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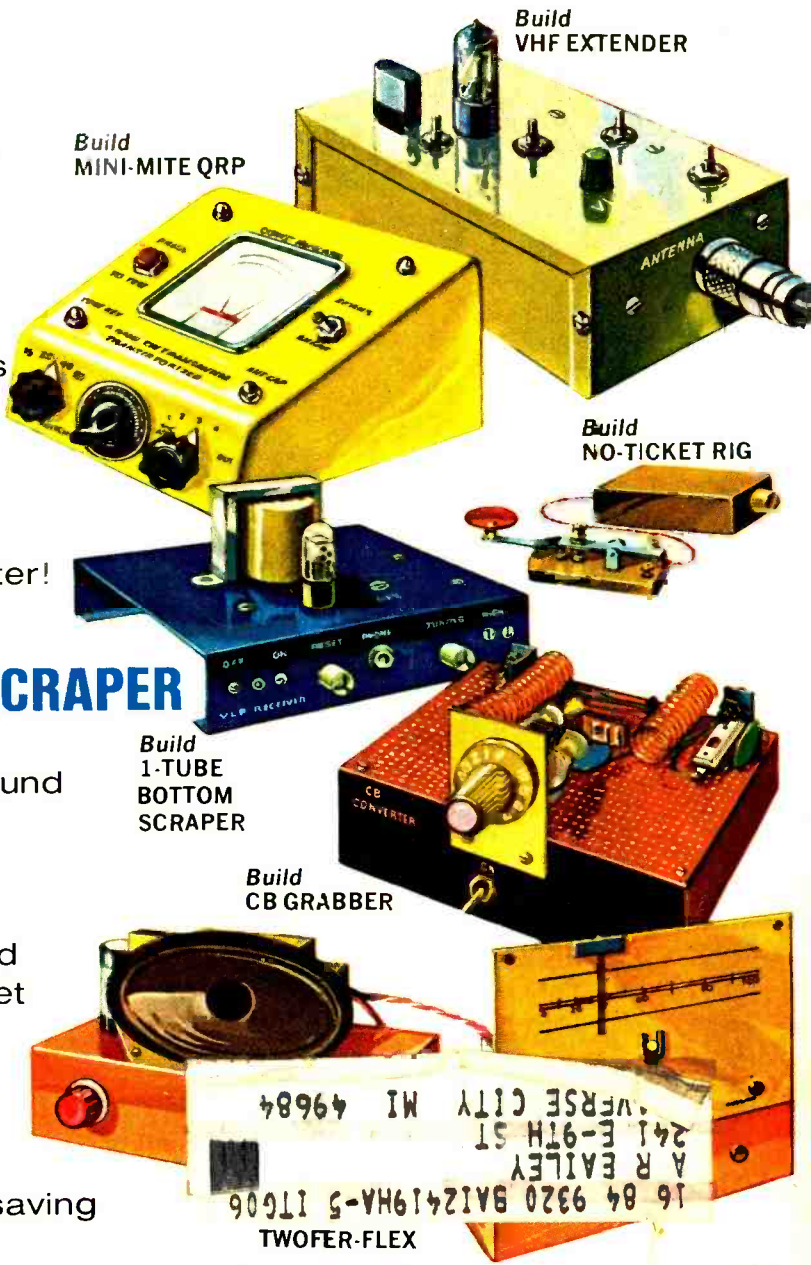

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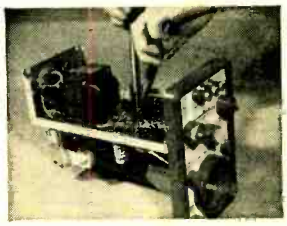
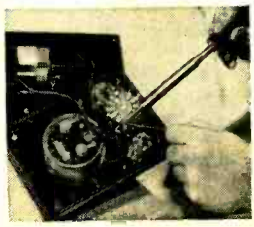


Construction of Multimeter.



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Science and Electronics

Volume 28 Number 6

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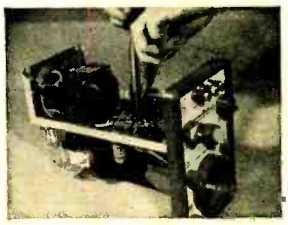

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★ Cover Highlights

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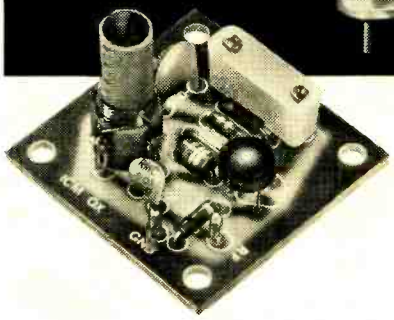

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Lo Kit 3 to 20 MHz
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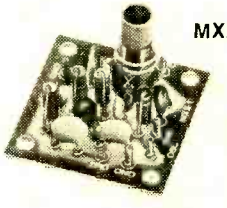

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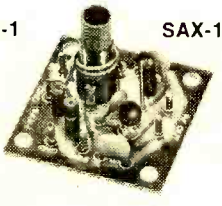

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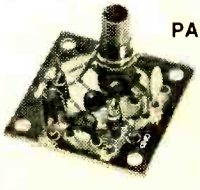

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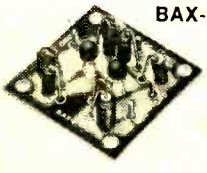

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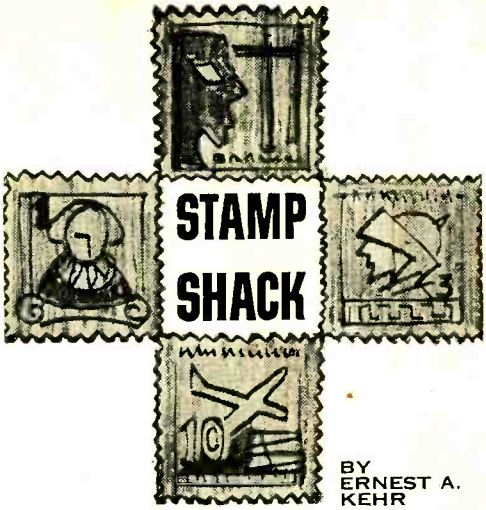


BY
ERNEST A.
KEHR

● ● Ascension Island is one of the most isolated places on the marine surface of this earth. But for all its remoteness, it now is in instantaneous communications with its more populous terrestrial neighbors across the seas, thanks to the Satellite Station erected there four years ago.

● Its 38 square miles of volcanic topography is in the South Atlantic, and until 1815, was uninhabited except for some ten species of sea birds that nested on and around the 35 extinct craters. At that time it was occupied by a garrison of British sailors and marines, instructed to prevent French forces to rescue Napoleon from his exile on St. Helena, 760 miles away.

● Until 1922, the island was used solely as a water and coaling station for British warships on their way to and from Africa, South America and Asia.

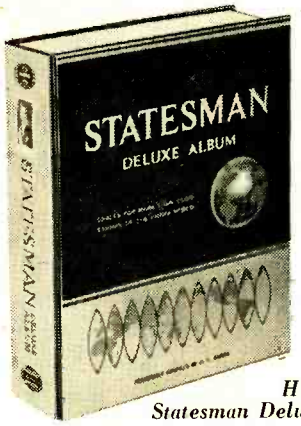
● Its communications history dates to 1899, when a crew of the Eastern Telegraph Co., Ltd., was sent down from London to begin the laying of cables that linked Ascension with St. Helena to the east, and St. Vincent to the northwest. Extensions subsequently were made to Freetown (Sierra Leone) and Rio de Janeiro and Buenos Aires, in South America. Seventeen years later Eastern's successor, Cables and Wireless, Ltd., installed the first radio relay station. More recently, the BBC installed facilities to relay programs between London, Africa and South America.

(Turn page)

Ascension Island Earth Station Issue

● Once the Space program was developed, Ascension's geographical position made it a perfect site to help track the various Apollo missions. The Cable and Wireless group envisioned its potentials, and in cooperation with NASA, started construction of an earth station to keep in touch with Spacecraft and satellites in orbit.
● Entirely British-owned, it was installed by the Marconi Company and opened for service in September, 1966. Since then, it was used to track all of the Apollo missions, including 11 and 12 that made it to the moon, and 13, which failed, but got back to a splashdown in one of history's most exciting events.
● Now that Ascension has a population of nearly 2,000 people—most of them concentrated in its coastal capital of Georgetown—the earth station is being used for commercial purposes. Its transmitting and receiving facilities are in constant contact with the two satellites that are 22,300 miles in orbit above its rocky surface. Its equipment is an advanced type of low-noise receivers, cooled to more than 250° below the freezing point, by helium at near liquid temperatures. Once TV comes to the island, the station will be able to pick up video and audio signals from most any part of the world.
● To proclaim the opening of this station, Ascension issued four special stamps with denominations of 4, 8 pence, 1¼ and 2½ shillings. Each depicts the immense dish receiver with symbolical waves linking it with one of the satellites, while the moon is in the distance. A portrait of Queen Elizabeth II is inset at the upper right.
● ● On the other side of the globe, Malaysia has entered the Space Age, too, by opening service of its earth station and commemorating it with a pair of special stamps. The 15-cent value, with its odd shape, shows the 97-foot fully steerable antenna which was erected at Kuantan, Pahang. The 30-cent shows that part of the globe in which Malaysia is located with the Intelsat III satellite floating above it.
● The facilities on the 60-acre site, which was selected because of its complete freedom from interference from existing terrestrial microwave stations, were built by Mitsubishi Shoji Kaisha, Ltd., of Japan on the basis of bids submitted by interested contractors. It cost more than $3 million.
● Its key components are the antenna, a supersensitive helium refrigerated receiver and high-power microwave transmitters. The antenna alone weighs 300 tons, but despite this is able to so accurately stay aimed at the Intelsat III, orbiting 22,300 miles above the Indian Ocean, that it never is more than one minute of an arc off the beam. The reflecting surface of the antenna must be within 1.2 millimeters of design to concentrate the radiated microwave power towards the satellite equivalent to 1 million watts. Links with this installation and Kuala Lumpur are provided by a high-quality microwave system.
● In setting up this earth station, Malaysia became the 50th of a 71-member Consortium founded to provide modern, Space-age telecommunications facilities around the earth.
● Because the specifications and system engineering designs were prepared by the Malaysian Telecommunication engineers (who also supervised the installation, testing and completion by the Japanese) the project forms an exceedingly great achievement of which the nation is proud.
● ● The American Topical Association, an international group of 9,000 collectors interested in stamps of the world which depict various topics: telecommunications, radio, Space, animals, birds, flags, etc., is the latest to take a strong stand on the matter of philatelic exploitation.
● At its June Convention in Montreal, the group declared that it will not officially recognize any poster adhesive, sticker or label produced in the similitude of a postage stamp by territories that have no postal service or by private operators with a view of deceiving collectors and charging unrealistic prices for such labels.
● Information about the ATA is available from Jerome Husak, Executive Secretary, 3305 N. 50 St., Milwaukee, Wisc. 53216.
● For those more interested in Sports stamps and covers, there is the new Sports Cover Club of America, details of which may be obtained from the club, at Box 48323, Los Angeles, Calif. 90048. ■
● ● Want an album? In an effort to encourage readers of the Stamp Shack to begin collecting postage stamps, this column will provide one

Malaysia Space Issues



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Statesman Deluxe Album

"Statesman Deluxe Stamp Album" to the person who submits the best reason why he (or she) would like to own one.

