntersville, Ala	1000
WPNX	Phenix City, Ala.	1000
WAIP	Prichard, Ala.	1000
KBYR	Anchorage, Alaska	1000
KDJI	Holbrook, Ariz.	1000
KCOK	Tulare, Calif.	1000
WNOG	Naples, Fla.	500
WTAL	Tallahassee, Fla.	5000
WGBA	Columbus, Ga.	5000
KTFI	Twin Falls, Idaho	5000
WKYR	Keyser, W.Va.	1000
WEIC	Charleston, Ill.	1000
WHBF	Rock Island, Ill.	50000
WWCA	Gary, Ind.	1000
WORX	Madison, Ind.	1000
KSCB	Liberal, Kans.	1000
WAIN	Columbia, Ky.	1000
WFUL	Fulton, Ky.	1000
WPRT	Prestonsburg, Ky.	5000
KVCL	Winnfield, La.	1000
WSPR	Springfield, Mass.	1000
WXYZ	Detroit, Mich.	5000
WLSN	Louisville, Miss.	1000
KUSN	St. Joseph, Mo.	1000
WTSN	Dover, N.H.	5000
WHLD	Niagara Falls, N.Y.	5000
WDLA	Walton, N.Y.	1000
WCGC	Belmont, N.C.	500
WMPM	Smithfield, N.C.	1000
WTSN	Dover, N.H.	5000
WILE	Cambridge, Ohio	1000
WLBR	Lebanon, Pa.	1000
KBOM	Mandan, N.Dak.	1000
KIHO	Sioux Falls, S.Dak.	1000
WLIK	Newport, Tenn.	5000
KIOX	Bay City, Tex.	1000
WHEM	Big Spring, Tex.	1000
KEPS	Eagle Pass, Tex.	1000
KFJZ	Fort Worth, Tex.	5000
WYUO	Newport, News, Va.	1000
KZUN	Opportunity, Wash.	1000
WKYR	Keyser, W.Va.	5000

1280—234.2

CHED	Edmonton, Alta.	10000
CJMS	Montreal, Que.	5000
CKCV	Quebec, Que.	1000
CKDA	Victoria, B.C.	5000
WPID	Piedmont, Ala.	1000
WNPT	Tuscaloosa, Ala.	1000
KHEP	Phoenix, Ariz.	1000
KFOX	Long Beach, Calif.	1000
KJOY	Stockton, Calif.	1000
KXOB	Stockton, Calif.	1000
KTLN	Denver, Colo.	5000
KSFT	Trinidad, Colo.	1000
WSUX	Seaford, Del.	1000
WDSP	DeFuniak Sprgs., Fla.	5000
WQIK	Jacksonville, Fla.	1000
WIPC	Lake Wales, Fla.	1000
WIBB	Macon, Ga.	1000
WMRO	Aurora, Ill.	250
WGBF	Evansville, Ind.	5000
KCOB	Newton, Iowa	1000
KSOK	Arkansas City, Kans.	1000
WHLN	Harlan, Ky.	1000
WDSU	New Orleans, La.	5000
WEIM	Fitchburg, Mass.	5000
WFYC	Alma, Mich.	1000
WTCN	Minneapolis, Minn.	1000
KVOX	Moorhead, Minn.	1000
KDKD	Clinton, Mo.	1000
KCNI	Broken Bow, Nebr.	1000
KTOO	Henderson, Nev.	5000
WHBI	Newark, N.J.	1000
WOV	New York, N.Y.	5000
WVET	Rochester, N.Y.	5000
WSAT	Salisbury, N.C.	1000
WONW	Defiance, Ohio	500
WLMJ	Jackson, Ohio	1000
KLCO	Poteau, Okla.	1000
KERG	Eugene, Oreg.	5000
WBRX	Berwick, Pa.	500
WHVR	Hanover, Pa.	5000
WKST	New Castle, Pa.	5000
WCMN	Arecibo, P.R.	1000
WANS	Anderson, S.C.	1000
WJAY	Mullins, S.C.	1000
WJGD	Columbia, Tenn.	1000
KWHI	Brenham, Tex.	1000
KLTI	Longview, Tex.	1000
KNAK	Salt Lake City, Utah	5000
WYVE	Wytheville, Va.	1000
KIT	Yakima, Wash.	5000
WNAM	Neenah, Wis.	1000

1290—232.4

CFAM	Altoona, Man.	1000
CKSL	London, Ont.	5000
WPBB	Jackson, Ala.	1000
WMLS	Sylacauga, Ala.	1000
KVOA	Tucson, Ariz.	1000
KDMS	El Dorado, Ark.	5000
KUOA	Siloam Sprgs., Ark.	5000
KHSL	Chico, Calif.	5000
KITO	San Bernardino, Calif.	5000
WCCC	Hartford, Conn.	500
WTUX	Wilmington, Del.	1000
WTMC	Ocala, Fla.	5000
WIRK	W. Palm Bch., Fla.	5000
WDEC	Americus, Ga.	1000
WCHK	Canton, Ga.	1000
WTOC	Savannah, Ga.	5000
KYTE	Pocatello, Idaho	1000
WIRL	Peoria, Ill.	5000
WCBL	Benton, Ky.	1000
KJEF	Jennings, La.	500
WHGR	Houghton Lake, Michigan	1000
WNIL	Niles, Mich.	500
KBMO	Benson, Minn.	500
WBLE	Batesville, Miss.	1000
KALM	Thayer, Mo.	1000
KGVO	Missoula, Mont.	5000
KOIL	Omaha, Nebr.	5000
WKNE	Keene, N.H.	5000
WNBF	Binghamton, N.Y.	5000
WHKY	Hickory, N.C.	5000
WEYE	Sanford, N.C.	1000
WTRX	Bellaire, Ohio	1000
WHIO	Dayton, Ohio	5000
KUMA	Pendleton, Oreg.	5000
KBKO	Portland, Oreg.	1000
WTRN	Tyrone, Pa.	500
WICE	Providence, R.I.	500
WFIG	Sumter, S.C.	1000
WOKE	Oak Ridge, Tenn.	1000
KIVY	Crockett, Tex.	500
KRGV	Weslaco, Tex.	5000
KTRN	Wichita Falls, Tex.	5000
WCLA	Colonial Hgts., Va.	1000
WVOW	Logan, W.Va.	5000
WMIL	Milwaukee, Wis.	1000
WCOW	Sparta, Wis.	1000

1300—230.6

CBAF	Moncton, N.B.	5000
CJRH	Richmond Hill, Ont.	500
WTLS	Tallassee, Ala.	1000
KROP	Brawley, Calif.	500
KWKW	Pasadena, Calif.	1000
KYNO	Fresno, Calif.	1000
KVOR	Colo. Sprgs., Colo.	1000
WAVZ	New Haven, Conn.	1000
WWTB	Tampa, Fla.	1000
WMTM	Moultrie, Ga.	5000
WIMO	Winder, Ga.	1000
KLER	Lewiston, Idaho	5000
WTAQ	LaGrange, Ill.	500
WFRX	W. Frankfort, Ill.	1000
KGLO	Mason City, Iowa	5000
WLEX	Lexington, Ky.	1000
WIBR	Baton Rouge, La.	1000
KLUE	Shreveport, La.	1000
WFBR	Baltimore, Md.	5000
WJDA	Quincy, Mass.	1000
WOOD	Grand Rap., Mich.	5000
WRBC	Jackson, Miss.	5000
KMMO	Marshall, Mo.	1000
KBRL	McCook, Nebr.	1000
WTNJ	Trenton, N.J.	250
WOSC	Fulton, N.Y.	1000
WGOL	Goldsboro, N.C.	1000
WSYD	Mt. Airy, N.C.	5000
WERE	Cleveland, Ohio	5000
WMVO	Mt. Vernon, Ohio	500
KOME	Tulsa, Okla.	5000
KRMW	The Dalles, Oreg.	1000
WTIL	Mayaguez, Puerto Rico	1000
KOLY	Mobridge, S.Dak.	1000
WCKI	Greer, S.C.	1000
WMAK	Nashville, Tenn.	5000
KVET	Austin, Tex.	1000
KTFY	Brownfield, Tex.	1000
KOL	Seattle, Wash.	5000
WCAW	Charleston, W.Va.	1000
WGKV	Charleston, W.Va.	1000
WCLG	Morgantown, W.Va.	1000
WKLC	St. Albans, W.Va.	1000

1310—228.9

CKOY	Ottawa, Ont.	5000
WHEP	Foley, Ala.	1000
WJAM	Marion, Ala.	5000
KTYL	Mesa, Ariz.	5000
KBOK	Malvern, Ark.	1000
KWBR	Oakland, Calif.	5000
KTKR	Taft, Calif.	500
KFKA	Greeley, Colo.	1000
WICH	Norwich, Conn.	1000
WOOO	Deland, Fla.	1000
WBRO	Waynesboro, Ga.	1000
WISH	Indianapolis, Ind.	5000
WJAM	Marion, Ala.	5000
KOKX	Keokuk, Iowa	1000
WLIX	Twin Falls, Idaho	5000
WTTL	Madisonville, Ky.	500
KIKS	Sulphur, La.	500
KUZN	W. Monroe, La.	1000
WLOB	Portland, Maine	1000
KRBI	St. Peter, Minn.	1000
WORC	Worcester, Mass.	1000
WKMH	Dearborn, Mich.	5000
KFSB	Joplin, Mo.	5000
KFBB	Great Falls, Mont.	5000
WJLK	Asbury Park, N.J.	250
WCAM	Camden, N.J.	250
WTLB	Utica, N.Y.	1000
WISE	Asheville, N.C.	5000
WTIK	Durham, N.C.	1000
KNOX	Grand Forks, N.Dak.	5000
WFAH	Alliance, Ohio	1000
KNPT	Newport, Oreg.	1000
WBFD	Bedford, Pa.	1000
WSGA	Ephrata, Pa.	1000
WNAE	Warren, Pa.	1000
WDKD	Kingstree, S.C.	5000
WDOD	Chattanooga, Tenn.	5000
WDXI	Jackson, Tenn.	1000
KZIP	Amarillo, Tex.	1000
WRR	Dallas, Tex.	5000
WFCR	Fairfax, Va.	1000
WGH	Newport News, Va.	5000
KARY	Prosser, Wash.	1000
WIBA	Madison, Wis.	5000

1320—227.1

CKNW	New Westminster, British Columbia	5000
CJSO	Sorel, P.Q.	1000
WAGF	Dothan, Ala.	1000
WEZB	Homewood, Ala.	1000
KWHN	Fort Smith, Ark.	5000
KRLW	Walnut Ridge, Ark.	1000
KCRA	Sacramento, Calif.	5000
KRFC	Rocky Ford, Colo.	1000
WATR	Waterbury, Conn.	1000
WJHP	Jacksonville, Fla.	5000
WHIE	Griffin, Ga.	1000
WNEG	Toccoa, Ga.	1000
WKAN	Kankakee, Ill.	1000
KLWN	Lawrence, Kans.	500
WBRT	Bardstown, Ky.	1000
WNGO	Mayfield, Ky.	1000
KVHL	Homer, La.	1000
WICO	Salisbury, Md.	500
WARA	Attleboro, Mass.	1000
WILS	Lansing, Mich.	5000
WDMJ	Marquette, Mich.	1000
WCPC	Houston, Miss.	1000
WRJW	Picayune, Miss.	5000
KXLW	Clayton, Mo.	1000
KOLT	Scottsbluff, Nebr.	1000
WWHG	Hornell, N.Y.	1000
WCOG	Greensboro, N.C.	1000
WHOK	Lancaster, Ohio	500
KWOE	Clinton, Okla.	1000
WKAP	Allentown, Pa.	1000
WJAS	Pittsburgh, Pa.	5000
WSCR	Scranton, Pa.	1000
WRIO	Rio Piedras, P.R.	500
WMSC	Columbia, S.C.	1000
KELO	Sioux Falls, S.Dak.	5000
WKIN	Kingsport, Tenn.	5000
KVNC	Colo. City, Tex.	1000
KSIJ	Gladewater, Tex.	1000
KXYZ	Houston, Tex.	5000
KDYL	Salt Lake City, Utah	5000
WLLY	Richmond, Va.	1000
KXRO	Aberdeen, Wash.	1000
KHIT	Walla Walla, Wash.	1000

1330—225.4

CBH	Halifax, N.S.	100
WROS	Scottsboro, Ala.	1000
KFAC	Los Angeles, Calif.	5000
WARN	Ft. Pierce, Fla.	1000
WEBY	Milton, Fla.	1000
WMEN	Tallahassee, Fla.	5000
WMLT	Dublin, Ga.	1000
WEAW	Evanston, Ill.	1000
WRRR	Rockford, Ill.	1000
WJPS	Evansville, Ind.	5000
KWWL	Waterloo, Iowa	5000
KFH	Wichita, Kans.	5000
WMOR	Morehead, Ky.	1000
KVOL	Lafayette, La.	1000
WASA	Havre deGrace, Md.	1000
WCRB	Waltham, Mass.	5000
WBBC	Flint, Mich.	1000
WLOL	Minneapolis, Minn.	5000
WJPR	Greenville, Miss.	1000
KGAK	Gallup, N.Mex.	5000
WPOW	Brooklyn, N.Y.	5000
WEVD	New York, N.Y.	5000
WHAZ	Troy, N.Y.	1000
WFIN	Findlay, Ohio	1000
KPOJ	Portland, Oreg.	5000
WIKK	Erie, Pa.	5000
WLAT	Conway, S.C.	1000
WFBC	Greenville, S.C.	5000
WAEW	Crossville, Tenn.	1000
WTRO	Dyersburg, Tenn	500
KMIL	Cameron, Tex.	500
KSWA	Graham, Tex.	500
KINE	Kingsville, Tex.	1000
KDOK	Tyler, Tex.	500
WBTM	Danville, Va.	5000
WETZ	New Martinsville, West Virginia	1000
WHBL	Sheboygan, Wis.	250
KOVE	Lander, Wyo.	1000

1340—223.7

CFSL	Weyburn, Sask.	250
CHAD	Amos, Que.	250
CJLS	Yarmouth, N.S.	250
CHRD	Drummondville, Que.	250
CJQC	Quebec, Que.	250
CJOB	Winnipeg, Man.	250
CKOX	Woodstock, Ont.	250
WKUL	Cullman, Ala.	250
WJOI	Florence, Ala.	250
WGWC	Selma, Ala.	250
WFEB	Sylacauga, Ala.	250
KIBH	Seward, Alaska	250
KRUX	Glendale, Ariz.	250
KNOG	Nogales, Ariz.	250
KBTA	Batesville, Ark.	250
KAGH	Crossett, Ark.	250
KBRS	Springdale, Ark.	250
KENL	Arcata, Calif.	250
KMAK	Fresno, Calif.	250
KAVL	Lancaster, Calif.	250
KWSD	Mt. Shasta, Calif.	250
KSFE	Needles, Calif.	250
KMOR	Oroville, Calif.	250
KDAN	Oroville, Calif.	250
KCMJ	Palm Sprgs., Calif.	250
KATY	San Luis Obispo, Calif.	250
KIST	Santa Barbara, Calif.	250
KSMA	Santa Maria, Calif.	250
KHUB	Nr. Watsonville, Calif.	250
KDEN	Denver, Colo.	250
KVRH	Salida, Colo.	250
WNHC	New Haven, Conn.	250
WOOK	Washington, D.C.	250
WTAN	Clearwater, Fla.	250
WROD	Daytona Bch., Fla.	250
WDSR	Lake City, Fla.	250
WTYS	Marianna, Fla.	250
WQXT	Palm Beach, Fla.	250
WJCM	Sebring, Fla.	250
WGAU	Athens, Ga.	250
WAKE	Atlanta, Ga.	250
WBBQ	Augusta, Ga.	250
WGAA	Cedartown, Ga.	250
WDAK	Columbus, Ga.	250
WWGS	Tifton, Ga.	250
KPST	Preston, Idaho	250
WSOY	Decatur, Ill.	250
WJPF	Herrin, Ill.	250
WJOL	Joliet, Ill.	250
WBIW	Bedford, Ind.	250
WTRC	Elkhart, Ind.	250
WLBC	Muncie, Ind.	250
KROS	Clinton, Iowa	250
KLIL	Estherville, Iowa	250
KCKN	Kansas City, Kans.	250
KSEK	Pittsburg, Kans.	250
WCMI	Ashland, Ky.	250
WNBS	Murray, Ky.	250
WEKY	Richmond, Ky.	250

Kc. Wave Length W.P.

(1340—223.7)

KRMD Shreveport, La. 250
WFAU Augusta, Maine 250
WABM Houlton, Maine 250
WGAW Gardner, Mass. 250
WNBH New Bedford, Mass. 250
WBRK Pittsfield, Mass. 250
WLEX Bad Axe, Mich. 250
WLAV Grand Rap., Mich. 250
WBSE Hillsdale, Mich. 100
WAGN Menominee, Mich. 250
WMBN Petoskey, Mich. 250
WEXL Royal Oak, Mich. 250
KDLM Detroit Lakes, Minn. 250
WEVE Eveleth, Minn. 250
KROC Rochester, Minn. 250
KWLM Willmar, Minn. 250
WJMB Brookhaven, Miss. 250
WAML Laurel, Miss. 250
KXEO Mexico, Mo. 250
KSMO Salem, Mo. 1340
KICK Springfield, Mo. 250
KCAP Helena, Mont. 250
KPRK Livingston, Mont. 250
KATL Miles City, Mont. 250
KRJF Miles City, Mont. 250
KBTK Missoula, Mont. 250
KFGT Fremont, Nebr. 100
KGFW Kearney, Nebr. 250
KSID Sidney, Nebr. 250
KORK Las Vegas, Nev. 250
KATO Reno, Nev. 250
WMID Atlantic City, N.J. 250
KVER Albuquerque, N.Mex. 250
KSIL Silver City, N.Mex. 250
WMBO Auburn, N.Y. 250
WENT Gloversville, N.Y. 250
WJOC Jamestown, N.Y. 250
WUSJ Lockport, N.Y. 250
WMSA Massena, N.Y. 250
WALL Middletown, N.Y. 250
WIRY Plattsburg, N.Y. 250
WTSB Lumberton, N.C. 250
WOXF Oxford, N.C. 250
WHED Washington, N.C. 250
WGNI Wilmington, N.C. 250
WAIR Winston-Salem, N.C. 250
WATG Ashland, Ohio 250
WOUB Athens, Ohio 100
WIZE Springfield, Ohio 250
WSTV Steubenville, Ohio 250
KIHN Hugo, Okla. 250
KOCY Okla. City, Okla. 250
KLOO Corvallis, Ore. 250
KUIN Grants Pass, Oreg. 250
KIHR Hood River, Oreg. 250
KFIR North Bend, Oreg. 250
WFBG Altoona, Pa. 250
WCVI Connellsville, Pa. 250
WEMR Emporium, Pa. 100
WSAJ Grove City, Pa. 100
WKRZ Oil City, Pa. 250
WHAT Philadelphia, Pa. 250
WRAW Reading, Pa. 250
WBRE Wilkes-Barre, Pa. 250
WWPA Williamsport, Pa. 250
WGRF Aguadilla, P.R. 250
WHAN Charleston, S.C. 250
WRHI Rock Hill, S.C. 250
WSSC Sumter, S.C. 250
KIJV Huron, S.D. 250
KRSD Rapid City, S.Dak. 250
WBAC Cleveland, Tenn. 250
WKRM Columbia, Tenn. 250
WGRV Greenville, Tenn. 250
WKGN Knoxville, Tenn. 250
WHHM Memphis, Tenn. 250
WCDT Winchester, Tenn. 250
KAND Corsicana, Tex. 250
KWKC Abilene, Tex. 250
KSET El Paso, Tex. 250
KNAF Fredericksburg, Tex. 250
KDUB Lubbock, Tex. 250
KRBA Lufkin, Tex. 250
KVKM Monahans, Tex. 250
KPDN Pampa, Tex. 250
KOLE Port Arthur, Tex. 250
KTXL San Angelo, Tex. 250
KVIC N. of Victoria, Tex. 250
KJAM Vernal, Utah 250
WTWN St. Johnsbury, Vt. 250
WSTA Charlotte Amalie, V.I. 250
WKEY Covington, Va. 250
WHAP Hopewell, Va. 250
WJMA Orange, Va. 250
KAGT Anacortes, Wash. 250
KPKW Pasco, Wash. 250
KAPA Raymond, Wash. 250
KSPO Spokane, Wash. 250
KMEL Wenatchee, Wash. 250
WHAR Clarksburg, W.Va. 250
WEPM Martinsburg, W.Va. 250
WMCD Welch, W.Va. 250
WLDY Ladysmith, Wis. 250
WRIT Milwaukee, Wis. 250
WFHR Wis. Rapids, Wis. 250
KOWB Laramie, Wyo. 250
KWOR Worland, Wyo. 250

1350—222.1

CHOV Pembroke, Ont. 1000
CJDC Dawson Creek, B.C. 1000
CHGB St. Anne de la Pocatiere, Que. 1000
CKLB Oshawa, Ont. 5000
CKEN Kentville, N.S. 1000
CKTR Three Rivers, Que. 1350
WGAD Gadsden, Ala. 5000
KWFC Hot Springs, Ark. 1000
KCSB San Bernardino, Calif. 500
KSRO Santa Rosa, Calif. 1000
KGHF Pueblo, Colo. 5000
WNLK Norwalk, Conn. 500
WPCT Putnam, Conn. 1000
WDCF Dade City, Fla. 1000
WRPB Warner Robbins, Ga. 1000
KORT Grangeville, Idaho 250
KRLC Lewiston, Idaho 5000
WEEK Peoria, Ill. 1000
WJBD Salem, Ill. 500
WIOU Kokomo, Ind. 1000
KRNT Des Moines, Iowa 5000
KMAN Manhattan, Kans. 500
WLOU Louisville, Ky. 1000
WSMB New Orleans, La. 5000
WHMI Howell, Mich. 500
WKOZ Kosciusko, Miss. 5000
KCHR Charleston, Mo. 1000
WLNH Laconia, N.H. 5000
WCBA Corning, N.Y. 1000
WHIP Mooresville, N.C. 1000
WADC Akron, Ohio 5000
WCHI Chillicothe, Ohio 500
KRHD Duncan, Okla. 250
KTLQ Tahlequah, Okla. 500
WORK York, Pa. 5000
WPFD Darlington, S.C. 500
WGSW Greenwood, S.C. 1000
KTXJ Jasper, Tex. 1000
KCOR San Antonio, Tex. 5000
WBLT Bedford, Va. 1000
WNVA Norton, Va. 5000
WSAP Portsmouth, Va. 5000
WPDR Portage, Wis. 1000

1360—220.4

WWWB Jasper, Ala. 1000
WMFC Monroeville, Ala. 1000
WELR Roanoke, Ala. 1000
KFFA Helena, Ark. 1000
KFIV Modesto, Calif. 1000
KRCK Ridgecrest, Calif. 1000
KGB San Diego, Calif. 1000
WDRC Hartford, Conn. 5000
WOBS Jacksonville, Fla. 5000
WKAT Miami Beach, Fla. 5000
WIOD Sanford, Fla. 500
WLBK DeKalb, Ill. 500
WVMC Mt. Carmel, Ill. 500
KXGI Ft. Madison, Iowa 1000
KSCJ Sioux City, Iowa 5000
KBTO El Dorado, Kans. 500
KDBC Mansfield, La. 1000
KVIM New Iberia, La. 1000
KTLD Tullulah, Iowa 500
WLYN Lynn, Mass. 1000
WGFG Kalamazoo, Mich. 1000
WKMI Kalamazoo, Mich. 5000
KLRS Mountain Grove, Mo. 1000
WNNJ Newton, N.J. 500
WWBZ Vineland, N.J. 1000
WKOP Binghamton, N.Y. 5000
WMNS Olean, N.Y. 1000
WCHL Chapel Hill, N.C. 1000
WSAI Cincinnati, Ohio 5000
KRTV Hillsboro, Oreg. 1000
KUIK Hillsboro, Oreg. 1000
WMCK McKeesport, Pa. 1000
WPPA Pottsville, Pa. 500
WELP Easley, S.C. 1000
WLCM Lancaster, S.C. 1000
WNAH Nashville, Tenn. 1000
KRAY Amarillo, Tex. 500
KACT Andrews, Tex. 500
KRIS Corpus Christi, Tex. 1000
KREL Baytown, Tex. 1000
KXOL Ft. Worth, Tex. 5000
WBOB Galax, Va. 1000
WHBG Harrisonburg, Va. 5000
KMO Tacoma, Wash. 5000
WHJC Matawan, W.Va. 1000
WBAY Green Bay, Wis. 5000
WMNE Menomonie, Wis. 1000
KVRS Rock Sprgs., Wyo. 1000

1370—218.8

KBUC Corona, Calif. 1000
KEEN San Jose, Calif. 5000
KGEN Tulare, Calif. 1000
WCOA Pensacola, Fla. 5000
WNTM Vero Beach, Fla. 1000
WBGR Jesup, Ga. 1000
WKLE Washington, Ga. 1000
WPRC Lincoln, Ill. 500
WTTS Bloomington, Ind. 5000
WGRY Gary, Ind. 500
KDTH Dubuque, Iowa 1000
KGNO Dodge City, Kans. 5000
KAPB Marksville, La. 1000
WEBB Dundalk, Md. 1000
WKIK Leonardtown, Md. 1000
WGHN Gr'd Haven, Mich. 500
KSUM Fairmont, Minn. 1000
KDIO Ortonville, Minn. 1000
WDOB Canton, Miss. 1000
KWRT Boonville, Mo. 1000
KCRV Caruthersville, Mo. 1000
KXLF Butte, Mont. 5000
KAWL York, Nebr. 500
WFEA Manchester, N.H. 5000
WALK Patchogue, N.Y. 500
WSAY Rochester, N.Y. 5000
WLTC Gastonia, N.C 1000
WTAB Tabor City, N.C. 5000
KAST Astoria Oreg. 1000
WSPD Toledo, Ohio 5000
WOTR Corry, Pa. 500
WPAZ Pottstown, Pa. 1000
WKMC Roaring Sprgs., Pa. 1000
WIVV Vieques, P.R. 1000
WDEF Chattanooga, Tenn. 5000
WDXE Lawrenceburg, Tenn. 1000
WRGS Rogersville, Tenn. 1000
KTXN Austin, Tex. 1000
KFRO Longview, Tex. 1000
KRWS Post, Tex. 500
KSOP Salt Lake City, Utah 1000
WBTN Bennington, Vt. 500
WHEE Martinsville, Va. 1000
WJWS South Hill, Va. 1000
WMOD Moundsville, W.Va. 1000
KVWO Cheyenne, Wyo. 1000

1380—217.3

CFDA Victoriaville, Que. 1000
CKPC Brantford, Ont. 1000
CKLC Kingston, Ont. 1000
KBVM Lancaster, Calif. 1000
KGRO Malvern, Ark. 1000
KNLR N. Little Rock, Ark 1000
KGMS Sacramento, Calif. 1000
KSBW Salinas, Calif. 1000
WAMS Wilmington, Del. 1000
WTSP St. Petersburg, Fla. 5000
WAOK Atlanta, Ga. 5000
WGYV Greenville, Ala. 1000
WKJG Ft. Wayne, Ind. 5000
KCIM Carroll, Iowa 250
WMTA Central City, Ky. 500
WWKY Winchester, Ky. 1000
WEND Baton Rouge, La. 500
WTTH Port Huron, Mich. 1000
KLIZ Brainerd, Minn. 1000
WNLA Indianola, Miss. 1000
WTUP Tupelo, Miss. 1000
KUDL Kansas City, Mo. 1000
KWK St. Louis, Mo. 5000
KUVR Holdredge, Nebr. 500
WAWZ Zarephath, N.J. 5000
WBNX New York, N.Y. 5000
WLOS Asheville, N.C. 5000
WTOB Winston-Salem, N.C. 5000
WPKO Waverly, Ohio 1000
KSWO Lawton, Okla. 1000
KMUS Muskogee, Okla. 1000
KSRV Ontario, Oreg. 1000
WACB Kittanning, Pa. 1000
WAYZ Waynesboro, Pa. 1000
WNRI Woonsocket, R.I. 1000
WSYB Rutland, Vt. 5000
WAGS Bishopville, S.C. 1000
KOTA Rapid City, S.Dak. 5000
KHON Honolulu, T.H. 5000
KJET Beaumont, Tex. 1000
KBWD Brownwood, Tex. 500
KTSM El Paso, Tex. 500
KMUL Muleshoe, Tex. 500
KBOP Pleasanton, Tex. 1000
WMBG Richmond, Va. 5000
KRKO Everett, Wash. 1000
WBEL Beloit, Wis. 5000

1390—215.7

WSPC Anniston, Ala. 5000
KDQN DeQueen, Ark. 500
KAMO Rogers, Ark. 1000
KGER Long Beach, Calif. 5000
KTUR Turlock, Calif. 1000
KFML Denver, Colo. 1000
WJCD Seymour, Ind. 1000
WGES Chicago, Ill. 5000
WFIW Fairfield, Ill. 500
KCLN Clinton, Iowa 1000
KCBC Des Moines, Iowa 1000
KNCK Concordia, Kans. 500
KNOE Monroe, La. 10000
WCAT Orange, Mass. 1000
WCER Charlotte, Mich. 1000
KRFO Owatonna, Minn. 500
WPLM Plymouth, Mass. 1000
WDEB Gulfport, Miss. 1000
WEOK Poughkeepsie, N.Y. 1000
WRIV Riverhead, N.Y. 500
WFBL Syracuse, N.Y. 5000
WEED Rocky Mt., N. C. 5000
WFNC Fayetteville, N.C. 5000
KLPM Minot, N.Dak. 5000
WOHP Bellefontaine, Ohio 500
WFMJ Youngstown, Ohio 5000
KCRC Enid, Okla. 1000
KSLM Salem, Oreg. 1000
WLAN Lancaster, Pa. 1000
WHPB Belton, S.C. 500
WCSC Charleston, S.C. 5000
WTJS Jackson, Tenn. 1000
KULP El Campo, Tex. 500
KBEC Waxahachie, Tex. 500
WEAM Arlington, Va. 5000
WWOD Lynchburg, Va. 5000
KYAK Yakima, Wash. 1000

1400—214.2

CKBC Bathurst, N.B. 250
CJFP Riviere du Loup, Que. 250
CKCY Sault Ste. Marie, Ont. 250
CKFH Toronto, Ont. 250
CKRB Ville St. George, Que. 250
CKRN Rouyn, Que. 250
CKSW Swift Current, Sask. 250
WMSL Decatur, Ala. 250
WXAL Demopolis, Ala. 250
WFPA Ft. Payne, Ala. 250
WGYV Greenville, Ala. 250
WJLD Homewood, Ala. 250
WJHO Opelika, Ala. 250
KSEW Sitka, Alaska 250
KCLF Clifton, Ariz. 250
KONI Phoenix, Ariz. 250
KTUC Tucson, Ariz. 250
KVOY Yuma, Ariz. 250
KELD El Dorado, Ark. 250
KCLA Pine Bluff, Ark. 250
KWYN Wynne, Ark. 250
KRE Berkeley, Calif. 250
KCRE Crescent City, Calif. 250
KREO Indio, Calif. 250
KSDA Redding, Calif. 250
KCOY Santa Maria, Calif. 250
KSPA Santa Paula, Calif. 250
KUKI Ukiah, Calif. 250
KKIN Visalia, Calif. 250
KRLN Canon City, Colo. 250
KDTA Delta, Colo. 250
KFTM Ft. Morgan, Colo. 250
KBNZ La Junta, Colo. 250
WSTC Stamford, Conn. 250
WFTL Ft. Lauderdale, Fla. 250
WIRA Ft. Pierce, Fla. 250
WRHC Jacksonville, Fla. 250
WPCF Panama City, Fla. 250
WPRY Perry, Fla. 250
WTRR Sanford, Fla. 250
WSGC Elberton, Ga. 250
WNEX Macon, Ga. 250
WMGA Moultrie, Ga. 250
WCOH Newnan, Ga. 250
WGSA Savannah, Ga. 250
KART Jerome, Idaho 250
KRPL Moscow, Idaho 250
KSPT Sandpoint, Idaho 250
WDWS Champaign, Ill. 250
WGIL Galesburg, Ill. 250
WEOA Evansville, Ind. 250
WBAT Marion, Ind. 250
KCOG Centerville, Iowa 250
KVFD Fort Dodge, Iowa 250
KVOE Emporia, Kans. 250
KTSW Emporia, Kans. 250
KAYS Hays, Kans. 250
WCYN Cynthiana, Ky. 250
WIEL Elizabethtown, Ky. 250
WFTG London, Ky. 250
WFPR Hammond, La. 250
KAOK Lake Charles, La. 250
WROO Augusta, Maine 250
WIDE Biddeford, Maine 250
WWIN Baltimore, Md. 250
WALE Fall River, Mass. 250
WLLH Lowell, Mass. 250
WHMP Northampton, Mass. 250
WELL Battle Creek, Mich. 250
WJLB Detroit, Mich. 250
WHDF Houghton, Mich. 250
WMAB Munising, Mich. 250
WSAM Saginaw, Mich. 250
WSJM St. Joseph, Mich. 250
WTCM Traverse City, Mich. 250
KMHL Marshall, Minn. 250
WMIN Mpls.-St. Paul, Minn. 250
WHLB Virginia, Minn. 250
WBIP Booneville, Miss. 250
WNAG Grenada, Miss. 250
WFOR Hattiesburg, Miss. 250
WJQS Jackson, Miss. 5000
WMBC Macon, Miss. 250
KSIM Sikeston, Mo. 250
KTTS Springfield, Mo. 250
KFRU Columbia, Mo. 250
KXGN Glendive, Mont. 250
KXLK Great Falls, Mont. 250
KCOW Alliance, Nebr. 250
KLIN Lincoln, Nebr. 250
KPTL Carson City, Nev. 250
KBMI Henderson, Nev. 250
KWNA Winnemucca, Nev. 250
WTSL Hanover, N.H. 250
WTSL Lebanon, N.H. 250
KGFL Roswell, N. Mex. 250
KTRC Santa Fe, N.Mex. 250
KCHS Truth or Consequences, New Mexico 250
KTNM Tucumcari, N.Mex. 250
WOND Pleasantville, N.J. 250
WABY Albany, N.Y. 250
WBNY Buffalo, N.Y. 250
WELM Elmira, N.Y. 250
WSLB Ogdensburg, N.Y. 250
WBMA Beaufort, N.C. 250
WGBG Greensboro, N.C. 250
WSIC Statesville, N.C. 250
WHCC Waynesville, N.C. 250
WLSE Wallace, N.C. 250
KEYJ Jamestown, N.Dak. 250
WMAN Mansfield, Ohio 250
WPAY Portsmouth, Ohio 250
KWON Bartlesville, Okla. 250
KTMC McAlester, Okla. 250
KNOR Norman, Okla. 250
KWIN Ashland, Oreg. 250
KOMB Cottage Grove, Oreg. 250
KBCH Oceanlake, Oreg. 250
KCTG Springfield, Oreg. 250

Kc.	Wave Length	W.P.
WEST	Easton, Pa.	250
WJET	Erie, Pa.	250
WHGB	Harrisburg, Pa.	250
WJAC	Johnstown, Pa.	250
WKBI	St. Marys, Pa.	250
WICK	Scranton, Pa.	250
WRAK	Williamsport, Pa.	250
WHOA	San Juan, P.R.	250
WCOS	Columbia, S.C.	250
WGTN	Georgetown, S.C.	250
WJAN	Spartanburg, S.C.	250
WJZM	Clarksville, Tenn.	250
WHUB	Cookeville, Tenn.	250
WKPT	Kingsport, Tenn.	250
WGAP	Maryville, Tenn.	250
WHAL	Shelbyville, Tenn.	250
KRUN	Ballinger, Tex.	250
KTXC	Big Spring, Tex.	250
KUNO	Corpus Christi, Tex.	250
KLUF	nr. Galveston, Tex.	250
KGVL	Greenville, Tex.	250
KEBE	Jacksonville, Tex.	250
KIUN	Pecos, Tex.	250
KEYE	Perryton, Tex.	250
KVOP	Plainview, Tex.	250
KDWT	Stamford, Tex.	250
KTEM	Temple, Tex.	250
KTFS	Texarkana, Tex.	250
KVOU	Uvalde, Tex.	250
KIXX	Provo, Utah	250
WDOT	Burlington, Vt.	250
WINA	Charlottesville, Va.	250
WLDW	Portsmouth, Va.	250
WHLF	So. Boston, Va.	250
WINC	Winchester, Va.	250
KFDR	Grand Coulee, Wash.	250
KWLK	Longview, Wash.	250
KTNT	Tacoma, Wash.	250
KYAK	Yakima, Wash.	250
WBLK	Clarksburg, W.Va.	250
WRON	Ronceverte, W.Va.	250
WKWK	Wheeling, W.Va.	250
WBTH	Williamson, W.Va.	250
WATW	Ashland, Wis.	250
WBIZ	Eau Claire, Wis.	250
WDUZ	Green Bay, Wis.	250
WRJN	Racine, Wis.	250
WRDB	Reedsburg, Wis.	250
WSAU	Wausau, Wis.	250
KATI	Caspar, Wyo.	250
KODI	Cody, Wyo.	250