● Published by the H. E. Harris Co., of Boston, this album provides spaces for more than 30,000 of the world's stamps, each one of which is clearly identified to show what stamp belongs in what space.

● This huge book is loaded with illustrations, contains a "how-to-collect-stamps" introduction and historical and geographic facts about the countries represented.

● While only one album will be awarded, each person who enters this contest will receive a packet of postage stamps from various lands, provided a self-addressed, stamped envelope is enclosed with the contest letter. Address your letters to the Stamp Shack, Davis Publications, Inc., 229 Park Avenue South, New York, NY 10003. Deadline is December 21, 1970. But, don't wait! Do it today! ■

"Someone shot a paper clip and shorted out the teaching machine!"

GREAT MEN OF SCIENCE

Ernest Lawrence—Physicist Father of the Atom-Smasher

"It isn't the rank or the money I want."

Dr. John Zeleny, chairman of Yale University's physics department, nodded understanding.

"I know. You want help—graduate students. But here at Yale we do things the Yale way . . ."

His eyes blazing, Zeleny's subordinate tried to restrain his voice.

"And 'the Yale way' means no graduate assistants until a man becomes associate professor, doesn't it? That's the only reason on Earth I want the promotion."

Ernest Lawrence didn't get what he wanted.

A few weeks earlier he had bought a coupe—a Reo Flying Cloud. Before signing the contract he'd recognized that ownership of such a car would mark him as a rebel against 'the Yale way.' No matter; he'd ask for—no, demand—that promotion. If he didn't get it, he'd let prestige go hang and take a job at a second-rate university.

Part of the pressure was a fruit of his own temperament. Much of it was a product of prevailing attitudes. An unwritten but generally accepted principle of the day held that if a man didn't make a name in physics before 30, he'd never make it.

Lawrence was 27. He simply didn't have time to wait for the slow and orderly process of faculty promotion to elevate him to a level where he could put graduate students to work on problems that intrigued him.

No promotion, no help, no Yale.

It was that simple. Lawrence had made up his mind before meeting with the chairman of his department. He had even gone so far as to look around a bit.

Out in California, the physics department at Berkeley was said to be eager and receptive. Of course it was second- or third-rate by comparison with the department at Yale. But some day, it might catch up.

Lawrence received and accepted an offer to go to Berkeley. He drove his Reo Flying Cloud across the continent in the summer of 1928. He had the title of assistant professor, several student assistants—and hardly any modern equipment.

No matter; Ernest had the tenacity of his immigrant grandfather who made it to the U.S. from Norway against "impossible" odds. After settling in South Dakota Ole Lavrensen did make one concession to social pressure; he changed his name to Lawrence.

Within a year after his grandson severed his ties with Yale, the young physicist just two generations out of Norway came across a paper by a Norwegian. Rolf Wideroe described how he had increased the energy of electrified potassium atoms. He didn't quite say so, but he implied that a small voltage might be able to give high velocities to particles—provided that voltage could be applied precisely and at crucial periods.

Ernest Lawrence took that obscure and simple idea, used it to build a magnetic instrument that actually did accelerate some particles. Since the magnetic field employed forces that created roughly circular patterns of movement, Lawrence called his little gadget the cyclotron.

The world's first cyclotron, only a few pounds in weight, was in operation before Lawrence was 31. Even he was astonished at the way it speeded up movement of protons.

At the cost of $1000.00 a larger model was built in 1931. It produced protons with energies of more than one million electron volts.

Once started, the process of instrument-building accelerated almost as rapidly as particles in cyclotrons. A dozen years earlier the Federal Telegraph Company had built a 75-ton electro-magnet destined for use in China. It never got there.

Lawrence heard of it, managed to get possession, and with it built the first truly big cyclotron. But even it was a baby by comparison with the 220-ton instrument he

by Webb Garrison

put together in 1939. Two years later, the magnet used for a new device was so big it had to be buried in order to minimize danger from its high-level field.

Physicists and engineers from all over the world flocked to California. Big-name universities in the U.S. and in Europe competed with one another in building bigger and more powerful cyclotrons.

It was all but inevitable that the father of the atom-smasher should be given the Nobel Prize for Physics. That honor came in 1940 —a war year during which it was impossible to make the trip to Sweden to accept in person.

Before his death in 1958, Ernest O. Lawrence won all the honors any man needs. His most cherished one, more important to him than the Nobel Prize, was a change in informal ratings of physics departments.

By the middle of the 1940s physicists from Ivy League universities of the east were openly competing for appointments at Berkeley. Largely through the impact of the man who didn't measure up to an assistant professorship at Yale, Berkeley had become No. 1 in atomic and sub-atomic physics. ■

"He would never admit it, of course . . . but he gets most of his ideas from the children's Dr. Seuss books!"

NEW PRODUCTS

So You Want to be Heard

All you orators, coaches, guides, campers, boating enthusiasts, hunters, lib leaders etc., here's a real voice saver. A new, lightweight, compact, solid state, battery powered Bull Horn, available in kit form only, that has enough output to blast through high noise areas up to 400 ft.

Spend a couple of hours assembling this great little stentor and you'll be the new hero in your group. The kit comes complete with printed circuit board, all required components and easy to follow assembly and wiring instructions. You don't have to be an engineer to put it together, all you need is a screw driver, wire cutters and pliers, and a soldering iron.

This new EICO BH-16 Bull Horn Kit, including all material and parts, with the exception of 4 standard *D* cells to power it, is priced at only $15.95.

EICO BH-16 Bull Horn Kit

The trigger switch in the handle, along with a variable volume control and carrying strap, makes this device a very handy communications aid. For additional information, write: EICO Electronic Instrument Co., Inc., 283 Malta St. Brooklyn, New York, 11207.

Put a Monitor in Your Pocket

Hallicrafters has two new pocket-portable monitor FM receivers, Portamon Models CRX-106 and CRX-107. You takes your choice of CRX-106, which covers the 27-50 MHz band; or CRX-107, tuning 144-174 MHz; depending on whether you want police, fire, civil defense, public service, business and industrial radio, citizens band, 10-Meter amateur, or other services. Both are fully transistorized and hand-held

Hallicrafters Portable Monitor

and have such features as adjustable squelch control; continuous tunability with no additional crystals to buy; RF stage; tunable superheterodyne circuit with three tuned IF stages; Class B push-pull amplification; automatic noise limiter; automatic gain control. There's a telescoping antenna and a built-in jack for an accessory AC power supply. Both monitors are equipped with a 2¼-in. 8-ohm speaker and slide-rule front dial. Size of each Portamon is 6 x 1⅝ x 2¾ in.; weight, 1 lb. Price of either CRX-106 or CRX-107 is $39.95, less battery. For additional data write to The Hallicrafters Co., 600 Hicks Rd., Rolling Meadows IL 60008.

If Rhythm Is Your Thing

Knight-Kit's new Rhythm Console lets you add ten perfect rhythms to your band's sound or provide percussive accompaniment for backing a soloist.

Knight-Kit model KG-393 Deluxe Rhythm Console creates electronically, the sounds of bass drum, snare drum, claves, cowbell, maracas, and high-low bongos with amazing realism through your PA or instrument amplifier. Just push a button to provide perfectly timed rhythms for swing, twist, slow rock, rhumba, mambo, beguine, bossanova, tango or waltz. Controls are provided for volume and tempo beats as well

(Continued on page 14)

YOU'RE BEING ROBBED!

Virtually every time that you spend money, whether at the supermarket, department store, drugstore, or gas station, you're being ROBBED! You're being duped, hoodwinked, and swindled out of the full value of your money by a combination of deceptive selling techniques that include Madison Avenue double-talk, mendacious salesmanship, and insidious labeling and packaging ploys. Senator Warren Magnuson, the most alert consumer watchdog in Congress, says that deceptive selling is today's "most serious form of theft, accounting for more dollars lost each year than robbery, larceny, auto thefts, embezzlement, and forgery combined." Sidney Margolius, the dean of American consumer writers, asserts that "Never in the 30 years I have been reporting on consumer problems has the public been as widely and steadily exploited as today." And Ralph Nader, the nation's most renowned champion of consumer rights, states that "Nowadays consumers are being manipulated and defrauded not just by marginal,fly-by-night hucksters, but by America's blue-chip business firms." In short, commercial flimflammery is rife throughout the nation and the American consumer is being victimized as never before. As a partial antidote to this widespread fraud and deception, an intrepid, authoritative, new publication has been launched. Its name is Moneysworth.

Moneysworth, as its name implies, aims to see that you get full value for the money you spend. It rates competitive products as to best buys (as among cameras, hi-fi's, automobiles, and the like); it offers tips on how to save money (they will *astound* you with their ingenuity); and it counsels you on the management of your personal finances (telling not only how to gain maximum return on your investments and savings, but also how to protect your money against the ravages of inflation). In short, Moneysworth is your own personal consumer crusader, trusted stockbroker, and chancellor of the exchequer—all in one.

Perhaps the best way to describe Moneysworth for you is to list the kinds of articles it prints:

Earn 12% on Your Savings (Fully Insured)

How to Buy A Car for $125 Over Dealer's Cost

Inaccurate Billing by the Phone Company

The Advantages of a Swiss Banking Account

The New U.S.-Made Minicars: An Evaluation

14 Recession-Wracked Cities Where Real Estate Is Selling for a Pittance

"Consuming Fire"—**Moneysworth** takes aim at companies that are defrauding the public.

Unsafe at Any Height—A comparison of the safety records of America's airlines.

A Consumer's Guide to Marijuana

Free Land and Free Money from Uncle Sam

Stocks that Are on the Rebound

Send Your Child to College Abroad

The Moneysworth Co-operative—Details of a price-discount co-op (for purchasing typewriters, cameras, and the like) that **Moneysworth** subscribers automatically become members of.

How Much Are You Worth?—An amazingly simple chart gives you the answer in 60 seconds.

High-Priced Lemons—Mechanical failures on brand-new Imperials,Continentals, and Cadillacs.

The Link Between Heart Attack and Coffee

The Economics of Being Black

Cashing In on Canada's New "Floating" Dollar

Cyclamates: Did America Overreact?

How to Buy Art Without Getting Framed

Critics' Consensus—A regular feature of **Moneysworth** in which the opinions of leading book, record, and film critics are tabulated.

Providing Your Teenager with Contraception

"Unit-Pricing"—The most revolutionary development in food stores since trading stamps.

The Effect of Air Pollution on Potency

The Great Odometer Gyp—How rent-a-car companies take the American public for a $10-million-a-year ride.

"No Load" Mutual Funds—A list of 45 funds that return the equivalent of an 8% profit at the very moment of investment.

12 Ways to Put the Touch on Friends—And 12 ways to demur.

How to Buy Medical Insurance Without Trauma

The Encouragement of Reckless Driving by GM, Chrysler, and Ford—Verbatim quotes from their souped-up ads in hot-rod magazines.

Taking Stock of Your Stockbroker—Nine ways to probe his probity.

Legal Ways to Beat Sales Taxes

Co-ops and Condominiums Explained

"The Safest Car of 19__"—A new series of annual awards by the editors of **Moneysworth.**

How to Break a Lease

Land Investment in Australia—At $1.20 an acre, land down under rates high among speculators.

How to Sue Without a Lawyer

The Impending Ban on Leaded Gasoline—How it should affect your next car purchase.

A Guide to Legal Abortion—Including the costs in different states.

And Now, Microwave Pollution—An exposé of the damage wrought to humans by radar, electronic ovens, and TV transmission.

Social Security's Special Rules for Women

How Metrecal Hurts Your Diet

Life Insurance: A Legalized Swindle—A Hartford actuary tells why he believes that "more than 90% of American policies are sold through misrepresentation, deceit, and fraud."

Teaching Your Child the Value of Money—Without having him *over*value it.

How to Handle Computerized Dunning Letters

Taxproof Money—A collection of highly creative, little-known, perfectly legal gimmicks.

How to Distinguish Health from Hokum at the Health-Food Store

Blindness Caused by Contact Lenses

Don't Buy U.S. Savings Bonds—Why they make a terrible investment, how they undermine sound government fiscal planning, and why one leading investment counsellor says, "They are palmed off mostly on rubes and financial boobs."

G.E.'s New Synthetic Diamonds: Will They Ruin the Value of Real Diamonds?

The Truth about Cut-Rate Gasolines

"No-Fault" Insurance Clarified

Checking Up on Your Social Security Account

That's the Spirit—Big bargains in booze, beer, and brandy.

Stop Chewing the Fat—How to read the new labels on frankfurters.

Free Checks—A list of 200 banks that allow unlimited writing of personal checks.

Bootleg Birth-Control Pills

When in Doubt, Deduct—The ten most common forms of income-tax overpayment.

$99 Fares to Europe

In sum, Moneysworth is a hip, trustworthy financial mentor. It reflects the quintessence of consumer sophistication.

In format, Moneysworth is a newsletter. It is designed for instantaneous communication and easy reference when you're shopping. It is published *fortnightly*. This ensures you that the information in Moneysworth will always be up-to-the-minute. Product ratings will appear precisely when you need them most (automobiles and sailboats will be rated in the spring, for example, and Christmas gifts and ski equipment in the fall.)

In style, Moneysworth is concise, pragmatic, and above all, useful. It is also completely forthright. Moneysworth does not hesitate to name brand names (whether to laud or lambaste them), to identify big corporations when they gouge the public, and to quote the actual prices and discounts that you are entitled to and should be getting. Moneysworth can afford to be this candid because *it carries no advertising whatsoever: it is beholden to no one but its readers.*

The editors of Moneysworth are a team of hard-nosed, experienced journalists. The editor-in-chief is Ralph Ginzburg, creator of the flamboyant magazines Fact, Eros, and Avant-Garde. Mr. Ginzburg was the first editor to provide a platform for Ralph Nader to express himself on the subject of automobile safety. Moneysworth's publisher is Frank R. Brady, generally regarded as one of the publishing industry's shrewdest financiers. Herb Lubalin, the world's foremost graphic designer, is Moneysworth's art director. Together, these men will produce the first—and only—consumer magazine with *charisma.*

Moneysworth is available by subscription only. Its price is $10 a year. However, right now you may order a special introductory Charter Subscription for ONLY $5! This is HALF PRICE!!

Moreover, we are so confident that Moneysworth will prove indispensable to you that we are prepared to make what is probably the most generous subscription offer in publishing history: *We will absolutely and unconditionally guarantee that* Moneysworth *will increase the purchasing power of your income by at least 15%—or we'll refund your money IN FULL.* In other words, if you now earn $10,000 a year, we'll guarantee that Moneysworth will increase the value of your income *by at least $1,500*—or you get your money back. As you can see, a subscription to Moneysworth is an absolutely foolproof investment.

To enter your subscription, simply fill out the coupon below and mail it with $5 to: Moneysworth, 110 W. 40th St., New York, New York 10018.

We urge you to act at once. Stop being robbed and start getting your Moneysworth.

MONEYSWORTH

110 W. 40 ST. N.Y., N.Y. 10018

I enclose $5 for a one-year subscription to Moneysworth, the authoritative new consumer newsletter. I understand that I am paying only *HALF PRICE!* Moreover, Moneysworth guarantees that it will increase the purchasing power of my income by at least 15% *or I will get my money back IN FULL.*

NAME

ADDRESS

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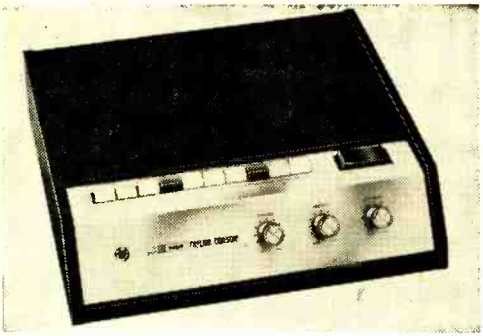


Knight-Kit KG-393 Rhythm Console

as adding the sound of cymbals in varying amounts to all rhythms except the rhumba, mambo and cha-cha.

Knight-Kit's new modular concept makes for easy assembly of this all solid state kit. Most components are mounted and soldered to printed circuit boards and critical circuits are factory wired and tested. Step-by-step assembly instructions for the interwiring of these sub-assemblies are supplied.

Knight-Kit Deluxe Rhythm Console, model KG-393, complete with a 10 foot cable for connecting to your amplifier sells for just $99.95.

All Knight-Kit products are available exclusively through Allied Radio Shack Stores or by mail to Allied Radio Shack, 100 N. Western Avenue, Chicago, Illinois 60680.

How to Reach Those Hard to get at Places

A new, highly versatile 14 piece, ¼-in. drive, socket wrench set has just been put on the market by Xcelite Incorporated, that contains components capable of being combined in seven different ways for driving both hex and square fasteners. It's possible to assemble the various units to have a reach from as short a range of 1½-in. to 9¼-in.

Xcelite 1001 Socket Wrench Set

In addition, a precision made, reversible ratcheting handle, with a short swing for close quarters, is included in the set of wrenches. Ratchet mechanism is fully enclosed to prevent dirt and grit from getting into and damaging it.

An unusual 5¾-in. spinner/extention has a drive socket inserted in the end of the plastic handle that adapts it for use, not only as a regular nut driver, but as a ratchet extension. The conventional 2-in. extension included in the kit fits either end of the spinner/extension or the ratchet.

The Xcelite No.-1001 set, packaged in an attractive green snap-lock case, molded of high impact plastic, contains nine hex sockets ranging from 3/16-in. through ½-in., and in addition, two dual purpose sockets with openings of ¼-in. and 5/16-in., that fit both hex and square nuts, bolts and drain pipe plugs, in addition to the ratchet and extensions.

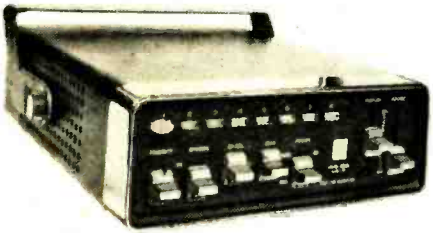
All are hot forged from A.I.S.I. alloy steel. This wrench set is made in U.S.A. and is available nationwide through local distributors and dealers. For further information write: Xcelite Incorporated, Orchard Park, N.Y. 14127.

Conquer Those Fascinating VHF-FM Bands

A unique new high band VHF-FM monitor receiver recently announced by Fanon Electronics, provides automatic scanning of 8 crystal controlled channels for reception of police, fire, business and weather reports.

Fanon Model APO-75 Monitor receiver covers the 150MHz VHF high vand with 8 crystal controlled frequencies for *on frequency* monitoring. A scanning system automatically monitors all 8 channels sequentially within one second by electronic switching. A priority feature enables constant monitoring of a desired frequency even when listening to other frequencies.

Its possible to set the receiver to by-pass a selected frequency, such as weather, that



Fanon APO-75 VHF-FM Monitor

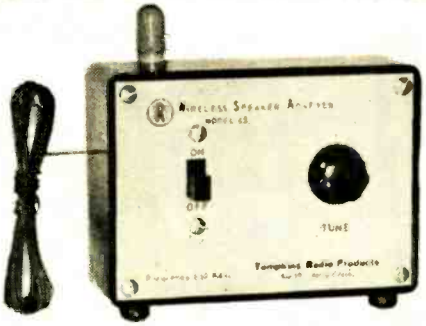
usually is a continuous carrier that would cause the scanner to lock on that frequency. The auto-manual scan switch, in conjunction with the channel selector switch, permits manual selection of any of the 8 channels.

The APO-75 features solid state design and employs integrated circuits for consistant superior performance and extra long service life. It comes complete with mounting bracket, AC and DC power cables and has a built-in 117VAC power supply, and sells for $149.95.

For further information, contact Fanon Electronics, 100 Hoffman Place, Hillside, New Jersey 07205.

Leave the Room but Carry the Sound!

A new device, the Wireless Speaker Adapter (WSA), enables you to listen to TV, tape recorder, stereo, CB, 2-way radio, hi-fi, anywhere within 100 feet on any regular or portable AM radio. With its automatic volume control you can use WSA for monitoring CB or amateur radio. The housewife can check the roast and keep up with the story line of a TV soap opera.