1410—212.6

CFUN	Vancouver, B.C.	1000
CHLP	Montreal, Que.	1000
WALA	Mobile, Ala.	5000
KTCS	Ft. Smith, Ark.	500
KWCB	Searcy, Ark.	1000
KERN	Bakersfield, Calif.	1000
KMYC	Marysville, Calif.	5000
KCAL	Redlands, Calif.	1000
WPOP	Hartford, Conn.	5000
KCOL	Ft. Collins, Colo.	1000
WDOV	Dover, Del.	1000
WMYR	Ft. Myers, Fla.	5000
WLAQ	Rome, Ga.	1000
WRMN	Elgin, Ill.	500
WTIM	Taylorville, Ill.	1000
KLEM	LeMars, Iowa	1000
KCLO	Leavenworth, Kans.	1000
KWBB	Wichita, Kans.	1000
WLBJ	Bowling Green, Ky.	5000
KDBS	Alexandria, La.	1000
WGRD	Grand Rap., Mich.	1000
WEGA	Newton, Miss.	500
WFCB	Dunkirk, N.Y.	500
WEGD	Concord, N.C.	1000
WSRC	Durham, N.C.	1000
WING	Dayton, Ohio	5000
KPAM	Portland, Oreg.	1000
WLSH	Lansford, Pa.	1000
KQV	Pittsburgh, Pa.	5000
KBUD	Athens, Tex.	250
KVLB	Cleveland, Tex.	500
KXIT	Dalhart, Tex.	1000
KRIG	Odessa, Tex.	1000
KBAL	San Saba, Tex.	500
KNAL	Victoria, Tex.	500
WRIS	Roanoke, Va.	5000
KUEN	Wenatchee, Wash.	1000
WKBH	LaCrosse, Wis.	5000
KWYO	Sheridan, Wyo.	500

1420—211.1

CKDM	Saskatoon, Sask.	5000
KPDC	Pocahontas, Ark.	1000
KSTN	Stockton, Calif.	1000
WLIS	Old Saybrook, Conn.	500
WDBF	Delray Bch., Fla.	500
WSTN	St. Augustine, Fla.	1000
WRBL	Columbus, Ga.	5000
WLET	Toccoa, Ga.	5000
WINI	Murphysboro, Ill.	500
WIMS	Michigan City, Ind.	1000
WOC	Davenport, Iowa	5000
WTCR	Ashland, Ky.	5000
WHBN	Harrodsburg, Ky.	1000
WVJS	Owensboro, Ky.	1000
KJCK	Junction City, Kans.	1000
KLFY	Lafayette, La.	1000
WBSM	New Bedford, Mass.	1000
WBEC	Pittsfield, Mass.	1000
WAMM	Flint, Mich.	500
KTOE	Mankato, Minn.	5000
WSUH	Oxford, Miss.	1000
WQBC	Vicksburg, Miss.	1000
KBTN	Neosho, Mo.	500
WALY	Herkimer, N.Y.	1000
WLNA	Peekskill, N.Y.	1000
WVOT	Wilson, N.C.	1000
WHK	Cleveland, Ohio	5000
KTJS	Hobart, Okla.	250
KYNG	Coos Bay, Oreg.	1000
WCOJ	Coatesville, Pa.	5000
WCED	DuBois, Pa.	5000
WCRE	Cheraw, S.C.	1000
WEMB	Erwin, Tenn.	1000
WKSR	Pulaski, Tenn.	1000
KFYN	Bonham, Tex.	250
KTRE	Lufkin, Tex.	1000
KGNB	New Braunfels, Tex.	1000
KPEP	San Angelo, Tex.	1000
WWSR	St. Albans, Vt.	1000
WDDY	Gloucester, Va.	1000
KITI	Chehalis, Wash.	1000
KUJ	Walla Walla, Wash.	5000
WPLY	Plymouth, Wis.	500

1430—209.7

CHEX	Peterborough, Ont.	1000
WFHK	Pell City, Ala.	1000
KHBM	Monticello, Ark.	1000
KAMP	El Centro, Calif.	1000
KARM	Fresno, Calif.	5000
KALI	Pasadena, Calif.	5000
KOSI	Aurora, Colo.	5000
WLAK	Lakeland, Fla.	5000
WGFS	Covington, Ga.	1000
WRCD	Dalton, Ga.	1000
WCMY	Ottawa, Ill.	500
WIRE	Indianapolis, Ind.	5000
KASI	Ames, Iowa	1000
WKIC	Hazard, Ky.	1000
KMRC	Morgan City, La.	500
WNAV	Annapolis, Md.	1000
WIL	St. Louis, Mo.	5000
WHIL	Medford, Mass.	5000
WION	Ionia, Mich.	500
WBRB	Mt. Clemens, Mich.	500
KRGI	Grand Island, Nebr.	1000
KALV	Alva, Mich.	5000
WNJR	Newark, N.J.	5000
WENE	Endicott, N.Y.	5000
WMNC	Morganton, N.C.	5000
WRXO	Roxboro, N.C.	1000
WFOB	Fostoria, Ohio	1000
WCLT	Newark, Ohio	500
KTUL	Lookout Mountain, Oklahoma	5000
KGAY	Salem, Oreg.	5000
WVAM	Altoona, Pa.	1000
WBLR	Batesburg, S.C.	5000
KBRK	Brookings, S.Dak.	500
WHER	Memphis, Tenn.	1000
WOKE	Oak Ridge, Tenn.	1000
WDBL	Springfield, Tenn.	1000
KSTB	Breckenridge, Tex.	1000
KCOH	Houston, Tex.	1000
KLO	Ogden, Utah	5000
KBRC	Mt. Vernon, Wash.	1000
WFIR	Weirton, W.Va.	1000
WBEV	Beaver Dam, Wis.	1000

1440—208.2

WHHY	Montgomery, Ala.	5000
KPOK	Scottsdale, Ariz.	1000
KDKY	Little Rock, Ark.	1000
KVON	Napa, Calif.	500
KPRD	Riverside, Calif.	1000
WBIS	Bristol, Conn.	500
WABR	Winter Park, Fla.	1000
WWCC	Bremen, Ga.	500
WGIG	Brunswick, Ga.	1000
KWIK	Pocatello, Idaho	1000
WRAJ	Anna, Ill.	500
WPRS	Paris, Ill.	500
WGEM	Quincy, Ill.	1000
WROK	Rockford, Ill.	500
WPGW	Portland, Ind.	500
KCHE	Cherokee, Iowa	500
KJAY	Topeka, Kans.	5000
WKLX	Paris, Ky.	1000
KMLB	Monroe, La.	5000
WAAB	Worcester, Mass.	5000
WBCM	Bay City, Mich.	500
WCHB	Inkster, Mich.	500
KEUE	Minneapolis, Minn.	5000
KFJM	Grand Forks, N.Dak.	500
WMLV	Millville, N.J.	1000
WJJL	Niagara Falls, N.Y.	1000
WBUY	Lexington, N.C.	5000
WHHH	Warren, Ohio	5000
KMED	Medford, Oreg.	5000
KODL	The Dalles, Oreg.	5000
WCDL	Carbondale, Pa.	5000
WGCB	Red Lion, Pa.	1000
WQDK	Greenville, S.C.	5000
WZYX	Cowan, Tenn.	1000
WHDM	McKenzie, Tenn.	500
KFDA	Amarillo, Tex.	5000
KEYS	Corpus Christi, Tex.	1000
KDNT	Denton, Tex.	1000
WKLV	Blackstone, Va.	5000
KITN	Olympia, Wash.	500
WHIS	Bluefield, W.Va.	5000
WJPG	Green Bay, Wis.	5000

1450—206.8

CBG	Gander, Nfld.	250
CFAB	Windsor, N.S.	250
CFJR	Brockville, Ont.	250
CHEF	Granby, P.Q.	250
CJMT	Chicoutimi, Que.	250
CJOY	Guelph, Ont.	250
WHMA	Anniston, Ala.	250
WBCO	Bessemer, Ala.	250
WDIG	Dothan, Ala.	250
WFUN	Huntsville, Ala.	250
WLAY	Muscle Shoals City, Ala.	250
KLAM	Cordova, Alaska	250
KHCD	Clifton, Ariz.	250
KAWT	Douglas, Ariz.	250
KNOT	Prescott, Ariz.	250
KOLD	Tucson, Ariz.	250
KGRH	Fayetteville, Ark.	250
KENA	Mena, Ark.	250
KYDR	Blythe, Calif.	250
KPAL	Palm Springs, Calif.	250
KTIP	Porterville, Calif.	250
KSAN	San Francisco, Calif.	250
KROG	Sonora, Calif.	250
KVEN	Ventura, Calif.	250
KAGR	Yuba City, Calif.	100
KGIW	Alamosa, Colo.	250
KYOU	Greeley, Colo.	250
WNAB	Bridgeport, Conn.	250
WILM	Wilmington, Del.	250
WOL	Washington, D.C.	250
WMFJ	Daytona Beach, Fla.	250
WSKB	Miami, Fla.	250
WBSR	Pensacola, Fla.	250
WSPB	Sarasota, Fla.	250
WSTU	Stuart, Fla.	100
WTNT	Tallahassee, Fla.	250
WGPC	Albany, Ga.	250
WBHF	Cartersville, Ga.	250
WCON	Cornelia, Ga.	250
WKEU	Griffin, Ga.	250
WMVG	Milledgeville, Ga.	250
WCCP	Savannah, Ga.	250
KEEP	Twin Falls, Idaho	250
WHFC	Cicero, Ill.	250
WKEI	Kewanee, Ill.	100
WCVS	Springfield, Ill.	250
WANE	Ft. Wayne, Ind.	250
WASK	Lafayette, Ind.	250
WAOV	Vincennes, Ind.	250
KPIG	Cedar Rapids, Iowa	250
KCRB	Chanute, Kans.	1000
KWBW	Hutchinson, Kans.	250
WTCO	Campbellsville, Ky.	1000
WNKY	Neon, Ky.	250
WPAD	Paducah, Ky.	250
KSIG	Crowley, La.	250
KNOC	Natchitoches, La.	250
WTIX	New Orleans, La.	250
WAGM	Presque Isle, Maine	250
WRKD	Rockland, Maine	250
WRUM	Rumford, Maine	250
WKTQ	South Paris, Maine	250
WTBO	Cumberland, Md.	250
WMAS	Springfield, Mass.	250
WATZ	Alpena Township, Mich.	250
WHTC	Holland, Mich.	250
WMIQ	Iron Mtn., Mich.	250
WKLA	Ludington, Mich.	250
WIBM	Jackson, Mich.	250
WHLS	Port Huron, Mich.	250
KATE	Albert Lea, Minn.	250
KBUN	Bemidji, Minn.	250
KBMW	Breckenridge, Minn.	250
WELY	Ely, Minn.	250
KDMA	Montevideo, Minn.	100
KFAM	St. Cloud, Minn.	250
WROX	Clarksdale, Miss.	250
WCJU	Columbia, Miss.	250
WJXN	Jackson, Miss.	250
WOKK	Meridian, Miss.	250
WNAT	Natchez, Miss.	250
WRDB	West Point, Miss.	250
KIRK	Kirksville, Mo.	250
KOKO	Warrensburg, Mo.	250
KXLQ	Bozeman, Mont.	250
KUDI	Great Falls, Mont.	250
WMBH	Joplin, Mo.	250
KWPM	West Plains, Mo.	250
KXLL	Missoula, Mont.	250
KWBE	Beatrice, Nebr.	250
KCSR	Chadron, Nebr.	250
KONE	Reno, Nev.	250
WKXL	Concord, N.H.	250
WFPG	Atlantic City, N.Y.	250
WCTC	New Brunswick, N.J.	250
KLOS	Albuquerque, N.Mex.	250
KENM	Portales, N.Mex.	250
WHDL	Allegany, N.Y.	250
KLMX	Clayton, N.Mex.	250
KOBE	Las Cruces, N.Mex.	250
WCLI	Corning, N.Y.	250
WWSC	Glen Falls, N.Y.	250
WKIP	Poughkeepsie, N.Y.	250
WKAL	Rome, N.Y.	250
WATA	Boone, N.C.	250
WGNC	Gastonia, N.C.	250
WBLA	Elizabethtown, N.C.	100
WHVH	Henderson, N.C.	250
WHKP	Hendersonville, N.C.	250
WHIT	New Bern, N.C.	250
KEYS	Williston, N.Dak.	250
WJER	Dover, Ohio	250
WMOH	Hamilton, Ohio	250
WLEC	Sandusky, Ohio	250
KWHW	Altus, Okla.	250
KGFF	Shawnee, Okla.	250
KSIW	Woodward, Okla.	250
KWRO	Coquille, Oreg.	250
KORE	Eugene, Oreg.	250
KFLW	Klamath Falls, Oreg.	250
KLBM	La Grande, Oreg.	250
KBPS	Portland, Oreg.	250
WLEU	Erie, Pa.	250
WGET	Gettysburg, Pa.	250
WDAD	Indiana, Pa.	250
WPAM	Pottsville, Pa.	250
WMAJ	State College, Pa.	250
WJPA	Washington, Pa.	250
WRDL	Caguas, P.R.	250
WRIA	Caguas, P.R.	250
WWRI	W. Warwick, R.I.	250
WQSN	Charleston, S.C.	250
WCRS	Greenwood, S.C.	250
WMYB	Myrtle Beach, S.C.	250
WHSC	Hartsville, S.C.	250
WDIX	Orangeburg, S.C.	250
KDSJ	Deadwood, S.Dak.	250
KYNT	Yankton, S.Dak.	250
WLAR	Athens, Tenn.	250
WDXB	Chattanooga, Tenn.	250
WDSG	Dyersburg, Tenn.	250
WTRD	Dyersburg, Tenn.	250
WLAF	LaFollette, Tenn.	100
WCRK	Morristown, Tenn.	250
WGNS	Murfreesboro, Tenn.	250
KRIC	Beaumont, Tex.	250
KBEN	Carrizo Sprgs., Tex.	250
KCTI	Gonzales, Tex.	250
KMBL	Junction, Tex.	250
KCYL	Lampasas, Tex.	250
KMHT	Marshall, Tex.	250
KNET	Palestine, Tex.	250
KSNY	Snyder, Tex.	250
KNEU	Provo, Utah	250
WTSA	Brattleboro, Vt.	250
WFTR	Front Royal, Va.	250
WREL	Lexington, Va.	250
WMVA	Martinsville, Va.	250
WLEE	Richmond, Va.	250
WLPM	Suffolk, Va.	250
KBKW	Aberdeen, Wash.	250
KCLX	Colfax, Wash.	250
KSEM	Moses Lake, Wash.	250
KONP	Port Angeles, Wash.	250
KAYE	Puyallup, Wash.	250
WWNR	Beckley, W.Va.	250
WPAR	Parkersburg, W.Va.	250
WHAW	Weston, W.Va.	250
KFIZ	Fond du Lac, Wis.	250
WDLB	Marshfield, Wis.	250
WPFP	Park Falls, Wis.	250
WRCO	Richland, Wis.	250
KBBS	Buffalo, Wyo.	250
KWRL	Riverton, Wyo.	250

1460—205.4

CJNB	N. Battleford, Sask.	1000
WFMH	Cullman, Ala.	5000
KDON	Salinas, Calif.	5000
KAFA	Colo. Sprgs., Colo.	1000
WBAR	Bartow, Fla.	1000
WFNM	DeFuniak Sprgs., Fla.	1000
WMBR	Jacksonville, Fla.	5000
WDMF	Buford, Ga.	1000
WROY	Carmi, Ill.	1000
KSO	Des Moines, Iowa	5000
WKAM	Goshen, Ind.	500
WOCH	North Vernon, Ind.	500
WRVK	Mt. Vernon, Ky.	500
WAIL	Baton Rouge, La.	5000
KBSF	Springhill, La.	1000
WBET	Brockton, Mass.	1000
WBRN	Big Rapids, Mich.	1000
WPON	Pontiac, Mich.	500
KRNY	Kearney, Nebr.	5000
KENO	Las Vegas, Nev.	1000
WOKO	Albany, N.Y.	5000
WNRC	New Rochelle, N.Y.	500
WHEC	Rochester, N.Y.	5000
WFVG	Fuquay Sprgs., N.C.	1000
WMMH	Marshall, N.C.	500
WBNS	Columbus, Ohio	1000
WPVL	Painesville, Ohio	500
KPLK	Dallas, Oreg.	500
WCMB	Harrisburg, Pa.	5000
WBCU	Union, S.C.	1000
WJAK	Jackson, Tenn.	1000
KBRZ	Freeport, Tex.	500
KILL	Lubbock, Tex.	500
WACO	Waco, Tex.	1000
WRAD	Radford, Va.	250
KIMA	Yakima, Wash.	5000
WRAC	Racine, Wis.	500

1470—204.0

CFOS	Owen Sound, Ont.	1000
KBLO	Hot Springs, Ark.	1000
KBMX	Coalinga, Calif.	500
KXOA	Sacramento, Calif.	1000
WMMW	Meriden, Conn.	1000
WDCL	Tarpon Sprgs., Fla.	5000
WAAG	Adel, Ga.	1000
WRGA	Rome, Ga.	5000
WMBD	Peoria, Ill.	5000
WCBC	Anderson, Ind.	1000
KTRI	Sioux City, Iowa	5000
KARE	Atchison, Kans.	1000
WSAC	Radcliff, Ky.	1000
KPLC	Lake Charles, La.	5000
WLAM	Lewiston, Maine	5000
WTTR	Westminster, Md.	1000
WNBP	Newburyport, Mass.	500
WKMF	Flint, Mich.	1000
WKLZ	Kalamazoo, Mich.	500

Kc. Wave Length W.P.

(1470—204.0)

KANO	Anoka, Minn.	1000
WCHJ	Brookhaven, Miss.	1000
WNAU	New Albany, Miss.	500
KGHM	Brookfield, Mo.	500
KTCB	Malden, Mo.	1000
WTKO	Ithaca, N.Y.	1000
WPDM	Potsdam, N.Y.	1000
WBIG	Greensboro, N.C.	5000
WTOE	Spruce Pine, N.C.	1000
WOHO	Toledo, Ohio	1000
KVLH	Pauls Valley, Okla.	250
KVIN	Vinita, Okla.	500
WSAN	Allentown, Pa.	5000
WFAR	Farrell, Pa.	500
WOIC	Columbia, S.C.	5000
WSOK	Nashville, Tenn.	1000
KRBC	Abilene, Tex.	5000
KWRD	Henderson, Tex.	500
KCNY	San Marcos, Tex.	250
KELA	Centralia, Wash.	1000
WPLH	Huntington, W.Va.	5000
WBKV	West Bend, Wis.	500
KSPR	Casper, Wyo.	5000

1480—202.6

WABB	Mobile, Ala.	5000
KGLU	Safford, Ariz.	1000
KIEM	Eureka, Calif.	5000
KYOS	Merced, Calif.	5000
KWIZ	Santa Ana, Calif.	1000
WAPG	Arcadia, Fla.	1000
WYZE	Atlanta, Ga.	5000
WRDW	Augusta, Ga.	5000
WTHI	Terre Haute, Ind.	1000
WRSW	Warsaw, Ind.	500
KLEE	Ottumwa, Iowa	500
KANS	Wichita, Kans.	5000
WKOA	Hopkinsville, Ky.	1000
WLEC	Jonesville, La.	500
KJOE	Shreveport, La.	1000
WSAR	Fall River, Mass.	5000
WMAX	Grand Rapids, Michigan	1000
KAUS	Austin, Minn.	1000
KGCX	Sidney, Mont.	5000
KLMS	Lincoln, Nebr.	1000
KWEW	Hobbs, N.Mex.	1000
WLEA	Hornell, N.Y.	1000
WHOM	New York, N.Y.	5000
WWOK	Charlotte, N.C.	1000
WAGR	Lumberton, N.C.	1000
WHBC	Canton, Ohio	5000
WCIN	Cincinnati, Ohio	1000
WTRA	Latrobe, Pa.	500
WDAS	Philadelphia, Pa.	1000
WISL	Shamokin, Pa.	1000
WLOK	Memphis, Tenn.	1000
KGKO	Dallas, Tex.	5000
KLVL	Pasadena, Tex.	1000
WNIX	Springfield, Vt.	1000
WBBL	Richmond, Va.	1000
WLEE	Richmond, Va.	5000
KBLU	Salem, Va.	1000
KRIV	Camas, Wash.	1000
KCVL	Colville, Wash.	1000
WISC	Madison, Wis.	1000

1490—201.2

CFRC	Kingston, Ont.	100
CJIC	Sault Ste. Marie, Ont.	250
CKCR	Kitchener, Ont.	250
CKBM	Montaquy, Que.	250
WANA	Anniston, Ala.	250
WAJF	Decatur, Ala.	250
WRLO	Lanett, Ala.	250
WHBB	Selma, Ala.	250
KYCA	Prescott, Ariz.	250
KXAR	Hope, Ark.	250
KTLO	Mtn. Home, Ark.	250
KORS	Paragould, Ark.	250
KOTN	Pine Bluff, Ark.	250
KXRJ	Russellville, Ark.	250
KDIA	Auburn, Calif.	250
KMAP	Bakersfield, Calif.	250
KPAS	Banning, Calif.	250
KOWL	Bijou, Calif.	250
KBLA	Burbank, Calif.	250
KICO	Calexico, Calif.	250
KAFP	Petaluma, Calif.	250
KDB	Santa Barbara, Calif.	250
KBLF	Red Bluff, Calif.	250
KSYC	Yreka, Calif.	250
KBOL	Boulder, Colo.	250
KOLO	Sterling, Colo.	250
WNLC	New London, Conn.	250
WTOR	Torrington, Conn.	250
WTRL	Bradenton, Fla.	250
WTTT	Coral Gables, Fla.	250
WJBS	DeLand, Fla.	250
WAHR	Miami Beach, Fla.	250
WSIR	Winter Haven, Fla.	250
WMOG	Brunswick, Ga.	250
WMJM	Cordele, Ga.	250
WMRE	Monroe, Ga.	250
WSFB	Quitman, Ga.	250
WSNT	Sandersville, Ga.	250
KTOH	Lihue, Hawaii	250
KBLI	Blackfoot, Idaho	250
KCID	Caldwell, Idaho	250
WKRO	Cairo, Ill.	250
WDAN	Danville, Ill.	250
WTMV	East St. Louis, Ill.	250
WOPA	Oak Park, Ill.	250
WKBV	Richmond, Ind.	250
WNDU	South Bend, Ind.	250
KBUR	Burlington, Iowa	250
WDBQ	Dubuque, Iowa	250
KRIB	Mason City, Iowa	250
KTOP	Topeka, Kans.	250
WCPM	Cumberland, Ky.	250
WFKY	Frankfort, Ky.	250
WKAY	Glasgow, Ky.	250
WOMI	Owensboro, Ky.	250
WSIP	Paintsville, Ky.	250
WIKC	Bogalusa, La.	250
KEUN	Eunice, La.	250
KCIL	Houma, La.	250
KRUS	Ruston, La.	250
WPOR	Portland, Maine	250
WTVL	Waterville, Maine	250
WARK	Hagerstown, Md.	250
WHAV	Haverhill, Mass.	250
WMOO	Milford, Mass.	100
WTXL	W. Springfield, Mass.	250
WABJ	Adrian, Mich.	250
WESK	Escanaba, Mich.	250
WBFC	Fremont, Mich.	250
KOZY	Grand Rapids, Minn.	250
WMON	Midland, Mich.	250
KXRA	Alexandria, Minn.	250
KLGR	Redwd. Falls, Minn.	100
WLOX	Biloxi, Miss.	250
WCLD	Cleveland, Miss.	250
WLAU	Laurel, Miss.	250
WHOC	Philadelphia, Miss.	250
WVIM	Vicksburg, Miss.	250
KDMO	Carthage, Mo.	250
KTTR	Rolla, Mo.	250
KDRO	Sedalia, Mo.	250
KBOW	Butte, Mont.	250
KBON	Omaha, Nebr.	250
WLDB	Atlantic City, N.J.	250
KWEW	Hobbs, N.Mex.	250
KRSN	Los Alamos, N.Mex.	250
KRTN	Raton, N.Mex.	250
WCSS	Amsterdam, N.Y.	250
WBTA	Batavia, N.Y.	250
WKNY	Kingston, N.Y.	250
WICY	Malone, N.Y.	250
WDLC	Port Jervis, N.Y.	250
WOLF	Syracuse, N.Y.	250
WSSB	Durham, N.C.	250
WFLB	Fayetteville, N.C.	250
WLOE	Leaksville, N.C.	250
WOOW	New Bern, N.C.	250
WSTP	Salisbury, N.C.	250
KNDC	Hettinger, N.Dak.	250
KOVC	Valley City, N.Dak.	250
WBEX	Chillicothe, Ohio	250
WSRS	Cleveland Hghts., Ohio	250
WOHI	E. Liverpool, Ohio	250
WMOA	Marietta, Ohio	250
WMRN	Marion, Ohio	250
KWRW	Guthrie, Okla.	100
KBIX	Muskogee, Okla.	250
KBKR	nr. Baker, Oreg.	250
KRNR	Roseburg, Oreg.	250
KBZY	Salem, Oreg.	250
WESB	Bradford, Pa.	250
WAZL	Hazleton, Pa.	250
WARD	Johnstown, Pa.	250
WGAL	Lancaster, Pa.	250
WMRF	Lewiston, Pa.	250
WMGW	Meadville, Pa.	250
WNBT	Wellsboro, Pa.	250
WMDD	Fajardo, Puerto Rico	250
WGCD	Chester, S.C.	250
WMRB	Greenville, S.C.	250
KORN	Mitchell, S.Dak.	250
WOPI	Bristol, Tenn.	250
WDXB	Chattanooga, Tenn.	250
WPLI	Jackson, Tenn.	250
WDXL	Lexington, Tenn.	250
WJJM	Lewisburg, Tenn.	250
WATO	Oak Ridge, Tenn.	250
KNOW	Austin, Tex.	250
KIBL	Beeville, Tex.	250
KBST	Big Spring, Tex.	250
KHUZ	Borger, Tex.	250
KNEL	Brady, Tex.	250
KSAM	Huntsville, Tex.	250
KVOW	Littlefield, Tex.	250
KPLT	Paris, Tex.	250
KGKB	Tyler, Tex.	250
KVWC	Vernon, Tex.	250
KVOG	Ogden, Utah	250
WIKE	Newport, Vt.	250
WCVA	Culpeper, Va.	250
WVEC	Hampton, Va.	250
WAYB	Waynesboro, Va.	250
KBRO	Bremerton, Wash.	250
KLOG	Kelso, Wash.	250
KENE	Toppenish, Wash.	250
KTEL	Walla Walla, Wash.	250
WTCS	Fairmont, W.Va.	250
WLOH	Princeton, W.Va.	250
WGEZ	Beloit, Wis.	250
WLDL	LaCrosse, Wis.	250
WOSH	Oshkosh, Wis.	250
WIGM	Medford, Wis.	250
KGOS	Torrington, Wyo.	250
KRTR	Thermopolis, Wyo.	250

1500—199.9

KXRX	San Jose, Calif.	1000
WTOP	Washington, D.C.	50000
WJBK	Detroit, Mich.	10000
KSTP	St. Paul, Minn.	50000
KTAN	Sherman, Tex.	250

1510—199.1

CKOT	Tillsonburg, Ont.	250
KOCS	Ontario, Calif.	250
KTIM	San Rafael, Calif.	1000
WKAI	Macomb, Ill.	250
WMEX	Boston, Mass.	5000
KIMO	Independence, Mo.	1000
WLAC	Nashville, Tenn.	50000
KCTX	Childress, Tex.	250
KSTV	Stephenville, Tex.	250
KGA	Spokane, Wash.	50000
WAUX	Waukesha, Wis.	250

1520—197.4

KTED	Laguna Beach, Calif.	1000
WHOW	Clinton, Ill.	1000
KSIB	Creston, Iowa	1000
WKBW	Buffalo, N.Y.	50000
WKIT	Mineola, N.Y.	250
KOMA	Okla. City, Okla.	50000
KGON	Oregon City, Oreg.	10000
WWWW	Rio Piedras, P.R.	250

1530—196.1

KFBK	Sacramento, Calif.	50000
WCKY	Cincinnati, Ohio	50000
KGBT	Harlingen, Tex.	50000

1540—195.0

ZNS	Nassau, B.W.I.	5000
KPOL	Los Angeles, Calif.	1000
KLKC	Parsons, Kans.	250
WSMI	Litchfield, Ill.	1000
WBNL	Boonville, Ind.	250
WLOI	LaPorte, Ind.	250
KXEL	Waterloo, Iowa	50000
KNEX	McPherson, Kans.	250
WDON	Wheaton, Md.	250
KSID	Sidney, Nebr.	250
WPTR	Albany, N.Y.	50000
WIFM	Elkin, N.C.	250
WJMO	Cleveland, Ohio	1000
WJMJ	Philadelphia, Pa.	1000
WPTS	Pittston, Pa.	1000
WPME	Punxsutawney, Pa.	1000
WADK	Newport, R.I.	1000
KCUL	Ft. Worth, Tex.	10000
KGBC	Galveston, Tex.	1000
KIWW	San Antonio, Tex.	250
KGIB	Bremerton, Wash.	1000
WTKM	Ft. Atkinson, Wis.	250

1550—193.5

CBE	Windsor, Ont.	10000
WHBS	Huntsville, Ala.	5000
KOBY	San Fran., Calif.	10000
KENT	Shreveport, La.	1000
KRES	St. Joseph, Mo.	5000
WLOA	Braddock, Pa.	1000
WBSC	Bennetsville, S.C.	10000

1560—192.3

CFRS	Simcoe, Ont.	250
KPMC	Bakersfield, Calif.	10000
WBYS	Canton, Ill.	250
KSWI	Council Bluffs, Iowa	500
WQXR	New York, N.Y.	50000
WTNS	Coshocton, Ohio	1000
WTOD	Toledo, Ohio	1000
KWCO	Chickasha, Okla.	1000
WENA	Bayamon, P.R.	250
WAGC	Chattanooga, Tenn.	10000
KHBR	Hillsboro, Tex.	250

1570—191.1

CHUB	Nanaime, B.C.	1000
CFRY	Portage la Prairie, Manitoba	250
CBI	Sidney, N.S.	1000
CFOR	Orillia, Ont.	10000
WCRL	Oneonta, Ala.	250
WRWJ	Selma, Ala.	1000
WETU	Wetumpka, Ala.	250
KCVR	Lodi, Calif.	1000
KLOV	Loveland, Colo.	250
WTWB	Auburndale, Fla.	1000
WFBF	Fernandina Bch., Fla.	1000
WJOE	Ward Ridge, Fla.	250
WOKZ	Alton, Ill.	1000
WFRL	Freeport, Ill.	1000
WBEE	Harvey, Ill.	1000
WTAY	Robinson, Ill.	250
WILO	Frankfort, Ind.	250
WKTL	Kendallville, Ind.	250
WLRP	New Albany, Ind.	1000
KFAD	Fairfield, Iowa	250
KJFJ	Webster City, Iowa	1000
KNDY	Marysville, Kans.	250
KWSK	Pratt, Kans.	250
WFLW	Monticello, Ky.	250
WABL	Amite, La.	500
KLLA	Leesville, La.	250
KMAR	Winnsboro, La.	500
WTOW	Towson, Md.	1000
WPEP	Taunton, Mass.	1000
WMRP	Flint, Mich.	1000
WFUR	Grand Rap., Mich.	1000
KMRS	Morris, Minn.	1000
WFLR	Dundee, N.Y.	1000
WNCA	Siler City, N.C.	1000
KLEX	Lexington, Mo.	250
WHOT	Campbell, Ohio	250
WPTW	Piqua, Ohio	250
WKOV	Wellston, Ohio	250
KTAT	Frederick, Okla.	250
KOLS	Pryor, Okla.	1000
KFGR	Forest Grove, Oreg.	1000
KOHU	Hermiston, Oreg.	250
WBUX	Doylestown, Pa.	250
WAKU	Latrobe, Pa.	1000
WMLP	Milton, Pa.	1000
WFGN	Gaffney, S.C.	250
WHLP	Centerville, Tenn.	1000
WTRB	Ripley, Tenn.	1000
KTER	Terrell, Tex.	250
KWIC	Salt Lake City, Utah	500
WYTI	Rocky Mount, Va.	500
WAPL	Appleton, Wis.	1000

1580—189.2

CBJ	Chicoutini, Que.	10000
WJHB	Talladega, Ala.	1000
KTML	Marked Tree, Ark.	250
KWIP	Merced, Calif.	500
KDAY	Santa Monica, Calif.	10000
WWIL	Ft. Lauderdale, Fla.	1000
WCLS	Columbus, Ga.	1000
WLBA	Gainesville, Ga.	5000
WDQN	DuQuoin, Ill.	250
WBBA	Pittsfield, Ill.	250
WKID	Urbana, Ill.	250
WCNB	Connersville, Ind.	250
WJVA	South Bend, Ind.	250
WAMW	Washington, Ind.	250
KCHA	Charles City, Iowa	250
KFMA	Davenport, Iowa	500
KDSN	Denison, Iowa	500
WWXL	Manchester, Ky.	250
WPKY	Princeton, Ky.	250
KLUV	Haynesville, La.	250
KLOU	Lake Charles, La.	1000
WPGC	Bradbury Hgts., Md.	1000
WFGM	Fitchburg, Mass.	1000
WAMY	Amory, Miss.	250
WGLC	Centreville, Miss.	250
WPMP	Pascagoula, Miss.	1000
KBIA	Columbia, Mo.	250
KNIM	Maryville, Mo.	250
WCRV	Washington, N.J.	250
KHAM	Albuquerque, M.Mex.	1000
WPAC	Patchogue, N.Y.	5000
WTYN	Tryon, N.C.	250
KZKY	Albemarle, N.Dak.	250
WVKO	Columbus, Ohio	1000
KLTR	Blackwell, Okla.	250
WANB	Waynesburg, Pa.	250
WYCL	York, S.C.	250
WTUC	Union City, Tenn.	250
KGAF	Gainesville, Tex.	250
KTLU	Rusk, Tex.	500
KWED	Seguin, Tex.	1000
KEVA	Shamrock, Tex.	250
WPUV	Pulaski, Va.	5000
WTTN	Watertown, Wis.	250

1590—188.7

WATM	Atmore, Ala.	100
WVNA	Tuscumbia, Ala.	5000
KSJO	San Jose, Calif.	1000
KUDU	Ventura, Calif.	1000
WBRY	Waterbury, Conn.	5000
WALB	Albany, Ga.	1000
WLFA	Lafayette, Ga.	5000
WNMP	Evanston, Ill.	1000
WGEE	Indianapolis, Ind.	5000
WPCO	Mt. Vernon, Ind.	500
KWBG	Boone, Iowa	1000
KEVL	White Castle, La.	1000
KVGB	Great Bend, Kans.	5000
WLBN	Lebanon, Ky.	1000
WTVB	Coldwater, Mich.	5000
WSDC	Marine City, Mich.	1000
WISK	So. St. Paul, Minn.	5000
WOKJ	Jackson, Miss.	1000
KDEX	Dexter, Mo.	1000
KPRS	Kansas City, Mo.	1000
WEHH	Elmira Hghts., Horseheads, N.Y.	500
WGTC	Greenville, N.C.	5000
WNOS	High Point, N.C.	1000
WAKR	Akron, Ohio	5000
WSRW	Hillsboro, Ohio	500
KHEN	Henryetta, Okla.	500
WXRF	Guayama, Puerto Rico	1000
WCBG	Chambersburg, Pa.	1000
WDRF	Chester, Pa.	1000
WABV	Abbeville, S.C.	1000
WACA	Camden, S.C.	1000
KERC	Eastland, Tex.	500
KYOK	Houston, Tex.	5000
KCBD	Lubbock, Tex.	1000
KBUS	Mexia, Tex.	500
KANN	Sinton, Tex.	1000
KTIX	Seattle, Wash.	5000
WSWW	Platteville, Wis.	1000
WTRW	Two Rivers, Wis.	1000

1600—187.5

CHVC	Niagara Falls, Ont.	5000
WAPX	Montgomery, Ala.	1000
KGST	Fresno, Calif.	1000

Kc.	Wave Length	W.P.
KWOW	Pomona, Calif.	1000
KUBA	Yuba City, Calif.	1000
KLAK	Lakewood, Colo.	1000
WKWF	Key West, Fla.	500
WGKA	Atlanta, Ga.	1000
WMCW	Harvard, Ill.	500
WBTO	Linton, Ind.	500
WARU	Peru, Ind.	1000
KLGA	Algona, Iowa	5000
KCRG	Cedar Rapids, Iowa	5000
KMDO	Ft. Scott, Kans.	500
WNES	Central City, Ky.	500
WSTL	Eminence, Ky.	500
KFNV	Ferriday, La.	1000
KLFT	Golden Meadow, La.	1000
KLVI	Vivian, La.	500
WINX	Rockville, Md.	1000
WBOS	Brookline, Mass.	5000
WJKO	Springfield, Mass.	5000
WHRV	Ann Arbor, Mich.	1000
WTRU	Muskegon, Mich.	5000
WKDL	Clarksdale, Miss.	1000
KATZ	St. Louis, Mo.	1000
KTTN	Trenton, Mo.	500
WONG	Oneida, N.Y.	1000
WWRL	Woodside, N.Y.	5000
WGIV	Charlotte, N.C.	1000
WFRC	Reidsville, N.C.	250
WBLY	Springfield, Ohio	1000
KUSH	Cushing, Okla.	1000
KASH	Eugene, Oreg.	1000
WFIS	Fountain Inn, S.C.	1000
WKBJ	Milan, Tenn.	1000
KBOR	Brownsville, Tex.	1000
KCFH	Cuero, Tex.	500
KMAE	McKinney, Tex.	1000
KOGT	Orange, Tex.	1000
WBOF	Virginia Bch., Va.	1000
WHLL	Wheeling, W.Va.	5000

United States and Canadian

Amplitude-Modulation (AM) Broadcasting Stations Listed Alphabetically by Location

Abbreviations: C.L., call letters; Kc., frequency in kilocycles; N.A., network affiliation—A: American Broadcasting Co., C: Columbia Broadcasting System, Inc.; M: Mutual Broadcasting System; N: National Broadcasting Co., Inc. (For watt power of station, see list arranged by Frequency, p. 169)