Herbert Salch Wireless Speaker Adapter

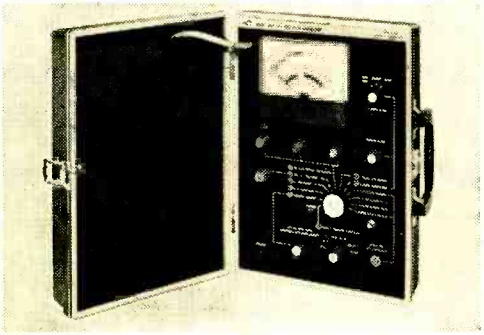
You hi-fi buffs can listen to your records while in another room without blasting everybody else out of the house. Only connections needed for WSA are two wires that clip to the equipment speaker, speaker terminals, or earphone

(Continued on page 16)

jack. The sound is broadcast through the air to the receiving radio, which is now used as an extension speaker. Price of the Wireless Speaker Adapter is $19.95 complete with 9-volt battery. There's an optional power supply for $3.95. WSA measures 4 x 3 x 1½ in. and comes in two models: model 65 output tunes from 640-660 kHz, model 76 from 750-770 kHz. For more dope write Herbert Salch & Co., Marketing Div. of Tompkins Radio Products, Woodsboro TX 78393.

Now Rejuvenate Color CRT'S

The B&K model 466 CRT Tester/Rejuvenator just introduced for color picture tubes, including new color tubes such as Trinitrons, as well as for B&W picture tubes, tests for opens, shorts or leakage between elements. It also rejuvenates guns and repairs shorted or leaky tubes, all without having to remove the CRT from the set.



B&K 466 CRT Tester/Rejuvenator

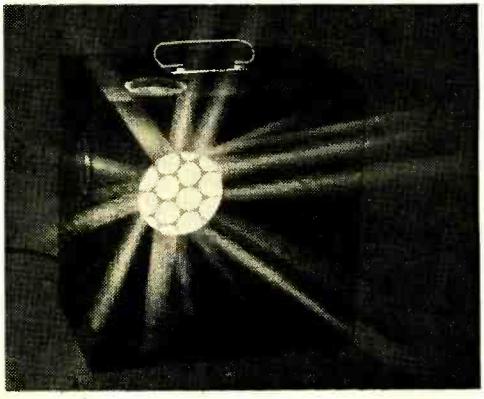
The model 466, manufactured by B&K, pioneers in the design of tester/rejuvenators, contains a number of unique features. For one, its exclusive monitored rejuvenation permits the reading of relative cathode emission improvement directly. This provides accurate rejuvenation for maximum CRT life in addition to saving time. Separate G-2 voltage range to check color guns to cut-off at recommended voltage setting, greatly speeds up tracking tests. Separate gun emission checking for fast color gun evaluation, reserve power-rejuvenation for restoring low emission CRT'S and super-rejuvenation are features that permit rejuvenation of many otherwise worthless tubes. Multi-socket adaptors included permits testing of new CRT'S such as Trinitrons and the GE 11-in. tubes.

Other important features are: at no time are any CRT elements allowed to float free, CRT'S are tested in all modes in accord with CRT manufacturer's recommended procedures, CRT elements are connected to test points with all others shorted to ground to provide greater accuracy and eliminate CRT damage. Heater G-1 and G-2 voltages are continuously variable and metered, thus there is no obsolescence of the instrument because of new CRT'S that require new heater voltage. Heater voltages are metered at the tube pins. This assures setting correct heater voltages regardless of heater load or line voltage variations, and G-1 voltage can be set with precise accuracy under all conditions.

Model 466 is computer styled for ease of operation, is housed in a light weight case, weighs only 8 pounds and sells for $129.95. For further information contact: DYNASCAN CORPORATION, 1801 W. Belle Plaine Ave., Chicago, Illinois 60631.

Get "Lit-Up" Without a Hangover

Edmund Scientific has brought the fixings for a psychedelic light party down to within the means of teen-agers. Their 3-color mechanical strobe (catalog No. 71,271) is priced at an eensy-weensy $28.50. A red, green, and blue color wheel, rotating in front of a 100-watt, 120-V reflector floodlamp, shoots out chromatic blasts of light every six seconds. Everything within a 500-sq-ft. area comes alive with color. Mechanical Strobe No. 71,271, which is convection-cooled through grilled vents, comes in a walnut cabinet, 9 x 10 x 6¼-in. with brass carrying handles, and has an in-line *on/off* plus 5½ ft of 110-VAC cord. By mail order only,

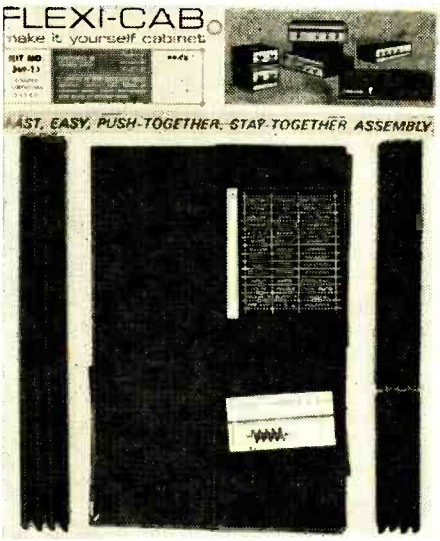


Edmund Scientific Mechanical Strobe

$28.50 postpaid, or write for more information to Edmund Scientific Co., 380 Edscorp Bldg., Barrington NJ 08007.

Fresh Help for the Home Brewer

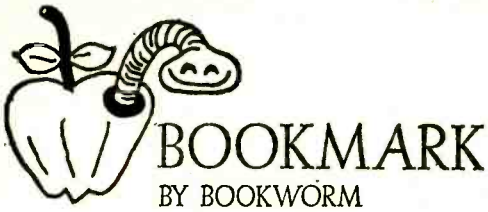
EICO has acquired a line of build-it-yourself vinyl-clad steel cabinets, called Flexi-Cab, which should take a lot of the sweat out of the electronics hobbyist's life. They recommend Flexi-Cab as a natural complement to the EICOCRAFT line of 39 build-it-yourself solid-state electronic science project kits. The do-it-oneself custom cabinets are available in three sizes and the prices range from $3.49 to $4.69. For additional information write to Eico, 283 Malta St., Brooklyn NY 11207.



EICO Flexi-Cab Custom Cabinets

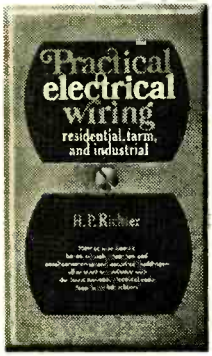
Hi-Lo Out There!

Courier Communications has a new hi-lo band FM-VHF monitor, model COP-50HL, with which you can listen to police, fire, and weather reports. You can use it at home on its built-in 117-VAC power supply, or operate it in your car from a 12-VDC battery. COP-50HL has six high band frequencies (150 to 175 MHz) and six low band frequencies (25 to 50 MHz). The monitor features crystal control on all channels (crystals not included), IC design, RF peaking control, adjustable squelch, and a tone control switch. In a rugged cabinet, COP-50HL measure 8 3.8 x 7½ x 2⅝ in. and is priced at $139.95. For additional information write to Courier Communications, 100 Hoffman Pl., Hillside NJ 07205.



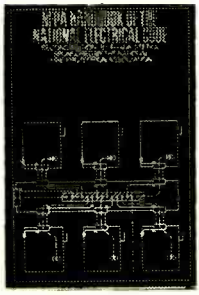
TWO new editions of electrical wiring texts have been released by McGraw-Hill Book Company. Both books are intended for electricians and future electricians; albeit, both texts are for you if you are a home owner who dabs in electrical home maintenance and modification. Admittedly, local codes and laws prohibit do-it-yourself electrical work as they prohibit taking of pot, but like the Volstead Act, these rules cannot be enforced. Therefore, why not become informed of the code requirements and good electrical practice if you plan to work at home! After all, an informed novice will do a better job, and he may not undertake some jobs when he realizes the dangerous excesses he is undertaking.

Practical Electrical Wiring—Residential, Farm and Industrial, eighth edition, by H.P. Richter is beyond any doubt, the foremost instructional manual on all types of electrical



664 pages
Hard cover
$12.50

wiring jobs for the man who does the work. Whether it's a question on the size or type of wire needed for any application, whether it's a matter of how to properly ground an installation . . . you'll find the answer in this text. The important word is "*how*"! *Practical Electrical Wiring* is the guide you'll need to work with in your home.



694 pages
Hard cover
$12.75

The other text is *NFPA Handbook of the National Electrical Code,* second edition, by Frank Stetka and sponsored by the National Fire Protection Association. In this handbook you will find clear and simple coverage of the latest National Electrical Code rules. It will help you make your wiring installation safe by ensuring that your work is comparable to an electrician's. Hundreds of diagrams and photographs and tables help you grasp every essential . . . even the rules are further explained in difficult cases.

Both books are published by McGraw-Hill Book Company, 330 West 42nd Street, New York, N. Y. 10036.

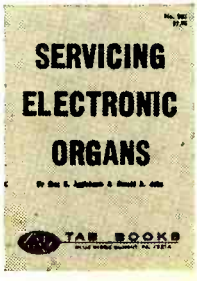
Electronic Brains. *Fundamentals of Digital Computers* by Donald D. Spencer is an excellent "primer" or introductory text to the general field of electronic computing and will enable

256 pages
Soft cover
$5.50

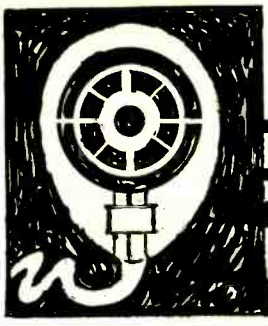
anyone, from any occupational field, to acquire a good, basic understanding of what computers do and how they do it. It begins with a discussion of various computer applications and takes a look at the history and evolution of computers. Subjects such as the functional organization of a computer, the individual components of a computer system, data preparations, storage devices, input and output peripheral devices, conversion units, computer languages, and the central processor are all discussed in detail. Published by Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Indiana 46268.

Music Lovers Only! A brand-new manual will help you become an expert serviceman on one of today's most exciting, increasingly-popular, home-entertainment devices—the electronic organ. This text tells how the various electronic

(Continued on page 103)



160 pages
Soft cover
$7.95



HAM TRAFFIC DE W7DQS

by MARSHALL LINCOLN

What's Ahead For Ham Radio?

We call ham radio a hobby now. But when it began, it actually was a part of the beginning of all commercial electronics. That's because everyone was new at the game—radio was a startling new development that no one fully understood. So, everyone in the business was an experimenter—and, in essence, an "amateur."

What did those early day hams do? For one thing, they bridged the Atlantic with radio on frequencies that know-it-all government officials said would never get out of their back yard. They also operated TV stations and radio-controlled model airplanes in the "primitive" days of the 1930s! They eagerly sought contacts with hard-to-work foreign stations on new uncharted wavelengths. In so doing, they helped develop the theories and measurements of ionospheric propagation that we all take for granted today.

In more recent times, hams pioneered in use of single sideband techniques, which ultimately were adopted by the Air Force and NASA for world-wide communications nets. They sent radio facsimile pictures to the South Pole, and they handled thousands of emergency messages during every major flood and earthquake and fire and explosion that occurred in this country and in many foreign countries. They've made hundreds of additional exciting and worthwhile contributions to society and technology.