Location	C.L.	Kc.	N.A.
Abbeville, La.	KROF	960	
Abbeville, S.C.	WABV	1590	
Aberdeen, Md.	WAMD	970	
Aberdeen, Miss.	WMPA	1240	
Aberdeen, S.Dak.	KABR	1220	
	KSDN	930	A
Aberdeen, Wash.	KBKW	1450	A
	KXRO	1320	M
Abilene, Tex.	KRBC	1470	A
	KWKC	1340	M
Abingdon, Va.	WBBI	1230	
Ada, Okla.	KADA	1230	A
Adalusia, Ala.	WCTA	920	
Adel, Ga.	WAAG	1470	
Adrian, Mich.	WABJ	1490	
Ahoskie, N.C.	WRCS	970	
Aiken, S.C.	WAKN	990	
Akron, Ohio	WAKR	1590	A
	WADC	1350	C
	WCUE	1150	
	WHKK	640	M
Alamogordo, N.M.	KALG	1230	M
Alamosa, Colo.	KGIW	1450	
Albany, Ga.	WALB	1590	M
	WGPC	1450	C
	WJAZ	1050	
Albany, Minn.	KASM	1150	
Albany, N.Y.	WABY	1400	
	WOKO	1460	M
	WPTR	1540	M
	WROW	590	A
Albany, Oreg.	KWIL	790	M
Albermarle, N.C.	WABZ	1010	
Albert Lea, Minn.	KATE	1450	A
Albertville, Ala.	WAVU	630	
Albion, Mich.	WALM	1260	
Albuquerque, N.M.	KABQ	1340	M
	KDEF	1150	
	KGGM	610	C
	KOAT	860	A
	KOB	770	N
	KQUE	920	
	KLOS	1450	
	KHAM	1580	
Alexander City, Ala.	WRFS	1050	
Alexandria, La.	KALB	580	A
	KDBS	1410	
	KVOB	970	
Alexandria, Minn.	KXRA	1490	
Alexandria, Va.	WPIK	730	
Algona, Iowa	KLGA	1600	
Alice, Tex.	KOPY	1070	M
Allegany, N.Y.	WHDL	1450	A
Allentown, Pa.	WHOL	1230	C
	WAEB	790	A
	WKAP	1320	
	WSAN	1470	N
Alliance, Nebr.	KCOW	1400	
Alliance, Ohio	WFAH	1310	
Alma, Mich.	WFYC	1280	
Alpena Township, Mich.	WATZ	1450	M
Alpine, Tex.	KVLF	1240	M
Alton, Ill.	WOKZ	1570	
Altona, Man.	CFAM	1290	
Altoona, Pa.	WFBG	1340	N
	WRTA	1240	A-M
	WVAM	1430	C
Alturas, Calif.	KCNO	570	
Altus, Okla.	KWHW	1450	M
Alva, Okla.	KALV	1430	
Amarillo, Tex.	KAMQ	1010	M
	KFDA	1440	A
	KGNC	710	N
	KLYN	940	C
	KRAY	1360	
	KZIP	1310	
Americus, Ga.	WDEC	1290	M
Ames, Iowa	KSAI	1430	
	WOI	640	
Amite, La.	WABL	1570	
Amory, Miss.	WAMY	1580	
Amos, Que.	CHAD	1340	
Amsterdam, N.Y.	WCSS	1490	
Anaconda, Mont.	KANA	1230	
Anacortes, Wash.	KAGT	1340	
Anchorage, Alaska	KBYR	1270	
	KFQD	730	C
	KENI	550	A-M-N
Andalusia, Ala.	WCTA	1340	M
Anderson, Ind.	WCBC	1470	
	WHBU	1240	A-C
Anderson, S.C.	WAIM	1230	C
	WANS	1280	M
Andrews, Tex.	KACT	1360	
Annapolis, Md.	WANN	1190	
	WNAV	1430	
Ann Arbor, Mich.	WHRV	1600	A
	WPAG	1050	
Anna, Ill.	WRAJ	1440	
Anniston, Ala.	WANA	1490	
	WHMA	1450	A
	WSPC	1390	M
Anoka, Minn.	KANO	1470	
Ansonia, Conn.	WADS	690	
Antigo, Wis.	WATK	900	
Artesia, N.M.	KSVP	990	M
Antigonish, N.S.	CJFX	580	
Apollo, Pa.	WAVL	910	
Apple Valley, Cal.	KAVR	960	
Appleton, Wis.	WAPL	1570	
	WHBY	1230	M
Aguadilla, P.R.	WABA	850	
	WGRF	1340	
Albemarle, N.Dak.	KZKY	1580	
Arcadia, Fla.	WAPG	1480	
Arcata, Calif.	KENL	1340	
Ardmore, Okla.	KVSO	1240	A
Arecibo, P.R.	WCMN	1280	
Arkadelphia, Ark.	KVRC	1240	M
Arkan. City, Kans.	KSOK	1280	
Arlington, Va.	WARL	780	
	WEAM	1390	
Asbury Park, N.J.	WJLK	1310	
Asheboro, N.C.	WGWR	1260	
Asheville, N.C.	WISE	1310	N
	WLOS	1380	N
	WSKY	1230	
	WWNC	570	C
Ashland, Ky.	WCMI	1340	C
	WTCR	1420	
Ashland, Ohio	WATG	1340	M
Ashland, Oreg.	KWIN	1400	M
Ashland, Wis.	WATW	1400	M
Ashtabula, Ohio	WICA	970	
Astoria, Oreg.	KAST	1370	M
	KVAS	1230	
Atchison, Kans.	KARE	1470	
Athens, Ala.	WJMW	730	
Athens, Ga.	WGAU	1340	C
	WRFC	960	
Athens, Ohio	WATH	970	
	WOUB	1340	
Athens, Tenn.	WLAR	1450	M
Athens, Tex.	KBUD	1410	
Atlanta, Ga.	WAGA	590	C
	WAKE	1340	C
	WAOK	1380	
	WERD	860	
	WGKA	1600	
	WGST	920	A
	WQXI	790	M
	WSB	750	N
	WYZE	1480	
Atlanta, Tex.	KALT	900	
Atlantic, Iowa	KJAW	1220	
Atlantic City, N.J.	WFPG	1450	C
	WLDB	1490	
	WMID	1340	A-M
Atmore, Ala.	WATM	1590	
Attleboro, Mass.	WARA	1320	
Auburn, Ala.	WAUD	1230	A
Auburn, Calif.	KDIA	1490	
Auburn, N.Y.	WMBO	1340	M
Auburndale, Fla.	WTWB	1570	
Auburndale, Wis.	WLBL	930	
Augusta, Ga.	WAUG	1050	
	WBBQ	1340	M
	WBIA	1230	
	WGAC	580	A
	WRDW	1480	C
Augusta, Maine	WRDO	1400	N
	WFAU	1340	M
Aurora, Colo.	KOSI	1430	
Aurora, Ill.	WMRO	1280	
Austin, Minn.	KAUS	1480	M
Austin, Tex.	KNOW	1490	A
	KTBC	590	C
	KTXN	1370	
	KVET	1300	M
Avalon, Calif.	KBIG	740	
Bad Axe, Mich.	WLEX	1340	
Bainbridge, Ga.	WMGR	930	M
Baker, Oreg.	KBKR	1490	
Bakersfield, Calif.	KAFY	550	M
	KBIS	970	
	KERN	1410	C
	KGEE	1230	N
	KMAP	1490	
	KPMC	1560	A
Balesburg, S.C.	WBLR	1430	
Ballinger, Tex.	KRUN	1400	
Baltimore, Md.	WBAL	1090	N
	WBMD	750	
	WCAO	600	C
	WCBM	680	M
	WFBR	1300	A
	WITH	1230	
	WSID	1010	
	WWIN	1400	A
Bangor, Maine	WABI	910	A
	WGUY	1230	C
	WLBZ	620	N
Banning, Calif.	KPAS	1490	
Barboursville, Ky.	WBVL	950	
Bardstown, Ky.	WBRT	1320	
Barnesboro, Pa.	WNCC	950	
Barnwell, S.C.	WBAW	740	
Barrie, Ont.	CKBB	1230	
Barstow, Calif.	KWTC	1230	
Bartlesville, Okla.	KWON	1400	
Bartow, Fla.	WBAR	1460	
Bastrop, La.	KTRY	730	
Batavia, N.Y.	WBTA	1490	M
Batesville, Ark.	KBTA	1340	M
Batesville, Miss.	WBLE	1290	
Bathurst, N.B.	CKBC	1400	
Baton Rouge, La.	WAIL	1460	A
	WEND	1380	
	WIBR	1300	
	WJBO	1150	N
	WLCS	910	A
	WXOK	1260	
Battle Creek, Mich.	WBCK	930	M
	WELL	1400	A
Baxley, Ga.	WHAB	1260	
Bay City, Mich.	WBCM	1440	A
	WWBC	1250	
Bay City, Tex.	KIOX	1270	M
Bay Minette, Ala.	WBCA	1150	
Bayamon, P.R.	WENA	1560	
Baytown, Tex.	KRCT	650	
	KREL	1360	
Beatrice, Nebr.	KWBE	1450	M
Beaufort, N.C.	WBMA	960	
Beaufort, S.C.	WBEU	960	
Beaumont, Tex.	KFDM	560	A
	KJET	1380	
	KRIC	1450	
	KTRM	990	
Beaver Dam, Wis.	WBEV	1430	
Beaver Falls, Pa.	WBVP	1230	
Beckley, W. Va.	WJLS	560	C
	WWNR	620	
Bedford, Ind.	WBIW	1340	M
Bedford, Pa.	WBFD	1310	
Bedford, Va.	WBLT	1350	M
Beeville, Tex.	KIBL	1490	
Bellaire, Ohio	WTRX	1290	
Bellefontaine, Ohio	WOHP	1390	
Belle Glade, Fla.	WSWN	900	
Belleville, Ont.	CJBQ	1230	
Belleville, Ill.	WIBV	1260	
Bellingham, Wash.	KPUG	1170	M
	KVOS	790	A
Belmont, N.C.	WCGC	1270	
Beloit, Wis.	WBEL	1380	
	WGEZ	1490	M
Belton, S.C.	WHPB	1390	
Bemidji, Minn.	KBUN	1450	M
Bend, Oreg.	KBND	1110	M
Bennetsville, S.C.	WBSC	1550	M
Bennington, Vt.	WBTN	1370	
Benson, Minn.	KBMO	1290	
Benton, Ark.	KBBA	690	
Benton, Ky.	WCBL	1290	
Benton Harbor, Mich.	WHFB	1060	
Berkeley, Calif.	KRE	1400	
Berlin, N.H.	WMOU	1230	
Bessemer, Ala.	WBCO	1450	
Bethesda, Md.	WUST	1120	
Bethlehem, Pa.	WGPA	1100	
Biddeford, Maine	WIDE	1400	M
Big Rapids, Mich.	WBRN	1460	
Big Sprg., Tex.	KBST	1490	A
	KHEM	1270	
	KTXC	1400	
Big Stone Gap, Va.	WLSD	1220	
Bijou, Calif.	KOWL	1490	
Biloxi, Miss.	WLOX	1490	M
	WVMI	570	
Billings, Mont.	KBMY	1240	M
	KGHL	790	N
	KOOK	970	C
	KOYN	910	
Binghamton, N.Y.	WINR	680	N
	WKOP	1360	M
	WNBF	1290	C
Birmingham, Ala.	WAPI	1070	C
	WBRC	960	N
	WCRT	1260	
	WEDR	1220	
	WILD	850	M
	WLBS	900	
	WSGN	610	A
	WVOK	690	
Bisbee, Ariz.	KSUN	1230	M
Bishop, Calif.	KIBS	1230	
Bishopville, S.C.	WAGS	1380	
Bismarck, N.Dak.	KFYR	550	N
Bismarck-Mandan, N.Dak.	KGCU	1270	A-M
	KBOM	1270	M
Blackfoot, Idaho	KBLI	1490	
Blackstone, Va.	WKLV	1440	M
Bloomington, Ill.	WJBC	1230	A
Bloomington, Ind.	WTTS	1370	A
Bloomsburg, Pa.	WCNR	930	
	WHLM	550	
	WLTR	690	
Bluefield, W.Va.	WHIS	1440	N
	WKOY	1240	M
Blythe, Calif.	KYOR	1450	A
Blytheville, Ark.	KLCN	910	
	WIKC	1490	N
Bogalusa, La.	WHXY	920	
Boise, Idaho	KBOI	950	C
	KGEM	1140	A
	KIDO	630	N
	KYME	740	
Bonham, Tex.	KFYN	1420	
Boone, Iowa	KFGQ	1260	
	KWBG	1590	
Boone, N.C.	WATA	1450	
Boonville, Ind.	WBNL	1540	
Boonville, Mo.	KWRT	1370	
Booneville, Miss.	WBIP	1400	
Boonville, N.Y.	WBRV	900	
Borger, Tex.	KHUZ	1490	M
Boston, Mass.	WBZ	1030	N
	WCOP	1150	
	WBMS	1090	
	WVDA	1260	A
	WEEI	590	C
	WHDH	850	
	WMEX	1510	
	WORL	950	
Boulder, Colo.	KBOL	1490	
Bowling Green, Kentucky	WKCT	930	A
	WLBJ	1410	M
Bowl. Green, Ohio	WTLG	730	
Bownemont, Conn.	WKNB	840	
Bozeman, Mont.	KXLQ	1450	N
	KBMN	1230	
Bradbury Hgts., Md.	WPGC	1580	
Braddock, Pa.	WLOA	1550	
Bradenton, Fla.	WTRL	1490	
Bradford, Pa.	WESB	1490	M
Brady, Tex.	KNEL	1490	
Brainerd, Minn.	KLIZ	1380	M
Brampton, Ont.	CFJB	1090	
Brandon, Man.	CKX	1150	
Branson, Mo.	KBHM	1220	
Brantford, Ont.	CKPC	1380	
Brattleboro, Vt.	WTSA	1450	A
Brawley, Calif.	KROP	1300	A

Location	C.L.	Kc.	N.A.
Breckenridge, Minn.	KBMW	1450	
Breckenridge, Tex.	KSTB	1430	
Bremen, Ga.	WWCC	1440	
Bremerton, Wash.	KBRO	1490	
	KGIB	1540	
Brenham, Tex.	KWHI	1280	
Brevard, N.C.	WPNF	1240	M-N
Brewton, Ala.	WEBJ	1240	M
Bridgeport, Conn.	WICC	600	M
	WNAB	1450	A
Bridgeton, N.J.	WSNJ	1240	
Bridgewater, N.S.	CKBW	1000	
Brigham City, Utah	KBUH	800	
Bristol, Conn.	WBIS	1440	
Bristol, Tenn.	WOPI	1490	N
Bristol, Va.	WCYB	690	A
	WFHG	980	M
Brockton, Mass.	WBET	1460	
Brockville, Ont.	CFJR	1450	
Broken Bow, Nebr.	KCNI	1280	
Brookfield, Mo.	KGHM	1470	
Brookhaven, Miss.	WCHJ	1470	
	WJMB	1340	
Brookings, S.Dak.	KBRK	1430	
Brookline, Mass.	WBOS	1600	
Brooklyn, N.Y.	WPOW	1330	
Brownfield, Tex.	KTFY	1300	
Brownsville, Tex.	KBOR	1600	
Brownwood, Tex.	KBWD	1380	M
	KEAN	1240	
Brunswick, Ga.	WGIG	1440	A
	WMOG	1490	M
Brunswick, Maine	WCME	900	
Bryan, Tex.	KORA	1240	M
Buffalo, N.Y.	WBEN	930	N
	WBNY	1400	
	WEBR	970	M
	WGR	550	N
	WKBW	1520	A
	WWOL	1120	
Buffalo, Wyo.	KBBS	250	
Buford, Ga.	WOMF	1460	
Burbank, Calif.	KBLA	1490	
Burley, Idaho	KBAR	1230	A
Burlington, Iowa	KBUR	1490	A
Burlington, N.C.	WBBB	920	M
	WFNS	1150	
Burlington, Vt.	WCAX	620	C
	WDOT	1400	
	WJOY	1230	A
Butler, Pa.	WBUT	1050	
	WISR	680	
Butte, Mont.	KBOW	1490	C
	KOPR	550	A-M
	KXLF	1370	N
Cadillac, Mich.	WATT	1240	M
Caguas, P.R.	WRIA	1450	
	WRDL	1450	
	WVJP	1110	
Cairo, Ga.	WGRA	1300	A
Cairo, Ill.	WKRO	1490	M
Caldwell, Idaho	KCID	1490	
Calexico, Calif.	KICO	1490	
Calgary, Alta.	CFAC	960	
	CFCN	1060	
	CKXL	1140	
Calhoun, Ga.	WCGA	900	
Camas, Wash.	KRIV	1480	
Cambridge, Md.	WCEM	1240	M
Cambridge, Mass.	WTAO	740	
Cambridge, Ohio	WILE	1270	
Camden, Ark.	KAMD	910	M
	KPIN	1370	
Camden, N.J.	WCAM	1310	
	WKDN	800	
Camden, S.C.	WACA	1590	
Camden, Tenn.	WFWL	1220	
Cameron, Tex.	KMIL	1330	
Camilla, Ga.	WCLB	1220	
Campbell, Ohio	WHOT	1570	
Campbellsville, Ky.	WLCK	1450	
Campbellton, N.B.	CKNB	950	
	WTCO	1450	
Camrose, Alta.	CFCW	1230	
Canon City, Colo.	KRLN	1400	
Canton, Ga.	WCHK	1290	
Canton, Ill.	WBYS	1560	
Canton, Miss.	WDOB	1370	
Canton, N.C.	WWIT	970	
Canton, Ohio	WAND	900	
	WCMW	1060	
	WHBC	1480	A
Cape Girardeau, Mo.	KFVS	960	M
	KGMO	1220	
Carbondale, Ill.	WCIL	1020	
Carbondale, Pa.	WCDL	1440	
Caribou, Maine	WFST	600	
Carlisle, Pa.	WHYL	960	
Carlsbad, N.Mex.	KAVE	1240	C
	KPBM	740	
Carmi, Ill.	WROY	1460	
Carrizo Springs, Tex.	KBEN	1450	
Carroll, Iowa	KCIM	1380	
Carrollton, Ala.	WRAG	590	
Carrollton, Ga.	WLBB	1100	
Carson City, Nev.	KPTL	1400	
Cartersville, Ga.	WBHF	1450	M
Carthage, Ill.	WCAZ	990	
Carthage, Mo.	KDMO	1490	
Caruthersville, Mo.	KCRV	1370	
Casa Grande, Ariz.	KPIN	1280	
Casper, Wyo.	KSPR	1470	M
Casper, Wyo.	KATI	1400	
	KVOC	1230	A
Cebu, P.I.	DYRU	1260	C
Cedar City, Utah	KSUB	590	C
Cedar Rapids, Iowa	KCRG	1600	N
	KPIG	1450	
	WMT	600	C
Cedartown, Ga.	WGAA	1340	
Center, Tex.	KDET	930	
Centerville, Calif.	KBIF	900	
Centerville, Iowa	KCOG	1400	
Centerville, Tenn.	WHLP	1570	
Central City, Ky.	WNES	1600	
	WMTA	1380	
Centralia, Ill.	WCNT	1210	
Centralia & Chehalis, Wash.	KELA	1470	M
Centreville, Miss.	WGLC	1580	
Chadron, Nebr.	KCSR	1450	
Chambersburg, Pa.	WCHA	800	
	WCBG	1590	
Champaign, Ill.	WDWS	1400	C
Chanute, Kans.	KCRB	1460	
Chapel Hill, N.C.	WCHL	1360	
Charleroi, Pa.	WESA	940	
Chas. City, Iowa	KCHA	1580	
Charleston, Ill.	WEIC	1270	
Charleston, Mo.	KCHR	1350	
Charleston, S.C.	WCSC	1390	C
	WHAN	1340	A
	WPAL	730	
	WQSN	1450	M
	WTMA	1250	N
Charleston, W.Va.	WCAW	1300	
	WCHS	580	C
	WGKV	1300	N-A
	WKNA	950	A
	WTIP	1240	M
Charlotte, Mich.	WCER	1390	
Charlotte, N.C.	WBT	1110	C
	WAYS	610	A
	WGIV	1600	
	WIST	930	M
	WSOC	1240	N
	WWOK	1480	
Charlotte Amalie, V.I.	WSTA	1340	
Charlottesville, Va.	WCHV	1260	A
	WELK	1010	
	WINA	1400	
Charlottetown, P.E.I.	CFCY	630	
Chatham, Ont.	CFCO	630	
Chattanooga, Tenn.	WAGC	1560	M
	WAPO	1150	A
	WDEF	1370	N
	WDOD	1310	C
	WDXB	1450	
	WMFS	1260	
Cheboygan, Mich.	WCBY	1240	
Cheektowaga, N.Y.	WNIA	1230	
Chehalis, Wash.	KITI	1420	
Cheraw, S.C.	WCRE	1420	
Cherokee, Iowa	KCHE	1440	
Chester, Pa.	WDRF	1590	
	WVCH	740	
Chester, S.C.	WGOD	1490	M
Cheyenne, Wyo.	KFBC	1240	A
	KVWO	1370	M
Chicago, Ill.	WAAF	950	
	WAIT	820	
	WBBM	780	C
	WCBD	820	
	WCFL	1000	
	WCRW	1240	
	WEDC	1240	
	WGES	1390	
	WGN	720	M
	WIND	560	
	WJJD	1160	
	WLS	890	A
	WMAQ	670	N
	WMBI	1110	
	WSBC	1240	
Chickasha, Okla.	KWCO	1560	M
Chico, Calif.	KHSL	1290	C
	KXDC	1060	M
Chicopee, Mass.	WACE	730	
Chicoutimi, Que.	CBJ	1580	
Childress, Tex.	KCTX	1510	M
Chillicothe, Mo.	KCHI	1010	
Chillicothe, Ohio	WBEX	1490	A
	WCHI	1350	
Chilliwack, B.C.	CHWK	1270	
Chipley, Fla.	WBGC	1240	
Chippewa Falls, Wis.	WCHF	1150	
Christiansburg, Va.	WBCR	1260	
Christiansted, V.I.	WIVI	1230	
Church Hill, Tenn.	WMCH	1260	
Cicero, Ill.	WHFC	1450	
Cincinnati, Ohio	WCKY	1530	
	WCIN	1480	
	WCPO	1230	M
	WKRC	550	C
	WLW	700	N-A
	WSAI	1360	A
Clanton, Ala.	WKLF	980	
Claremont, N.H.	WTSV	1230	A
Clarksburg, W.Va.	WBLK	1400	N
	WHAR	1340	M
	WPDX	750	
Clarksdale, Miss.	WROX	1450	M
	WKDL	1600	
	WDXN	540	
	WJZM	1400	M
Clayton, Mo.	KXLW	1320	
Clayton, N.Mex.	KLMX	1450	
Clearfield, Pa.	WCPA	900	
Clearwater, Fla.	WTAN	1340	
Cleburne, Tex.	KCLE	1120	
Cleveland, Miss.	WCLD	1490	
Cleveland, Ohio	KYW	1100	N
	WDOK	1260	
	WERE	1300	
	WGAR	1220	C
	WHK	1420	M
	WJMO	1540	
	WJW	850	A
Cleveland, Tenn.	WBAC	1340	M
Cleveland, Tex.	KVLB	1410	
Cleve. Hgts., Ohio	WSRS	1490	
Clifton, Ariz.	KCLF	1400	A
	KHCD	1450	
Clinton, Ill.	WHOW	1520	
	KROS	1340	M
Clinton, Iowa	KCLN	1390	
Clinton, Mo.	KDKD	1280	
Clinton, N.C.	WRRZ	880	A
Clinton, Okla.	KWOE	1320	
Cloquet, Minn.	WKLK	1230	
Clovis, N.Mex.	KCLV	1240	A
	KICA	980	M
Coachella, Calif.	KCHV	970	
Coalinga, Calif.	KBMX	1470	
Coatesville, Pa.	WCOJ	1420	
Cocoa, Fla.	WKKO	860	
Cody, Wyo.	KODI	1400	A
Coeur d'Alene, Idaho	KVNI		M
Coffeyville, Kans.	KGGF	690	A
Colby, Kans.	KXXX	790	
Coldwater, Mich.	WTVB	1590	
Coleman, Tex.	KSTA	1000	
Colfax, Wash.	KCLX	1450	
College Sta., Tex.	WTAW	1150	
Colonial Heights, Va.	WCLA	1290	
Colorado City, Tex.	KVNC	1320	
Colo. Sprgs., Colo.	KRDO	1240	
	KVOR	1300	C
	KWBY	740	
	KAFA	1460	
Columbia, Ky.	WAIN	1270	
Columbia, Miss.	WCJU	1450	M
Columbia, Mo.	KFRU	1400	A
	KBIA	1580	
Columbia, S.C.	WCOS	1400	A
	WIS	560	N
	WMSC	1320	C
	WNOK	1230	M
	WOIC	1470	
Columbia, Tenn.	WJGD	1280	
	WKRM	1340	M
Columbus, Ga.	WDAK	1340	N
	WRBL	1420	C
	WGBA	1270	A
	WCLS	1580	
Columbus, Ind.	WCSI	1010	
Columbus, Miss.	WACR	1050	M
	WCBI	550	
Columbus, Nebr.	KJSK	920	
Columbus, Ohio	WBNS	1460	C
	WCOL	1230	A
	WOSU	820	
	WTVN	610	M
	WVKO	1580	
Colville, Wash.	KCVL	1480	
Concord, N.H.	WKXL	1450	C
Concord, N.C.	WEGO	1410	
Concordia, Kans.	KNCK	1390	
Connellsville, Pa.	WCVI	1340	
Connersville, Ind.	WCNB	1580	
Conroe, Tex.	KMCO	900	
Conway, Ark.	KCON	1230	
Conway, N.H.	WJWG	1050	
Conway, S.C.	WLAT	1330	M
Cookeville, Tenn.	WHUB	1400	C
Coolidge, Ariz.	KCKY	1150	C
Coos Bay, Oreg.	KOOS	630	M
	KYNG	1420	
Coquille, Oreg.	KWRO	1450	
Coral Gables, Fla.	WTTT	1490	
	WVCG	1070	
Corbin, Ky.	WCTT	680	M
Cordele, Ga.	WMJM	1490	M
Cordova, Alaska	KLAM	1450	
Corinth, Miss.	WCMA	1230	M
Cornelia, Ga.	WCON	1450	A
Corner Brook, Nfld.	CBY	790	
Corning, N.Y.	WCBA	1350	
	WCLI	1450	A
Cornwall, Ont.	CKSF	1230	
Corona, Calif.	KBUC	1370	
Corpus Christi, Tex.	KATR	1030	
	KCCT	1150	
	KEYS	1440	C
	KRIS	1360	M-N
	KSIX	1230	A
	KUNO	1400	M
Corry, Pa.	WOTR	1370	
Corsicana, Tex.	KAND	1340	
Cortez, Colo.	KVFC	740	
Cortland, N.Y.	WKRT	920	
Corvallis, Oreg.	KOAC	550	
	KFLY	1240	
	KLOO	1340	
Coshocton, Ohio	WTNS	1560	
Cottage Grove, Oreg.	KOMB	1400	
Coudersport, Pa.	WFRM	600	
Council Bluffs, Iowa	KSWI	1560	
Covington, Ga.	WGFS	1430	
Covington, Ky.	WZIP	1050	
Covington, La.	WARB	730	
Covington, Tenn.	WKBL	1250	
Covington, Va.	WKEY	1340	A
Cowan, Tenn.	WZYX	1440	
Craig, Colo.	KRAI	550	
Crescent City, Calif.	KCRE	1400	
Creston, Iowa	KSIB	1520	
Crestview, Fla.	WCNU	1010	
	WJSB	1050	
Crewe, Va.	WSVS	800	
Crockett, Tex.	KIVY	1290	
Crookston, Minn.	KROX	1260	
Crossett, Ark.	KAGH	1340	N
Crossville, Tenn.	WAEW	1330	
Crowley, La.	KSIG	1450	
Cuero, Tex.	KCFH	1600	
Cullman, Ala.	WFMH	1460	
	WKUL	1340	M
Culpeper, Va.	WCVA	1490	M
Cumberland, Ky.	WCPM	1490	M
Cumberland, Md.	WCUM	1230	A-M
	WTBO	1450	N
Cushing, Okla.	KUSH	1600	
Cynthiana, Ky.	WCYN	1400	
Dade City, Fla.	WDCF	1350	
Dalhart, Tex.	KXIT	1410	
Dallas, Oreg.	KPLK	1460	
Dallas, Tex.	KRLD	1080	C
	KIXL	1040	
	KSKY	660	
	KLIF	1190	
	WFAA	570	A
	WFAA	820	N
	KGKO	1480	
	WRR	1310	M
The Dalles, Oreg.	KRMW	1300	
Dalton, Ga.	WBLJ	1230	M
	WRCD	1430	
Danbury, Conn.	WLAD	800	
Danville, Ill.	WDAN	1490	C
	WITY	980	
Danville, Ky.	WHIR	1230	M
Danville, Va.	WBTM	1330	A
	WDVA	1250	M
Darlington, S.C.	WPFD	1350	
Dauphin, Man.	CKDM	1050	
Davenport, Iowa	WOC	1420	N
	KFMA	1580	
	KSTT	1170	M
Dawson, Ga.	WDWD	990	A
Dawson Creek, B.C.	CJDC	1350	
Dayton, Ohio	WHIO	1290	C
	WING	1410	A
	WONE	980	
	WAVI	1210	
Daytona Beach, Fla.	WNDB	1150	M-A
	WMFJ	1450	
	WROD	1340	N
Deadwood, S.Dak.	KDSJ	980	M
Dearborn, Mich.	WKMH	1310	
Decatur, Ala.	WHOS	800	
	WAJF	1490	
	WMSL	1400	M
Decatur, Ga.	WEAS	1010	
	WTAM	970	
Decatur, Ill.	WDZ	1050	A
	WSOY	1340	C
Decorah, Iowa	KDEC	1240	M
	KWLC	1240	
Defiance, Ohio	WONW	1280	
De Funiak Springs, Fla.	WDSP	1280	
	WFNM	1460	
De Kalb, Ill.	WLBK	1360	
De Land, Fla.	WJBS	1490	N
	WOOO	1310	
Delano, Calif.	KCHJ	1010	
Delray, Bch., Fla.	WDBF	1420	
Del Rio, Tex.	KDLK	1230	
Delta, Colo.	KDTA	1400	
Deming, N.Mex.	KOTS	1230	
Demopolis, Ala.	WXAL	1400	M
Denison, Iowa	KDSN	1580	
Denison, Tex.	KDSX	950	
Denton, Tex.	KDNT	1440	
Denver, Colo.	KDEN	1340	
	KFML	1390	
	KIMN	950	M
	KLIR	990	
	KLZ	560	C
	KMYR	710	
	KOA	850	N
	KPOF	910	
	KFSC	1220	
	KTLN	1280	
	KVOD	630	A
De Queen, Ark.	KDQN	1390	
DeRidder, La.	KDLA	1010	
Des Moines, Iowa	KCBC	1390	
	KIOA	940	M
	KRNT	1350	C
	KSO	1460	A
	KWDM	1150	
	WHO	1040	N
Detroit, Mich.	WCAR	1130	
	WJBK	1500	
	WJLB	1400	
	WJR	760	C
	WWJ	950	N
	WXYZ	1270	A
Detroit Lakes, Minn.	KDLM	1340	
Devils Lake, N.Dak.	KDLR	1240	M
Dexter, Mo.	KDEX	1590	
Dickinson, N.Dak.	KDIX	1230	
Dickson, Tenn.	WDKN	1260	

Location	C.L.	Kc.	N.A.
Dillon, Mont.	KDBM	800	
Dillon, S.C.	WDSC	800	A-M
Dinuba, Calif.	KRDU	1240	
Dodge City, Kans.	KGNO	1370	
Dothan, Ala.	WAGF	1320	N
	WDIG	1450	A
	WOOF	560	
Douglas, Ariz.	KAWT	1450	N
Douglas, Ga.	WDMG	860	
Douglas, Wyo.	KWIV	1050	
Dover, Del.	WDOV	1410	
Dover, N.H.	WTSN	1270	
Dover, Ohio	WJER	1450	
Doylestown, Pa.	WBUX	1570	
Drummondville, Que.	CHRD	1340	
Dublin, Ga.	WMLT	1330	
Du Bois, Pa.	WCED	1420	C
Dubuque, Iowa	KDTH	1370	N
	WDBQ	1490	A-M
Duluth, Minn.	KDAL	610	C
	WDSM	710	M
	WEBC	560	N
	WREX	1080	
Dumas, Tex.	KDDD	800	
Duncan, Okla.	KRHD	1350	M
Dundalk, Md.	WAYE	860	
	WEBB	1360	
Dundee, N.Y.	WFLR	1570	
Dunkirk, N.Y.	WFCB	1410	
Dunn, N.C.	WCKB	780	
Du Quoin, Ill.	WDQN	1580	
Durango, Colo.	KIUP	930	M
Durant, Okla.	KSEO	750	
Durham, N.C.	WDNC	620	C
	WSRC	1410	
	WSSB	1400	M
	WTIK	1310	A
Dyersburg, Tenn.	WDSG	1450	M
	WTRO	1330	
Eagle Pass, Tex.	KEPS	1270	
Easley, S.C.	WELP	1360	
Eastland, Tex.	KERC	5190	
E. Lansing, Mich.	WKAR	870	
E. Liverpool, Ohio	WOHI	1490	A
E. Point, Ga.	WTJH	1260	
E. St. Louis, Ill.	WTMV	1490	
Easton, Pa.	WEEX	1230	
	WEST	1400	N
Eau Claire, Wis.	WEAU	790	N
	WBIZ	1400	A-M
	WRFW	1050	
Eau Gallie, Fla.	WMEG	920	
Edenton, N.C.	WCDJ	1260	
Edinburg, Tex.	KURV	710	
Edmonds, Wash.	KGDN	630	
Edmonton, Alta.	CBX	1010	
	CBXA	740	
	CFRN	1260	
	CHED	1080	
	CHFA	680	
	CJCA	930	
	CKUA	580	
Edmundston, N.C.	CJEM	570	
Effingham, Ill.	WCRA	1090	
Elberton, Ga.	WSGC	1400	M
El Cajon, Calif.	KBAB	910	
El Campo, Tex.	KULP	1390	
El Centro, Calif.	KXO	1230	M
El Dorado, Ark.	KDMS	1290	
	KELD	1400	A
El Dorado, Kans.	KBTO	1360	
Electra, Tex.	KELT	1050	
Elgin, Ill.	WRMN	1410	
Elizabeth City, N.C.	WCNC	1240	M
	WGAI	560	A
Elizabethton, Tenn.	WBEJ	1240	M
Elizabethtown, Ky.	WIEL	1400	
Elizabethtown, N.C.	WBLA	1450	
Elk City, Okla.	KASA	1240	M
Elkhart, Ind.	WTRC	1340	N
Elkin, N.C.	WIFM	1540	M
Elkins, W.Va.	WDNE	1240	M
Elko, Nev.	KELK	1240	M
Ellensburg, Wash.	KXLE	1240	
Elmira, N.Y.	WELM	1400	A-C
	WENY	1230	M-N
Elmira Hghts.-Horseheads, N.Y.		1590	
El Paso, Tex.	KROD	600	C
	KELP	920	
	KHEY	690	A
	KSET	1340	M
	KTSM	1380	N
Ely, Minn.	WELY	1450	
Ely, Nev.	KELY	1230	M
Elyria, Ohio	WEOL	930	
Eminence, Ky.	WSTL	1600	
Emporia, Kans.	KTSW	1400	M
	KVOE	1400	
Emporia, Va.	WEVA	860	
Endicot, N.Y.	WENE	1430	A
Englewood, Colo.	KGMC	1150	
Enid, Okla.	KCRC	1390	A
	KGWA	960	M
Enterprise, Ala.	WIRB	1230	
Ephrata, Pa.	WSGA	1310	
Ephrata, Wash.	KULE	730	
Erie, Pa.	WERC	1260	N
	WIKK	1330	N
	WJET	1400	
	WLEU	1450	M
Erwin, Tenn.	WEMB	1420	
Escanaba, Mich.	WDBC	680	M
	WESK	1490	