What Were They Like? What type of person did it take build a TV station back in the days when ordinary radio broadcasting was still in its infancy? What kind of person is needed to pioneer a better way to transmit the human voice than on so-called "ancient modulation?" What kind of person does it take to stay at his mike and key around the clock talking to strangers he'll never meet, just because they need help? What kind of person would dare to even think that a group of guys working in their basement workshops could build a communications satellite?

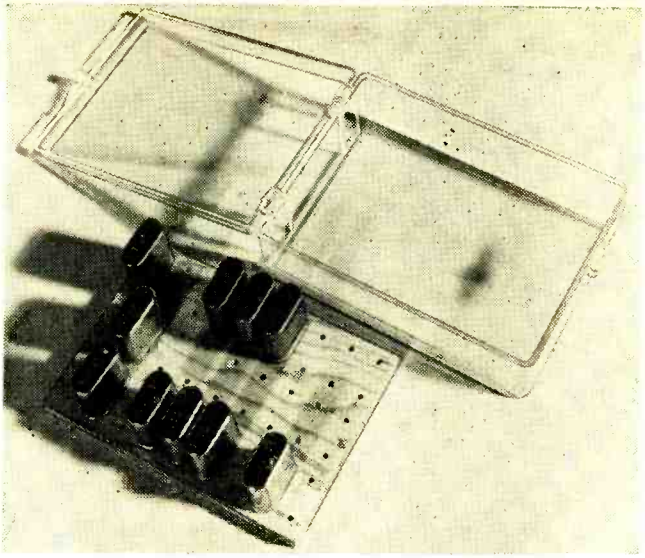
The kind of guys and gals who did these things are the kind of persons who make up the backbone of ham radio. These are people who enjoy a technical challenge and are proud of their accumulated ability to solve problems and create new ideas in electronics and communications.

Hams typically have been the pioneers in home electronics systems of all types: hi-fis, intercoms, TVs, remote controls, and alarms. You name it, and chances are a ham has been active in its initial development. This is because many persons who become interested in ham radio later transfer their ham knowledge to other fields of electronics.

For this reason, it's very sad to see commercial interests losing their appreciation of the value of ham radio. The ham is no longer thought of as an innovator—and as a fellow who's learning new things about all fields of electronics. Now, the ham is being looked upon as merely a guy who "plays with radio."

Opportunity Is Endless. In truth, though, ham radio provides an opportunity for technical training and experience that's available in no other way. Much of this can be put to use by the individual ham in his job or in providing a service for his community and his country. Despite flamboyant claims you may hear, there's no other radio service that can do this fully.

To deserve the fine reputation which we have had for many years, it's necessary for us to show a responsible attitude in our hamming. Ham radio does not exist merely



Plastic box of type supplied with some electronic components can become useful storage bin for amateur crystals. Simply cut piece of ¼-in. plywood to fit inside box and drill pairs of holes spaced to match pins on crystals. With plywood in box, crystals can be plugged in (more or less) and arranged so changing frequencies is easy as 123.

to provide a place for rag chewing, as some "modern style" hams seem to think. Instead, rag chewing is one of the privileges we enjoy as a fringe benefit.

Ham radio does not exist to provide a medium for contests, as some wallpaper collectors seem to think. Instead, contests are another of the fun games we're allowed to play because their real intent is to sharpen our abilities as radio operators.

Ham radio does not exist merely as a form of recreation, as some of the cry babies among us seem to think. The real recreation we receive is part of our inheritance, and it goes along with the acquiring by us of the ability to understand and operate radio transmitting and receiving equipment.

Anyone can push a button and yak into a mike . . . and if he's lucky, he may get a simple thought conveyed to someone a few miles away. We have millions of policemen and cab drivers and utility repairmen and delivery boys who do it every day.

This sort of thing can be handled by literally anyone, with no training, no technical knowledge, no license requirements, and generally no sense of discipline in how to use a radio.

But from hams, more is expected. It's intended that hams should have skills and attitudes which place them far above this level. To keep us on our toes, each of us needs to remember our own personal set of Ten Commandments. For hams, these comprise the Amateur's Code, which is just as

(Continued on page 104)

THE AMATEUR'S CODE

The Amateur is Gentlemanly . . . He never knowingly uses the air for his own amusement in such a way as to lessen the pleasure of others. He abides by the pledges given by the ARRL in his behalf to the public and the Government.

The Amateur is Loyal . . . He owes his amateur radio to the American Radio Relay League, and he offers it his unswerving loyalty.

The Amateur is Progressive . . . He keeps his station abreast of science. It is built well and efficiently. His operating practice is clean and regular.

The Amateur is Friendly . . . Slow and patient sending when requested, friendly advice and counsel to the beginner, kindly assistance and cooperation for the broadcast listener; these are marks of the amateur spirit.

The Amatuer is Balanced . . . Radio is his hobby. He never allows it to interfere with any of the duties he owes to his home, his job, his school, or his community.

The Amateur is Patriotic . . . His knowledge and his station are always ready for the service of his country and his community.

LITERATURE LIBRARY

1. *Allied Radio Shack* wants to introduce you to the colorful world of electronics. Discover great buys from wide selections. Get the details from *Allied* today!

2. It's just off the press—*Lafayette's* all-new 1971 illustrated catalog packed with CB gear, hi-fi components, test equipment, tools, ham rigs—get your free copy!

3. Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools and instructions included.

4. *Olson's* catalog is a multi-colored newspaper that's packed with more bargains than a phone book has names.

5. *Edmund Scientific's* new catalog contains over 4000 products that embrace many interests and fields.

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7. *Custom Alarms* reveals how inexpensive professional alarms can really be. Install one yourself. Circle 7 for exclusive catalog.

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11. Now available from *EDI (Electronic Distributors, Inc.)*: a catalog containing hundreds of electronic items.

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15. Here's a free 20-page booklet that tells you how to improve your TV pic and a do-it-yourself approach to installing a Master Antenna TV (MATV) system. *Mosley Electronics* will wing it your way.

16. *RCA* Experimenter's Kits for hobbyists, hams, technicians and students are the answer for successful and enjoyable projects.

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18. Heath's new 1971 full-color catalog is a shopper's dream. Its 116 pages are chuck full of gadgets and goodies everyone would want to own. You just got to see their new color TV set!

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21. Bone up on CB with the latest Sams books. Titles range from "ABC's of CB Radio" to "99 Ways to Improve your CB Radio."

22. You can become an electrical engineer only if you take the first step. Let *ICS* send you their free illustrated catalog describing 17 special programs.

23. For success in communications, broadcasting and electronics, get First Class FCC license. *Grantham School of Electronics* will show you how.

24. CB antenna catalog by Antenna Specialists makes the pickin' easy. Get your copy today!

25. Kit builder? Like wired products? *EICO's* 1971 catalog takes care of both breeds of buyers at prices you will like.

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1+1=GREAT!

a message from the Editor

SCIENCE AND ELECTRONICS will cease publication in its present form with this issue. Beginning with the first 1971 issue, S/E will be an integral part of ELEMENTARY ELECTRONICS.

In this last issue of 1970, we saw fit to reprint the finest and most successful construction projects ever published in SCIENCE AND ELECTRONICS. This selection is based on our reader response through the years. Unfortunately, several very hot projects could not be published in this issue because parts for these projects are no longer available. However, a few selected projects are being redesigned and pepped up for publication at a later date in ELEMENTARY ELECTRONICS.

Subscribers to SCIENCE AND ELECTRONICS will automatically be offered the opportunity of completing their subscriptions with issues of our sister publication, ELEMENTARY ELECTRONICS. Subscribers to both magazines will be offered the opportunity of having their subscriptions to ELEMENTARY ELECTRONICS extended by the time remaining on their SCIENCE AND ELECTRONICS subscriptions.

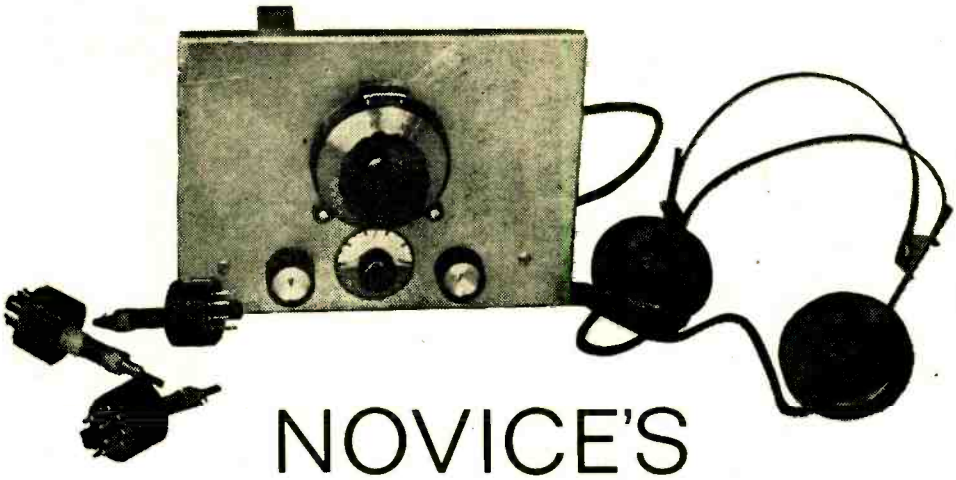
Much of the best of SCIENCE AND ELECTRONICS will be made part of the new, expanded ELEMENTARY ELECTRONICS. We urge you to join one of hobby electronics' biggest readerships by joining us in ELEMENTARY ELECTRONICS.

WHITE'S RADIO LOG, long an integral part of SCIENCE AND ELECTRONICS, will now appear in its *entirety* in a brand-new publication, COMMUNICATIONS WORLD. Published semi-annually, COMMUNICATIONS WORLD will be on your newsstand in January and September. Significantly, White's Radio Log will form but a part of the all-new COMMUNICATIONS WORLD.

Look for us. We'll be waiting for you. Come in and call for

ELEMENTARY ELECTRONICS
COMMUNICATIONS WORLD

Great first receiver for the beginner
or reliable standby for the old pro,
it tunes 600 kHz to 38 MHz in four bands
using one triple-triode tube and plug-in coils!