Location	C.L.	Kc.	N.A.
Estherville, Iowa	KLIL	1340	A
Etowah, Tenn.	WCPH	1220	
Eufaula, Ala.	WULA	1240	M
Eugene, Oreg.	KORE	1450	M
	KASH	1600	A
	KERG	1280	C
	KUGN	590	N
Eunice, La.	KEUM	1490	M
Eureka, Calif.	KHUM	980	C
	KDAN	790	
	KIEM	1480	M
Eustis, Fla.	WLCO	1240	
Evanston, Ill.	WEAW	1330	
	WNMP	1590	
Evanston, Wyo.	KLUK	1240	M
Evansville, Ind.	WEOA	1400	C
	WGBF	1280	N
	WIKY	820	
	WJPS	1330	A
Eveleth, Minn.	WEVE	1340	M
Everett, Wash.	KRKO	1380	M
	KQTY	1230	
Fairbanks, Alaska	KFAR	660	A-M-N
	KFRB	900	C
Fairfax, Va.	WFCR	1310	
Fairfield, Ill.	WFIW	1390	
Fairfield, Iowa	KFAD	1570	
Fairmont, Minn.	KSUM	1370	M
Fairmont, N.C.	WFMO	860	
Fairmont, W.Va.	WMMN	920	C
	WTCS	1490	A
Fajardo, P.R.	WMDD	1490	
Falfurrias, Tex.	KBLP	1260	
Fall River, Mass.	WALE	1400	M
	WSAR	1480	A
Falls Church, Va.	WFAX	1220	
Falls City, Nebr.	KTNC	1230	
Fargo, N.Dak.	WDAY	970	N
	KFNW	900	
	KFGO	790	A
Faribault, Minn.	KDHL	920	
Farmington, Mo.	KREI	800	
Farmington, N.Mex.	KVBC	1240	
Farmville, Va.	WFLO	870	
Farrell, Pa.	WFAR	1470	
Fayette, Ala.	WWWF	990	
Fayetteville, Ark.	KGRH	1450	M
Fayetteville, N.C.	WFAI	1230	C
	WFNC	1390	M
	WFLB	1490	A
	WWNF	1230	
Fayetteville, Tenn.	WEKR	1240	M
Fergus Falls, Minn.	KGDE	1250	M
Fernandina Beach, Fla.	WFBF	1570	
Ferriday, La.	KFNV	1600	
Festus, Mo.	KJCF	1010	
Findlay, Ohio	WFIN	1330	
Fisher, W.Va.	WELD	690	
Fitchburg, Mass.	WEIM	1280	M
	WFGM	1580	
Fitzgerald, Ga.	WBHB	1240	M
Flagstaff, Ariz.	KCLS	600	
	KVNA	690	A
Flat River, Mo.	KFMO	1240	M
Flin Flon, Man.	CFAR	590	
Flint, Mich.	WFDF	910	N
	WBBC	1330	M
	WAMM	1420	
	WMRP	1570	
	WKMF	1470	
	WTAC	600	A
Flomaton, Ala.	WTCB	990	
Florence, Ala.	WJOI	1340	A
	WOWL	1240	
Florence, S.C.	WJMX	970	A
	WOLS	1230	
Floydada, Tex.	KFLD	900	
Foley, Ala.	WHEP	1310	
Fond du Lac, Wis.	KFIZ	1450	M
Forest, Miss.	WMAG	860	
Forest City, N.C.	WBBO	780	
Forest Grove, Oreg.	KFGR	1570	
Forrest City, Ark.	KXJK	950	
Ft. Atkinson, Wis.	WTKM	1540	
Ft. Bragg, Calif.	KDAC	1230	
Ft. Collins, Colo.	KCOL	1410	
Ft. Dodge, Iowa	KVFD	1400	M
	KEOK	540	
Ft. Frances, Ont.	CFOB	800	
Ft. Lauderdale, Fla.	WFTL	1400	
	WWIL	1580	
Ft. Lupton, Colo.	KHIL	800	
Ft. Madison, Iowa	KXGI	1360	
Ft. Morgan, Colo.	KFTM	1400	
Ft. Myers, Fla.	WINK	1240	C
	WMYR	1410	
Ft. Payne, Ala.	WFPA	1400	
	WZOB	1250	
Ft. Pierce, Fla.	WARN	1330	A
	WIRA		M-N
Ft. Scott, Idaho	KMDO	1600	
Ft. Smith, Ark.	KFPW	1230	C
	KFSA	950	A
	KTCS	1410	
	KWHN	1320	M
Ft. Stockton, Tex.	KFST	860	
Ft. Valley, Ga.	WFPM	1150	
Ft. Walton, Fla.	WFTW	1260	
Ft. Walton Beach, Fla.	WFBS	950	
Ft. Wayne, Ind.	WGL	1250	A
	WOWO	1190	N

Location	C.L.	Kc.	N.A.
Ft. Wayne, Ind.	WANE	1450	C
	WKJG	1380	M
Ft. William, Ont.	CKPR	580	
Ft. Worth, Tex.	KCNC	870	
	KCUL	1540	
	KFJZ	1270	M
	KNOK	970	
	WBAP	570	A
	WBAP	820	N
	KXOL	1360	
Fostoria, Ohio	WFOB	1430	
Fountain Inn, S.C.	WFIS	1600	
Framingham, Mass.	WKOX	1190	
Frankfort, Ind.	WILO	1570	
Frankfort, Ky.	WFKY	1490	M
Franklin, Ky.	WFKN	1220	
Franklin, N.C.	WFSC	1050	
Franklin, Tenn.	WAGG	950	
Franklin, Va.	WYSR	1250	
Frederick, Md.	WFMD	930	C
Frederick, Okla.	KTAT	1570	
Fredericksburg, Tex.	KNAF	1340	M
Fredericksburg, Va.	WFVA	1230	A
Fredericton, N.B.	CFNB	550	
Freeport, Ill.	WFRL	1570	
Freeport, N.Y.	WGBB	1240	
Freeport, Tex.	KBRZ	1460	
Fremont, Mich.	WBFC	1490	
Fremont, Nebr.	KFGT	1340	M
Fremont, Ohio	WFRO	900	
Fresno, Calif.	KARM	1430	A
	KFRE	940	C
	KGST	1600	
	KMAK	1340	
	KMJ	580	N
	KYNO	1300	M
Front Royal, Va.	WFTR	1450	M
Fulton, Ky.	WFUL	1270	
Fulton, Mo.	KFAL	900	
Fulton, N.Y.	WOSC	1300	
Fuquay Sprgs., N.C.	WFVG	1460	
Gadsden, Ala.	WGAD	1350	A
	WETO	930	
	WCAS	570	
Gaffney, S.C.	WFGN	1570	
Gainesville, Fla.	WDVH	980	
	WGGG	1230	A
	WRUF	850	M
Gainesville, Ga.	WGGA	550	M
	WDUN	1240	A
	WLBA	1580	
Gainesville, Tex.	KGAF	1580	
Galax, Va.	WBOB	1360	M
Galesburg, Ill.	WGIL	1400	
Gallatin, Tenn.	WHIN	1010	
Gallipolis, Ohio	WJEH	990	
Gallup, N.Mex.	KGAK	1330	
Galt, Ont.	CKGR	1110	
Galveston, Tex.	KLUF	1400	M
	KGBC	1540	
Gander, Nfld.	CBG	1450	
Garden City, Kans.	KNCO	1050	
	KIUL	1240	M
Gardner, Mass.	WGAW	1340	
Gary, Ind.	WWCA	1270	
	WGRY	1370	
Gastonia, N.C.	WGNC	1450	A
	WLTC	1370	
Gaylord, Mich.	WATC	900	
Geneva, Ala.	WGEA	1150	
Geneva, N.Y.	WGVA	1240	A
Georgetown, Del.	WJWL	900	
Georgetown, S.C.	WGTN	1400	M
Gettysburg, Pa.	WGET	1450	
Gladewater, Tex.	KSIJ	1320	
Glasgow, Ky.	WKAY	1490	
Glasgow, Mont.	KLTZ	1240	
Glendale, Ariz.	KRUX	1340	
Glendale, Calif.	KIEV	870	
Glendive, Mont.	KXGN	1400	
Glen Falls, N.Y.	WWSC	1450	C
Glenwood Sprgs., Colo.	KGLN	980	M
Globe, Ariz.	KWJB	1240	N
Gloucester, Va.	WDDY	1420	
Gloversville-Johnston, N.Y.	WENT	1340	C
Golden, Colo.	KGOL	1250	
Golden Meadow, La.	KLFT	1600	
Goldsboro, N.C.	WFMC	730	
	WGBR	1150	A
	WGOL	1300	
Gonzales, Tex.	KCTI	1450	
Goodland, Kans.	KWGB	730	M
Goshen, Ind.	WKAM	1460	
Grafton, W.Va.	WVVW	1260	
Graham, Tex.	KSWA	1330	
Granby, Que.	CHEF	1450	
Grand Coulee, Wash.	KFDR	1400	
Grand Falls, Nfld.	CBT	990	
Grand Forks, N.Dak.	KFJM	1440	
	KILO	1060	C
	KNOX	1310	M
Grand Haven, Mich.	WGHN	1370	
Grand Island, Nebr.	KMMJ	750	A
	KRGI	1430	
Grand Junction, Colo.	KREX	920	M
	KEXO	1230	
Grand Prairie, Alta.	CEGE	1050	

Location	C.L.	Kc.	N.A.
Grand Prairie, Tex.	KBCS	730	
Grand Rapids, Mich.	WJEF	1230	C
	WFUR	1570	
	WGRD	1410	
	WLAV	1340	A
	WMAX	1480	
	WOOD	1300	N
Grand Rapids, Minn.	KOZY	1490	M
Grangeville, Idaho	KORT	1230	
Grants, N.Mex.	KMIN	980	
Grants Pass, Oreg.	KUIN	1340	M
Gravelbourg, Sask.	CFGR	1230	
Gt. Barrington, Mass.	WSBS	860	
Gt. Bend, Kans.	KVGB	1590	M-N
Gt. Falls, Mont.	KFBB	1310	C
	KUDI	1450	
	KMON	560	A-M
	KXLK	1400	N
Greeley, Colo.	KFKA	1310	
	KYOU	1450	
Green Bay, Wis.	WBAY	1360	C
	WJPG	1440	M
	WDUZ	1400	A
Greenfield, Mass.	WHAI	1240	
Greensboro, N.C.	WBIG	1470	C
	WCOG	1320	A
	WGBG	1400	M
	WPET	950	
Greensburg, Pa.	WHJB	620	
Greenville, Ala.	WGYV	1380	A
Greenville, Miss.	WJPR	1330	M
	WDDT	900	
	WGVM	1260	
Greenville, N.C.	WGTC	1590	M
Greenville, S.C.	WESC	660	M
	WFBC	1330	N
	WMRB	1490	C
	WMUU	1260	
	WQOK	1440	A
Greenville, Tenn.	WGRV	1340	M
Greenville, Tex.	KGVL	1400	M
Greenwood, Miss.	WABG	960	A
	WGRM	1240	N
Greenwood, S.C.	WCRS	1450	N
	WGSW	1350	M
Greer, S.C.	WEAB	800	
	WCKI	1300	
Grenada, Miss.	WNAG	1400	M
Gresham, Oreg.	KGRO	1230	
Gretna, Va.	WMNA	730	
Griffin, Ga.	WKEU	1450	M
	WHIE	1320	
Grove City, Pa.	WSAJ	1340	
Grundy, Va.	WNRG	1250	
Guayama, P.R.	WXRF	1590	
Guelph, Ont.	CJOY	1450	
Gulfport, Miss.	WDEB	1390	
	WGCM	1240	A
Guntersville, Ala.	WGSV	1270	
Guthrie, Okla.	KWRW	1490	
Guymon, Okla.	KGYN	1220	
Hagerstown, Maryland	WARK	1490	C
	WJEJ	1240	A-M
Haines City, Fla.	WGTO	540	
Haleyville, Ala.	WJBB	1230	M
Halifax, N.S.	CBH	1330	
	CHNS	960	
	CJCH	920	
Hamilton, Ala.	WERH	970	
Hamilton, Ohio	WMOH	1450	
Hamilton, Ont.	CHML	900	
	CKOC	1150	
Hamilton, Tex.	KCLW	900	
Hammond, Ind.	WJOB	1230	
Hammond, La.	WFPR	1400	
Hampton, Va.	WVEC	1490	N
Hancock, Mich.	WMPL	920	
Hanford, Calif.	KNGS	620	
Hannibal, Mo.	KHMO	1070	M
Hanover, N.H.	WTSL	1400	A
Hanover, Pa.	WHVR	1280	M
Harlan, Ky.	WHLN	1280	M
Harlingen, Tex.	KGBT	1530	
Harriman, Tenn.	WHBT	1230	M
Harrisburg, Ill.	WEBQ	1240	
Harrisburg, Pa.	WHGB	1400	A
	WCMB	1460	M
	WHP	580	C
	WKBO	1230	N
Harrison, Ark.	KHOZ	1240	M
Harrisonburg, Va.	WHBG	1360	
	WSVA	550	N
Harrodsburg, Ky.	WHBN	1420	
Hartford, Conn.	WDRC	1360	C
	WCCC	1290	
	WPOP	1410	M
	WTIC	1080	N
Hartselle, Ala.	WHRT	860	
Hartsville, S.C.	WHSC	1450	M
Hartwell, Ga.	WKLY	980	
Harvard, Ill.	WMCW	1600	
Harvey, Ill.	WBEE	1570	
Hastings, Nebr.	KHAS	1230	M
Hattiesburg, Mississippi	WBKH	950	
	WFOR	1400	N
	WHSY	1230	A
Haverhill, Mass.	WHAV	1490	
Havre, Mont.	KOJM	610	
Havre de Grace, Md.	WASA	1330	

Location	C.L.	Kc.	N.A.
Hawkinsville, Ga.	WCEH	610	
Hays, Kans.	KAYS	1400	
Hazard, Ky.	WKIC	1430	M
Hazlehurst, Miss.	WMDC	1220	
Hazleton, Pa.	WAZL	1490	N-M
Helena, Ark.	KFFA	1360	M
Helena, Mont.	KCAP	1340	
	KXLJ	1240	N
Hempstead, N.Y.	WHLI	1100	
Henderson, Ky.	WSON	860	M
Henderson, Nev.	KBMI	1400	
	KTOO	1280	
Henderson, N.C.	WHNC	890	M
	WHVH	1450	
Henderson, Tex.	KGRI	1000	
	KWRD	1470	
Hendersonville, N.C.	WHKP	1450	A
Henryetta, Okla.	KHEN	1590	
Hereford, Tex.	KPAN	860	
Herkimer, N.Y.	WALY	1420	
Hermiston, Oreg.	KOHU	1570	
Herrin, Ill.	WJPF	1340	M
Hettinger, N.Dak.	KNDC	1490	
Hibbing, Minn.	WMFG	1240	N
Hickory, N.C.	WHKY	1290	A
	WIRC	630	M
High Point, N.C.	WMFR	1230	A
	WNOS	1500	
	WHPE	1070	
Hillsboro, Ohio	WSRW	1590	
Hillsboro, Oreg.	KUIK	1360	
Hillsboro, Tex.	KHBR	1560	
Hillsdale, Mich.	WBSE	1340	
Hilo, Hawaii	KHBC	970	C
	KILA	850	
Hobart, Okla.	KTJS	1420	
Hobbs, N.Mex.	KWEW	1480	M
Holbrook, Ariz.	KDJI	1270	
Holdredge, Nebr.	KUVR	1380	
Holland, Mich.	WHTC	1450	
Hollywood, Fla.	WGMA	1320	
Holyoke, Mass.	WREB	930	
Homer, La.	KVHL	1320	
Homestead, Pa.	WAMO	860	
Homewood, Ala.	WEZB	1320	
	WJLB	1400	
Honolulu, Hawaii	KGMB	590	C
	KHON	1380	
	KIKI	830	
	KGU	760	N
	KHVH	1040	
	KPOA	630	M
	KULA	690	A
Hood River, Oreg.	KIHR	1340	
Hope, Ark.	KXAR	1490	M
Hopewell, Va.	WHAP	1340	
Hopkinsville, Ky.	WHOP	1230	C
	WKOA	1480	
Hornell, N.Y.	WWHG	1320	
	WLEA	1480	M
Hot Springs, Ark.	KWFC	1350	A-M
	KBHS	590	
	KBLO	1470	
Houghton, Mich.	WHDF	1400	
Houghton Lake, Mich.	WHGR	1290	
Houlton, Maine	WABM	1340	
Houma, La.	KCIL	1490	N
Houston, Miss.	WCPC	1320	
Houston, Tex.	KCOH	1430	
	KLBS	610	
	KNUZ	1230	
	KPRC	950	N
	KTHT	790	M
	KTRH	740	C
	KXYZ	1320	A
	KYOK	1590	
Howell, Mich.	WHMI	1350	
Hudson, N.Y.	WHUC	1230	
Hugo, Okla.	KIHN	1340	
Hull, Que.	CKCH	970	
Humbolt, Tenn.	WIRJ	740	
Huntington, N.Y.	WGSM	740	
Huntington, Pa.	WHUN	1150	
Huntington, W.Va.	WPLH	1470	
	WHTN	800	
	WSAZ	930	A
Huntsville, Ala.	WBHP	1230	M
	WFUN	1450	
	WHBS	1550	A
Huntsville, Tex.	KSAM	1490	M
Huron, S.Dak.	KIJV	1340	M-N
Hutchinson, Kan.	KWBW	1450	N
	KWHK	1260	
Hutchinson, Minn.	KDUZ	1260	
Idabel, Okla.	KBEL	1240	
Idaho Falls, Idaho	KID	590	C
	KIFI	1060	A-M
Independence, Kans.	KIND	1010	M
Independence, Mo.	KIMO	1510	
Indiana, Pa.	WDAD	1450	C
Indianapolis, Ind.	WFBM	1260	C
	WGEE	1590	
	WIBC	1070	M
	WIRE	1430	N
	WXLW	950	
Indianola, Miss.	WNLA	1380	
Indio, Calif.	KREO	1400	A
Inkster, Mich.	WCHB	1440	
Ionia, Mich.	WION	1430	
Iowa City, Iowa	KXIC	800	
	WSUI	910	

Location	C.L.	Kc.	N.A.
Iron Mtn., Mich.	WMIQ	1450	A
Iron River, Mich.	WIKB	1230	M
Ironton, Ohio	WIRO	1230	M
Ironwood, Mich.	WJMS	630	M
Ishpeming, Mich.	WJPD	1240	
Ithaca, N.Y.	WHCU	870	C
	WTKO	1470	
Jackson, Ala.	WPBB	1290	
Jackson, Mich.	WIBM	1450	A
	WKHM	970	M
Jackson, Miss.	WJDX	620	M
	WJQS	1400	C
	WJXN	1450	
	WOKJ	1590	
	WRBC	1300	M
	WSLI	930	A
Jackson, Ohio	WLMJ	1280	
Jackson, Tenn.	WDXI	1310	N
	WJAK	1460	
	WPLI	1490	
	WTJS	1390	A
Jacksonville, Fla.	WJAX	930	N
	WJHP	1320	M
	WIVY	1050	
	WMBR	1460	C
	WOBS	1360	
	WPDQ	600	A
	WQIK	1280	
	WRHC	1400	
Jacksonville, Ill.	WLDS	1180	
Jacksonville, N.C.	WJNC	1240	M
	WLAS	910	
Jacksonville, Tex.	KEBE	1400	
Jacksonville, Bch., Fla.	WZRO	1010	
Jamestown, N.Dak.	KEYJ	1400	
	KSJB	600	
Jamestown, N.Y.	WJTN	1240	A
	WJOC	1340	M
Janesville, Wis.	WCLO	1230	M
Jasper, Ala.	WWWB	1360	M
Jasper, Ind.	WITZ	990	
Jasper, Tex.	KTXJ	1350	
Jefferson City, Mo.	KLIK	950	
	KWOS	1240	M
Jennings, La.	KJEF	1290	
Jerome, Idaho	KART	1400	
Jesup, Ga.	WBGR	1370	
Johnson City, Tenn.	WJHL	910	A
	WETB	790	
Johnstown, Pa.	WJAC	1400	N
	WARD	1490	C
	WCRO	1230	A-M
Joliet, Ill.	WJOL	1340	
Jonesboro, Ark.	KBTM	1230	M
	KNEA	970	
Jonesville, La.	WLEC	1480	
Jonquiere, Que.	CKRS	590	
Joplin, Mo.	WMBH	1450	M
	KFSB	1310	
	KODE	1230	C
Junction, Tex.	KMBL	1450	
Junc. City, Kans.	KJCK	1420	
Juneau, Alaska	KINY	800	C
	KJNO	630	A-M-N
Kaimuki, Hawaii	KAIM	870	
Kalamazoo, Mich.	WKZO	590	C
	WKLZ	1470	
	WGFG	1360	A-N
	WKMI	1360	
Kalispell, Mont.	KGEZ	600	
	KOFI	980	
Kamloops, B.C.	CFJC	910	
Kane, Pa.	WADP	960	
Kankakee, Ill.	WKAN	1320	
Kannapolis, N.C.	WGTL	870	
Kans. City, Kans.	KCKN	1340	
Kansas City, Mo.	KCMO	810	A
	KFRM	550	
	KMBC	980	C
	KPRS	1590	
	KUDL	1380	
	WDAF	610	N
	WHB	710	M
Kearney, Nebr.	KGFW	1340	M
	KRNY	1460	
Keene, N.H.	WKNE	1290	C
Kelowna, B.C.	CKOV	630	
Kelso, Wash.	KLOG	1490	
Kendallville, Ind.	WKTL	1570	
Kenedy, Tex.	KENN	990	
Kenmore, N.Y.	WXRA	1080	
Kennett, Mo.	KBOA	830	
Kennewick-Pasco-Richland, Wash.	KEPR	610	
Kenora, Ont.	CJRL	1220	
Kenosha, Wis.	WLIP	1050	
Kentville, N.S.	CKEN	1350	
Keokuk, Iowa	KOKX	1310	
Kermit, Tex.	KERB	600	
Kerrville, Tex.	KERV	1230	
Ketchikan, Alaska	KABI	580	A-M-N
	KTKN	930	C
Kewanee, Ill.	WKEI	1450	
Keyser, W.Va.	WKYR	1270	
Key West, Fla.	WKWF	1600	M
Kilgore, Tex.	KOCA	1240	
Killeen, Tex.	KLEN	1050	
Kingman, Ariz.	KAAA	1230	A
Kings Mountain, N.C.	WKMT	1220	
Kingsport, Tenn.	WKIN	1320	
	WKPT	1400	N
Kingston, N.Y.	WKNY	1490	
Kingston, Ont.	CFRC	1490	
	CKLC	1380	
	CKWS	960	

Location	C.L.	Kc.	N.A.
Kingstree, S.C.	WDKD	1310	
Kingsville, Tex.	KINE	1330	
Kinston, N.C.	WELS	1010	
	WFTC	960	A
	WISP	1230	
Kirkland, Wash.	KNBX	1050	
Kirkland Lake, Ont.	CJKL	560	
Kirksville, Mo.	KIRK	1450	
Kitchener, Ont.	CKCR	1490	
Kissimmee, Fla.	WRWB	1220	
Kittanning, Pa.	WACB	1380	
Klamath Falls, Oreg.	KFJI	1150	M
	KFLW	1450	A
	KLAD	900	
Knoxville, Tenn.	WBIR	1240	A
	WIBK	800	
	WIVK	860	
	WATE	620	N
	WKGN	1340	M
	WKXV	900	
	WNOX	990	C
Kokomo, Ind.	WIOU	1350	C
Kosciusko, Miss.	WKOZ	1350	A
Laconia, N.H.	WLNH	1350	
LaCrosse, Wis.	WKBH	1410	N
	WLDL	1490	M
	WKTY	580	A
Ladysmith, Wis.	WLDY	1340	
Lafayette, Ga.	WLFA	1590	
Lafayette, Ind.	WASK	1450	M
Lafayette, La.	KLFY	1420	A
	KVOL	1330	N
LaFollette, Tenn.	WLAF	1450	
LaGrande, Oreg.	KLBM	1450	
LaGrange, Ga.	WLAG	1240	M
	WTRP	620	
LaGrange, Ill.	WTAQ	1300	
Laguna Beach, Calif.	KTED	1520	
LaJunta, Colo.	KBNZ	1400	
Lake Charles, La.	KLOU	1580	C
	KPLC	1470	N
	KAOK	1400	
Lake City, Fla.	WDSR	1340	
Lake City, S.C.	WJOT	1260	
Lakeland, Fla.	WLAK	1430	N
	WONN	1230	M
Lakeview, Oreg.	KQIK	1230	
Lake Wales, Fla.	WIPC	1280	
Lakewood, Colo.	KLAK	1600	
Lamar, Colo.	KLMR	920	
Lamesa, Tex.	KPET	690	
Lampasas, Tex.	KCYL	1450	
Lancaster, Calif.	KAVL	1340	
	KBVM	1380	
Lancaster, Ohio	WHOK	1320	
Lancaster, Pa.	WGAL	1490	N
	WLAN	1390	A-M
Lancaster, S.C.	WLCM	1360	
Lander, Wyo.	KOVE	1330	M
Lanett, Ala.	WRLD	1490	
Lansford, Pa.	WLSH	1410	
Lansing, Mich.	WILS	1320	M
	WJIM	1240	A-N
Lapeer, Mich.	WMPC	1230	
LaPorte, Ind.	WLOI	1540	
Laramie, Wyo.	KOWB	1340	A
Laredo, Tex.	KVOZ	1240	M
LaSalle, Ill.	WLPO	1220	
LaSarre, Que.	CKLS	1240	
LasCruces, N.Mex.	KOBE	1450	
	KGRT	1570	
Las Vegas, Nev.	KENO	1460	A
	KLAS	1010	C
	KORK	1340	N
	KRAM	920	M
	KRBO	1050	
Las Vegas, N.Mex.	KFUN	1230	M
Latrobe, Pa.	WAKU	1570	
	WTRA	1480	
Laurel, Miss.	WAML	1340	N
	WLAU	1490	A-M
Laurens, S.C.	WLBG	860	
Laurinburg, N.C.	WEWO	1080	
Lawrence, Kans.	KFKU	1250	
	KLWN	1320	
Lawrence, Mass.	WCCM	800	
	WNAC	680	M
Lawrenceburg, Tenn.	WDXE	1370	M
Lawton, Okla.	KSWO	1380	A
	KCCO	1050	
Leadville, Colo.	KLVC	1230	
Leaksville, N.C.	WLOE	1490	M
Leamington, Ont.	CJSP	710	
Leavenworth, Kans.	KCLO	1410	
Lebanon, Ky.	WLBN	1590	
Lebanon, Mo.	KLWT	1230	M
Lebanon, N.H.	WTSL	1400	A
Lebanon, Oreg.	KGAL	920	
Lebanon, Pa.	WLBR	1270	
Lebanon, Tenn.	WCOR	900	
Leesburg, Fla.	WLBE	790	M
Leesville, La.	KLLA	1570	
LeMars, Iowa	KLEM	1410	
Lemoyne, Pa.	WCMB	1460	M
Lenoir, Tenn.	WLIL	730	
Leonardtown, Md.	WKIK	1370	
Lethbridge, Alta.	CJOC	1220	
Levelland, Tex.	KLVT	1230	
Lewisburg, Tenn.	WJJM	1490	M
Lewiston, Idaho	KRLC	1350	M
	KLER	1300	
	KOZE	950	

Location	C.L.	Kc.	N.A.
Lewiston, Maine	WCOU	1240	M
	WLAM	1470	A
Lewiston, Mont.	KXLO	1230	M
Lewiston, Pa.	WKVA	920	A
	WMRF	1490	N
Lexington, Ky.	WLAP	630	A
	WLEX	1300	
	WVLK	590	M
Lexington, Mo.	KLEX	1570	
Lexington, Nebr.	KRVN	1010	
Lexington, N.C.	WBUY	1440	
Lexington, Tenn.	WDXL	1490	
Lexington, Va.	WREL	1450	N
Lexington Pk., Md.	WPTX	920	
Libby, Mont.	KLCB	1230	M
Liberal, Kans.	KSCB	1270	
Liberty, N.Y.	WVOS	1240	
Lihue, T.H.	KTOH	1490	
Lima, Ohio	WIMA	1150	A
Lincoln, Ill.	WPRC	1370	
Lincoln, Nebr.	KFOR	1240	A
	KLIN	1400	
	KLMS	1480	
Lincolnton, N.C.	WLON	1050	
Lindsay, Ont.	CKLY	910	
Linton, Ind.	WBTO	1600	
Litchfield, Ill.	WSMI	1540	
Little Falls, Minn.	KLTF	960	
Little Falls, N.Y.	WLFH	1230	M
Littlefield, Tex.	KVOW	1490	
Little Rock, Ark.	KARK	920	N
	KGHI	1250	A
	KLRA	1010	
	KOKY	1440	
	KTHS	1090	C
	KVLC	1050	
	KXLR	1150	M
Live Oak, Fla.	WNER	1250	
Livingston, Mont.	KPRK	1340	M
Livingston, Tenn.	WLIV	920	
Lloydminster, Alta.	CKSA	1150	
Lock Haven, Pa.	WBPZ	1230	
Lockport, N.Y.	WUSJ	1340	
Lodi, Calif.	KCVR	1570	
Logan, Utah	KVNU	610	M
Logan, W.Va.	WLOG	1230	M
	WVOW	1290	
Logansport, Ind.	WSAL	1230	M
London, Ky.	WFTG	1400	
London, Ont.	CFPL	980	
	CKSL	1290	
Long Beach, Calif.	KFOX	1280	
	KGER	1390	
Longmont, Colo.	KLMO	1050	
Longview, Tex.	KFRO	1370	A
	KLTI	1280	
Longview, Wash.	KWLK	1400	M
	KBAM	1220	
Lookout Mountain, Okla.	KTUL	1430	C
Los Alamos, N.Mex.	KRSN	1490	A
Los Angeles, Calif.	KABC	790	A
	KFI	640	N
	KHJ	930	M
	KFSG	1150	
	KFWB	980	
	KGFJ	1230	
	KFAC	1330	
	KLAC	570	
	KMPC	710	
	KNX	1070	C
	KPOL	1540	
	KPOP	1020	
	KRKD	1150	
Louisville, Ky.	WAVE	970	N
	WGRC	790	M
	WHAS	840	C
	WKLO	1080	A
	WINN	1240	
	WKYW	900	
	WLOU	1350	
Louisville, Miss.	WLSM	1270	
Loveland, Colo.	KLOV	1570	
Lovington, N.Mex.	KLEA	630	
Lowell, Mass.	WCAP	980	
	WLLH	1400	M
Lubbock, Tex.	KCBD	1590	M-N
	KDAV	580	
	KDUB	1340	
	KFYO	790	A
	KILL	1460	
	KSEL	950	M
Ludington, Mich.	WKLA	1450	A
Lufkin, Tex.	KRBA	1340	A
	KTRE	1420	M
Lumberton, N.C.	WAGR	1480	
	WTSB	1340	M
Lynchburg, Va.	WLVA	590	A
	WWOD	1390	M
	WBRG	1050	
Lynn, Mass.	WLYN	1360	
Macomb, Ill.	WKAI	1510	
Macon, Ga.	WBML	1240	N
	WIBB	1280	
	WMAZ	940	C
	WNEX	1400	A-M
Macon, Miss.	WMBC	1400	
Madison, Fla.	WMAF	1230	
Madison, Ga.	WMGE	1250	
Madison, Ind.	WORX	1270	
Madison, Wis.	WHA	970	
	WIBA	1310	N
	WISC	1480	A
	WKOW	1070	C
Madisonville, Ky.	WFMW	730	
	WTTL	1310	

Location	C.L.	Kc.	N.A.
Magnolia, Ark.	KVMA	630	M
Malden, Mo.	KTCB	1470	
Malone, N.Y.	WICY	1490	M
Malvern, Ark.	KBOK	1310	
	KDAS	1420	
Marion, Va.	WMEV	1010	A
Manchester, Ky.	WWXL	1580	
Manchester, N.H.	WFEA	1370	C
	WGIR	610	
	WKBR	1240	
	WMUR	610	A-M
Manhattan, Kans.	KSAC	580	
	KMAN	1350	
Manila, P.I.	DZPI	1800	M-C
	DZRH	710	N
Manistee, Mich.	WMTE	1340	
Manitowoc, Wis.	WWOC	980	
	WOMT	1240	M
Mankato, Minn.	KYSM	1230	N
	KTOE	1420	A
Mansfield, La.	KDBC	1360	
Mansfield, Ohio	WMAN	1400	A
Marianna, Fla.	WTYS	1340	M
Marietta, Ga.	WFOM	1230	
	WBIE	1050	
Marietta, Ohio	WMOA	1490	M
Marine City, Mich.	WSDC	1590	
Marinette, Wis.	WMAM	570	N
Marion, Ala.	WJAM	1310	
Marion, Ill.	WGGH	1150	
Marion, Ind.	WBAT	1400	C
	WMRI	860	
Marion, N.C.	WBRM	1250	
Marion, Ohio	WMRN	1490	A
Marion, Va.	WMEV	1010	A
Marked Tree, Ark.	KTML	1580	
Marksville, La.	KAPB	1370	
Marlin, Tex.	KMLW	1010	
Marquette, Mich.	WDMJ	1320	M
Marshall, Minn.	KMHL	1400	A
Marshall, Mo.	KMMO	1300	
Marshall, N.C.	WMMH	1460	
Marshall, Tex.	KMHT	1450	M
Marshalltown, Iowa	KFJB	1230	M
Marshfield, Wis.	WDLB	1450	
Martinsburg, W.Va.	WEPM	1340	M
Martinsville, Va.	WHEE	1370	
	WMVA	1450	N
Marysville, Calif.	KMCY	1410	M
Marysville, Kans.	KNDY	1570	
Maryville, Mo.	KNIM	1580	
Maryville, Tenn.	WGAP	1400	
Mason City, Iowa	KGLO	1300	C
	KRIB	1490	M
	KSMN	1010	
Massena, N.Y.	WMSA	1340	A
Massillon, Ohio	WTIG	990	
Matane, Que.	CKBL	1250	
Matawan, W.Va.	WHJC	1360	
Mattoon, Ill.	WLBH	1170	
Mayaguez, P.R.	WAEL	600	
	WKJB	710	
	WORA	1150	
	WPRA	990	
	WTIL	1300	
Mayfield, Ky.	WKTM	1050	M
	WNGO	1320	
Maysville, Ky.	WFTM	1240	M
McAlester, Okla.	KTMC	1400	A
	KNED	1150	
McAllen, Tex.	KRIO	910	A-M
McComb, Miss.	WHNY	1250	A
	WAPF	980	
McCook, Nebr.	KBRL	1300	M
McGehee, Ark.	KVSA	1220	
McKeesport, Pa.	WEDO	810	
	WMCK	1360	
McKenzie, Tenn.	WHDM	1440	
McKinney, Tex.	KMAE	1600	
McMinnville, Oreg.	KMCM	1260	
McMinnville, Tenn.	WBMC	960	
	WMMT	1230	M
McPherson, Kans.	KNEX	1540	
Meadville, Pa.	WMGW	1490	A
Medford, Mass.	WHIL	1430	
Medford, Oreg.	KMED	1440	N
	KBOY	730	
	KYJC	1230	A-C
Medford, Wis.	WIGM	1490	M
Medicine Hat, Alta.	CHAT	1270	
Melbourne, Fla.	WMMB	1240	
Memphis, Tenn.	WHBQ	560	M
	WHER	1430	
	WMC	790	N
	WDIA	1070	
	WMPS	680	A
	WHHM	1340	
	WLOK	1480	
	WREC	600	C
	KWEM	990	
Mena, Ark.	KENA	1450	M
Menominee, Mich.	WAGN	1340	A
Menomonie, Wis.	WMNE	1360	
Merced, Calif.	KYOS	1480	M
	KWIP	1580	
Meriden, Conn.	WMMW	1470	
Meridian, Miss.	WCOC	910	C
	WMOX	1240	M
	WOKK	1450	A
Mesa, Ariz.	KTYL	1310	
Metropolis, Ill.	WMOK	920	
Mexia, Tex.	KBUS	1590	
Mexico, Mo.	KXEO	1340	M
Mexico, Pa.	WJUN	1220	
Miami, Fla.	WGBS	710	C
	WCKR	610	N
Miami, Fla.	WFEC	1220	
	WMIE	1140	
	WQAM	560	A
	WSKB	1450	
	WINZ	940	
Miami, Okla.	KGLC	910	
Miami Beach, Fla.	WAHR	1490	
	WKAT	1360	M
	WMBM	800	
Michigan City, Ind.	WIMS	1420	
Middlesboro, Ky.	WMIK	560	
Middletown, Conn.	WCNX	1150	
Middletown, N.Y.	WALL	1340	
Middletown, Ohio	WPFB	910	
Midland, Mich.	WMDN	1490	
Midland, Tex.	KCRS	550	A
	KJBC	1150	
Milan, Tenn.	WKBJ	1600	
Miles City, Mont.	KRJF	1340	M
	KATL	1340	
Milford, Del.	WKSB	930	
Milford, Mass.	WMOO	1490	
Milledgeville, Ga.	WMVG	1450	M
Millville, N.J.	WMLV	1440	
Milton, Fla.	WEBY	1330	
Milton, Pa.	WMLP	1570	
Milwaukee, Wis.	WEMP	1250	
	WFOX	860	M
	WRIT	1340	
	WISN	1150	C
	WMIL	1290	
	WOKY	920	A
	WTMJ	620	N
Minden, La.	WPAK	1240	
Mineral Wells, Tex.	KORC	1140	
Mineola, N.Y.	WKIT	1520	
Minneapolis, Minn.	KEUE	1440	
	WCCO	830	C
	WLOL	1330	
	WMIN	1400	
	WDGY	1130	M
	WPBC	980	
	WTCN	1280	A
	KTIS	900	
	KUOM	770	
Minot, N.Dak.	KLPM	1390	A
	KCJB	910	C
Missoula, Mont.	KGVO	1290	C
	KXLL	1450	N
	KBTK	1340	
Mitchell, S.Dak.	KORN	1490	M
Moberly, Mo.	KNCM	1230	
Mobile, Ala.	WALA	1410	N
	WABB	1480	A-M
	WKAB	840	
	WKRG	710	C
	WMOZ	960	
Mobridge, S.Dak.	KOLY	1300	
Modesto, Calif.	KTRB	860	
	KBEE	970	
	KFIV	1360	A
Moline, Ill.	WQUA	1230	A
Monahans, Tex.	KVKM	1340	M
Moncton, N.B.	CBAF	1300	
	CKCW	1220	
Monitt, Mo.	KRMO	990	
Monroe, Ga.	WMRE	1490	
Monroe, La.	KMLB	1440	A
	KLIC	1230	M
	KNOE	1390	N
Monroe, Mich.	WMIC	560	
Monroe, N.C.	WMAP	1060	
Monroe, Wis.	WEKZ	1260	
Monroeville, Ala.	WMFC	1360	
Montaquy, Que.	CKBM	1490	
Monterey, Calif.	KIDD	630	
	KMBY	1240	C
Montevideo, Minn.	KDMA	1450	A
Montgomery, Ala.	WBAM	740	
	WCOV	1170	
	WAPX	1600	A
	WHHY	1440	N
	WMGY	800	
	WRMA	950	
Montgomery, W.Va.	WMON	790	M
Monticello, Ark.	KHBM	1430	
Monticello, Ky.	WFLW	1570	
Montpelier-Barre, Vt.	WSKI	1240	A
Montreal, Que.	CBF	690	
	CBM	940	N
	CFCF	600	A
	CHLP	1410	
	CJAD	800	
	CJMS	1280	
	CKAC	730	C
Montrose, Colo.	KUBC	1260	
Montrose, Pa.	WPEL	1250	
Mooresville, N.C.	WHIP	1350	
Moorhead, Minn.	KVOX	1280	M
Moosejaw, Sask.	CHAB	800	
Morehead, Ky.	WMOR	1330	
Morehead City, N.C.	WMBL	740	
Morgan City, La.	KMRC	1430	
Morganton, N.C.	WMNC	1430	N
Morgantown, W.Va.	WAJR	1230	
	WCLG	1300	
Morrilton, Ark.	KVOM	800	
Morris, Minn.	KMRS	1570	
Morristown, N.J.	WMTR	1250	
Morristown, Tenn.	WCRK	1450	M
Moscow, Idaho	KRPL	1400	
Moses Lake, Wash.	KSEM	1450	
	KWIQ	1260	
Moultrie, Ga.	WMGA	1400	A
Moultrie, Ga.	WMTM	1300	
Moundsville, W.Va.	WMOD	1370	
Mountain Grove, Mo.	KLRS	1360	
Mt. Airy, N.C.	WPAQ	740	
	WSYD	1300	
Mt. Carmel, Ill.	WVMC	1360	
Mt. Clemens, Mich.	WBRB	1430	
Mt. Jackson, Va.	WSIG	790	
Mt. Pleasant, Mich.	WCEN	1150	
Mt. Pleasant, Tex.	KIMP	960	
Mt. Shasta, Calif.	KWSD	1340	
Mt. Vernon, Ill.	WMIX	940	
Mt. Vernon, Ind.	WPCO	1590	
Mt. Vernon, Ky.	WRVK	1460	
Mt. Vernon, Ohio	WMVO	1300	
Mt. Vernon, Wash.	KBRC	1430	
Muleshoe, Tex.	KMUL	1380	
Mullins, S.C.	WJAY	1280	
Muncie, Ind.	WLBC	1340	C
Munfordville, Ky.	WLOC	1150	
Murfreesboro, Tenn.	WGNS	1450	
	WMTS	860	
Murphysboro, Ill.		1420	
Murray, Ky.	WNBS	1340	
Murray, Utah	KMUR	1230	
Muscatine, Iowa	KWPC	860	
Muscle Shoals City, Alabama	WLAY	1450	M
Muskegon, Mich.	WKBZ	850	A
	WTRU	1600	
	WMUS	1090	
Muskogee, Okla.	KBIX	1490	A
	KMUS	1380	
Myrtle Beach, S.C.	WMYB	1450	
Nacogdoches, Tex.	KOSF	1230	A
	KSFA	860	
Nampa, Idaho	KFXD	580	M
Nanaimo, B.C.	CHUB	1570	
Nanticoke, Pa.	WHWL	730	
Napa, Calif.	KVON	1440	
Naples, Fla.	WNOG	1270	
Narrows, Va.	WNRV	990	
Nashua, N.H.	WOTW	900	
Nashville, Tenn.	WKDA	1240	
	WLAC	1510	C
	WMAK	1300	M
	WNAH	1360	
	WSIX	980	A
	WSM	650	N
	WSOK	1470	
Natchez, Miss.	WMIS	1240	N
	WNAT	1450	A
Natchitoches, La.	KNOC	1450	
Needles, Calif.	KSFE	1340	
Neenah, Wis.	WNAM	1280	
Nelson, B.C.	CKLN	1240	
Neon, Ky.	WNKY	1450	
Neosho, Mo.	KBTN	1420	
Nevada, Mo.	KNEM	1240	
New Albany, Ind.	WLRP	1570	
New Albany, Miss.	WNAU	1470	
Newark, N.J.	WAAT	970	
	WHBI	1280	
	WNJR	1430	
	WVNJ	620	
Newark, Ohio	WCLT	1430	
New Bedford, Mass.	WBSM	1420	
	WNBH	1340	
New Bern, N.C.	WHIT	1450	M
	WOOW	1490	
Newberry, S.C.	WKDK	1240	M
New Braunfels, Tex.	KGNB	1420	
New Britain, Conn.	WHAY	910	
New Brunswick, N.J.	WCTC	1450	
Newburgh, N.Y.	WGNY	1220	
Newburyport, Mass.	WNBP	1410	
New Carlisle, Que.	CHNC	610	
Newcastle, N.B.	CKMR	790	
New Castle, Pa.	WKST	1280	M
Newcastle, Wyo.	KASL	1240	
New Glasgow, N.S.		1230	
New Haven, Conn.	WAVZ	1300	
	WELI	960	A
	WNHC	1340	N-A
New Iberia, La.	KANE	1240	A
	KVIM	1360	
New Kensington, Pa.	WKPA	1150	M
New London, Ct.	WNLC	1490	
New Martinsville, W.Va.	WETZ	1330	
Newman, Ga.	WCOH	1400	M
New Orleans, La.	WDSU	1280	N
	WJBW	1230	
	WJMR	990	
	WMRY	600	
	WBOK	800	
	WNOE	1060	M
	WSMB	1350	A
	WTIX	1450	
	WTPS	940	
	WWEZ	690	
	WWL	870	C
Newport, Ark.	KNBY	730	
Newport, Ky.	WNOP	740	
Newport, Oreg.	KNPT	1310	
Newport, R.I.	WADK	1540	
Newport, Tenn.	WLIK	1270	
Newport, Vt.	WIKE	1490	
Newport News, Va.	WGH	1310	A
	WYUO	1270	
New Rochelle, N.Y.	WNRC	1460	
New Smyrna Beach, Fla.	WSBB	1230	
Newton, Iowa	KCOB	1280	
Newton, Kans.	KJRG	950	
Newton, Miss.	WEGA	1410	
Newton, N.J.	WNNJ	1360	
Newton, N.C.	WNNC	1230	
New Ulm, Minn.	KNUJ	860	
New Westminster, B.C.	CKNW	1320	
New York, N.Y.	WABC	770	A
	WBNX	1380	
	WCBS	880	C
	WEVD	1330	
	WHOM	1480	
	WINS	1010	
	WLIB	1190	
	WMCA	570	
	WMGM	1050	
	WNEW	1130	
	WNYC	830	
	WOR	710	M
	WOV	1280	
	WQXR	1560	
	WRCA	660	N
Niagara Falls, N.Y.	WHLD	1270	
	WJJL	1440	
Niagara Falls, Ont.	CHVS	1600	
Niles, Mich.	WNIL	1290	
Nogales, Ariz.	KNOG	1340	C
Norfolk, Nebr.	WJAG	780	
Norfolk, Va.	WTAR	790	C
	WCMS	1050	
	WNOR	1230	
	WRAP	850	
Norfolk-Portsmouth, Va.	WSAP	1350	
Norman, Okla.	WNAD	640	
	KNOR	1400	
Norristown, Pa.	WNAR	1110	
N. Adams, Mass.	WNAW	860	
	WMNB	1230	
N. Battleford, Sask.	CJNB	1460	
North Bay, Ont.	CFCH	600	
North Bend, Oreg.	KFIR	1340	C
Northfield, Minn.	WCAL	770	
Northampton, Mass.	WHMP	1400	
N. Little Rock, Ark.	KNLR	1380	
North Platte, Nebr.	KJLT	970	
	KODY	1240	N
No. Vancouver, B.C.		1070	
N. Vernon, Ind.	WOCH	1460	
No. Wilkesboro, N.C.	WKBC	810	
Norton, Va.	WNVA	1350	M
Norwalk, Conn.	WNLK	1350	
	WICH	1310	
Norwich, N.Y.	WCHN	970	
Oahu, Hawaii	KANI	1150	
Oakdale, La.	KREH	900	
Oak Hill, W.Va.	WOAY	860	
Oakland, Calif.	KLX	910	
	KROW	960	
	KWBR	1310	
Oak Park, Ill.	WOPA	1490	
Oak Ridge, Tenn.	WATO	1490	M
	WOKE	1290	
Oakville, Ont.	CHWO	1250	
Ocala, Fla.	WMOP	900	
	WTMC	1290	N
Oceanlake, Oreg.	KBCH	1400	
Oceanside, Calif.	KSLR	1230	
Odessa, Tex.	KECK	920	
	KOSA	1230	C
	KOYL	1310	
	KRIG	1410	M
Oelwein, Iowa	KOEL	950	
Ogallala, Nebr.	KOGA	930	
Ogden, Utah	KLO	1430	M
	KKOG	730	
	KVOG	1490	
Ogdensburg, N.Y.	WSLB	1400	M
Oil City, Pa.	WKRZ	1340	M
Okla. City, Okla.	KBYE	890	
	KLPR	1140	
	KOCY	1340	M
	KOMA	1520	C
	KTOK	1000	A
	KTOW	800	
	WKY	930	N
Okmulgee, Okla.	KHBG	1240	M
Old Saybrook, Conn.	WLIS	1420	
Olean, N.Y.	WMNS	1360	
Olney, Ill.	WVLN	740	
Olympia, Wash.	KGY	1240	M
	KITN	1440	
Omaha, Nebr.	KBON	1490	M
	KFAB	1110	C
	KOIL	1290	A
	KOWH	660	
	WOW	590	C-N
Omak, Wash.	KOMW	680	
Oneida, N.Y.	WONG	1600	
Oneonta, Ala.	WCRL	1570	
Oneonta, N.Y.	WDOS	730	M
Ontario, Calif.	KOCS	1510	
Ontario, Oreg.	KSRV	1380	
Opelika, Ala.	WPHO	1400	M
Opelousas, La.	KSLO	1230	A-M
Opp, Ala.	WAMI	860	

Location	C.L.	Kc.	N.A.
Opportunity, Wash.	KZUN	1270	
Orange, Mass.	WCAT	1390	
Orange, Tex.	KOGT	1600	
Orange, Va.	WJMA	1340	M
Orangeburg, S.C.	WDIX	1450	A
	WRNO	1150	A-M
	WTND	920	
Oregon City, Oreg.	KGON	1520	N
Orillia, Ont.	CFOR	1570	
Orlando, Fla.	WDBO	580	C
	WHOO	990	A
	WLOF	950	M
	WORZ	740	N
Oroville, Calif.	KMOR	1340	
Ortonville, Minn.	KDIO	1350	
Osage Bch., Mo.	KRMS	1150	
Osceola, Ark.	KOSE	860	
Oshawa, Ont.	CKLB	1240	
Oshkosh, Wis.	WOSH	1490	A
Oskaloosa, Iowa	KBOE	740	
Ottawa, Ill.	WCMY	1430	
Ottawa, Kans.	KOFO	1220	
Ottawa, Ont.	CBO	910	
	CFRA	560	
	CKOY	1310	
Ottumwa, Iowa	KBIZ	1240	M
	KLEE	1480	
Owatonna, Minn.	KRFO	1390	
Owensboro, Ky.	WOMI	1490	M
	WVJS	1420	
Owen Sound, Ont.	CFOS	1470	
Owosso, Mich.	WOAP	1080	
Oxford, Miss.	WSUH	1420	
Oxford, N.C.	WOXF	1340	
Oxnard, Calif.	KOXR	910	
Ozark, Ala.	WOZK	900	
Paducah, Ky.	WKYB	570	N
	WPAD	1450	C
Painesville, Ohio	WPVL	1460	
Paintsville, Ky.	WSIP	1490	M
Palatka, Fla.	WWPF	1260	A
Palestine, Tex.	KNET	1450	
Palm Bch., Fla.	WQXT	1340	A
Palm Sprgs., Calif.	KCMJ	1340	C
	KDES	920	
	KPAL	1450	
Palo Alto, Calif.	KIBE	1220	
Pampa, Tex.	KPDN	1340	M
	KPAT	1230	
Panama City, Fla.	WDLP	590	N
	WPCF	1400	A-M
Paragould, Ark.	KDRS	1490	
Paris, Ill.	WPRS	1440	
Paris, Ky.	WKLX	1440	
Paris, Tenn.	WTPR	710	M
Paris, Tex.	KPLT	1490	A
	KFTV	1250	
Parkersburg, W.Va.	WCEF	1050	
	WPAR	1450	C
	WCOM	1230	A
Park Falls, Wis.	WPFP	1450	
Parsons, Kans.	KLKC	1540	
Pasadena, Calif.	KALI	1430	
	KPPC	1240	
	KXLA	1110	
	KWKW	1300	
Pasadena, Tex.	KLVL	1480	
Pascagoula, Miss.	WPMP	1580	
Paseo, Wash.	KORD	910	
	KPKW	1340	A
Pase Robles, Calif.	KPRL	1230	M
Patchogue, L.I., N.Y.			
	WALK	1370	
	WPAC	1580	
Paterson, N.J.	WPAT	930	
Pauls Valley, Okla.	KVLH	1470	
Pawtucket, R.I.	WPAW	550	
Peace River, Alta.	CKYL	630	
Pecos, Tex.	KIUN	1400	M
Peekskill, N.Y.	WLNA	1420	
Pekin, Ill.	WSIV	1140	
Pell City, Ala.	WFHK	1430	
Pembroke, Ont.	CHOV	1350	
Pendleton, Oreg.	KWRC	1240	A
	KUBE	1050	
	KUMA	1290	
Pensacola, Fla.	WBOP	980	
	WBSR	1450	C-M
	WEAR	1230	A
	WCOA	1370	N
	WPFA	790	
Penticton, B.C.	CKOK	800	
Peoria, Ill.	WEEK	1350	N
	WMBD	1470	C
	WIRL	1290	A-M
	WPEO	1020	
Perry, Fla.	WPRY	1400	
Perry, Ga.	WBBN	980	
Perryton, Tex.	KEYE	1400	M
Peru, Ind.	WARU	1600	
Petaluma, Calif.	KAFP	1490	
Peterborough, Ont.	CHEX	1430	
Petersburg, Va.	WSSV	1240	M
Petoskey, Mich.	WMBN	1340	M
Phenix City, Ala.	WPNX	1270	M
Philadelphia, Miss.	WHOC	1490	
Philadelphia, Pa.	WCAU	1210	C
	WDAS	1480	
	WFIL	560	A
	WHAT	1340	
	WIBG	990	
	WIP	610	M
	WJMJ	1540	
Philadelphia, Pa.	WPEN	950	
	WRCV	1060	
	WTEL	860	
Philipsburg, Pa.	WPHB	1260	
Phoenix, Ariz.	KIFN	860	
	KONI	1400	
	KHEP	1280	
	KOY	550	M
	KOOL	960	C
	KPHO	910	A
	KRIZ	1230	
	KTAR	620	N
Picayune, Miss.	WRJW	1320	
Piedmont, Ala.	WPID	1280	
Pierre, S.Dak.	KGFX	630	
Pikeville, Ky.	WLSI	900	
	WPKE	1240	
Pine Bluff, Ark.	KCLA	1400	
	KOTN	1490	M
Pineville, Ky.	WMLF	1230	
Pineville, W.Va.	WWYO	970	
Pipestone, Minn.	KLOH	1050	
Piqua, Ohio	WPTW	1570	
Pittsburg, Calif.	KECC	990	
Pittsburg, Kans.	KOAM	860	N
	KSEK	1340	
Pittsburgh, Pa.	KDKA	1020	N
	KQV	1410	C
	WCAE	1250	A
	WILY	1080	
	WJAS	1320	M
	WPIT	730	
	WWSW	970	
Pittsfield, Ill.	WBBA	1580	
Pittsfield, Mass.	WBEC	1420	A
	WBRK	1340	M
Pittston, Pa.	WPTS	1540	
Plainview, Tex.	KVOP	1400	M
Plant City, Fla.	WPLA	910	
Platteville, Wis.	WSWW	1590	
Plattsburg, N.Y.	WEAV	960	A
	WIRY	1340	M
Pleasanton, Tex.	KBOP	1380	
Pleasantville, N.J.	WOND	1400	
Plymouth, Mass.	WPLM	1390	
Plymouth, Wis.	WPLY	1420	
Pocahontas, Ark.	KPOC	1420	
Pocatello, Idaho	KEYY	1240	M
	KSEI	930	N
	KWIK	1440	A
	KYTE	1290	
Pocomoke City, Md.	WDVM	540	
Pomona, Calif.	KWOW	1600	
Ponca City, Okla.	WBBZ	1230	M
Ponce, P.R.	WPRP	910	
	WPAB	550	
	WLEO	1170	
	WISO	1260	
Pontiac, Mich.	WPON	1460	
Poplar Bluff, Mo.	KWOC	930	
Portage, Wis.	WPDR	1350	
Portage la Prairie, Man.			
	CFRY	1570	
Port Alberni, B.C.	CJAV	1240	
Portales, N.Mex.	KENM	1450	
Port Angeles, Wash.	KONP	1450	
Port Arthur, Ont.	CFPA	1230	
Port Arthur, Tex.	KOLE	1340	
	KPAC	1250	M
Portersville, Calif.	KTIP	1450	A
Port Huron, Mich.	WHLS	1450	M
	WTTH	1380	A
Port Jervis, N.Y.	WDLC	1490	
Portland, Ind.	WPGW	1440	
Portland, Maine	WCSH	970	N
	WGAN	560	C
	WLOB	1310	
	WPOR	1490	A-M
Portland, Oreg.	KBPS	1450	
	KBKO	1290	
	KEX	1190	
	KGW	620	A
	KOIN	970	C
	KPAM	1410	
	KPDQ	800	
	KPOJ	1330	M
	KWJJ	1080	
	KXL	750	
Portsmouth, N.H.	WHEB	750	M
Portsmouth, Ohio	WPAY	1400	C
	WNXT	1260	A
Portsmouth, Va.	WLOW	1400	
	WSAP	1350	M
Post, Tex.	KRWS	1370	
Poteau, Okla.	KLCO	1280	
Potsdam, N.Y.	WPDM	1470	
Pottstown, Pa.	WPAZ	1370	
Pottsville, Pa.	WPAM	1450	M
	WPPA	1360	
Poughkeepsie, N.Y.	WEOK	1390	
	WKIP	1450	A
Powell, Wyo.	KPOW	1260	M
Poynette, Wis.	WIBU	1240	
Prairie du Chien, Wis.			
	WPRE	980	
Pratt, Kans.	KWSK	1570	
Prescott, Ariz.	KYCA	1490	N
	KNOT	1450	
Presque Isle, Me.	WAGM	1450	
Preston, Idaho	KPST	1340	
Prestonsburg, Ky.	WPRT	1270	
Price, Utah	KOAL	1230	M
Prichard, Ala.	WAIP	1270	
Prince Albert, Sask.	CKBI	900	
Prince George, B.C.	CKPG	550	
Prince Rupert, B.C.	CFPR	1240	
Princeton, Ind.	WRAY	1250	
Princeton, Ky.	WPKY	1580	
Princeton, W.Va.	WLOH	1490	A
Prineville, Oreg.	KRCO	690	
Prosser, Wash.	KARY	1310	
Providence, R.I.	WEAN	790	M
	WHIM	1110	
	WICE	1290	
	WJAR	920	N
	WPRO	630	C
	WRIB	1220	
Provo, Utah	KIXX	1400	A
	KNEU	1450	
	KOVO	960	M
Pryor, Okla.	KOLS	1570	
Pueblo, Colo.	KDZA	1230	
	KFEI	970	
	KGHF	1350	A
	KCSJ	590	M
Pulaski, Tenn.	WKSR	1420	A
Pulaski, Va.	WPUV	1580	N
Pullman, Wash.	KWSC	1250	
	KOFE	1150	
Punxsutawney, Pa.	WPXY	1300	M
Putnam, Conn.	WPCT	1350	
Puyallup, Wash.	KAYE	1450	
Quanah, Tex.	KOLJ	1150	
Quebec, Que.	CBV	980	
	CHRC	800	
	CJQC	1340	
	CKCV	1280	
Quincy, Fla.	WCNH	1230	M
Quincy, Ill.	WGEM	1440	A
	WTAD	930	C
Quincy, Mass.	WJDA	1300	
Quitman, Ga.	WSFB	1490	
Racine, Wis.	WRAC	1460	
	WRJN	1400	A
Radcliff, Ky.	WSAC	1470	
Radford, Va.	WRAD	1460	
Raleigh, N.C.	WKIX	850	A
	WPTF	680	N
	WMSN	570	
	WRAL	1240	M
Rapid City, S.Dak.	KOTA	1380	C
	KRSD	1340	M
Raton, N.Mex.	KRTN	1490	M
Rawlins, Wyo.	KRAL	1240	A
Raymond, Wash.	KAPA	1340	
Reading, Pa.	WEEU	850	A
	WHUM	1240	C
	WRAW	1340	N
Redding, Calif.	KROG	1230	
	KSDA	1400	
	KVCV	600	C
Red Bluff, Calif.	KBLF	1490	
Red Deer, Alta.	CKRD	850	
Redlands, Calif.	KCAL	1410	
Red Lion, Pa.	WGCB	1440	
Redmond, Oreg.	KJUN	1240	A
	KSGA	1240	
Red Wing, Minn.	KCUE	1250	
Redwood Falls, Minn.			
	KLGR	1490	
Reedsburg, Wis.	WRDB	1400	
Regina, Sask.	CBK	540	
	CKCK	620	
	CKRM	980	
Reidsville, N.C.	WFRC	1600	A
	WREV	1220	
Reno, Nev.	KOH	630	N
	KATO	1340	M
	KOLO	920	C
	KONE	1450	
	KWRN	1230	A
Renton, Wash.	KXRN	910	
Rexburg, Idaho	KRXK	1230	
Rhinelander, Wis.	WOBT	1240	M
Rice Lake, Wis.	WJMC	1240	M
Richfield, Utah	KSVC	980	M
Richland, Wash.	KALE	960	
Richland, Wis.	WRCO	1450	
Richlands, Va.	WRIC	540	
Richmond, Ind.	WKBV	1490	A
Richmond, Ky.	WEKY	1340	
Richmond, Va.	WANT	990	
	WBBL	1480	
	WLEE	1480	M
	WLLY	1320	
	WMBG	1380	N
	WRNL	910	A
	WRVA	1140	C
	WXGI	950	
Richmond Hill, Ont.	CJRH	1300	
Ridgecrest, Calif.	KRCK	1360	
	KRKS	1240	
Rimouski, Que.	CJBR	900	
Rio Piedras, P.R.	WRIO	1320	
	WWWW	1520	
Ripley, Tenn.	WTRB	1570	
Riverhead, N.Y.	WRIV	1390	
Riverside, Calif.	KPRO	1440	
Riverton, Wyo.	KWRL	1450	A
Riviere du Loup, Que.			
	CJFP	1400	
Roanoke, Ala.	WELR	1360	
Roanoke, Va.	WDBJ	960	C
	WRIS	1410	
	WRKE	910	
	WROV	1240	A-M
	WSLS	610	N
Roanoke Rapids, N.C.			
	WCBT	1230	M
Roaring Sprgs., Pa.	WKMC	1370	
Roberval, Que.	CHRL	910	
Robinson, Ill.	WTAY	1570	
Rochester, Minn.	KROC	1340	N
Rochester, N.H.	WWNH	930	
Rochester, N.Y.	WBBF	950	M
	WHAM	1180	N
	WHEC	1460	C
	WRNY	680	
Rochester, N.Y.	WSAY	1370	
	WVET	1280	A-M
Rochester, Pa.	WRYO	1050	
Rockford, Ill.	WROK	1440	A
	WRRR	1330	
Rock Hill, S.C.	WRHI	1340	M
	WTYC	1150	
Rockingham, N.C.	WAYN	900	
Rock Island, Ill.	WHBF	1270	C
Rockland, Maine	WRKD	1450	A
Rock Springs, Wyo.	KVRS	1360	M
Rockville, Md.	WINX	1600	
Rockwood, Tenn.	WRKH	580	
Rocky Ford, Colo.	KRFC	1320	
Rocky Mount, N.C.	WCEC	810	
	WEED	1390	A
Rocky Mount, Va.	WYTI	1570	
Rogers, Ark.	KAMD	1390	
Rogers City, Mich.	WHAK	960	
Rogersville, Tenn.	WRGS	1370	
Rolla, Mo.	KTTR	1490	
Rolling, Wis.	WATK	900	
Rome, Ga.	WLAQ	1410	A
	WRGA	1470	M
	WROM	710	
Rome, N.Y.	WKAL	1450	M
Ronceverte, W.Va.	WRON	1400	N
Roseburg, Oreg.	KRNR	1490	C-M
	KRXL	1240	
Rosenberg, Tex.	KFRD	980	
Roswell, N.Mex.	KSWS	1230	A
	KGFL	1400	M
	KBIM	910	
Rouyn, Que.	CKRN	1400	
Roxboro, N.C.	WRXO	1430	
Royal Oak, Mich.	WEXL	1340	
Rumford, Me.	WRUM	790	
Rupert, Idaho	KAYT	970	
Rushton, La.	KRUS	1490	
Rusk, Texas	KTLU	1580	
Russell, Kans.	KRSL	990	
Russellville, Ala.	WWWR	920	
Russellville, Ark.	KXRJ	1490	M
Russellville, Ky.	WRUS	800	
Rutland, Vt.	WHWB	1000	
	WSYB	1380	M
Sackville, N.B.	CBA	1070	
Sacramento, Calif.	KCRA	1320	N
	KFBK	1530	A
	KGMS	1380	
	KROY	1240	C
	KXOA	1470	M
Safford, Ariz.	KGLU	1480	N
Saginaw, Mich.	WKNX	1210	
	WSAM	1400	N
	WSGW	790	M
St. Albans, Vt.	WWSR	1420	
St. Albans, W.Va.	WKLC	1300	
St. Anne de la Pocatiere, Que.	CHGB	1350	
St. Augustine, Fla.	WFOY	1240	C
	WSTN	1420	
St. Boniface, Man.	CKSB	1250	
St. Catharine, Ont.	CKTB	620	
St. Cloud, Minn.	KFAM	1450	N
	WJON	1240	A
St. Jean, Que.	CHRS	1090	
St. Jerome, Que.	CKJL	900	
Saint John, N.B.	CFBC	930	
	CHSJ	1150	
St. John, V.I.	WOTV	1190	
St. John's, Nfld.	CBN	640	
	CJON	930	
	VOAR	1230	
	VOCM	590	
	VOWR	800	
St. Johnsbury, Vt.	WTWN	1340	
St. Joseph, Mich.	WSJM	1400	
St. Joseph, Mo.	KFEQ	680	A-M
	KRES	1550	M
	KUSN	1270	
St. Joseph d'Alma, Que.			
	CFGT	1270	
St. Louis, Mo.	KATZ	1600	
	KFUO	850	
	KMOX	1120	C
	KSD	550	N
	KSTL	690	
	KWK	1380	M
	KXOK	630	A
	WEW	770	
	WIL	1430	A
St. Mary's, Pa.	WKBI	1400	
St. Paul, Minn.	KSTP	1500	N
	WISK	1590	
St. Peter, Minn.	KRBI	1310	
St. Petersburg, Fla.	WPIN	680	
	WSUN	620	A
	WTSP	1380	M
St. Thomas, Ont.	CHLO	680	
Ste. Genevieve, Mo.	KSGM	980	
Salem, Ill.	WJBD	1350	
Salem, Ind.	WSLM	1220	
Salem, Mass.	WESX	1230	
Salem, Mo.	KSMO	1340	
Salem, Oreg.	KSLM	1390	M
	KBZY	1490	
Salem, Va.	WBLU	1480	
Salida, Colo.	KVRH	1340	
Salina, Kans.	KSAL	1150	M
Salinas, Calif.	KDON	1460	
	KSBW	1380	M
Salisbury, Md.	WBOC	960	M
	WICO	1320	
Salisbury, N.C.	WSTP	1490	M
	WSAT	1280	A
Salt Lake City, Utah			
	KALL	910	M

Location	C.L.	Kc.	N.A.
Salt Lake City	KOYL	1320	N
	KLUB	570	A
	KNAK	1280	
	KSL	1160	C
	KSOP	1370	
	KWHO	860	
	KWIC	1570	
San Angelo, Tex.	KTXL	1340	M
	KGKL	960	A
	KPEP	1420	
	KWFR	1260	
San Antonio, Tex.	KCOR	1350	
	KENS	680	C
	KEXX	1250	
	KITE	930	
	KIWW	1540	
	KMAC	630	M
	KONO	860	
	KTSA	550	A
	WOAI	1200	N
San Bernardino, Calif.	KCSB	1350	
	KFXM	590	M
	KRND	1240	
	KITO	1290	A
Sandersville, Ga.	WSNT	1490	
San Diego, Calif.	KCBQ	1170	A
	KFMB	540	
	KFSD	600	N
	KGB	1360	M
	KSON	1240	
	KSDO	1130	
Sandpoint, Idaho	KSPT	1400	
Sandusky, Ohio	WLEC	1450	M
San Fernando, Calif.	KGIL	1260	
Sanford, Fla.	WTRR	1400	
Sanford, N.C.	WEYE	1290	
	WWGP	1050	
San Francisco, California	KFRC	610	M
	KCBS	740	C
	KJBS	1100	
	KNBC	680	N
	KOBY	1550	
	KPOO	1010	
	KSAN	1450	
	KSFO	560	
	KYA	1260	
Sanger, Calif.	KSJV	900	
San Jose, Calif.	KLOK	1170	
	KSJO	1590	
	KEEN	1370	
	KXRX	1500	
San Juan, P.R.	WAPA	680	
	WHOA	1400	
	WIPR	940	
	WKAQ	580	C
	WKVM	810	
	WIAC	580	
	WITA	1140	
San Luis Obispo, Calif.	KATY	1340	A
	KVEC	920	M
San Marcos, Tex.	KCNY	1470	
San Mateo, Calif.	KVSM	1050	
San Rafael, Calif.	KTIM	1510	
San Saba, Tex.	KBAL	1410	
Sanford, Fla.	WIOD	1360	
Santa Ana, Calif.	KWIZ	1480	
Santa Barbara, Cal.	KDB	1490	M
	KIST	1340	N
	KTMS	1250	A
Santa Cruz, Calif.	KSCO	1080	
Santa Fe, N.Mex.	KTRC	1400	A
	KVSF	1260	C
Santa Maria, Cal.	KCOY	1400	A
	KSMA	1340	
Santa Monica, Cal.	WDAY	1580	
	KOWL	1580	
Santa Paula, Calif.	KSPA	1400	
Santa Rosa, Calif.	KSRO	1350	
Santurce, P.R.	WIBS	740	
Saranac Lake, N.Y.	WNBZ	1240	A
Sarasota, Fla.	WKXY	930	
	WSPB	1450	C
Saratoga Springs, N.Y.	WSPN	900	
Sarnia, Ont.	CHOK	1070	
Saskatoon, Sask.	CFQC	600	
	CFNS	1170	
	CKOM	1420	
Saugerties, N.Y.	WSKN	920	
Sault Ste. Marie, Michigan	WSOO	1230	A
Sault Ste. Marie, Ontario	CJIC	1490	
	CKCY	1400	
Savannah, Ga.	WCCP	1450	M
	WJIV	900	
	WSAV	630	N
	WGSA	1400	
	WTOC	1290	C
	WOAR	1400	
	WFRP	1230	A
Savannah, Tenn.	WORM	1010	
Sayre, Pa.	WATS	960	
Schenectady, N.Y.	WGY	810	N
	WSNY	1240	
Scottsbluff, Nebr.	KNEB	960	M
	KOLT	1320	C
Scottsboro, Ala.	WCRI	1050	
	WROS	1330	
Scottsdale, Ariz.	KPOK	1440	
Scranton, Pa.	WARM	590	A
	WEJL	630	
	WGBI	910	C
	WICK	1400	
	WSCR	1320	N
Seaford, Del.	WSUX	1280	
Seattle, Wash.	KAYO	1150	
	KING	1090	A
	KIRO	710	C
	KJR	950	
	KOL	1300	
	KOMO	1000	N
	KRSC	1150	
	KTIX	1590	
	KTW	1250	
	KVI	570	M
	KXA	770	
Searcy, Ark.	KWCB	1410	
Sebring, Fla.	WJCM	1340	M
Sedalia, Mo.	KDRO	1490	M
	KSIS	1050	
Seguin, Tex.	KWED	1580	
Selma, Ala.	WGWC	1340	C
	WHBB	1490	N
	WRWJ	1570	
Seminole, Okla.	KWSH	1260	
Seminole, Tex.	KSML	1250	
Seneca Township, S.C.	WSNW	1150	
Sevierville, Tenn.	WSEV	930	
Seward, Alaska	KIBH	1340	C
Seymour, Ind.	WJCD	1390	
Seymour, Tex.	KSEY	1230	
Shamokin, Pa.	WISL	1480	M
Shamrock, Tex.	KEVA	1580	
Sharon, Pa.	WPIC	790	
Shawano, Wis.	WTCH	960	
Shawinigan Falls, Que.	CKSM	1220	
Shawnee, Okla.	KGFF	1450	M
Sheboygan, Wis.	WHBL	1330	A
	WSHE	950	
Shelby, Mont.	KIYI	1150	M
Shelby, N.C.	WOHS	730	M
Shelbyville, Tenn.	WHAL	1400	M
Shenandoah, Iowa	KFNF	920	M
	KMA	960	A
Sherbrooke, Que.	CHLT	900	
	CKTS	1240	
Sheridan, Wyo.	KWYO	1410	M
Sherman, Tex.	KRRV	910	M
	KTAN	1500	
Show Low, Ariz.	KVWM	1050	
Shreveport, La.	KRMD	1340	A
	KANV	1050	
	KENT	1550	M
	KCIJ	980	
	KJOE	1480	
	KLUE	1300	
	KTBS	710	N
	KWKH	1130	C
Sidney, Mont.	KGCX	1480	M
Sidney, Nebr.	KSID	1340	A
Sikeston, Mo.	KSIM	1400	
Siler City, N.C.	WNCA	1570	
Siloam Sprgs., Ark.	KUOA	1290	M
Silver City, N.Mex.	KSIL	1340	C
Silver Sprgs., Md.	WGAY	1050	
Simcoe, Ont.	CFRS	1560	
Sinton, Tex.	KANN	1590	
Sioux City, Iowa	KSCJ	1360	A
	KCOM	620	
	KMNS	620	
	KTRI	1470	M
Sioux Falls, S.Dak.	KISO	1230	
	KELO	1320	N
	KIHO	1270	M
	KSOO	1140	A
Sitka, Alaska	KIFW	1230	C
	KSEW	1400	
Skowhegan, Maine	WGHM	1150	
Smithfield, N.C.	WMPM	1270	
Smiths Falls, Ont.	CJET	1070	
Snyder, Tex.	KSNY	1450	M
Somerset, Ky.	WSFC	1240	M
Somerset, Pa.	WVSC	990	
Sonora, Calif.	KROG	1450	
Sorel, P.Q.	CJSO	1320	
So. Bend, Ind.	WNDU	1490	A
	WJVA	1580	
	WSBT	960	C
Southbridge, Mass.	WESO	970	
So. Boston, Va.	WHLF	1400	A
So. Canton, Ohio	WHBC	1480	
Southern Pines, N.C.	WEEB	990	A
South Hill, Va.	WJWS	1370	
South Paris, Maine	WTKQ	1450	
So. Pittsburgh, Tenn.	WEPG	910	
So. St. Paul, Minn.	WISK	1590	
Sparta, Ill.	WHCO	1230	
Sparta, Tenn.	WSMT	1050	
Sparta, Wis.	WKLJ	990	
	WCOW	1290	
Spartanburg, S.C.	WJAN	1400	M
	WORD	910	A-N
	WSPA	950	C
Spencer, Iowa	KICD	1240	
Spokane, Wash.	KSPO	1340	
	KGA	1510	A
	KHQ	590	N
	KNEW	790	M
	KREM	970	
	KXLY	920	C
Springdale, Ark.	KBRS	1340	A
Springfield, Ill.	WCVS	1450	A-M
	WMAY	970	N
	WTAX	1240	C
Springfield, Mass.	WBZA	1090	N
	WHYN	560	C
	WJKO	1600	
	WMAS	1450	
	WSPR	1270	A
Springfield, Mo.	KGBX	1260	N
	KICK	1340	M
	KTTS	1400	C
	KWTO	560	A
Springfield, Ohio	WIZE	1340	A
	WBLY	1600	
Springfield, Oreg.	KCTG	1400	
	KEED	1050	
Springfield, Tenn.	WDBL	1430	
Springfield, Vt.	WNIX	1480	
Springhill, La.	KBSF	1460	
Spruce Pine, N.C.	WTOE	1470	
Stamford, Conn.	WSTC	1400	A
	WKBS	1520	
Stamford, Tex.	KDWT	1400	
Staunton, Va.	WTON	1240	A
Starkville, Miss.	WSSO	1230	
State College, Pa.	WMAJ	1450	M
Statesboro, Ga.	WWNS	1240	M
Statesville, N.C.	WSIC	1400	M
Stephenville, Tex.	KSTV	1510	
Sterling, Colo.	KGEK	1230	
	KOLO	1490	
Sterling, Ill.	WSDR	1240	
Steubenville, Ohio	WSTV	1340	M
Stevens Point, Wis.	WTWT	1010	
Stillwater, Minn.	WAVN	1220	
Stillwater, Okla.	KSPI	780	M
Stockton, Calif.	KJOY	1280	
	KRAK	1140	C
	KSTN	1420	
	KWG	1230	A
	KXOB	1280	M
Storm Lake, Iowa	KAYL	990	
Stratford, Ont.	CJCS	1240	
Streator, Ill.	WIZZ	1250	
Stroudsburg, Pa.	WVPO	840	
Stuart, Fla.	WSTU	1450	
Sturgeon Bay, Wis.	WDOR	910	
	WOKW	1260	
Sturgis, Mich.	WSTR	1230	
Stuttgart, Ark.	KWAK	1240	M
Sudbury, Ont.	CKSO	790	
	CHNO	900	
Suffolk, Va.	WLPM	1450	A
Sulphur, La.	KIKS	1310	
Sulphur Sprgs., Tex.	KSST	1230	M
Summerside, P.E.I.	CJRW	1240	
Summerville, Ga.	WGTA	950	
Sumter, S.C.	WFIG	1290	M
	WSSC	1340	A
Sunbury, Pa.	WKOK	1240	A-C
Sunnyside, Wash.	KREW	1230	
Superior, Wis.	WDSM	710	A
Susanville, Calif.	KSUE	1240	
Swainsboro, Ga.	WJAT	800	
Sweetwater, Tex.	WDEH	800	
	KXOX	1240	M
Swift Current, Sask.	CKSW	1400	
Sydney, N.S.	CBI	1570	
	CJCB	1270	
Sylacauga, Ala.	WFEB	1340	M
	WMLS	1290	
Syracuse, N.Y.	WHEN	620	A
	WFBL	1390	C
	WNDR	1260	M
	WOLF	1490	
	WSYR	570	N
Tabor City, N.C.	WTAB	1370	
Tacoma, Wash.	KMO	1360	
	KTAC	850	
	KTNT	1400	
Taft, Calif.	KTKR	1310	
Talladega, Ala.	WJHB	1580	
	WHTB	1230	M
Tallahassee, Fla.	WMEN	1330	
Tallassee, Ala.	WTLS	1300	
	WTAL	1270	C
	WTNT	1450	A
Tampa, Fla.	WALT	1110	
	WDAE	1250	C
	WFLA	970	N
	WHBO	1050	
	WIOK	1150	
	WSUN	620	A
	WWTB	1300	
Tarboro, N.C.	WCPS	760	
Tarpon Sprgs., Fla.	WDCL	1470	
Taunton, Mass.	WPEP	1570	
Taylor, Tex.	KTAE	1260	
Taylorville, Ill.	WTIM	1410	
Tell City, Ind.	WTCI	1230	
Temple, Tex.	KTEM	1400	M
Terre Haute, Ind.	WBOW	1230	N
	WTHI	1480	C
Terrell, Tex.	KTER	1570	
Texarkana, Ark.	KOSY	790	M
Texarkana, Tex.	KCMC	1230	A
	KTFS	1400	
Texas City, Tex.	KTLW	920	
Thayer, Mo.	KALM	1290	
The Dalles, Oreg.	KODL	1440	
Thermopolis, Wyo.	KRTR	1490	
	KTHE	1240	
Thief River Falls, Minn.	KTRF	1230	
Thetford Mines, Que.	CKLD	1230	
Thibodaux, La.	KTIB	630	
Thomaston, Ga.	WSFT	1220	M
Thomasville, Ala.	WJDB	630	
Thomasville, Ga.	WPAX	1240	
	WKTG	730	
Thomasville, N.C.	WTNC	790	
Thomson, Ga.	WTWA	1240	M
Three Rivers, Que.	CHLN	550	
	CKTR	1350	
Ticonderoga, N.Y.	WIPS	1250	
Tifton, Ga.	WWGS	1340	M
Tillamook, Oreg.	KTIL	1240	
Tillsonburg, Ont.	CKOT	1510	
Timmins, Ont.	CFCL	580	
	CKGB	680	
Toccoa, Ga.	WLET	1420	M
	WNEG	1320	
Toledo, Ohio	WOHO	1470	
	WSPD	1370	N
	WTOD	1560	
	WTOL	1230	A
Tooele, Utah	KTUT	990	
Topeka, Kans.	WIBW	580	C
	KJAY	1440	
	WREN	1250	A
	KTOP	1490	M
Toppenish, Wash.	KENE	1490	
Toronto, Ont.	CBL	740	N
	CFRB	1010	C
	CHUM	1050	
	CJBC	860	
	CKEY	580	M
	CKFH	1400	
Torrington, Conn.	WLCR	990	
	WTOR	1490	A
Torrington, Wyo.	KGOS	1490	A
Towson, Md.	WTOW	1570	
Trail, B.C.	CJAT	610	
Traverse City, Mich.	WTCM	1400	M
Trenton, Mo.	KTTN	1600	
Trenton, N.J.	WTNJ	1300	
	WBUD	1260	
	WTTM	920	N
Tri City, Okla.	KWSH	1260	A
Trinidad, Colo.	KCRT	1240	M
	KSFT	1490	
Troy, Ala.	WTBF	970	M
Troy, N.Y.	WHAZ	1330	
	WTRY	980	
Truro, N.S.	CKCL	600	
Truth or Consequences, New Mexico	KCHS	1400	
Tryon, N.C.	WTYN	1580	
Tucson, Ariz.	KTUC	1400	M
	KCNA	580	A
	KEVT	690	
	KTKT	990	
	KOLD	1450	C
	KVOA	1290	N
Tucumcari, N.Mex.	KTNM	1400	M
Tulare, Calif.	KCOK	1270	
	KGEN	1370	
Tulia, Tex.	KTUE	1260	
Tullahoma, Tenn.	WJIG	740	
Tullulah, La.	KTLD	1360	
Tulsa, Okla.	KAKC	970	
	KOME	1300	A
	KRMG	740	A
	KVOO	1170	N
	KFMJ	1050	
Tupelo, Miss.	WELO	580	M
	WTUP	1380	
Turlock, Calif.	KTUR	1390	
Tuscaloosa, Ala.	WJRD	1150	N
	WNPT	1280	
	WTBC	1230	M
Tuskegee, Ala.	WTUS	580	
	WTBC	1230	M
Tuscumbia, Ala.	WVNA	1590	
Twin Falls, Idaho	KTFI	1270	N
	KLIX	1310	A-M
	KEEP	1450	C
Two Rivers, Wis.	WTRW	1590	
Tyler, Tex.	KDOK	1330	
	KGJB	1490	M
	KTBB	600	A
Tyrone, Pa.	WTRN	1290	
Ukiah, Calif.	KUKI	1400	
Union, Mo.	KLPW	1220	
Union, S.C.	WBCU	1460	M
Union City, Tenn.	WENK	1240	M
	WTUC	1580	
Uniontown, Pa.	WMBS	590	C
Urbana, Ill.	WILL	580	
	WKID	1580	
Utica, N.Y.	WIBX	950	C
	WRUN	1150	A
	WTLB	1310	A
Uvalde, Tex.	KVOU	1400	M
Val D'Or, Que.	CKVD	1230	
	WGAF	910	A
	WJEM	1150	
Valdosta, Ga.	WGOV	950	M
Vallejo, Calif.	KGYW	1190	
Valley City, N.Dak.	KOVC	1490	
Vancleave, Ky.	WMTC	730	
Vancouver, B.C.	CBU	690	
	CFUN	1410	
	CJOR	600	
	CKWX	980	M
Vancouver, Wash	KHFS	1150	
	KVAN	910	
Ventura, Calif.	KVEN	1450	M
	KUDU	1590	
Verdun, Que.	CKVL	850	
Vermillion, S.Dak.	KUSD	690	
Vernal, Utah	KJAM	1340	
Vernon, B.C.	CJIB	940	
Vernon, Tex.	KVWC	1490	M
Vero Beach, Fla.	WNTM	1370	
Vicksburg, Miss.	WQBC	1420	M
	WVIM	1490	
Victoria, B.C.	CJVI	900	
	CKDA	1280	