NOVICE'S ONE-TUBE MULTIBANDER

By David Jay Green, W6FFK

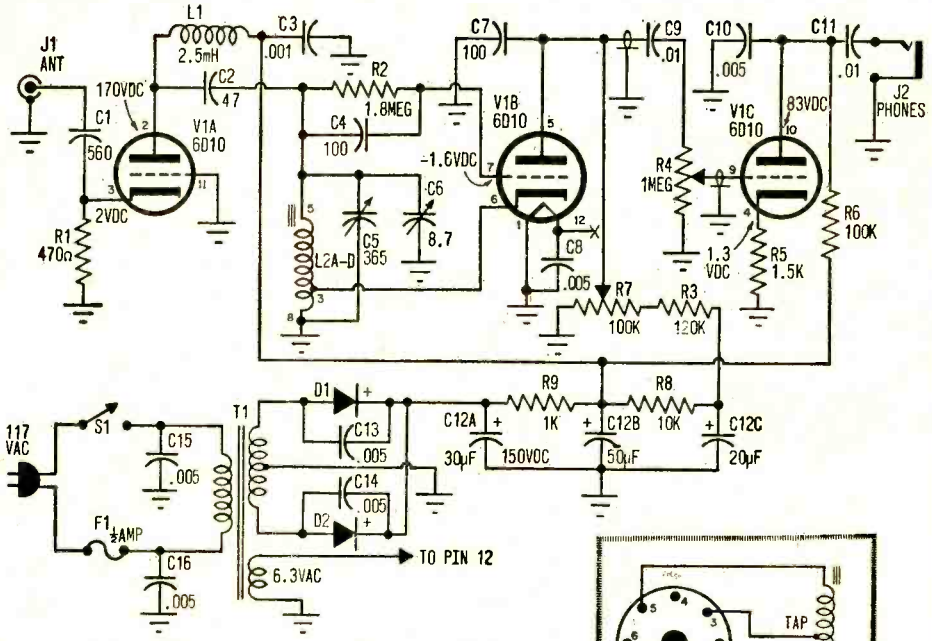
■ What the newcomer to radio needs is a good, sensitive, selective little receiver to get started with. Whether he be SWL or ham, the one additional requirement usually is that the receiver be inexpensive. To buy a commercial unit that'll fill the bill on all counts is easier said than done. But to get such a receiver, there is an easy way that'll pay an extra dividend as well. The solution is to build Multibander.

First off, the novice will get a rig that'll put him in the swing of things. And second, he'll get good experience in circuit construction and receiver techniques.

Our Multibander features an RF stage for excellent sensitivity—in conjunction with a good antenna and ground it'll pick up just about everything worth hearing. The isolated grid-leak detector has regeneration and gives good selectivity for separating crowded signals. And, a stage of audio gives enough gain for more than adequate headset volume.

The frosting on the Multibander cake is the fact that it uses simple straightforward circuitry. And, a single

•MULTIBANDER•



Schematic of Multibander shows three-stage circuit using grounded-grid RF amplifier, regenerative detector, and an audio amplifier. Diagram at right gives L2 connections.

PARTS LIST FOR NOVICE'S ONE-TUBE MULTIBANDER

C1—560-pF capacitor
C2—47-pF capacitor
C3—.001-uF capacitor
C4, C7—100-pF capacitor
C5—365-uF variable capacitor (Lafayette 32H1103 or equiv.)
C6—8.7-pF variable capacitor (Allied 43D3759 or equiv.)
C8, C10, C13, C14, C15, C16—.005-uF capacitor
C9, C11—.01-uF capacitor
C12A, B, C—20-, 30-, 50-uF 150-VDC electrolytic capacitor (Lafayette 34H7545 or equiv.)
D1, D2—750-mA, 750-PIV silicon rectifier (Lafayette 19H5002 or equiv.)
F1—½-A fuse and holder
J1—Phono jack
J2—Phone jack
L1—2.5-mH RF choke (Lafayette 34H8792 or equiv.)
L2A—Tapped oscillator coil (J. W. Miller A5496C or equiv.)
L2B—Tapped oscillator coil (J. W. Miller C5496C or equiv.)
L2C—Tapped oscillator coil (J. W. Miller C5496C or equiv.)
L2D—Tapped oscillator coil (J. W. Miller D5496C or equiv.)
R1—470-ohm, ½-watt resistor
R2—1,800,000-ohm, ½-watt resistor
R3—120,000-ohm, ½-watt resistor
R4—1,000,000-ohm potentiometer, audio taper
R5—1500-ohm, ½-watt resistor
R6—100,000-ohm, ½-watt resistor
R7—100,000-ohm potentiometer, linear taper
R8—10,000-ohm, ½-watt resistor
R9—1000-ohm, ½-watt resistor
S1—S.p.s.t. switch on R4
T1—Power transformer; 117-VAC pri.; 250-VAC, 25-mA and 6.3-VAC, 1-A sec. (Stancor PS8419 or equiv.)
V1—6D10 compactron tube
1—12-pin socket for 6D10
1—Octal socket for plug-in coils
4—Octal tube bases
1—2⅞-in dia. vernier dial (Lafayette 99H6029 or equiv.)
1—7 x 7 x 2-in. metal chassis (Lafayette 12H8203 or equiv.)
1—8 x 6-in. aluminum sheet for front panel
Misc.—Terminal strips, line cord, knobs, wire, solder, etc.

three-stage compactron and plug-in coils make it easy and inexpensive to build.

Circuit Operation. Radio signals are coupled through C1 to the grounded-grid RF amplifier section of V1A. This serves two purposes: to get amplification of the signal and to isolate the detector stage from the antenna. Reason is that by isolating the detector, the tuned circuit isn't loaded down, has a higher Q, and is therefore more sensitive and selective. Also, the isolated detector regenerates more smoothly over a wider range.

The amplified signals from the RF stage are then fed to the tuned circuit of the plug-in coil (L2), the main tuning capacitor (C5), and the bandspread capacitor (C6). The grid bias for the detector stage of V1 is developed by the grid-leak composed of R2 and C4.

Regenerative feedback is provided by connecting the cathode of V1B to the tap of L2, and is controlled by varying the voltage to the detector by means of regen control R7.

The detected signals are coupled by C9 to the volume control (R4) and fed to the grid of the audio stage V1C. Amplified audio is then passed to the phone jack by C11.

Construction. The front panel is a 6 x 8-in. piece of sheet aluminum mounted on the chassis with two sheet metal screws. When the front panel is mounted, drill pilot holes for the volume control, the regen control, and the bandspread capacitor. Remove the front panel, and then enlarge the pilot holes to accommodate the controls. The main tuning capacitor is mounted with ⅜-in. aluminum spacers and must be mounted close enough to the front panel to couple to the vernier dial.

Follow the layout shown in the photos for mounting the various components. Actual parts placement isn't critical and can be rearranged to suit—just remember to follow good RF practices and keep leads short.

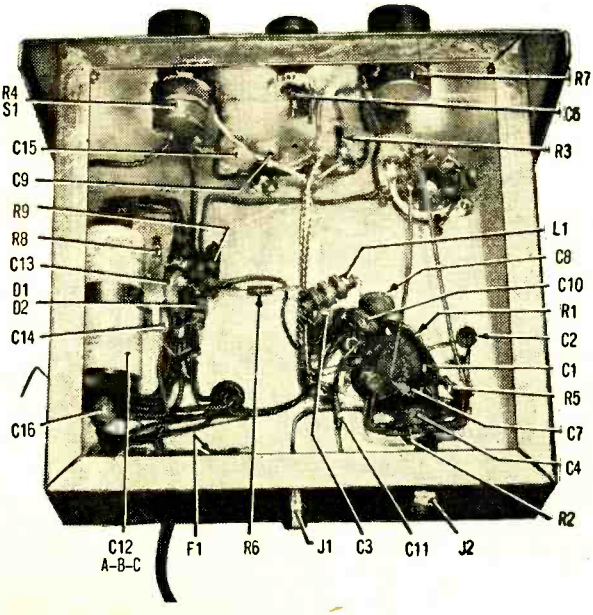
The triple-section electrolytic is mounted on one of the transformer mounting screws, as is a 6-post terminal strip. This terminal strip is used to mount the small components of the power supply. The fuse holder for F1 can be mounted on the remaining transformer screw.

The two shielded leads going to the volume and regen controls are made by slipping hookup wire into a piece of braided shielding. The connection to the main tuning capacitor is made with insulated buss wire through a small chassis hole.

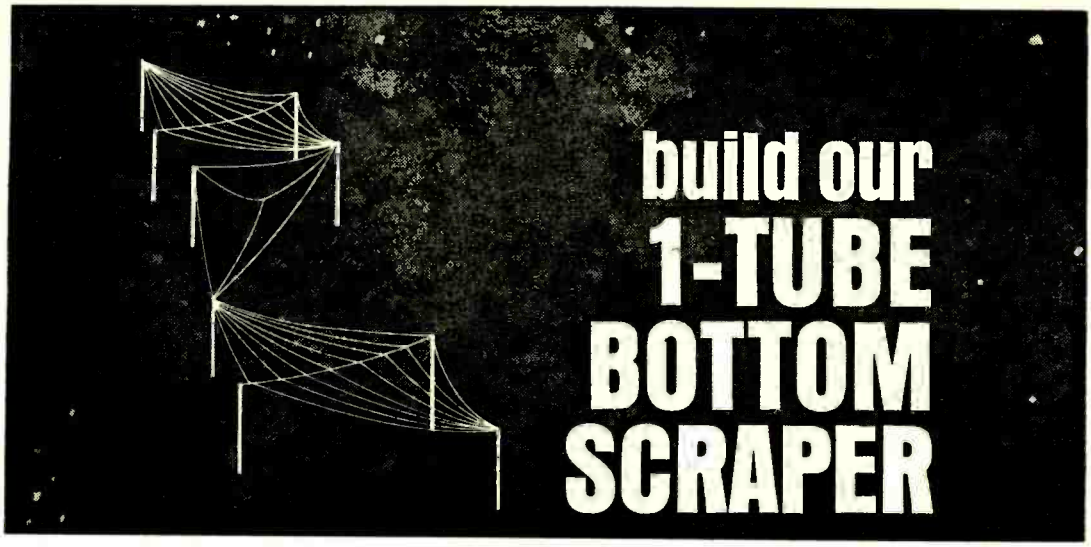
Wire the receiver from the schematic, keeping leads short. Careful placement of components around the tube socket is necessary to avoid a rat's nest of wires. Follow the component placement shown in the photos, and you won't have any trouble.

The four plug-in coils are made by wiring the oscillator coils (L2A, B, C, D) inside the tube bases, as shown. The leads should be

(Continued on page 106)



Following suggested layout, there is plenty of room for parts, simplifying construction. Since majority of circuit components are attached to compactron socket, care must be taken here to avoid a rat's nest of wire and components. Top side of finished Multibander is shown above.