Location	C.L.	Kc.	N.A.
Victoria, Tex.	KNAL	1410	
	KVIC	1340	M
Victoriaville, Que.	CFDA	1380	
Vidalia, Ga.	WVOP	970	M
Vieques, P.R.	WIVV	1370	
Ville Marie, Que.	CKVM	710	
Ville Platte, La.	KVPI	1050	
Ville St. Georges, Que.	CKRB	1400	
Vincennes, Ind.	WAOV	1450	M
Vineland, N.J.	WWBZ	1360	
Vinita, Okla.	KVIN	1470	
Virginia, Minn.	WHLB	1400	N
Virginia Bch., Va.	WBOF	1600	
Visalia, Calif.	KKIN	1400	
Waco, Tex.	WACO	1460	A
	KWTX	1230	M
Wadena, Minn.	KWAD	920	M
Wadesboro, N.C.	WADE	1210	
Wailuku, T.H.	KMVI	550	
Waipahu Oahu, Hawaii	KAHU	920	
Wallace, Idaho	KWAL	620	M
Wallace, N.C.	WLSE	1400	M
Walla Walla, Wash.	KHIT	1320	
	KUJ	1420	M
	KTEL	1490	A
	KWWB	1490	
Walnut Ridge, Ark.	KRLW	1320	
Walterboro, S.C.	WALD	1220	M
Waltham, Mass.	WCRB	1330	
Walton, N.Y.	WDLA	1270	
Ward Ridge, Fla.	WJDE	1570	
Ware, Mass.	WARE	1250	
Warner Robbins, Ga.	WRPB	1350	
Warren, Ark.	KWRF	860	
Warren, Ohio	WHHH	1440	M
Warren, Pa.	WNAE	1310	
Warrenton, Mo.	KWRE	730	
Warrensburg, Mo.	KOKO	1450	
Warsaw, Ind.	WRSW	1480	
Warsaw, Va.	WNNT	690	
Wasco, Calif.	KWSO	1050	
Washington, D.C.	WGMS	570	
	WMAL	630	A
	WOL	1450	
	WOOK	1340	
	WWDC	1260	M
	WRC	980	N
	WTOP	1500	C
Washington, Ga.	WKLE	1370	
Washington, Ind.	WAMW	1580	
Washington, N.J.	WCRV	1580	
Washington, N.C.	WHED	1340	
	WRRF	930	A
Washington, Pa.	WJPA	1450	M
Washington, Wis.	WEAU	790	N
Washington Court House, Ohio	WCHO	1250	
Waterbury, Conn.	WATR	1320	A
	WBRY	1590	C
	WWCO	1240	M
Waterbury, Vt.	WDEV	550	M
Waterloo, Iowa	KXEL	1540	A
	KNWS	1090	
	KWWL	1330	M
Watertown, N.Y.	WATN	1240	M
	WWNY	790	C
Watertown, S.Dak.	KWAT	950	M
Watertown, Wis.	WTTN	1580	
Waterville, Me.	WTVL	1490	A
Watrous, Sask.	CBK	540	
Watsonville, Calif.	KHUB	1340	
Waukegan, Ill.	WKRS	1220	
Waukesha, Wis.	WAUX	1510	
Waupaca, Wis.	WDUX	800	
Wausau, Wis.	WSAU	1400	N
	WOSA	550	M
	WHVF	1230	
Waverly, Ohio	WPKO	1380	
Waxahachie, Tex.	KBEC	1390	
Waycross, Ga.	WACL	570	
	WAYX	1230	M
Waynesboro, Ga.	WBRO	1310	
Waynesboro, Miss.	WABO	990	
Waynesboro, Pa.	WAYZ	1380	
	WANB	1580	
Waynesboro, Va.	WAYB	1490	M
Waynesville, N.C.	WHCC	1400	M
Weatherford, Tex.	KZEE	1220	
Webster City, Iowa	KJFJ	1570	
Weirton, W.Va.	WEIR	1430	
Weiser, Idaho	KWEI	1240	
Welch, W.Va.	WELC	1150	
	WMCO	1340	
Wellsboro, Pa.	WNBT	1490	
Wellston, Ohio	WLBE	1570	
Wellsville, N.Y.	WLSV	790	
Wenatchee, Wash.	KPQ	560	A
	KUEN	1410	
	KMEL	1340	M
Weslasco, Tex.	KRGV	1290	N
W. Bend, Wis.	WBKV	1470	
W. Frankfort, Ill.	WFRX	1300	
W. Lafayette, Ind.	WBAA	920	
W. Monroe, La.	KUZN	1310	
W. Palm Beach, Fla.	WEAT	850	N
	WJNO	1230	C
	WIRK	1290	M
West Plains, Mo.	KWPM	1450	
West Point, Miss.	WROB	1450	M
W. Springfield, Mass.	WTXL	1490	
W. Yarmouth, Mass.	WOCB	1240	
Westerly, R.I.	WERI	1230	A
Westminster, Md.	WTTR	1470	
Weston, W.Va.	WHAW	1450	M
W. Warwick, R.I.	WWRI	1450	
Wetumpka, Ala.	WETU	1570	
Wewoka-Seminole, Okla.	KWSH	1260	
Weyburn, Sask.	CFSL	1340	
Wheaton, Md.	WOON	1540	
Wheeling, W.Va.	WHLL	1600	
	WKWK	1400	A
	WWVA	1170	C
White Castle, La.	KEVL	1590	
White Plains, N.Y.	WFAS	1230	
Whitesburg, Ky.	WTCW	920	
Whiteville, N.C.	WENC	1220	M
Wichita, Kans.	KAKE	1240	M
	KANS	1480	N
	KFBI	1070	A
	KFH	1330	C
	KWBB	1410	
Wichita Falls, Tex.	KFOX	990	A
	KTRN	1290	M
	KWFT	620	C
Wildwood, N.J.	WCMC	1230	
Wilkes-Barre, Pa.	WBAX	1240	M
	WBRE	1340	N
	WILK	980	A
Williamson, W.Va.	WBTH	1400	M
Williamsport, Pa.	WLYC	1050	
	WRAK	1400	N
	WWPA	1340	C
Williamston, N.C.	WIAM	900	
Williston, N.D.	KEYS	1450	
Wilmar, Minn.	KWLM	1340	A
Wilmington, Del.	WAMS	1380	M
	WDEL	1150	N
	WILM	1450	A
	WTUX	1290	
Wilmington, N.C.	WMFD	630	A
	WKLM	980	
	WGNI	1340	
Wilson, N.C.	WGTM	590	C
	WVOT	1420	M
Winchester, Ky.	WWKY	1380	
Winchester, Tenn.	WCDT	1340	A
Winchester, Va.	WINC	1400	A
Winder, Ga.	WIMO	1300	
Windsor, N.S.	CFAB	1450	
Windsor, Ont.	CBE	1550	
	CKLW	800	M
Winnfield, La.	KVCL	1270	
Wingham, Ont.	CKNX	920	
Winnemucca, Nev.	KWNA	1400	
Winnipeg, Man.	CBW	990	
	CKRC	630	
	CKY	580	
	CJOB	1340	
Winnsboro, La.	KMAR	1570	
Winona, Minn.	KWNO	1230	A
Winslow, Ariz.	KVNC	1010	
Winston-Salem, N.C.	WAAA	980	
	WAIR	1340	A
	WSJS	600	N
	WTOB	1380	M-C
Winter Haven, Fla.	WSIR	1490	M
Winter Park, Fla.	WABR	1440	
Wisconsin Rapids, Wis.	WFHR	1340	M
Woodside, N.Y.	WWRL	1600	
Woodstock, Ont.	CKOX	1340	
Woodward, Okla.	KSIW	1450	M
Woonsocket, R.I.	WNRI	1380	
	WWON	1240	M
Wooster, Ohio	WWST	960	
Worcester, Mass.	WAAB	1440	M-N
	WNEB	1230	
	WORC	1310	A
	WTAG	580	C
Worland, Wyo.	KWOR	1340	A
Worthington, Minn.	KWOA	730	
Worthington, Ohio	WRFD	880	
Wynne, Ark.	KWYN	1400	
Wytheville, Va.	WYVE	1280	M
Yakima, Wash.	KIT	1280	A-N
	KIMA	1460	C
	KUTI	980	
	KYAK	1390	M
Yankton, S.D.	KYNT	1450	
	WNAX	570	C
Yarmouth, N.S.	CJLS	1340	
Yazoo City, Miss.	WAZF	1230	M
York, Nebr.	KAWL	1370	
York, Pa.	WNOW	1250	
	WORK	1350	N
	WSBA	910	A-N
York, S.C.	WYCL	1580	
Yorkton, Sask.	CJGX	940	
Youngstown, Ohio	WBBW	1240	A
	WFMJ	1300	N
	WKBN	570	C
Yreka, Calif.	KSYC	1490	
Yuba City, Calif.	KUBA	1600	
	KAGR	1450	
Yuma, Ariz.	KOFA	1240	
	KVOY	1400	M
	KYUM	560	N
Zanesville, Ohio	WHIZ	1240	N
Zarephath, N.J.	WAWZ	1380	

World-Wide Short-Wave Stations

Active and Most Commonly Heard in U. S. Listed by Frequency

(For Canadian Short-Wave Stations, see separate listing, p. 186) Abbreviations: Kc., frequency in kilocycles (to change to megacycles, divide by 1000); C.L. call letters. Due to malfunction of transmitter, interference by other stations, jamming, variance in propagational conditions, or reallocation of frequencies, stations may use other frequencies than those given

Kc.	C.L.	Location
3275	VP4RD	Port-of-Spain, Trinidad
3300		Belize, Brit. Honduras
3310	YVOG	Trujillo, Venez.
3320	YVQG	Barcelona, Venez.
3330	YVQL	El Tigre, Venez.
3340	YVMV	Carora, Venez.
3350	YVKT	Caracas, Venez.
3360	YVOC	San Cristobal, Vz.
3360	ZQI	Kingston, Jamaica
3370	YVMI	Maracaibo, Venez.
3380	YVQN	Puerto La Cruz, Vz.
3390	YVKX	Caracas, Venez.
3400	YVKP	Caracas, Venez.
3410	YVMK	Cabimas, Venez.
3420	YVOE	Merida, Venez.
3440	YVLI	Maracay, Venez.
3450	YVQI	Barcelona, Venez.
3460	YVLC	Valencia, Venez.
3480	YVLE	Puerto Cabello, Vz.
3490	YVRA	Maturin, Venez.
3620	YVLG	Maracay, Venez.
3980		Suva, Fiji Islands
4650	HC2AJ	Guayaquil, Ecua.
4752	YVMA	Maracaibo, Venez.
4768	HJEF	Cali, Colombia
4775	HJGB	Bucaramanga, Col.
4783	HJAB	Barranquilla, Col.
4790	YVQC	Ciudad Bolivar, Vz.
4797	HJFU	Armenia, Colombia
4800	YVME	Maracaibo, Venez.
4805	ZYS8	Manaos, Brazil
4810	YVMG	Maracaibo, Venez.
4815	HJBB	Cucuta, Col.
4820	XEJG	Guadalajara, Mex.
4820	YVNB	Coro, Venez.
4830	YVOA	San Cristobal, Vez.
4835	HJKE	Bogota, Colombia
4840	YVOI	Valera, Venez.
4845	CSA93	Ponta Delgada, Az.
4848	HJGF	Bucaramanga, Col.
4850	YVMS	Barquisimeto, Vz.
4855	HJFN	Neiva, Colombia
4860	JKL	Tokyo, Japan
4860	YVPA	San Filipe, Venez.
4865	PRC5	Belem, Para, Brazil
4865	HJFA	Pereira, Colombia
4871	HJBG	Cucuta, Colombia
4880	YVKF	Caracas, Venez.
4892	YVKB	Caracas, Venez.
4895	HJCH	Bogota, Col.
4895	PRF6	Manaos, Brazil
4897	VLX4	Perth, Aust.
4900	YVQE	Ciudad Bolivar, Vz.
4903	HJAG	Barranquilla, Col.
4907	YVMM	Coro, Venez.
4910	JKI	Nazaki, Japan
4910	YDB2	Djakarta, Indon.
4915		Accra, Ghana
4915	YVKR	Caracas, Venez.
4917	HI9B	Santiago, Dom.Rep.
4917	VLM4	Brisbane, Aus.
4930	HJAP	Cartagena, Col.
4940	JKM	Kawachi, Japan
4940	YVMQ	Barquisimeto, Vz.
4945	HJCW	Bogota, Col.
4950	ZQI	Kingston, Jamaica
4951		Dakar, Senegal
4960	YVQA	Cumana, Venez.
4967	HJAE	Cartagena, Col.
4970	YVLK	Caracas, Venez.
4985	YVMO	Barquisimeto, Vz.
4993	HIIA	Santiago, D.Rep.
5014	PJC3	Willimstad, Curac.
5020	HJFW	Manizales, Col.
5023	HI8Z	Santiago, D.Rep.
5030	YVKM	Caracas, Venez.
5045	ZYP23	Petropolis, Brazil
5050	YVKD	Caracas, Venez.
5053	HI2L	Ciudad Trujillo, D.R.
5055	HJDW	Medellin, Col.
5758	PZH5	Paramaribo, Surinam
5070	HJKH	Sutatenza, Colom.
5870	TIGPH	San Jose, C.Rica
5875	HRN	Tegucigalpa, Hond.
5920	HRA	Tegucigalpa, Hond.
5940		Khabarovsk, U.S.S.R.
5947		Moscow, U.S.S.R.
5948	4V2S	Port-au-Prince, H.
5952	TGNA	Guatemala, Guat.
5965	HJCF	Bogota, Colombia
5969	HVJ	Vatican City
5973	HI4T	Ciudad Trujillo, D.R.
5981	ZFY	Georgetown, Br.Gui.
5985		Radio Free Europe, Munich, Germany
5985		Shanghai, China
5990		Andorra, Andorra
5990	TGJA	Guatemala, Guat.
5995	HO50	Panama, Panama
6000	HJKD	Bogota, Colombia
6005		Berlin, Germany
6005	HP5K	Colon, Panama
6009	HJFC	Armenia, Colombia
6010	GRB	London, England
6010	OLR2A	Prague, Czecho.
6012	XEOI	Mexico, Mex.
6015	KU2XAJ	USS Courier in Mediterranean
6016	PRA8	Recife, Brazil
6018	HJCX	Bogota, Col.
6020		Kiev, U.S.S.R.
6020		Radio Free Europe, Munich, Germany
6020	WRCA	New York, U.S.A.
6020	XEUW	Vera Cruz, Mex.
6024		Brazzaville, Fr.Eq.Africa
6025		Radio Nederland
6026	HIIJ	San Pedro, D.R.
6028	ELBC	Monrovia, Liberia
6030		Stuttgart, Germany
6030	DZH6	Manila, P.I.
6030	XEKW	Morelia, Mex.
6030	HP5B	Panama, Pan.
6035	GWS	London, England
6035		Monte Carlo, Monaco
6035	XYZ	Rangoon, Burma
6037		San Jose, Costa Rica
6040	GSY	London, England
6040	KCBR	Delano, Calif.
6040		Tangier, Tangier
6040	WLWO	Cincinnati, U.S.A.
6044	HIIN	Ciudad Trujillo, D.R.
6045	YDF	Djakarta, Indonesia
6050	GSA	London, England
6054	HJEX	Cali, Colombia
6055	HER2	Bern, Switzerland
6060	GSX	London, England
6060	KRCA	San Fran., U.S.A.
6060		Tangier I, Tangier
6060	WABC	New York, U.S.A.
6065	SBO	Motala, Sweden
6065	XEXE	Mexico City, Mex.
6069	JOB	Tokyo, Japan
6070		Petropavlovsk, U.S.S.R.
6070	GRR	London, England
6075	KGEI	San Fran., U.S.A.
6080	KRCA	San Fran., Calif.
6080		Munich III, Germany
6081	OAX4Z	Lima, Peru
6085	ORU	Brussels, Belgium
6085	VP4RD	Port-of-Spain, Trinidad
6085	ZYK2	Recife, Brazil
6090	GWM	London, England
6090	VLI6	Sydney, Australia
6092		Luxemburg
6095		Horby, Sweden
6095		Radio Free Europe, Munich, Germany
6095	ZYB7	Sao Paulo, Brazil
6098	HJFK	Pereira, Colombia
6100		Belgrade, Yugoslavia
6100		Munich, Germany
6100	WRCA	New York, U.S.A.
6110	GSL	London, England
6112	HI1Z	Ciudad Trujillo, D.R.
6115		Berlin, Germany

Kc.	C.L.	Location
6120	HC2FB	Guayaquil, Ecua.
6120	ZJ14	Limassol, Cyprus
6120		Tangier, Tangier
6120	WRCA	New York, U.S.A.
6122	HP5H	Panama, Pan.
6124	HRQ	San Pedro Sula, Hond.
6125	GWA	London, England
6130	XEUZ	Mexico, Mex.
6130	COCD	Havana, Cuba
6130		Port Moresby, New Guinea
6135	HJED	Cali, Colombia
6140		Munich, Germany
6145	HJDE	Medellin, Col.
6147	PRL9	Rio de Janeiro, Br.
6150	GRW	London, England
6150	TGAZ	Guatemala, Guat.
6160	HJKJ	Bogota, Colombia
6160		Honolulu, Hawaii
6160		Munich, Germany
6165	GWK	London, England
6165	HER3	Bern, Switzerland
6167	4VCM	Port-au-Prince, H.
6170		Munich, Germany
6170	GSZ	London, England
6170	KCBR	Delano, Cal., U.S.A.
6170	YVKO	Caracas, Venez.
6172	ZJM5	Limassol, Cyprus
6175	XEXA	Mexico, Mex.
6180	LRM	Mendoza, Argentina
6180		Ashkabad, U.S.S.R.
6180	GRO	London, England
6182	TGWB	Guatemala, Guat.
6185	KRCA	San Fran., U.S.A.
6185	HJCT	Bogota, Colombia
6190		Frankfurt, Germany
6190	HI9T	Puerto Plata, D.R.
6190	WLWD	Cincinnati, U.S.A.
6190	WRCA	New York, U.S.A.
6195	GRN	London, England
6195		Honolulu, Hawaii
6200		Paris, France
6215	SP13	Warsaw, Poland
6235	HRD2	La Ceiba, Hond.
6235		Karachi, Pakistan
6248		Budapest, Hungary
6285	TGTQ	Guatemala, Guat.
6295	DTM1	Leopoldville, Belgian Congo
6295	TGLA	Guatemala, Guat.
6320		Baden-Baden, Germany
6322	COCW	Havana, Cuba
6335	TGTA	Guatemala, Guat.
6351	HRP1	San Pedro Sula, Hond.
6374	CSA21	Lisbon, Port.
6405	TGQA	Quezaltenango, Guat.
6632	HC2RL	Guayaquil, Ecu.
6450	COCY	Santa Clara, Cuba
6660	HROW	Tegucigalpa, Hond.
6758	YNVP	Managua, Nic.
6790	ZJM6	Limassol, Cyprus
6830	4XB21	Tel Aviv, Israel
6870	HC4EB	Manta, Ecuador
7105		Paris, France
7112	CR4AA	Praia, Cape V. Isls.
7120	GRM	London, England
7135	BED7	Taipei, Formosa
7135	MCM	London, England
7145		Radio Free Europe, Lisbon, Portugal
7145		Radio Free Europe
7150	GRT	London, England
7165		Moscow, U.S.S.R.
7175	VUD	Delhi, India
7180	JOA	Tokyo, Japan
7185	GRK	London, England
7200	GWZ	London, England
7205		Warsaw, Poland
7210	GWL	London, England
7210	HEI3	Bern, Switzerland
7222		Budapest, Hungary
7230	GSW	London, England
7240		Moscow, U.S.S.R.
7240		Paris, France
7250	GWI	London, England
7257	JKH	Tokyo, Japan
7260	GSU	London, England
7260		Moscow, U.S.S.R.
7280	GWN	London, England
7285	JKJ	Tokyo, Japan
7285	TAS	Ankara, Turkey
7290		Hamburg, Germany
7290	VUD	Delhi, India
7295		Moscow, U.S.S.R.
7300		Radio Free Europe, Munich, Germany
7300	SVD2	Athens, Greece
7315	YSO	San Salvador, Salv.
7320	GRJ	London, England
7335	BEC36	Taipei, Formosa
7360		Moscow, U.S.S.R.
7670		Sofia, Bulgaria
7850	ZAA	Tirana, Albania
7863	SUX	Cario, Egypt
7933	HLKA	Pusan, S. Korea
7951		Alicante, Spain
8036	FXE	Beirut, Lebanon
8664	COJK	Camaguey, Cuba
8825	COCQ	Havana, Cuba
8955	COKG	Santiago, Cuba
9007		Voice of Zion, Tel Aviv, Israel
9026	CDBZ	Havana, Cuba
9236	COBQ	Havana, Cuba
9252		Bucharest, Rumania
9290	PRN9	Rio de Janeiro, Brazil
9316	LRS	Buenos Aires, Arg.
9340	OAX4J	Lima, Peru
9363	COBC	Havana, Cuba
9369		Madrid, Spain
9380		Khabarovsk, U.S.S.R.
9400	OTM2	Leopoldville, Belgian Congo
9410	GRI	London, England
9440		Brazzaville, Fr. Eq. Africa
9452	LRY1	Buenos Aires, Arg.
9463	TAP	Ankara, Turkey
9480		Moscow, U.S.S.R.
9490	KUJ39	Agana, Guam.
9500	XEWW	Mexico, Mex.
9504	OLR3B	Prague, Czecho.
9505	HOLA	Colon, Panama
9505	JBD	Kawachi, Japan
9510	YVHJ	Barquisimeto, Ven.
9510	GSB	London, England
9515	KRCA	San Fran., Calif.
9515	TAT	Ankara, Turkey
9520		Colombo, Ceylon
9520	HJKF	Bogota, Colombia
9520	OZF	Skamlebak, Denmark
9520	VLT9	Port Moresby, British New Guinea
9520	WLWO	Cincinnati, U.S.A.
9525	GWJ	London, England
9525	ZBW3	Victoria, Hong Kong
9527		Warsaw, Poland
9530		Honolulu, Hawaii
9530		Manila, Philippines
9530	KCBR	Delano, Cal., U.S.A.
9530	WABC	New York, U.S.A.
9530	WGEO	Schenect'y, U.S.A.
9531	COCO	Havana, Cuba
9535	HER4	Bern, Switzerland
9535	SBU	Stockholm, Sweden
9540		Munich, Germany
9540	VLG9	Melbourne, Aus.
9540	ZL2	Wellington, N. Zeal
9543	XYZ	Rangoon, Burma
9548	XEFT	Vera Cruz, Mex.
9550	HVJ	Vatican City
9550		Paris, France
9550	OLR3A	Prague, Czecho.
9555	OIX2	Pori, Finland
9555	XETT	Mexico, Mex.
9560	JBD2	Kawachi, Japan
9560		London, England
9560		Paris, France
9560		Tangier, Tangier
9560	WLWO	Cincinnati, U.S.A.
9560	WRCA	New York, U.S.A.
9565		Komsomolsk, U.S.S.R.
9565	ZYK3	Recife, Brazil
9570		Algiers, Algeria
9570	GWX	London, England
9570	KWID	San Fran., U.S.A.
9570		Warsaw, Poland
9570		Bucharest, Rumania
9575		Rome, Italy
9580	GSC	London, England
9580	VLB9	Shepparton, Aus.
9585		Madrid, Spain
9590	PCJ	Hilversum, Neth.
9590	WABC	New York, U.S.A.
9600	GRY	London, England
9600	KCBR	Delano, Cal., U.S.A.
9600	KRCA	San Fran., U.S.A.
9600		Leningrad, U.S.S.R.
9605	HP5J	Panama, Pan.
9605	JKL2	Toyko, Japan
9605		Radio Free Europe, Lisbon, Portugal
9607		Athens, Greece
9610	VLX9	Perth, Australia
9610	ZYC8	Rio de Janeiro, Brazil
9610	LLG	Oslo, Norway
9610	XERQ	Mexico, Mex.
9615		Tangier, Tangier
9615	VLB9	Shepparton, Aus.
9615	WRCA	New York, U.S.A.
9618	TIDCR	San Jose, C.Rica
9620		Horby, Sweden
9620		Paris, France
9620	ZL8	Wellington, N.Z.
9625	XEBT	Mexico, Mex.
9625	GWO	London, England
9625	VP4RD	Port-au-Spain, Trinidad
9630	HJKC	Bogota, Colombia
9630	VUD4/10	Delhi, India
9630		Rome, Italy
9635		Munich, Germany
9635		Tangier, Tangier
9640		Accra, Ghana
9640	DZH2	Manila, P.I.
9640	GVZ	London, England
9645		Karachi, Pakistan
9645	LLH	Oslo, Norway
9645	TIFC	San Jose, C.Rica
9646	HVJ9	Vatican City
9650		Honolulu, Hawaii
9650		Moscow, U.S.S.R.
9650		Tangier, Tangier
9650	WABC	New York, U.S.A.
9652	ZJM8	Limassol, Cyprus
9654	DTC2	Leopoldville, Belgian Congo
9655	JK12	Nazaki, Japan
9656	4VEH	Cap-Haitien, Haiti
9660	EQC	Teheran, Iran
9660	GWP	London, England
9660	VLQ9	Brisbane, Aus.
9665	HEU8	Bern, Switzerland
9668	TGNB	Guatemala, Guat.
9670		Munich, Germany
9670		Tangier, Tangier
9670	WGEO	Schenectady, U.S.A.
9670	KGEI	San Fran., U.S.A.
9670		Moscow, U.S.S.R.
9675	GWT	London, England
9675	JOB3	Tokyo, Japan
9680		Paris, France
9680	XEQQ	Mexico, Mex.
9680	VUD	Delhi, India
9680		Moscow, U.S.S.R.
9680		Tangier, Tangier
9680	VLR9/VLH9	Melbourne, Australia
9685		Paris, France
9685	WLWO	Cincinnati, U.S.A.
9690	LRA	Buenos Aires, Arg.
9690	GRX	London, England
9690		Moscow, U.S.S.R.
9690		Singapore, Malaya
9695	JKM2	Kawachi, Japan
9700	GWY	London, England
9700	WRCA	New York, U.S.A.
9700		Sofia, Bulgaria
9700		Tangier, Tangier
9700	WLWO	Cincinnati, U.S.A.
9700	KCBR	Delano, Cal., U.S.A.
9700	WCBR	Delano, Calif., USA
9700	FZF6	Ft. de France, Mart.
9710		Moscow, U.S.S.R.
9710		Dakar, Fr. W. Africa
9710	YDF6	Djakarta, Indonesia
9710		Rome, Italy
9715		Cairo, Egypt
9716		Moscow, U.S.S.R.
9717		Radio Free Europe, Ger.
9720	PRL7	Rio de Janeiro, Brazil
9730		Nanking, China
9730	DZH7	Manila, P.I.
9730		Leipzig, Germany
9735	HI2T	Ciudad Trujillo, D.R.
9741	CSA27	Lisbon, Portugal
9743	HCJB	Quito, Ecuador
9745	ORU	Brussels, Belgium
9760	CR7BE	Lourence Marques, Moz.
9764	TGWA	Guatemala, Guat.
9770		London, England
9770	ORU	Brussels, Belgium
9770	PRL4	Rio de Jan., Brazil
9780		Rome, Italy
9785		Monte Carlo, Monaco
9825	GRH	London, England
9830		Budapest, Hungary
9833	COBL	Havana, Cuba
9865	YDF8	Djakarta, Indonesia
9915	GRU	London, England
9966		Brazzaville, Fr. Eq. Africa
10058	SUV	Cario, Egypt
10220	PSH	Rio de Janeiro, Brazil
10258	XRRA	Peiping, China
10780	SDB2	Motala, Sweden
11027	CSA29	Lisbon, Portugal
11090	CSA92	PontaDelgada, Azores
11630		Leningrad, U.S.S.R.
11650		Peking, China
11670		Bangkok, Thailand
11680	HJCQ	Bogota, Colombia
11680	GRG	London, England
11685		Peking, China
11695	HP5A	Panama, Panama
11700	GVW	London, England
11702		Paris, France
11705	JOA4	Tokyo, Japan
11705	SBP	Motala, Sweden
11710		Moscow, U.S.S.R.
11710		Tangier, Tangier
11710	VUD5/7	Delhi, India
11710	WLWD	Cincinnati, U.S.A.
11714	ZJM7	Limassol, Cyprus
11715	HEI5	Bern, Switzerland
11718		Athens, Greece
11720	PRL8	Rio de Janeiro, Brazil
11720		Radio Canada (Montreal)
11720	OTM4	Leopoldville, Belgian Congo
11720	ORY2	Brussels, Belgium
11724	HNG	Baghdad, Iraq
11725	COCY	Havana, Cuba
11730	GVV	London, England
11730	KGEI	San Fran., U.S.A.
11730	PHI	Hilversum, Nether.
11730	CE1173	Santiago, Chile
11735	BED6	Taipei, Formosa
11735	LKQ	Frederikstad, Nor.
11735		Radio Free Europe, Ger.
11740		Moscow, U.S.S.R.
11740		Warsaw, Poland
11740	WRUL	Boston, U.S.A.
11742	CE1174	Santiago, Chile
11750	GSD	London, England
11755		Moscow, U.S.S.R.
11760	OLR4B	Prague, Czecho.
11760		Tangier, Tangier
11760	VLA11/VLB11	Shepparton, Aus.
11760	VUD7/11	Delhi, India
11764	CR7BH	Lourenco Marques, Mozambique
11770	GVU	London, England
11770	YDE/YDF7	Djakarta, Indonesia
11775	WRCA	New York, U.S.A.
11780		Moscow, U.S.S.R.
11780	XEQH	Mexico, D.F.
11780	ZL3	Wellington, N.Z.
11790	WABC	New York, U.S.A.
11790	GWV	London, England
11790	VUD	Delhi, India
11790	KRCA	San Fran., U.S.A.
11790	WRUL	Boston, U.S.A.
11790		Tangier, Tangier
11795		Cologne, Germany
11795	YDF3	Djakarta, Indonesia
11795	WRUL	Boston, U.S.A.
11800	GWH	London, England
11800		Brussels, Belgium
11810		Moscow, U.S.S.R.
11810		Rome, Italy
11810	VLA11	Shepparton, Aus.
11810	VLC11	Shepparton, Aus.
11815		Warsaw, Poland
11820	GSN	London, England
11820	XEBR	Hermosillo, Mex.
11825	JK16	Tokyo, Japan
11825		Moscow, U.S.S.R.
11825	ZYK3	Recife, Brazil
11830	FZS4	Saigon, Fr.Indo-C.
11830		Moscow, U.S.S.R.
11830		Tangier, Tangier
11830	WABC	New York, U.S.A.
11830	WRCA	New York, U.S.A.
11835	CXA19	Montevideo, Uru.
11840	VLW11	Perth, Australia
11840	OLR4A	Prague, Czecho.
11840	LRT	Tucuman, Argentina
11845		Karachi, Pakistan
11847		Paris, France
11850	VLB11	Shepparton, Aus.
11850	ORU	Brussels, Belgium
11850	TGNC	Guatemala, Guat.
11850	VUD11	Delhi, India
11850	LLK	Oslo, Norway
11855	DZH9	Manila, Philippines
11855		Radio Free Europe, Lisbon, Portugal
11860	GSE	London, England
11860	KWID	San Fran., U.S.A.
11865	CR6RA	Luanda, Angola
11865	HER5	Bern, Switzerland
11870		Munich, Germany
11870	KRCA	San Fran., U.S.A.
11870	KWID	San Fran., U.S.A.
11870		Tangier, Tangier
11870	WBOS	Boston, U.S.A.
11870	WRUL	Boston, U.S.A.
11875	DLR4C	Prague, Czecho.
11880		Moscow, U.S.S.R.
11880	LRS	Buenos Aires, Arg.
11880	VLG11/VLH11	Melbourne, Aus.
11880		Horby, Sweden
11880	XEHH	Mexico, Mex.
11880	GRE	London, England
11880	SBP	Stockholm, Sweden
11885	APK3	Karachi, Pakistan
11890		Moscow, U.S.S.R.
11890	GWW	London, England
11890	KZFJ	Manila, P.I.
11890	WRCA	New York, U.S.A.
11895	FHE3	Dakar, Fr.W.Af.
11895		Manila, Philippines
11900	CE1190	Valparaiso, Chile
11900	CXA10	Montevideo, Uru.
11900	HCJB	Calvary Radio Ministry
11900	WGED	Schenectady, U.S.A.
11900	XEXE	Mexico City, Mex.
11905		Rome, Italy
11910		Budapest, Hungary
11910		Karachi, Pakistan
11915		Damascus, Syria
11915	HCJB	Quito, Ecuador
11918	BED4	Taipei, Formosa
11924	FZS4	Saigon, Vietnam
11930	GVX	London, England
11935		Warsaw, Poland
11937		Bucharest, Rumania
11955	GVY	London, England
11960		Moscow, U.S.S.R.
11950	YSAX	San Salvador, Salv.
11963		Lisbon, Portugal
11970		Brazzaville, Fr.Eq.Africa
11972	TIHH	San Jose, C.Rica
11975		Colombo, Ceylon
11980		Moscow, U.S.S.R.
11995	CSA32	Lisbon, Portugal
11998	CE1180	Santiago, Chile
12040	GRV	London, England
12095	GRF	London, England
12175	TFJ	Reykjavik, Iceland
14492		Radio Moscow
14690	PSF	Rio de Janeiro, Brazil
15050	ETAA	Addis Ababa, Eth.
15050	V3USE	Forest Side, Mauritius
15060		Peking, China
15070	GWC	London, England
15095	HVJ	Vatican City
15100	CSA39	Lisbon, Portugal
15100		Moscow, U.S.S.R.
15100	EPB	Teheran, Iran
15105	KGEI	San Fran., U.S.A.
15105	KRCA	San Fran., U.S.A.
15105	OAX4X	Lima, Peru
15110	GWG	London, England
15110		Moscow, U.S.S.R.
15116	HCJB	Quito, Ecuador
15120		Colombo, Ceylon
15120		Moscow, U.S.S.R.
15120		Rome, Italy
15120		Warsaw, Poland
15125	CSA36	Lisbon, Portugal
15130		Tangier, Tangier
15130	WABC	New York, U.S.A.
15130	WLWO	Cincinnati, U.S.A.

Kc.	C.L.	Location
15130	KRCA	San Fran., U.S.A.
15130	WRCA	New York, U.S.A.
15135	PRB23	Sao Paulo, Brazil
15140	GSF	London, England
15145	YDC	Djakarta, Indonesia
15145	ZYK2	Recife, Brazil
15150	OAX4R	Lima, Peru
15150	CE1515	Santiago, Chile
15155	SBT	Motala, Sweden
15156	ZYB9	Sao Paulo, Brazil
15160	VUD5/7	Delhi, India
15160	VLB15	Shepparton, Aus.
15160	TAB	Tartessus, Spain
15160	TAU	Ankara, Turkey
15165	WLWO	Cincinnati, U.S.A.
15165	ZYN7	Fortaleza, Brazil
15170	LKV	Oslo, Norway
15170	TGWA	Guatemala, Guat.
15170		Moscow, U.S.S.R.
15175	LLM	Oslo, Norway
15180	GSO	London, England
15180		Moscow, U.S.S.R.
15180	OZH2	Shamlebak, Den.
15190	VUD5/11	Delhi, India
15190	OIX4	Pori, Finland
15195	TAQ	Ankara, Turkey
15200		Moscow, U.S.S.R.
15200	VLA15/VLC15	Shepparton, Aus.
15205	XESC	Mexico, Mexico
15205	XEXE	Mexico, Mexico
15210		Munich, Germany
15210	GWU	London, England
15210	WRCA	New York, U.S.A.
15210	VLG15	Melbourne, Aus.
15210		Tangier, Tangier
15220	PCJ	Hilversum, Neth.
15220	XESC	Mexico, Mexico
15220	ZL10	Wellington, N.Z.
15225	JBD3	Kawachi, Japan
15228		Komsomolsk, U.S.S.R.
15230	GWD	London, England
15230		Moscow, U.S.S.R.
15230	OLR5A	Prague, Czecho.
15230	VLH15	Melbourne, Aus.
15230	WRUL	Boston, U.S.A.
15235	BED3	Taipei, Formosa
15235	JBD4	Kawachi, Japan
15235	JOA4	Tokyo, Japan
15235	JOB5	Tokyo, Japan
15240		Belgrade, Yugoslavia
15240	KRCA	San Fran., U.S.A.
15240		Paris, France
15240	VLH15	Melbourne, Aus.
15240	WLWO	Cincinnati, U.S.A.
15250		Manila, P.I.
15250	WLWO	Cincinnati, U.S.A.
15250		Tangier, Tangier
15260	GSI	London, England
15270		Karachi, Pakistan
15270	KCRR	Delano, Cal., U.S.A.
15270		Munich, Germany
15270	WABC	New York, U.S.A.
15270		Sverdlovsk, U.S.S.R.
15280		Munich, Germany
15280	ZL4	Wellington, N.Z.
15280		Moscow, U.S.S.R.
15280		Tangier, Tangier
15285	CR7BG	Lourenco Marques, Mozambique
15285	WRCA	New York, U.S.A.
15285	WRUL	Boston, U.S.A.
15290	LRU	Buenos Aires, Arg.
15290	VUD5/9	Delhi, India
15295		Tangier, Tangier
15300	DZH8	Manila, P.I.
15300	GWR	London, England
15300		Singapore, Malaya
15305	HER6	Bern, Switzerland
15305	RV97	Novosibirsk, U.S.S.R.
15310	KCBR	Delano, Calif.
15310	GSP	London, England
15320	VLG15	Melbourne, Aus.
15320	VLC15	Shepparton, Aus.
15320		Moscow, U.S.S.R.
15320	OLR5B	Prague, Czech.
15325		Rome, Italy
15330	KGEI	San Fran., U.S.A.
15330		Sofia, Bulgaria
15330	WLWO	Cincinnati, U.S.A.
15330	WGEO	Schenectady, U.S.A.
15335		Brussels, Belgium
15335		Karachi, Pakistan
15340		Moscow, U.S.S.R.
15340	KCBR	Delano, Cal., U.S.A.
15340		Tangier, Tangier
15345		Athens, Greece
15347	LRA	Buenos Aires, Arg.
15350		Paris, France
15350	WRUL	Boston, U.S.A.
15350	WLWO	Cincinnati, U.S.A.
15350	VUD8	Delhi, India
15352		Luxemburg
15360		London, England
15360		Moscow, U.S.S.R.
15364	ZYC9	Rio de Jan., Brazil
15390		Moscow, U.S.S.R.
15400		Paris, France
15400		Rome, Italy
15405	PZC	Paramaribo, Surinam
15410		Moscow, U.S.S.R.
15425		Radio Netherlands
15435	GWE	London, England
15440		Moscow, U.S.S.R.
15450	GRD	London, England
15595		Brazzaville, Fr.Eq.Africa
15620		Madrid, Spain
17700	GVP	London, England
17715	GRA	London, England
17720	LRA5	Buenos Aires, Arg.
17730	GVQ	London, England
17750	WRUL	Boston, U.S.A.
17760		Lisbon, Portugal
17760	WGEO	Schenectady, U.S.A.
17760	KGEI	San Fran., U.S.A.
17760	VUD	Delhi, India
17770	KCBR	Delano, Cal., U.S.A.
17770		Rome, Italy
17770		Tangier, Tangier
17775		Hilversum, Netherlands
17780	VUD/10/11	Delhi, India
17780	WRCA	New York, U.S.A.
17780		Manila, P.I.
17784	HER7	Bern, Switzerland
17790	GSG	London, England
17795	WLWO	Cincinnati, U.S.A.
17800	HCJB	Calvary Radio
17800	KRCA	San Fran., U.S.A.
17800	WLWO	Cincinnati, U.S.A.
17800	KRHO	Honolulu, Hawaii
17800		Stockholm, Sweden
17802	OIX5	Pori, Finland
17804		Rome, Italy
17805	DZ16	Manila, P.I.
17810	GSV	London, England
17810		Moscow, U.S.S.R.
17815	WRUL	Boston, U.S.A.
17820		Colombo, Ceylon
17825	LLN	Oslo, Norway
17830	TAV	Ankara, Turkey
17830		Moscow, U.S.S.R.
17830	WABC	New York, U.S.A.
17835		Karachi, Pakistan
17840		Brazzaville, Fr.Eq.Africa
17840		Moscow, U.S.S.R.
17940	VLC17	Shepparton, Aus.
17840	HVJ	Vatican City
17852		Paris, France
17865		Damascus, Syria
17870	CSA44	Lisbon, Portugal
17890	HCJB	Quito, Ecuador
18025	GRQ	London, England
18080	GVO	London, England
18130	GRP	London, England
21460	KRCA	San Fran., U.S.A.
21470	GSH	London, England
21480		Hilversum, Netherlands
21490		Paris, France
21500	WRCA	New York, U.S.A.
21510	VUD5	Delhi, India
21520	HER8	Bern, Switzerland
21520	WLWO	Cincinnati, U.S.A.
21530	GSJ	London, England
21530		Moscow, U.S.S.R.
21540	VLB2	Shepparton, Aus.
21550	GST	London, England
21560		Moscow, U.S.S.R.
21560		Rome, Italy
21570	WABC	New York, U.S.A.
21580		Horby, Sweden
21590	WGEO	Schenectady, N.Y.
21610	WRCA	New York, U.S.A.
21620		Colombo, Ceylon
21640	GRZ	London, England
21650	WLWO	Cincinnati, U.S.A.
21660		Lisbon, Portugal
21670	LLP	Oslo, Norway
21675	GVR	London, England
21680	VLC21	Shepparton, Aus.
21690		Tangier, Tangier
21700	VUD10	Delhi, India
21710	GVS	London, England
21730	WRCA	New York, U.S.A.
21740	KCBR	Delano, Cal., U.S.A.
21740	KGEI	San Fran., U.S.A.
21740		Paris, France
21750	GVT	London, England
25750	GSQ	London, England
26100	GSK	London, England

Canadian Short-Wave Stations

Listed by Frequency

Abbreviations: Kc., frequency in kilocycles (to change to megacycles, divide by 1000), C.L., call letters

Kc.	C.L.	Location
5970	CBNX	St. John's, Nfld.
	CKNA	Sackville, N.B.
5990	CHAY	Sackville, N.B.
6005	CFCX	Montreal, Que.
6010	CJCX	Sydney, N.S.
6030	CFVP	Calgary, Alta.
6060	CKRZ	Sackville, N.B.
6070	CFRX	Toronto, Ont.
6080	CKFX	Vancouver, B.C.
6090	CBFW	Montreal, Que.
	CKOB	Sackville, N.B.
6130	CHNX	Halifax, N.S.
6150	CKRO	Winnipeg, Man.
6160	CBUX	Vancouver, B.C.
	CHAC	Sackville, N.B.
9520	CBFR	Montreal, Que.
9585	CKLP	Sackville, N.B.
9610	CBFX	Montreal, Que.
	CHLS	Sackville, N.B.
9630	CBFO	Montreal, Que.
	CKLO	Sackville, N.B.
9710	CHLR	Sackville, N.B.
9740	CHFO	Sackville, N.B.
11705	CBFY	Montreal, Que.
	CKXA	Sackville, N.B.
11720	CBFL	Montreal, Que.
	CHOL	Sackville, N.B.
	CKRX	Winnipeg, Man.
11760	CBFA	Montreal, Que.
	CKRA	Sackville, N.B.
11900	CKEX	Sackville, N.B.
11945	CKEX	Sackville, N.B.
15090	CKLX	Sackville, N.B.
15190	CBFZ	Montreal, Que.
	CKCX	Sackville, N.B.
15320	CKCS	Sackville, N.B.
17710	CHSB	Sackville, N.B.
17735	CHRX	Sackville, N.B.
17820	CKNC	Sackville, N.B.
17865	CHYS	Sackville, N.B.
21600	CKRP	Sackville, N.B.
21710	CHLA	Sackville, N.B.

Note: Sackville, N.B., is often transmitter location only.

United States

Frequency-Modulation (FM) Stations

(Territories and possessions follow states) Abbreviations; C.L., call letters, Mc., megacycles (for frequency in kilocycles, change decimal point to comma and add two zeros); asterisk (*) indicates educational station

ALABAMA

Location	C.L.	Mc.
Albertville	WAVU-FM	105.1
Alexander City	WRFS-FM	106.1
Andalusia	WCTA-FM	98.1
Anniston	WHMA-FM	100.5
Birmingham	WAFM	99.5
	WJLN	104.7
	WSGN-FM	93.7
Clanton	WKLF-FM	100.9
Cullman	WFMH-FM	101.1
Decatur	WHOS-FM	92.5
Lanett	WRLD-FM	102.9
Mobile	WABB-FM	102.1
	WKRG-FM	99.9
Talladega	WHTB-FM	97.1
Tuscaloosa	WTBC-FM	95.7
Tuscaloosa	WUOA	*91.7

ARIZONA

Location	C.L.	Mc.
Mesa	KTYL-FM	104.7
Phoenix	KELE	95.5
	KFCA	*88.5
Tucson	KTKT-FM	99.5

ARKANSAS

Location	C.L.	Mc.
Blytheville	KLCN-FM	96.1
Ft. Smith	KFPW-FM	94.9
Jonesboro	KBTM-FM	101.9
Mammoth Springs	KAMS	103.9
Pocahontas	KPOC-FM	97.7
Siloam Springs	KUOA-FM	105.7

CALIFORNIA

Location	C.L.	Mc.
Bakersfield	KERN-FM	94.1
	KQXR	101.5
Berkeley	KPFA	94.1
	KPFB	*89.3
	KRE-FM	102.9
Beverly Hills	KCBH	98.7
	KPAL	104.3
Claremont	KSPC	*90.7
Eureka	KRED-FM	96.3
Fresno	KARM-FM	101.9
	KMJ-FM	97.9
	KRFM	93.7
Glendale	KBMS	105.9
	KFMU	97.1
	KHOF-FM	99.5
	KUTE	101.9
Hollywood	KFWB-FM	94.7
	KHJ-FM	101.1
	KNX-FM	93.1
Long Beach	KFOX-FM	102.3
	KLON	*88.1
	KNDB	103.1
Los Angeles	KABC-FM	95.5
	KCBH	98.7
	KFAC-FM	104.3
	KNX-FM	93.1
	KRHM	94.7
Los Angeles	KRKD-FM	96.3
	KSRT	93.9
	KUSC	*91.5
	KXLU	*88.7
Marysville	KMYC-FM	99.9
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
Mt. Diablo	KSBR	100.5
Oceanside	KOEN	*89.7
Ontario	KEDO	93.5
Sacramento	KCRA-FM	96.1
	KFBK-FM	96.9
	KJML	95.3
	KXDA-FM	107.9
Sausalito	KDFC	102.1
Stockton	KCVN	91.3
San Bernardino	KVCR	*91.9
San Diego	KFSD.FM	94.1
	KSDS	*88.3
	KSON-FM	104.7
San Francisco	KALW	*91.7
	KCBS-FM	103.7
	KEAR	97.3
	KGO-FM	103.7
	KNBC-FM	99.7
	KRON-FM	96.5
San Jose	KSJO-FM	95.3
San Mateo	KCSM	*90.9
Santa Anna	KWIZ-FM	96.7
Santa Clara	KSCU	*90.1
Santa Monica	KCRW	*89.9
Stockton	KCVN	*91.3

COLORADO

Location	C.L.	Mc.
Boulder	KRNW	97.3
Colorado Springs	KRCC	*91.3
	KSHS	*90.5
Denver	KFEL-FM	97.3
	KFML-FM	98.5
Manatou Springs	KCMS-FM	102.7

CONNECTICUT

Location	C.L.	Mc.
Brookfield	WGHF	94.5
Danbury	WLAD-FM	98.3
Hartford	WHCN	93.7
	WTIC.FM	96.5
Meriden	WMMW-FM	95.7
New Haven	WNHC.FM	99.1
Stamford	WSTC-FM	96.7

DELAWARE

Location	C.L.	Mc.
Dover	WDOV-FM	94.7
Wilmington	WDEL-FM	93.7
	WJBR	99.9

DISTRICT OF COLUMBIA

Location	C.L.	Mc.
Washington	WASH-FM	97.1
	WCFM	99.5
	WFAN	100.3
	WGMS-FM	103.5
	WMAL-FM	107.3

Location	C.L.	Mc.
Washington, D.C.	WOL-FM	98.7
	WRC-FM	93.9
	WTOP-FM	96.3
	WWDC-FM	101.1

FLORIDA

Location	C.L.	Mc.
Daytona Beach	WNDB-FM	94.5
Gainesville	WRUF-FM	*104.1
Jacksonville	WJAX-FM	95.1
	WJHP-FM	96.9
	WMBR-FM	96.1
Lakeland	WFSI	*88.1
Miami	WAHR-FM	93.9
	WCKR-FM	97.3
	WGBS-FM	96.3
	WLRD	93.9
	WTHS	*91.7
	WWPB-FM	101.5
Miami Beach	WKAT-FM	93.1
Orlando	WDBO-FM	92.3
	WHOO-FM	96.5
	WORZ	100.3
Palm Beach	WQXT-FM	97.9
Panama City	WDLP-FM	98.9
St. Petersburg	WTSP-FM	102.5
Tallahassee	WFSU-FM	*91.5
Tampa	WDAE-FM	100.7
	WFLA-FM	93.3
	WPKM	104.7
	WTUN	*88.9
Winter Park	WPRK	*91.5

GEORGIA

Location	C.L.	Mc.
Athens	WGAU-FM	99.5
Atlanta	WABE	*90.1
	WAGA-FM	103.3
	WAKE-FM	95.5
	WGKA-FM	92.9
	WSB-FM	98.5
Augusta	WAUG-FM	105.7
	WBBQ-FM	103.7
Columbus	WRBL-FM	93.3
Gainesville	WDUN-FM	103.9
Lagrange	WLAG-FM	104.1
Macon	WMAZ-FM	99.1
Newnan	WCOH-FM	96.7
Rome	WRGA-FM	106.5
Savannah	WSAV-FM	100.3
	WTOC-FM	97.3
Swainsboro	WJAT-FM	101.7
Toccoa	WLET-FM	106.1

IDAHO

Location	C.L.	Mc.
Pocatello	KSEI-FM	96.5

ILLINOIS

Location	C.L.	Mc.
Bloomington	WJBC-FM	101.5
Canton	WBYS-FM	100.9
Carbondale	WSRV	91.9
Carmi	WROY-FM	97.3
Champaign	WDWS-FM	97.5
Chicago	WBBM-FM	96.3
	WBEZ	*91.5
	WCLM	101.9
	WEFM	99.5
	WENR-FM	94.7
	WFJL	*93.1
	WFMF	100.3
	WFMT	98.7
	WMAQ-FM	101.1
	WMFT	98.7
	WNIB	97.1
	WSEL	104.3
Decatur	WSOY-FM	102.1
DeKalb	WNIC	*91.1
Effingham	WSEI	95.7
Elgin	WEPS	*88.1
Elmwood Park	WXFM	105.9
Evanston	WEAW	105.1
	WNUR	*89.3
Harrisburg	WEBQ-FM	99.9
Jacksonville	WLDS-FM	100.5
Macomb	WWKS	*91.3
Mattoon	WLBH-FM	96.9
Mt. Vernon	WMIX-FM	94.1
Oak Park	WOPA-FM	102.3
Olney	WVLN-FM	92.9
Paris	WPRS-FM	98.3
Peoria	WMBD-FM	92.5
Quincy	WGEM-FM	105.1
	WTAD-FM	99.5
Rockford	WROK-FM	97.5
Rock Island	WHBF-FM	98.9
Springfield	WTAX-FM	103.7
Urbana	WILL-FM	*90.9

INDIANA

Location	C.L.	Mc.
Bloomington	WFIU	*103.7
Connersville	WCNB-FM	100.3
Crawfordsville	WBBS	106.5
Elkhart	WCMR-FM	95.1
	WTRC-FM	100.7
Evansville	WIKY-FM	104.1
	WEVC	*91.5
	WPSR	90.7
Gary	WGVE	*88.1
Greencastle	WGRE	*91.7
Hammond	WJOB-FM	92.3
Hartford City	WHCI	*91.9
Huntington	WVSH	*91.9
Indianapolis	WAJC	*104.5
	WFMS	102.3
	WIAN	*90.1
Jasper	WITZ-FM	104.7
Madison	WORX-FM	96.7
Marion	WMRI-FM	106.9
Muncie	WMUN	104.1
Muncie	WWHI	*91.5
	WYSN	91.1
New Albany	WNAS	*88.1
New Castle	WCTW	102.5
	WYSN	*91.1
South Bend	WHFS	101.3
Terre Haute	WBOW-FM	101.1
	WTHI-FM	99.9
Wabash	WSKS	*91.3
Warsaw	WRSW	107.3
Washington	WFML	106.5

IOWA

Location	C.L.	Mc.
Ames	WOI-FM	*90.1
Boone	KFGQ	*99.3
Clinton	KROS-FM	96.1
Davenport	WOC-FM	103.7
Des Moines	KDPS	*88.1
	KSO-FM	97.3
	WHO-FM	100.3
Dubuque	WDBQ	103.3
Iowa City	KSUI	*91.7
Mason City	KGLO-FM	101.1
Muscatine	KWPC-FM	99.7
Storm Lake	KAYL-FM	101.5
Waverly	KWAR	89.1

KANSAS

Location	C.L.	Mc.
Emporia	KSTE	*88.7
Lawrence	KANU	*91.5
Manhattan	KSDB-FM	*88.1
Ottawa	KTJO-FM	*88.1
Wichita	KFH-FM	100.3
	KMUW	*89.1

KENTUCKY

Location	C.L.	Mc.
Ashland	WCMI-FM	93.7
Bowling Green	WBON	101.1
	WLBJ-FM	101.1
Central City	WNES-FM	101.9
Fulton	WFUL-FM	104.9
Henderson	WSON-FM	99.5
Hopkinsville	WHOP-FM	98.7
Lexington	WBKY	*91.3
	WLAP-FM	94.5
Louisville	WFPK	*91.9
	WFPL	*89.3
Madisonville	WFMW-FM	93.9
Mayfield	WKTM-FM	107.1
Owensboro	WOMI-FM	92.5
	WVJS-FM	96.1
Paducah	WPAD-FM	96.9

LOUISIANA

Location	C.L.	Mc.
Alexandria	KALB-FM	96.9
Baton Rouge	WAIL-FM	104.3
	WBRL	98.1
	WLSU	*91.7
Monroe	KMBL-FM	104.1
New Orleans	WBEH	89.3
	WDSU-FM	105.3
	WRCM	97.1
	WWMT	95.7
Shreveport	KRMD-FM	101.1
	KTBS-FM	96.5
	KWKH-FM	94.5

MAINE

Location	C.L.	Mc.
Brunswick	WBOR	*91.1
Caribou	WFST-FM	97.7
Lewiston	WCOU-FM	93.9

MARYLAND

Location	C.L.	Mc.
Annapolis	WNAV-FM	99.1
Baltimore	WBJC	*88.1
	WCAO-FM	102.7
	WITH-FM	104.3
Bethesda	WUST-FM	106.3
Bradbury Heights	WRNC	95.5
Cumberland	WCUM-FM	102.0
Hagerstown	WJEJ-FM	104.7
Oakland	WBUZ	95.5

MASSACHUSETTS

Location	C.L.	Mc.
Amherst	WAMF	*88.1
	WMUA	*91.1
Boston	WBUR	*90.9
	WCOP-FM	100.7
	WEEI-FM	103.3
	WERS	*88.9
	WHDH-FM	94.5
	WRKO-FM	98.5
Brockton	WBET-FM	97.7
Cambridge	WGBH-FM	*89.7
	WHRB-FM	107.1
	WXHR	96.9
Greenfield	WHAI-FM	98.3
Lowell	WLLH-FM	99.5
Lynn	WLYN-FM	105.5
New Bedford	WBSM-FM	97.3
	WNBH-FM	98.1
Pittsfield	WBEC-FM	94.3
S. Hadley	WMHC	88.5
Springfield	WBZA-FM	97.1
	WEDK	*91.7
	WHYN-FM	93.1
	WMAS-FM	94.7
Waltham	WCRE-FM	102.5
W. Yarmouth	WOCB-FM	94.3
Williamstown	WCFM	*90.1
Winchester	WHSR-FM	*91.9
Worcester	WTAG-FM	96.1

MICHIGAN

Location	C.L.	Mc.
Ann Arbor	WUOM	*91.7
Benton Hrbr.	WHFB-FM	99.9
Coldwater	WTVB-FM	98.3
Dearborn	WKMH-FM	100.3
Detroit	WDET-FM	*101.9
	WDTR	*90.9
	WJBK-FM	93.1
	WJLB-FM	97.9
	WJR-FM	96.3
	WWJ-FM	97.1
	WXYZ-FM	101.1
E. Lansing	WKAR-FM	*90.5
Flint	WFBE	*95.1
	WFUM	*107.1
Grand Rapids	WFRS	92.5
	WJEF-FM	93.7
	WLAV-FM	96.9
Highland Pk.	WHPR	*88.1
Hillsdale	WBSE-FM	103.9
Kalamazoo	WMCR	*102.1
Oak Park	WLDM	95.5
Royal Oak	WOAK	*98.3
	WOMC	104.3
Saginaw	WSAM-FM	98.1
Sturgis	WSTR-FM	103.1

MINNESOTA

Location	C.L.	Mc.
Duluth	WEBC-FM	92.3
Mankato	KYSM-FM	103.5
Minneapolis	KTIS-FM	*98.5
	KWFM	97.1
	WLOL-FM	99.5
	WMNS-FM	99.5
	WTCN-FM	97.1
St. Cloud	KFAM-FM	104.7
St. Paul	WMIN-FM	99.5
	WNOV	89.1
Winona	KWNO-FM	97.5

MISSISSIPPI

Location	C.L.	Mc.
Gulfport	WGCM-FM	101.5
Jackson	WJDX-FM	102.9
Meridian	WMMI	*88.1

MISSOURI

Location	C.L.	Mc.
Clayton	KFUO-FM	99.1
Jefferson City	KWOS-FM	98.5
Joplin	WMBH-FM	96.1
Kansas City	KCMO-FM	94.9
Kennett	KBOA-FM	98.9
Poplar Bluff	KWOC-FM	94.5
Springfield	KTTS-FM	94.7
St. Louis	KCFM	93.7
	KSLH	*91.5
West Plains	KWPM-FM	97.3

NEVADA

Location	C.L.	Mc.
Reno	KNEV	95.5

NEW HAMPSHIRE

Location	C.L.	Mc.
Berlin	WMOU-FM	103.7
Claremont	WTSV-FM	106.1
Manchester	WKBR-FM	95.7
Nashua	WOTW-FM	106.3

NEW JERSEY

Location	C.L.	Mc.
Asbury Park	WJLK-FM	94.3
Bridgeton	WSNJ-FM	98.9
Newark	WAAT-FM	94.7
	WBGO	*88.3
New Brunswk.	WCTC-FM	98.3
South Orange	WSOU	*89.5
Trenton	WTOA	97.5
Zarephath	WAWZ-FM	99.1

NEW MEXICO

Location	C.L.	Mc.
Albuquerque	KANW	*89.1
	KHFM	96.3
Los Alamos	KRSN-FM	98.5
Mountain Park	KMFM	97.9

NEW YORK

Location	C.L.	Mc.
Auburn	WMBO-FM	96.1
Allegany	WHDL-FM	95.7
Bay Shore	WMBO-FM	96.1
	WRBS	105.9
Binghamton	WNBF-FM	98.1
	WKOP-FM	95.3
Brooklyn	WNYE	*91.5
Buffalo	WBEN-FM	106.5
	WBNY-FM	92.9
	WWOL-FM	104.1
	WXRC	103.3
Cherry Valley	WRRC	101.9
Corning	WCLI-FM	106.1
Cortland	WKRT-FM	99.9
DeRuyter	WRRD	105.1
Floral Park	WSHS	*90.3
Hempstead	WHLI-FM	98.3
Hornell	WWHG-FM	105.3
Ithaca	WHCU-FM	97.3
	WITJ	*91.7
Jamestown	WJTN-FM	93.3
Massena	WMSA-FM	105.3
New Rochelle	WNRC-FM	93.5
New York	WABC-FM	95.5
	WBAI	99.5
	WBFM	101.9
	WCBS-FM	101.1
	WEVD-FM	97.9
	WFUV	*90.7
	WGHF	101.9
	WHOM-FM	92.3
	WKCR-FM	*89.9
	WMGM-FM	100.3
	WNYC-FM	93.9
	WOR-FM	98.7
	WQXR-FM	96.3
	WRCA-FM	97.1
	WWRL-FM	105.1
Niagara Falls	WHLD-FM	98.5
Ogdensburg	WSLB-FM	106.1
Patchogue	WALK-FM	97.5
Poughkeepsie	WKIP-FM	104.7
Rochester	WHFM	98.9
Schenectady	WGFM	99.5
South Bristol	WRRE	95.1
Springville	WSPE	*88.1
Syracuse	WAER	*88.1
	WDDS-FM	93.1
	WSYR-FM	94.5
Troy	WFLY	92.3
Utica	WRUN-FM	105.7
Watertown	WWNY-FM	100.5
Wethersfield	WRRL	107.7
White Plains	WFAS-FM	103.9
Woodside	WWRL-FM	105.1

NORTH CAROLINA

Location	C.L.	Mc.
Asheboro	WGWR-FM	92.3
Asheville	WLOS-FM	104.3
Burlington	WBBB-FM	101.1
	WFNS-FM	93.9
Chapel Hill	WUNC	*91.5
Charlotte	WSOC-FM	103.5
Clingman's Pk.	WMIT	106.9
Durham	WDNC-FM	105.1
Elkin	WIFM-FM	100.9
Fayetteville	WFNC-FM	98.1
Forest City	WBBO-FM	93.3
Gastonia	WGNC-FM	101.9
Goldsboro	WEQR	96.9
Greensboro	WGPS	*89.9
Greenville	WWWS	*91.3
Henderson	WHNC-FM	92.5
High Point	WHPE-FM	95.5
	WHPS	*89.3
	WMFR-FM	99.5
	WNOS-FM	100.3
Leaksville	WLOE-FM	94.5
Laurinburg	WEWO-FM	96.5
Lexington	WBUY-FM	94.3
Raleigh	WKIX-FM	96.1
	WPTF-FM	94.7
	WRAL-FM	101.5
Reidsville	WREV-FM	102.1
Roanoke Rapids	WKFM	98.5
Rocky Mount	WEED-FM	92.1
	WFMA	100.7
Salisbury	WSTP-FM	106.5
Sanford	WSNS	103.1
	WWGP-FM	105.5
Shelby	WOHS-FM	96.1
Statesville	WSIC-FM	105.7
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Winston-Salem	WAIR-FM	93.1
	WSIS-FM	104.1

OHIO

Location	C.L.	Mc.
Akron	WAKR-FM	97.5
	WAPS	*89.1
Alliance	WFAH-FM	101.7
Ashland	WATG-FM	101.3
Ashtabula	WICA-FM	103.7
Athens	WOUI	*91.5
Bellaire	WTRX-FM	100.5
Bowling Green	WBGU	*88.1
Canton	WHBC-FM	94.1
Cincinnati	WCPO-FM	105.1
	WKRC-FM	101.9
	WSAI-FM	102.7
Cleveland	KYW-FM	105.7
	WBOE	*90.3
	WDOK-FM	102.1
	WERE-FM	98.5
	WGAR-FM	99.5
	WHK-FM	100.7
	WJW-FM	104.1
Cleveland Hts.	WSRS-FM	95.3
Columbus	WCBE	*90.5
	WCOL-FM	92.3
	WOSU-FM	*89.7
	WVKO	94.7
Dayton	WHIO-FM	99.1
Delaware	WSLN	*91.1
Elyria	WEOL-FM	107.3
Findlay	WFIN-FM	100.5
Fostoria	WFOB	96.7
Fremont	WFRO-FM	99.3
Kent	WKSU-FM	*88.1
Lima	WIMA-FM	102.1
Marion	WMRN-FM	106.9
Mt. Vernon	WMVO-FM	93.7
Newark	WCLT-FM	100.3
Oxford	WMUB	*88.5
Portsmouth	WPAY-FM	104.1
Steubenville	WSTV-FM	103.5
Toledo	WSPD-FM	101.5
	WTDS	*91.3
	WTOL-FM	104.7
	WTRT	99.9
Wooster	WWST-FM	104.5
Youngstown	WKBN-FM	98.9

OKLAHOMA

Location	C.L.	Mc.
Norman	WNAD-FM	*90.9
Oklahoma City	KOKH	*88.9
Shawnee	KBGC	*89.9
Stillwater	KAMC-FM	*90.5
	KSPI-FM	93.9
Tulsa	KWGS	*90.5

OREGON

Location	C.L.	Mc.
Eugene	KRVM	*90.1
	KUGN-FM	99.1
	KWAX	*91.1
Grants Pass	KGPO	98.9

Location	C.L.	Mc.
Oretech, Oregon	KTEC	*88.1
Portland	KEX-FM	92.3
	KOIN-FM	101.1
	KPFM	97.1
	KPOJ-FM	98.7
	KQFM	100.3
PENNSYLVANIA		
Allentown	WFMZ	100.7
Altoona	WVAM-FM	100.1
Bethlehem	WGPA-FM	95.1
Butler	WBUT-FM	97.7
Bloomsburg	WHLM-FM	106.5
Chambersburg	WCHA-FM	95.9
Dubois	WCED-FM	102.1
Easton	WEST-FM	107.9
	WEEK-FM	98.3
Erie	WERC-FM	99.9
Harrisburg	WHP-FM	97.3
Havertown	WHHS	*89.3
Hazleton	WAZL-FM	97.9
Johnstown	WARD-FM	92.1
	WJAC-FM	95.5
Lancaster	WGAL-FM	101.3
	WLAN-FM	96.9
Lebanon	WLBR-FM	100.1
Meadville	WMGW-FM	100.3
Philadelphia	WCAU-FM	98.1
	WFIL-FM	102.1
	WFLN	95.7
	WHAT-FM	105.3
	WHYY	*90.9
	WIBG-FM	94.1
	WIP-FM	93.3
	WPEN-FM	102.9
	WPWT	*91.7
	WRTI-FM	*90.1
Pittsburgh	KDKA-FM	92.9
	WDUQ	*91.5
	WJAS-FM	99.7
	WKJF	93.7
	WWSW-FM	94.5
Pottsville	WPPA-FM	101.9
Scranton	WEJL	107.3
	WGBI-FM	101.3
	WUSV	*89.9
Sharon	WPIC-FM	102.9
State College	WDFM	*91.1
Sunbury	WKOK-FM	94.1
Warren	WRRN	92.3
Washington	WJPA-FM	104.3
Wilkes-Barre	WBRE-FM	98.5
Williamsport	WLYC-FM	105.1

Location	C.L.	Mc.
	WRAK-FM	100.3
York	WNOW-FM	105.7
	WRZE	98.5
RHODE ISLAND		
Providence	WPJB-FM	105.1
	WPRO-FM	92.3
	WTMH	101.5
Woonsocket	WWON-FM	106.3
SOUTH CAROLINA		
Anderson	WCAC	101.1
Charleston	WCSC-FM	96.9
	WTMA-FM	95.1
Columbia	WCOS-FM	97.9
	WIS-FM	94.5
	WUSC-FM	*89.9
Dillon	WDSC-FM	92.9
Greenville	WESC-FM	92.5
	WFBC-FM	93.7
Greenwood	WCRS-FM	95.7
Orangeburg	WORG-FM	102.7
Rock Hill	WRHI-FM	97.5
Seneca	WSNW-FM	98.1
Spartanburg	WDXY	100.5
	WSPA-FM	98.9
TENNESSEE		
Bristol	WTUM	96.9
Chattanooga	WDOD-FM	96.5
Crossville	WAEW-FM	97.1
Greeneville	WGRV-FM	94.9
Harriman	WHBT-FM	95.3
Jackson	WTJS-FM	104.1
Johnson City	WJHL-FM	100.7
Kingsport	WKPT-FM	98.5
Knoxville	WBIR-FM	93.3
	WKCS	*91.1
	WUOT	*91.9
Memphis	WMCF	99.7
Nashville	WSOK-FM	105.9
TEXAS		
Abilene	KAOC-FM	*91.1
Austin	KHFI	98.3
Baytown	KREL-FM	92.1
Beaumont	KRIC-FM	97.5
Cedar Hills	KDFW	107.9
Cleburne	KCLE-FM	94.3
Corpus Christi	KDMC	95.5
Dallas	KIXL-FM	104.5
	KNER	*88.1

Location	C.L.	Mc.
	KRLD-FM	92.5
	WRR-FM	101.1
	KSFM	105.3
	KSMU-FM	*89.3
	KVTT	*91.7
Denton	KDNT-FM	106.3
El Paso	KVOF-FM	*88.5
Ft. Worth	WBAP-FM	100.5
Houston	KPRC-FM	102.9
	KTRH-FM	101.1
	KUHF	*91.3
Nacogdoches	KELS	100.1
Plainview	KHBL	*88.1
San Antonio	KISS	99.5
	KAML-FM	97.3
	KOKE-FM	101.5
	KONO-FM	92.9
Texarkana	KCMC-FM	98.1
Wichita Falls	KWFT-FM	99.9
UTAH		
Ephraim	KEPH	*88.9
Logan	KVSC	*88.1
Salt Lake City	KDYL-FM	98.7
	KSL-FM	100.3
	KUTF	97.1
VIRGINIA		
Arlington	WARL-FM	105.1
Charlottesville	WINA-FM	95.3
Crewe	WSVS-FM	104.7
Harrisonburg	WEMC	*91.7
	WSVA-FM	100.7
	WWOD-FM	100.1
Martinsville	WMVA-FM	96.3
Newport News	WGH-FM	97.3
Norfolk	WMTI	*89.7
	WRVC	102.5
Richmond	WCOD	98.1
	WRFK	89.1
	WRVA-FM	94.5
	WRNL-FM	102.1
	WRVB	94.5
Roanoke	WDBJ-FM	94.9
	WROV-FM	103.7
	WSLS-FM	99.1
South Norfolk	WFOS	*90.5
Winchester	WRFL	92.5
WASHINGTON		
Cheney	KEWC-FM	*89.9
Pierce County	KCPS	*90.9
Richland	KALE-FM	103.9

Location	C.L.	Mc.
Seattle	KING-FM	98.1
	KIRO-FM	100.7
	KISW	99.9
	KUOW	*90.5
Spokane	KREM-FM	92.9
Tacoma	KCPS	90.9
	KTNT	97.3
	KTOY	*91.7
WEST VIRGINIA		
Beckley	WJLS-FM	99.5
Charleston	WKNA-FM	97.5
Fairmont	WJPB	92.3
Huntington	WHTN-FM	100.5
Logan	WLOG-FM	103.3
Martinsburg	WEPM-FM	94.3
Morgantown	WAJR-FM	99.3
Oak Hill	WOAY-FM	94.1
Parkersburg	WPAR-FM	106.5
Wheeling	WKWK-FM	97.3
	WWVA-FM	98.7
WISCONSIN		
Appleton	WLFM	*91.1
Chilton	WHKW	*89.3
Colfax	WHWC	*88.3
Delafield	WHAD	*90.7
Eau Claire	WEAU-FM	94.1
Greenfield Twp.	WWCF	94.9
Highland	WHHI	91.3
Highland Twp.	WHSA	*89.9
Holman	WHLA	*90.3
Iowa County	WHHI	*91.3
Janesville	WCLO-FM	99.9
Madison	WHA-FM	*88.7
	WHLA	90.3
	WHRM	91.9
	WHSA	89.9
	WISC-FM	98.1
	WMFM	104.1
Marshfield	WDLB-FM	103.9
Milwaukee	WFMR	96.5
Racine	WRJN-FM	100.7
Rice Lake	WJMC-FM	96.3
Sheboygan	WHBL-FM	100.3
Waukesha	WAUX-FM	95.3
Wausau	WHRM	*91.9
Wisc. Rapids	WFHR-FM	103.3
HAWAII		
Honolulu	KAIM-FM	95.5
	KUOH	*90.5
	KVOK	*88.1

Canadian

Frequency-Modulation (FM) Stations

C.L., call letters, Mc., megacycles (For frequency in Kilocycles, change decimal point to comma and add two zeros)

Location	C.L.	Mc.
Brantford, Ont.	CKPC-FM	92.1
Cornwall, Ont.	CKSF-FM	104.5
Edmonton, Alta.	CFRN-FM	100.3
	CJCA-FM	99.5
	CKUA-FM	98.1
Ft. William, Ont.	CKPR-FM	94.3
Halifax, N.S.	CHNS-FM	96.1
Kingston, Ont.	CFRC-FM	91.9
	CKLC-FM	99.5
	CKWS-FM	96.3
Kitchener, Ont.	CKCR-FM	96.7
London, Ont.	CFPL-FM	95.9
Montreal, Que.	CBF-FM	95.1
	CBM-FM	100.7
	CFCF-FM	106.5
Oshawa, Ont.	CKLB-FM	93.5
Ottawa, Ont.	CBO-FM	103.3
	CFRA-FM	93.9
Quebec, Que.	CHRC-FM	98.1
Rimouski, Que.	CJBR-FM	101.5
St. Catharines, Ont.	CKTB-FM	97.7
Sydney, N.S.	CJCB-FM	94.9
Timmins, Ont.	CKGB-FM	94.5
Toronto, Ont.	CBC-FM	99.1
	CFRB-FM	99.9
	CHFI-FM	98.1
	CJRT-FM	91.1
Vancouver, B.C.	CBU-FM	105.7
Verdun, Que.	CKVL-FM	96.9
Victoria, B.C.	CKOA-FM	98.5
Windsor, Ont.	CKLW-FM	93.9
Winnipeg, Man.	CJOB-FM	103.1

United States Television Stations

Listed Alphabetically by Location

(Territories and possessions follow states). C.L., call letters; Chan., channel number; asterisk (*) indicates educational station.