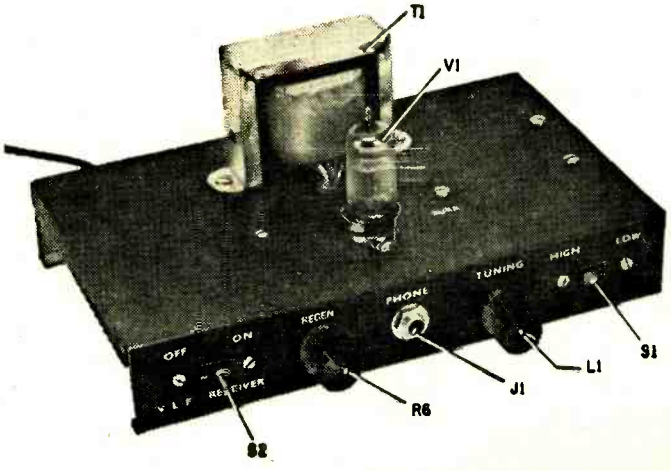
build our 1-TUBE BOTTOM SCRAPER

■ Here's a one-tube receiver project that has been designed especially for eavesdropping on the Navy's super-powered CW stations that operate in the vicinity of 20 kHz(kc). Whether you're interested in high-speed code practice with 5-letter cipher groups, want to copy the latest news flashes in plain English, or merely want to set your watch by good ol' Naval Observatory time signals, it will pay you to have a receiver that tunes to the fantastically-long wavelengths in the neighborhood of 15,000 meters.

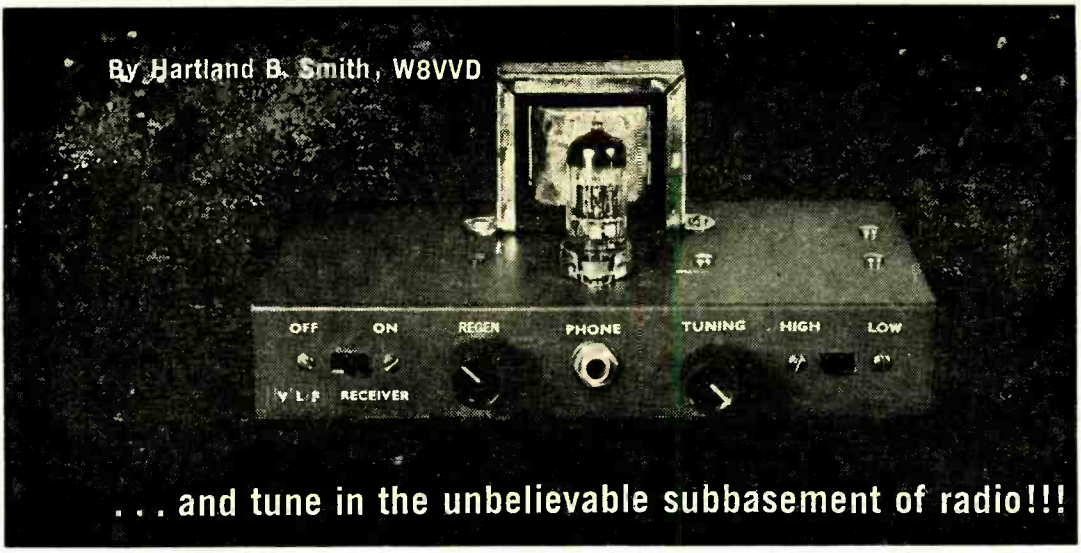
Just think of it, a half wave antenna for this range is almost 5-miles long! Of course you won't need one that long to pick up signals satisfactorily. In Michigan, where the author lives, a hundred feet of wire and a good ground provide excellent reception, day or night, of NAA in Maine; NSS, Maryland; and NPG on the west coast. As a matter of fact, that's why Uncle Sam uses such long waves. They offer consistently good reception all over the world so that even submerged nuclear subs on the other side of the globe can get their latest orders without difficulty.

About The Circuit. The receiver consists of a regenerative detector that tunes from 13 to 28 kHz plus a single stage of audio amplification. A self-contained power supply furnishes DC for the tube.

You tune to different VLF stations by varying the position of the slug in L1, a TV horizontal-oscillator coil which is paralleled



Bottom Scraper was built on chassis without panel or cabinet. If you want a more impressive receiver, unit can be housed in a small sloping-front enclosure.



by C1. An extra capacitor, C2, may be switched across coil L1 to provide sufficient tuning range—to cover the entire band from 13 to 28 kHz. Schematic diagram is located on page 49.

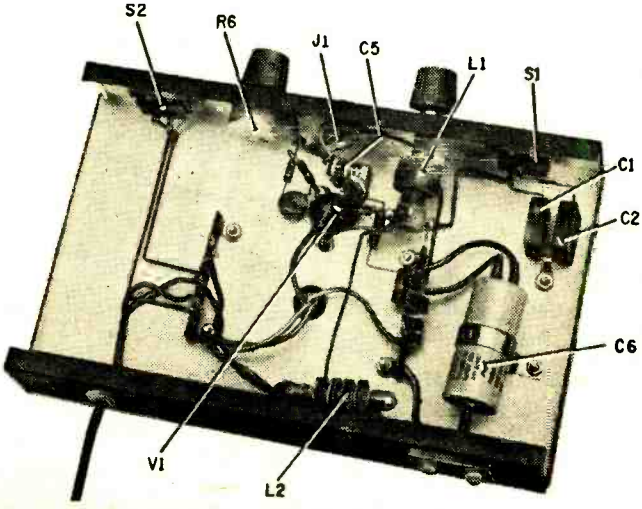
In the antenna circuit, choke L2 passes very-low frequencies, but offers a high impedance to strong local broadcast signals. It prevents them from reaching the grid of V1A where they would be detected and cause unwanted interference.

Potentiometer R6 is the regeneration control which varies the screen voltage of V1A. When this voltage is set at the proper level, V1A oscillates to provide the beat note required for reception of CW signals.

The detector's output is coupled, via C4, to the grid of V1B where the audio signal is amplified. The plate circuit of this stage is capacitance-coupled to high-impedance headphones plugged into J1.

The half-wave rectifier power supply furnishes approximately 150-volts DC to the plates of tube V1. The filament winding of transformer T1 supplies 6.3 volts AC for the heater.

Construction. Most articles tell you to carefully follow the layout of the original and to avoid parts substitutions. This receiver is different. You can employ just about any layout that suits your fancy, without degrading the performance of the set. As a matter of fact, the short, direct leads usually required in RF circuits are of little



Bottom view of chassis of Bottom Scraper shows there is plenty of room, so smaller chassis could be used without affecting operation. Other frequencies below 540 kHz can be tuned if additional capacitors are switched by a multi-position S1.

Bottom Scraper

consequence in a unit that operates at or near the audio frequency range.

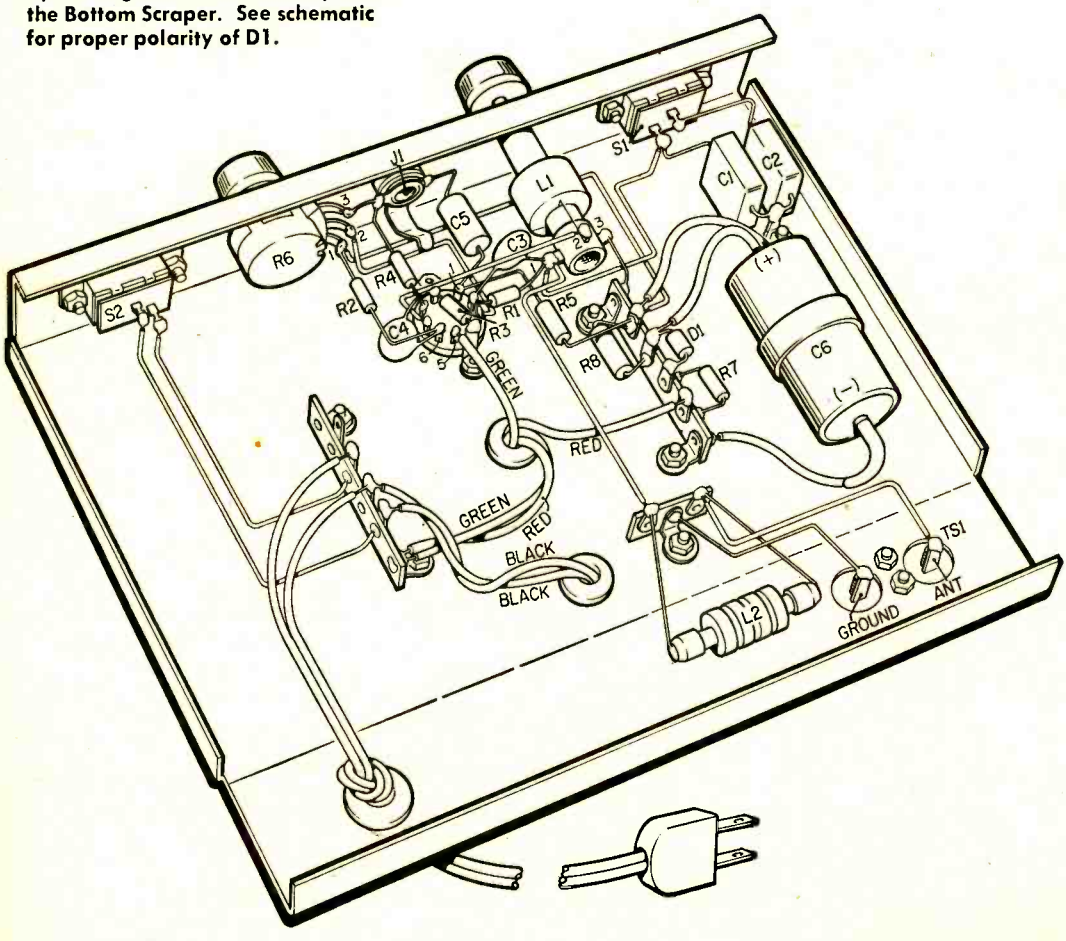
With the exception of L1, C1, and C2, component values may vary by as much as 50% from the figures specified, with little or no effect on the receiver's operation. As a result, this gadget is a natural for construction from junk box parts.

The threaded brass adjustment shaft of L1 is too small to accept knobs designed for ¼-in. shafts. A short length of plastic rod or wooden dowel is cemented over the end of the shaft so that an ordinary knob can be fastened to it. Since L1 was not designed by the manufacturer for constant tuning, it will pay you to apply a small amount of Lubriplate or Vaseline to the threads in order to minimize friction and wear.

Operation. Attach an antenna at least a hundred feet long to the ANT terminal of TS1 and a good cold-water pipe ground to the other terminal. Screw the slug of L1 fully counterclockwise (all the way out of the coil) and open S1 (*HIGH* setting). Plug a pair of headphones into J1 and turn S2 *on*.

After V1 has warmed up for a minute or two, advance R6 until you hear a hissing

Pictorial diagram can be used by the beginner to successfully wire the Bottom Scraper. See schematic for proper polarity of D1.