Location	C.L.	Chan.
ALABAMA		
Andalusia	WAIQ	*2
Birmingham	WABT	13
	WBIQ	*10
	WBRC-TV	6
Decatur	WMSL-TV	23
Dothan	WTVY	9
Florence	WOWL	15
Mobile	WALA-TV	10
	WKRG-TV	5
Montgomery	WCOV-TV	20
	WSFA-TV	12
Mumford	WTIQ	*7
ARIZONA		
Phoenix	KOOL-TV	10
	KPHO-TV	5
	KTVK	3
	KVAR	12
Tucson	KGUN-TV	9
	KOLD-TV	13
	KVOA-TV	4
Yuma	KIVA	11

Location	C.L.	Chan.
ARKANSAS		
El Dorado	KRBB	10
Ft. Smith	KFSA-TV	22
	KNAC-TV	5
Little Rock	KARK-TV	4
	KTHV	11
Pine Bluff	KATV	7
Texarkana	KCMC-TV	6
CALIFORNIA		
Bakersfield	KBAK-TV	29
	KERO-TV	10
Chico	KHSL-TV	12
Eureka	KIEM-TV	3
Fresno	KFRE-TV	12
	KJEO	47
	KMJ-TV	24
Los Angeles	KABC-TV	7
	KCOP	13
	KHJ-TV	9
	KNXT	2
	KRCA	4
	KTLA	5
	KTTV	11
Redding	KVIP-TV	7
Sacramento	KBET-TV	10
	KCCC-TV	40

Location	C.L.	Chan.
	KCRA-TV	3
Salinas	KSBW-TV	8
San Diego	KFMB-TV	8
	KFSD-TV	10
(Tijuana, Mex.)	XETV	6
San Francisco	KGO-TV	7
	KPIX	5
	KQED	*9
	KRON-TV	4
	KSAN-TV	32
San Jose	KNTV	11
San Luis Obispo	KSBY-TV	6
Santa Barbara	KEY-T	3
Stockton	KOVR	13
Tulare	KVVG	27
COLORADO		
Colorado Springs	KKTV	11
	KRDO-TV	13
Denver	KBTV	9
	KLZ-TV	7
	KOA-TV	4
	KRMA-TV	*6
	KTVR	2
Grand Junction	KREX-TV	5
Montrose	KFXJ-TV	10
Pueblo	KCSJ-TV	5

Location	C.L.	Chan.
CONNECTICUT		
Bridgeport	WICC-TV	43
Hartford	WHCT	18
New Britain	WNBC	30
New Haven	WNHC-TV	8
Waterbury	WATR-TV	53
DELAWARE		
Wilmington	WVUE	12
DIST. OF COLUMBIA		
Washington	WMAL-TV	7
	WRC-TV	4
	WTOP-TV	9
	WTTG	5
FLORIDA		
Daytona Beach	WESH-TV	2
Fort Lauderdale	WITV	17
Fort Myers	WINK-TV	11
Jacksonville	WJCT	*7
	WMBR-TV	4
Miami	WCKT	7
	WTHS-TV	*3
	WTVJ	4
Orlando	WDBO-TV	6
Palm Beach	WPTV	5

Location	C.L.	Chan.
Panama City	WJDM-TV	7
Pensacola	WEAR-TV	3
St. Petersburg	WSUN-TV	38
Tampa	WFLA-TV	8
	WTVT	13
W. Palm Beach	WEAT-TV	12

GEORGIA

Location	C.L.	Chan.
Albany	WALB-TV	10
Athens	WGTV	*8
Atlanta	WAGA-TV	5
	WSB-TV	2
	WETV	*30
	WLW-A	11
Augusta	WJBF	6
	WRDW-TV	12
Columbus	WRBL-TV	4
	WTVM	28
Macon	WMAZ-TV	13
Rome	WROM-TV	9
Savannah	WSAV-TV	3
	WTOC-TV	11
Thomasville	WCTV	6

IDAHO

Location	C.L.	Chan.
Boise	KBOI	2
	KIDO-TV	7
Idaho Falls	KID-TV	3
Lewiston	KLEW-TV	3
Twin Falls	KLIX-TV	11

ILLINOIS

Location	C.L.	Chan.
Champaign	WCIA	3
Chicago	WBBM-TV	2
	WBKB	7
	WGN-TV	9
	WNBQ	5
	WTTW	*11
Danville	WDAN-TV	24
Decatur	WTVP	17
Harrisburg	WSIL-TV	22
Peoria	WEEK-TV	43
	WTVH	19
Quincy	WGEM-TV	10
Rockford	WREX-TV	13
	WTVO	39
Rock Island	WHBF-TV	4
Springfield	WICS	20
Urbana	WILL-TV	*12

INDIANA

Location	C.L.	Chan.
Bloomington	WTTV	4
Elkhart	WSJV-TV	52
Evansville	WFIE-TV	62
	WTVW	7
Ft. Wayne	WANE-TV	15
	WKJG-TV	33
Indianapolis	WFBM-TV	6
	WLWI	13
	WISH-TV	8
Lafayette	WFAM-TV	59
Muncie	WLBC-TV	49
South Bend	WNDU-TV	46
	WSBT-TV	34
Terre Haute	WTHI-TV	10

IOWA

Location	C.L.	Chan.
Ames	WOI-TV	5
Cedar Rapids	KCRG-TV	9
	WMT-TV	2
Davenport	WOC-TV	6
Des Moines	KRNT-TV	8
	WHO-TV	13
Fort Dodge	KQTV	21
Mason City	KGLO-TV	3
Ottumwa	KTVO	3
Sioux City	KTIV	4
	KVTV	9
Waterloo	KWWL-TV	7

KANSAS

Location	C.L.	Chan.
Great Bend	KCKT	2
Hutchinson	KTVH	12
Manhattan	KSAC-TV	8
Pittsburg	KOAM-TV	7
Topeka	WIBW-TV	13
Wichita	KAKE-TV	10
	KARD-TV	3

KENTUCKY

Location	C.L.	Chan.
Ashland	WALN-TV	59
Henderson	WEHT	50
Lexington	WLEX-TV	18
Louisville	WAVE-TV	3
	WHAS-TV	11
Paducah	WPSD-TV	6

LOUISIANA

Location	C.L.	Chan.
Alexandria	KALB-TV	5
Baton Rouge	WAFB-TV	28
	WBRZ	2
Lafayette	KLFY-TV	10
Lake Charles	KPLC-TV	7
	KTAG-TV	25
Monroe	KNOE-TV	8
	KLSE	*13
New Orleans	WDSU-TV	6
	WJMR-TV	20
	WWEZ-TV	32
	WYES	*8
Shreveport	KSLA-TV	12
	KTBS-TV	3

MAINE

Location	C.L.	Chan.
Bangor	WABI-TV	5
	W-TWO	2
Poland Spring	WMTW	8
Portland	WCSH-TV	6
	WGAN-TV	13
Presque Isle	WAGM-TV	8

MARYLAND

Location	C.L.	Chan.
Baltimore	WAAM	13
	WBAL-TV	11
	WMAR-TV	2
Salisbury	WBOC-TV	16

MASSACHUSETTS

Location	C.L.	Chan.
Adams	WCDC	19
Boston	WBZ-TV	4
	WGBH-TV	*2
	WNAC-TV	7
Greenfield	WRLP	32
Springfield	WHYN-TV	55
	WWLP	22

MICHIGAN

Location	C.L.	Chan.
Ann Arbor	WPAG-TV	20
Bay City	WNEM-TV	5
Cadillac	WWTV	13
Detroit	WBID	50
	WJBK-TV	2
	WTVS	*56
	WWJ-TV	4
	WXYZ-TV	7
(Windsor, Ont.)	CKLW-TV	9
East Lansing	WKAR-TV	*60
Flint	WJRT	12
Grand Rapids	WOOD-TV	8
	WMCN	23
Kalamazoo	WKZO-TV	3
Lansing	WJIM-TV	6
	WTOM-TV	54
Marquette	WDMJ-TV	6
Saginaw	WKNX-TV	57
Traverse City	WPBN-TV	7

MINNESOTA

Location	C.L.	Chan.
Austin	KMMT	6
Duluth	KDAL-TV	3
	WDSM-TV	6
Minneapolis	KMGM-TV	9
	WCCO-TV	4
	WTCN-TV	11
Rochester	KROC-TV	10
St. Paul	KSTP-TV	5
	KTCA-TV	*8

MISSISSIPPI

Location	C.L.	Chan.
Columbus	WCBI-TV	4
Hattiesburg	WDAM-TV	9
Jackson	WJTV	12
	WLBT	3
Meridian	WTOK-TV	11
Tupelo	WTWV	9

MISSOURI

Location	C.L.	Chan.
Cape Girardeau	KFVS-TV	12
Columbia	KOMU-TV	8
Hannibal	KHQA-TV	7
Jefferson City	KRCG-TV	13
Joplin	KODE-TV	12
Kansas City	KCMO-TV	5
	KMBC-TV	9
	WDAF-TV	4
Kirksville	KTVO	3
St. Joseph	KFEQ-TV	2
St. Louis	KETC	*9
	KSD-TV	5
	KTVI	2
	KWK-TV	4
Sedalia	KDRO-TV	6
Springfield	KTTS-TV	10
	KYTV	3

MONTANA

Location	C.L.	Chan.
Billings	KOOK-TV	2
Butte	KXLF-TV	6
Glendive	KXGN-TV	5
Great Falls	KFBB-TV	5
Missoula	KGVO-TV	13

NEBRASKA

Location	C.L.	Chan.
Hastings	KHAS-TV	5
Hayes Center	KHPL-TV	6
Kearney	KHOL-TV	13
Lincoln	KOLN-TV	10
	KUON-TV	*12
Omaha	KMTV	3
	WOW-TV	6
Scottsbluff	KSTF	10

NEVADA

Location	C.L.	Chan.
Henderson	KLRJ-TV	2
Las Vegas	KLAS-TV	8
	KSHO-TV	13
Reno	KOLO-TV	8

NEW HAMPSHIRE

Location	C.L.	Chan.
Manchester	WMUR-TV	9

NEW MEXICO

Location	C.L.	Chan.
Albuquerque	KGGM-TV	13
	KOAT-TV	7
	KOB-TV	4
Carlsbad	KAVE-TV	6
Clovis	KICA-TV	12
Roswell	KSWS-TV	8

NEW YORK

Location	C.L.	Chan.
Albany	WCDA-TV	41
	WTRI	35
Binghamton	WINR-TV	40
	WNBF-TV	12
Buffalo	WBEN-TV	4
	WBUF	17
	WGR-TV	2
Carthage	WCNY-TV	7
Elmira	WSYE-TV	18
Hagaman	WCDB	29
New York	WABC-TV	7
	WABD	5
	WATV	13
	WCBS-TV	2
	WOR-TV	9
	WPIX	11
	WRCA-TV	4
Plattsburg	WPTZ-TV	5
Poughkeepsie	WKNY-TV	21
Rochester	WHEC-TV	10
	WROC-TV	5
	WVET-TV	10
Schenectady	WRGB	6
Syracuse	WHEN-TV	8
	WSYR-TV	3
Utica	WKTV	13

NORTH CAROLINA

Location	C.L.	Chan.
Asheville	WISE-TV	62
	WLOS-TV	13
Chapel Hill	WUNC-TV	*4
Charlotte	WBTV	3
	WSOC-TV	9
Durham	WTVD	11
Fayetteville	WFLB-TV	18
Greensboro	WFMY-TV	2
Greenville	WNCT	9
Raleigh	WNAO-TV	28
	WRAL-TV	5
Washington	WITN	7
Wilmington	WMFD-TV	6
Winston-Salem	WSJS-TV	12

NORTH DAKOTA

Location	C.L.	Chan.
Bismarck	KBMB-TV	12
	KFYR-TV	5
Dickinson	KDIX-TV	2
Fargo	WDAY-TV	6
Grand Forks	KNOX-TV	10
Minot	KCJB-TV	13
Valley City	KXJB-TV	4
Williston	KUMV-TV	8

OHIO

Location	C.L.	Chan.
Akron	WAKR-TV	49
Cincinnati	WCET	*48
	WCPO-TV	9
	WKRC-TV	12
	WLW-T	5
Cleveland	KYW-TV	3
	WEWS	5
	WJW-TV	8
Columbus	WBNS-TV	10
	WLW-C	4
	WOSU-TV	*34
	WTVN-TV	6
Dayton	WHIO-TV	7
	WLW-D	2
Lima	WIMA-TV	35
Steubenville	WSTV-TV	9
Toledo	WSPD-TV	13
Youngstown	WFMJ-TV	21
	WKBN-TV	18
	WKST-TV	45
Zanesville	WHIZ-TV	18

OKLAHOMA

Location	C.L.	Chan.
Ada	KTEN	10
Ardmore	KVSO-TV	12
Enid	KGEO-TV	5
Lawton	KSWO-TV	7
Muskogee	KTVX	8
Oklahoma City	KETA	*13
	KWTV	9
	WKY-TV	4
Tulsa	KOTV	6
	KVOO-TV	2

OREGON

Location	C.L.	Chan.
Coos Bay	KOOS-TV	16
Corvallis	KOAC-TV	*7
Eugene	KVAL-TV	13
Klamath	KOTI	2
Medford	KBES-TV	5
Portland	KGW-TV	8
	KOIN-TV	6
	KPTV	12
Roseburg	KPIC-TV	4

PENNSYLVANIA

Location	C.L.	Chan.
Altoona	WFBG-TV	10
Erie	WICU	12
	WSEE-TV	35
Harrisburg	WCMB-TV	27
	WHP-TV	55
	WTPA	71
Johnstown	WARD-TV	56
	WJAC-TV	6
Lancaster	WGAL-TV	8
Lebanon	WLBR-TV	15
Philadelphia	WCAU-TV	10
	WFIL-TV	6
	WHYY-TV	*35
	WRCV-TV	3
Pittsburgh	KDKA-TV	2
	WENS	16
	WQED	*13
Scranton	WARM-TV	16
	WDAU-TV	22
Wilkes-Barre	WBRE-TV	28
	WILK-TV	34
York	WNOW-TV	49
	WSBA-TV	43

RHODE ISLAND

Location	C.L.	Chan.
Providence	WJAR-TV	10
	WPRO-TV	12

SOUTH CAROLINA

Location	C.L.	Chan.
Anderson	WAIM-TV	40
Charleston	WCSC-TV	5
	WUSN-TV	2
Columbia	WIS-TV	10
	WNOK-TV	67
Florence	WBTW	8
Greenville	WFBC-TV	4
Spartanburg	WSPA-TV	7

SOUTH DAKOTA

Location	C.L.	Chan.
Florence	KDLO-TV	3
Rapid City	KOTA-TV	3
Sioux Falls	KELO-TV	11

TENNESSEE

Location	C.L.	Chan.
Chattanooga	WDEF-TV	12
	WRGP-TV	3
Jackson	WDXI-TV	7
Johnson City	WJHL-TV	11
Knoxville	WATE-TV	6
	WBIR-TV	6
Memphis	WHBQ-TV	13
	WKNO	10
	WMCT	5
	WREC-TV	3
Nashville	WLAC-TV	5
	WSIX-TV	8
	WSM-TV	4

TEXAS

Location	C.L.	Chan.
Abilene	KRBC-TV	9
Alpine	KAMT-TV	12
Amarillo	KFDA-TV	10
	KGNC-TV	4
Austin	KTBC-TV	7
Beaumont	KFDM-TV	6
Big Spring	KEDY-TV	4
Bryan	KBTX-TV	3
Corpus Christi	KRIS-TV	6
	KSIX-TV	10
Dallas	KRLD-TV	4
	WFAA-TV	8
El Paso	KELP-TV	13
	KROD-TV	4
	KTSM-TV	9
(Ciudad Juarez, Mex.)		
	XEJ-TV	5
Ft. Worth	KFJZ-TV	11
	WBAP-TV	5
Galveston	KGUL-TV	11
Harlingen	KGBT-TV	4
Houston	KPRC-TV	2
	KTRK-TV	13
	KUHT	*8
Laredo	KHAD-TV	8
Lubbock	KCBD-TV	11
	KDUB-TV	13
Lufkin	KTRE-TV	9
Midland	KMID-TV	2
Odessa	KOSA-TV	7
Port Arthur-Beaumont		
	KPAC-TV	4
San Angelo	KCTV	8
San Antonio	KCOR-TV	41
	KENS-TV	5
	KONO-TV	12
	WOAI-TV	4
Sweetwater	KPAR-TV	12
Temple	KCEN-TV	6
Texarkana	KCMC-TV	6
Tyler	KLTV	7
Waco	KWTX-TV	10
Weslaco	KRGV-TV	5
Wichita Falls	KFDX-TV	3
	KSYD-TV	6

UTAH

Location	C.L.	Chan.
Salt Lake City	KSL-TV	5
	KTVT	4
	KUED	*7
	KUTV	2

VERMONT

Location	C.L.	Chan.
Burlington	WCAX-TV	3

VIRGINIA

Location	C.L.	Chan.
Bristol	WCYB-TV	5
Harrisonburg	WSVA-TV	3
Newport News	WACH-TV	33
Lynchburg	WLVA-TV	13
Hampton	WVEC-TV	15
Norfolk	WTAR-TV	3
	WTOV-TV	27
Petersburg	WXEX-TV	8
Richmond	WRVA-TV	12
	WTVR	6
Roanoke	WDBJ-TV	7
	WSLS-TV	10

WASHINGTON

Location	C.L.	Chan.
Bellingham	KVOS-TV	12
Ephrata	KBAS-TV	43
Pasco	KEPR-TV	19
Seattle	KCTS	*9
	KING-TV	5
	KOMO-TV	4
Spokane	KHQ-TV	6
	KREM-TV	2
	KXLY-TV	4
Tacoma	KTNT-TV	11
	KTVW	13
Walla Walla	KRTV	8
Yakima	KIMA-TV	29

Location	C.L.	Chan.
WEST VIRGINIA		
Bluefield	WHIS-TV	6
Charleston	WCHS-TV	8
Fairmont	WJBP	35
Huntington	WHTN-TV	13
	WSAZ-TV	3
Oak Hill	WOAY-TV	4
Parkersburg	WTAP	15
Wheeling	WTRF-TV	7
WISCONSIN		
Eau Claire	WEAU-TV	13
Green Bay	WBAY-TV	2
	WFRV-TV	5
La Crosse	WKBT	8
Madison	WHA-TV	*21
	WISC-TV	3
	WKOW-TV	27
	WMTV	33
Marinette	WMBV-TV	11
Milwaukee	WISN-TV	12
	WMVS-TV	*10
	WTMJ-TV	4
	WXIX	19
Superior	WDSM-TV	6
Wausau	WSAU-TV	7
Whitefish Bay	WITI-TV	6
WYOMING		
Casper	KTWO-TV	2
Cheyenne	KFBC-TV	5

Location	C.L.	Chan.
U. S. TERRITORIES AND POSSESSIONS		
ALASKA		
Anchorage	KENI-TV	2
	KTVA	11
Fairbanks	KFAR-TV	2
	KTVF	11
Juneau	KINY-TV	8
GUAM		
Agana	KUAM-TV	8
PUERTO RICO		
Mayaquez	WORA-TV	5
San Juan	WAPA-TV	4
	WIPR-TV	*6
	WKAQ-TV	2
HAWAII		
Hilo	KHBC-TV	9
Honolulu	KGMB-TV	9
	KHVH-TV	13
	KONA	11
	KULA-TV	4
Wailuku	KMAU	3
	KMVI-TV	12

Canadian Television Stations

Listed Alphabetically by Location

Abbreviations: C.L., call letters; Chan., channel number.

Location	C.L.	Chan.
ALBERTA		
Calgary	CHCT-TV	2
Edmonton	CFRN-TV	3
Lethbridge	CJLH-TV	7
Medicine Hat	CHAT-TV	6
BRITISH COLUMBIA		
Kamloops	CFCR-TV	4
Vancouver	CBUT	9
Victoria	CHEK-TV	6
MANITOBA		
Brandon	CKX-TV	5
Winnipeg	CBWT	4
LABRADOR		
Goose Bay	CFLA-TV	8
NEW BRUNSWICK		
Moncton	CKCW-TV	2
Saint John	CHSJ-TV	4
NEWFOUNDLAND		
Argentia	CJOX-TV	10
St. John's	CJON-TV	6
Stephenville	CFSN-TV	8
NOVA SCOTIA		
Halifax	CBHT	3
Sydney	CJCB-TV	4
ONTARIO		
Barrie	CKVR-TV	3
Hamilton	CHCH-TV	11
Kingston	CKWS-TV	11
Kitchener	CKCO-TV	13
London	CFPL-TV	10
North Bay	CKGN-TV	10
Peterborough	CHEX-TV	12
Ottawa	CBOFT	9
	CBOT	4
Port Arthur	CFCJ-TV	2
Sault Ste. Marie	CJIC-TV	2
Sudbury	CKSO-TV	5
Timmins	CFCL-TV	6
Toronto	CBLT	6
Windsor	CKLW-TV	9
Wingham	CKNX-TV	8
PRINCE EDWARD ISLAND		
Charlottetown	CFCY-TV	13
QUEBEC		
Jonquiere	CKRS-TV	12
Montreal	CBFT	2
	CBMT	6
Quebec	CFCM-TV	4
	CKMI-TV	5
Rimouski	CJBR-TV	3
Rouyn	CKRN-TV	4
Sherbrooke	CHLT-TV	7
SASKATCHEWAN		
Regina	CKCK-TV	2
Saskatoon	CFQC-TV	8

The Evolution of Broadcasting

RADIO communication was born of many minds and developments. In the 1860's, Maxwell predicted the existence of radio waves. Hertz later demonstrated that rapid variations of electric current can be projected into space in the form of waves similar to those of light and heat. In 1895, Marconi transmitted radio signals for a short distance and, at the turn of the century, conducted successful trans-atlantic tests.

This new communication medium was first known as "wireless". American use of the term "radio" is traced to about 1912 when the Navy, feeling that "wireless" was too inclusive, adopted the word "radiotelegraph". The word "broadcast" likewise stems from early United States naval reference to "broadcast" of orders to the fleet.

Broadcasting as we know it today was largely made possible by development of the vacuum tube by Fleming in 1904, and its improvement by De Forest in 1906.

The first voice broadcast is a subject for debate. Claims to that distinction range from "Hello, Rainey" said to have been sent by Stubblefield to a partner in a demonstration near Murray, Ky., in 1892, to an impromptu program from Brant Rock, Mass., by Fessenden in 1906, which was picked up by nearby ships.

There were other early experimental audio transmissions—such as De Forest putting the singer Caruso on the air in 1910 and trans-atlantic voice tests by the Navy station at Arlington, Va., in 1915—but it was not until after World War I that regular broadcasting stations developed from experimental operations going back to 1912. However, records of the Department of Commerce show KDKA, Pittsburgh, as the first commercially licensed standard AM (amplitude modulation) broadcast station, dating from November 1920.

There was experimental network operation over telephone lines as early as 1922. In that year WJZ (now WABC), New York, and WGY, Schenectady, broadcast the world series. Early in 1923 WEAF (now WRCA), New York, and WNAC, Boston, picked up a football game from Chicago. Later that same year WEAF and WGY were connected with KDKA, Pittsburgh, and KYW (now in Cleveland), Chicago, to carry talks made at a dinner in New York. President Coolidge's message to Congress was broadcast by six stations in late 1923. In 1926 the National Broadcasting Co. started the first regular network with 24 stations. Its first coast-to-coast hookup, in 1927, broadcast a football game. The first round-the-world broadcast was made from Schenectady in 1930.

Historical. There was a Wireless Ship Act of 1910 which applied to use of radio by ships, but the Radio Act of 1912 was the first domestic law for the control of radio in general.

Early broadcasting was experimental and. therefore, non-commercial. In 1919 broadcasters operated as "limited commercial stations". In 1922 the "wavelength" of 360 meters (approximately 830 kilocycles) was assigned for the transmission of "important news items, entertainment, lectures, sermons, and similar matter".

So rapid was the development of aural broadcasting that, upon recommendation of the National Radio Conference of 1923 and 1924 the Department of Commerce allocated 550 to 1500 kilocycles for standard broadcast (AM being the only regular broadcast at that time), and authorized operating power up to 5000 watts (5 kilowatts).

Increase in the number of AM stations caused so much interference that the National Radio Conference of 1925 asked for a limitation on broadcast time and power since many broadcasters were jumping their frequencies and increasing their power and operating time at will, regardless of the effect on other stations.

In 1926 President Coolidge urged Congress to remedy matters. The result was the Dill-White Radio Act of 1927 which created a five-member Federal Radio Commission with certain regulatory powers over radio.

At the request of President Roosevelt, the Secretary of Commerce in 1933 appointed an interdepartmental committee to study the overall interstate and international electrical communications situation. The resultant Communications Act of 1934 created the present Federal Communications Commission.

Call Letters. International agreement provides for the national identification of a radio station by the first letter of its assigned call signal, and for this purpose apportions the alphabet among different nations. United States stations use the initial letters K, N, and W, exclusively, and part of the A series.

Broadcast stations are assigned call letters beginning with K or with W.

During radio's infancy, most of the broadcast stations were in the East. As inland stations developed, the Mississippi River was made the dividing line of K and W calls. KDKA, Pittsburgh, was assigned the K letter before the present system was put into effect.

Broadcast Operation. In AM broadcast the audio waves are impressed on the carrier wave in a manner to cause its amplitude (or power) to vary with the audio waves. The frequency of the carrier remains constant. This is known as "amplitude modulation". In "frequency modulation" (FM), the amplitude remains unchanged but the frequency is varied in a manner corresponding to the voice or music to be transmitted.

AM broadcast stations use "medium waves". That is to say, they transmit 540,000 to 1,600,000 waves a second. At 540,000 waves a second, the distance between the crests is approximately 1,800 feet. This is known as "wave length". A station transmitting 540,000 waves a second is said to have a "frequency" of 540,000 cycles or 540 kilocycles.

The so-called "short-wave" (long-distance) broadcast stations transmit from 6,000,000 to 25,000,000 waves per second. These waves are sent out one after another so rapidly that the distance between their crests (wave length) is only about 37 to 150 feet. Under international agreement, certain high frequency bands are allocated for broadcasts directed between nations. Frequencies used by international broadcast stations are in the bands between 6000 and 21700 kilocycles.

The modulated radio wave from the radio station is picked up by the home receiving antenna; in the receiver the audio and carrier waves are separated by a device called a detector or demodulator, and the audio wave is relayed to the loud speaker where it is transformed back into the sound that you hear.

AM Broadcast. The 535 to 1605 kilocycles portion of the the radio spectrum is now used for AM broadcast. The band consists of 107 channels, each 10 kilocycles in width. Individual stations are assigned to frequencies in the center of each channel, such as 540 kilocycles, 550 kilocycles, etc. AM broadcast stations use power of from 100 watts up to 50 kilowatts (50,000 watts).

"Clear channels" are set apart by international agreement for the operation of maximum powered AM stations to serve remote rural areas. The other channels are shared by so many regional and local stations that people living outside populous communities must at night depend largely upon the strong signals of distant clear channel stations which are protected against night-time interference.

FM Broadcast. FM (frequency modulation) broadcast has several advantages over the older AM broadcast. FM has higher fidelity characteristics and is ordinarily free of static, fading and background overlapping of other station programs.

FM's greater tonal range capability is due primarily to the fact that it uses a channel 20 times wider than that employed for AM broadcast. Then, too, FM occupies a higher portion of the radio spectrum where static and other noise is less prevalent than at lower frequencies.

Most FM stations serve areas within a radius of approximately 35 to 75 miles, although high-powered FM stations sometimes reach out 100 miles or more. Low-power stations have a limited local coverage.

The principle of frequency modulation has long been known but its advantages for broadcasting were not realized until shortly before World War II. Largely as a result of interest evoked by extensive FM development work by Edwin H. Armstrong in the 1930's, the Commission authorized increased FM experimentation and in 1940, after extensive public hearings, provided for commercial FM operation to start January 1, 1941.

There was no "first" individual commercial FM grant because, on October 31, 1940, the Commission authorized construction permits to 15 such stations simultaneously. The first commercial FM station licensed by the Commission was WSM-FM Nashville (May 29, 1941), which operated until 1951.

FM stations were initially assigned call letters with added numerals, but in 1943 the present letter system was adopted. There is optional use of the suffix "FM" to distinguish FM stations from AM stations under joint operation.

Because of skywave interference experienced on the then FM band of 42-50 megacycles, the Commission in 1945, after public hearing, moved FM to its present higher and less vulnerable position in the radio spectrum—88 to 108 megacycles—providing 80 channels for commercial FM and 20 channels for nonprofit educational broadcast.

TV Broadcast. The TV transmitter is, in effect, two separate units. One sends out the picture and the other the sound. Visual transmission is by amplitude modulation (AM). The sound portion employs frequency modulation (FM). The frequency space used for the combined video and sound transmission is about 600 times larger than for an AM program.

Like other forms of radio, TV was made possible by electronic discoveries in the late 19th century and early 20th century. In 1884, Nipkow, a German, patented a scanning disk for transmitting pictures by wireless. In our own country, Jenkins began his study of the subject about 1890. Rignoux and Fournier conducted "television" experiments in France in the 1900's. In 1915 Marconi predicted "visible telephone". In 1923 Zworykin applied for a patent on the iconoscope (TV camera tube). Two years later Jenkins demonstrated mechanical TV apparatus. There were experiments by Alexanderson, Farnsworth, and Baird in 1926-1927. An experimental TV program was sent by wire between New York and Washington by the Bell Telephone Laboratories in 1927, in which Herbert Hoover, then Secretary of Commerce, participated.

The Federal Radio Commission reported that "a few" broadcast stations were experimenting with video in 1928. In that year, WGY, Schenectady, experimentally broadcast the first drama by TV. Large-screen TV was demonstrated by RCA at a New York theatre in 1930, and RCA tested outdoor TV pick-up at Camden, N. J., in 1936.

Seventeen experimental TV stations were operating in 1937. The first United States President seen on TV was Franklin D. Roosevelt, when he opened the New York World's Fair in 1939. That year also saw the first telecast major league baseball game, college football game and professional boxing match.

The first grant looking to regular TV operation was issued to WNBT, New York, on June 17, 1941, effective July 1 of that year. One June 24, 1941, WCBW (now WCBS-TV), New York, was authorized to commence program tests July 1 thereafter. By May of 1942 ten commercial TV stations were on the air.

As predicted by the Commission in 1945 it became increasingly evident that the few available VHF channels were inadequate to provide a truly nationwide competitive TV service. Also, operating stations developed interference which had not been anticipated when TV broadcasting began. As a result, the Commission on September 30, 1948, stopped granting new TV stations pending a study of the situation. This was the so-called television "freeze" order.

On April 14, 1952, the Commission announced the lifting of the TV "freeze", the addition of 70 UHF channels (between 470-890 megacycles) to the 12 VHF channels (between 54-216 megacycles) then in use, and the adoption of a table making more than 2,000 channel assignments (over 1,400 UHF and over 500 VHF) to nearly 1,300 communities throughout the United States and its territories, including 242 assignments for noncommercial educational use.

The first commercial TV grants following the lifting of the freeze were made on July 11, 1952, simultaneously, to three Denver, Colo. stations—KFEL-TV, KDEN and KBTV. KFEL-TV began program operation on July 19 thereafter. The first UHF commercial TV station to go on the air was KPTV, Portland, Oregon, on September 20, 1952.

The initial commercial grant to the territories and possessions was made on July 23, 1952, to WKAQ-TV, San Juan, Puerto Rico.

The first noncommercial educational TV grant was made July 23, 1952, to the Kansas State College of Agriculture and Applied Science (KSAC-TV), at Manhattan, Kans.—*Condensed from FCC Information Bulletin No. 2.*

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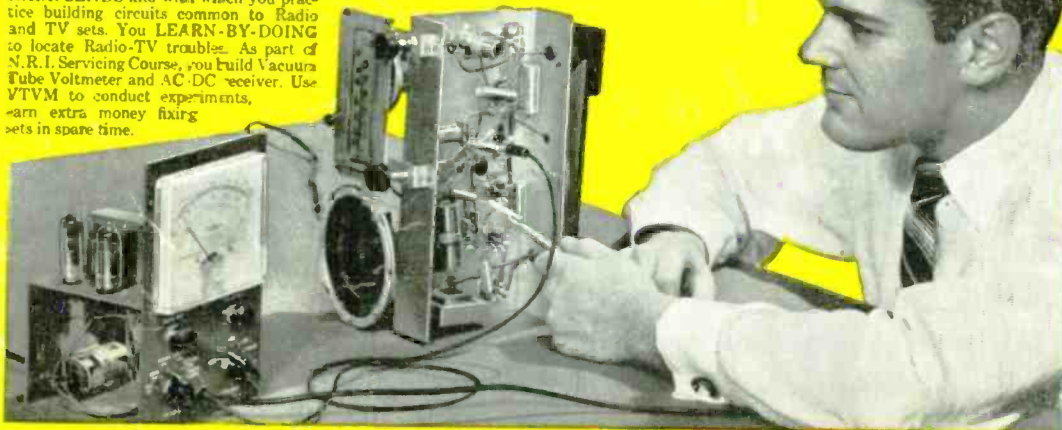

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