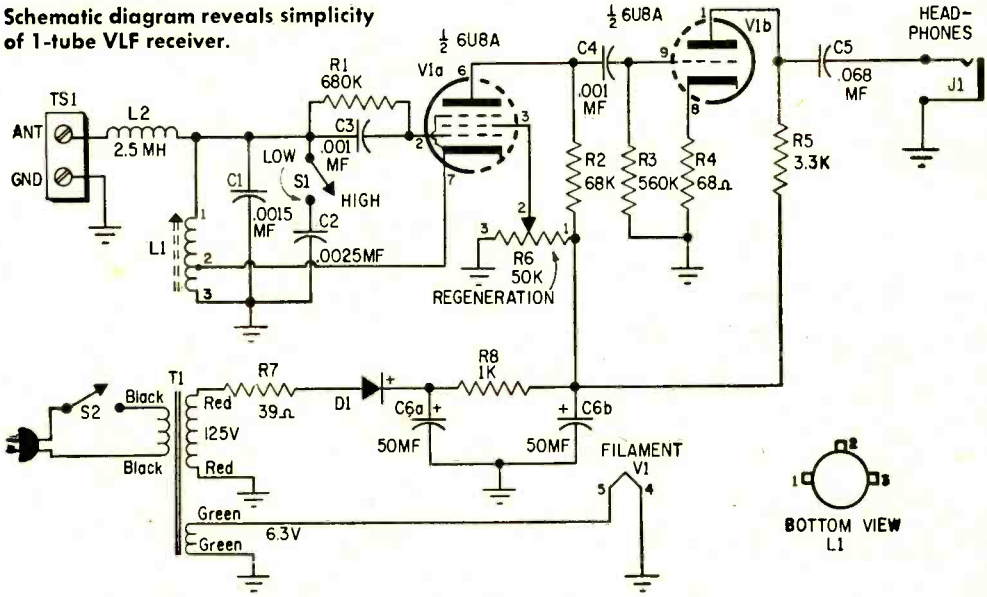
noise in the phones, which denotes that V1A is oscillating. Slowly turn the knob of L1 clockwise. As you do this, you should hear two or three different CW stations. Peak L1 and R6 for optimum reception of the desired signal. A regenerative receiver isn't very selective, so don't be surprised if you can hear the other stations faintly in the background when you are tuned to a signal.

With S1 open, the tuning range is approximately 20 to 28 kHz. With it closed, the range is 13 to 20 kHz. You'll hear a whistle when the slug is all the way into L1 and S2 is closed. This is because the detector in the Bottom Scraper is actually oscillating at 13 kHz, a frequency which all but the oldest fogeys are easily capable of hearing.

Back the slug out a bit and the whistle will disappear. NAA, the lowest-frequency signal you'll pick up, operates just beyond the audible range. Therefore, the oscillation produced by the detector at this frequency won't bother you—at least not unless you have the supersensitive ears of an Airedale or Dachshund.

For best results, always operate the receiver with R6 set close to the point where oscillation just commences. Advancing the regeneration control too far will not only reduce sensitivity, but may even cause the oscillator to take off at an audio rate, producing an uncomfortably loud howl. ■

Schematic diagram reveals simplicity of 1-tube VLF receiver.



LONG-WAVE RECEIVER PARTS LIST

C1—.0015-mf. silver mica capacitor
C2—.0025-mf. silver mica capacitor
C3, C4—.001-mf. ceramic disc capacitor
C5—.068-mf., 200-volt tubular capacitor
C6—50-, 50-mf., 150-volt dual electrolytic capacitor
D1—500-ma., 400-piv., silicon diode rectifier (IN2070 or equiv.)
J1—Open circuit phone jack
L1—16-42 millihenry TV horizontal-oscillator coil (J. W. Miller 6211 or equiv.)
L2—2.5 mh. RF choke
R1—680,000-ohm, ½-watt resistor
R2—68,000-ohm, ½-watt resistor
R3—560,000-ohm, ½-watt resistor
R4—68-ohm, ½-watt resistor
R5—3300-ohm, 1-watt resistor
R6—50,000-ohm linear taper potentiometer
R7—39-ohm, ½-watt resistor
R8—1000-ohm, 1-watt resistor
S1, S2—S.p.s.t. slide switch
T1—Power Transformer. Pri.: 117 volt, 60 Hz; Sec.: 125 volt, 50 ma.; 6.3-volt, 2-amp (Knight 54A1411 or equiv.)
TS1—2-screw terminal strip
V1—6U8A tube
2—4-terminal insulated tie strips
2—Knobs
1—9x5½x1½-inch aluminum chassis
1—9-prong miniature tube socket
Misc.—Solder lugs, wire, solder, 6-32 machine screws and nuts, power cord and plug, rubber grommets, etc.

Estimated cost: $14.00
Construction time: 3 hours

By Ed Morris, KRP1830

Rates rocks for activity
Checks crystals for stability
Spots channels with rapidity

CB Rock Rater X 3

■ What can our CB Rock Rater do for you? Plenty! For one thing, it'll measure the relative activity of your CB crystals. What does this mean to you? It means that you can quickly determine if a crystal isn't up to par. And this is important because with a low activity crystal in your rig's transmitter, it just can't put out for you like it should, and the net result is decreased operating range!

This nifty little package can also check your crystals for other defects, such as jumping frequency, which, in extreme cases can put you far enough off frequency to throw you right out of the CB band!

Now about your receiver alignment. Are all the channels receiving dead on frequency where they should be? If not, our Rock Rater and a few CB transmit crystals lets you align the receiver yourself—and save the service fee.

Our multi-purpose CB test instrument is compact, measuring only 4 x 2⅛ x 1⅝ in., and it won't clutter your operating area. Being inexpensive to build, it won't put a crimp in a tight budget either. And last but no means least, simple circuitry makes it a snap to build, even for the beginner.

How Rock Rater Works. The heart of the operation of this device is a crystal controlled Colpitts oscillator. This oscillator, formed by transistor Q1 and its associated components, generates an RF signal output when an external CB crystal is inserted into the crystal socket. The frequency of the output signal is determined by the crystal frequency.

The amount of RF generated is, to a large extent, determined by the activity of the crystal under test. A weak crystal, one whose activity is low, will not permit the oscillator to generate as much output as another higher activity crystal.

The output from the oscillator is applied to the center arm of selector switch S2 (see schematic). When the switch is placed in the lower position, the RF is rectified by the action of diode D1. It is then filtered by capacitors C4, C5 and calibration potentiometer R3. The resulting DC, which is proportional to the original RF, is then read on meter M1.

When the switch is in the upper position, the RF oscillator output is applied to the antenna jack through capacitor C6. This is the position used when the Rock Rater is used as a channel spotter or an alignment generator.

Mechanically Speaking. Although the exact layout of the Rock Rater is not critical, best results will be obtained, especially for the beginner, if the layout presented is followed. The more advanced builder should feel free to modify details to suit his needs. In any case, good high-frequency construction practices should be followed.

Start work on the case by drilling the proper size holes as shown in the drawings. The use of a T-square will aid in obtaining accurate placement of the various holes.

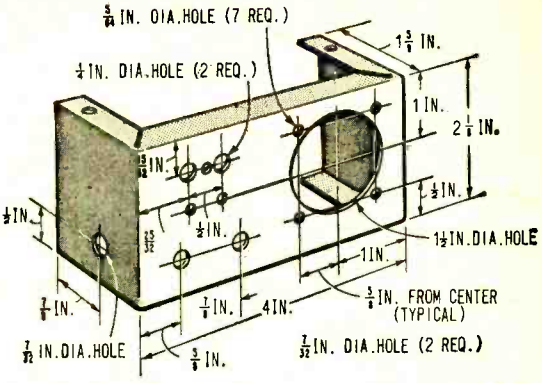
The cut-out for meter M1 can easily be made with the use of a chassis punch of the proper size. If one is not available, a hand nibbler will do the job.

The mounting clip for the battery is made from the center spring clip from a size "AA" cell holder. This clip is easily removed from the battery holder by drilling out the retaining eyelets with a .125-in. drill.

Finishing The Case. A strikingly professional appearance can be achieved, even by the beginner, by simply spray painting and lettering the case. The little additional time and effort involved will prove to be well worth the results. To prepare the case for painting, first remove all traces of dirt and oil from it. Any remaining dirt or oil will prevent the paint from adhering properly. The easiest way to clean it is to wash the case well with soap and water. After the case has dried, be sure to protect it from your own fingerprints.

When painting the case, remember to use very thin, light coats. The key to a good finish is to use a light touch. Allow each coat of paint to dry thoroughly before applying the next. For a really first-rate job, apply a primer coat to the bare metal first.

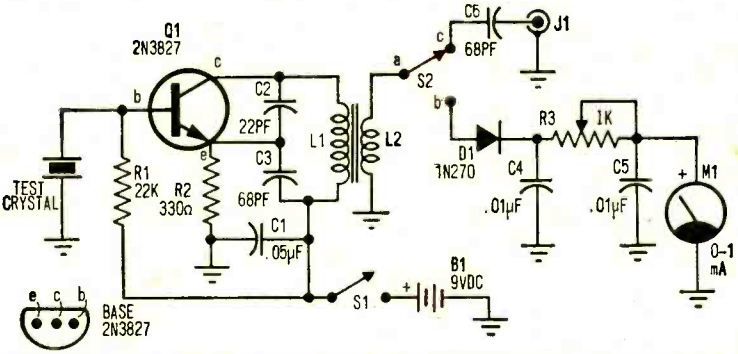
After the paint has dried hard, preferably overnight, it's time to apply the lettering. Whichever you use, whether dri-transfers or decals, be sure to follow the manufacturer's directions exactly. A final coat or two of a clear plastic acrylic spray may then be applied to protect the lettering.



To insure easy construction, lay out chassis box holes as dimensioned above. Then remove burrs and apply several coats of spray paint for a professional appearance.

Electrical Construction. Most of the electrical components are mounted on a 1¾ x 1¾-in. piece of perforated board. This board is mounted on the meter terminals as shown.

Begin the electrical construction by wiring the board according to the schematic diagram. The general parts layout can be easily determined from the photos. Although transistor Q1 is a silicon transistor and is not



Schematic diagram of Rock Rater shows Colpitts oscillator whose output is fed to either meter M1 for rock-rating or to antenna jack J1 for channel spotting.

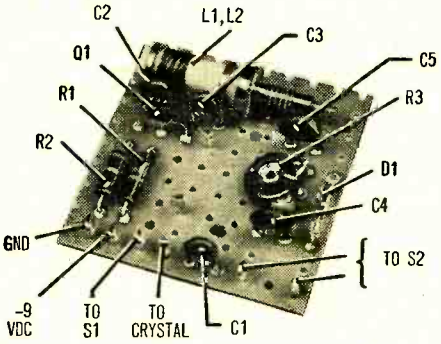
ROCK RATER PARTS LIST

B1—9-volt transistor battery (Burgess 2U6)
C1—0.05-uF, 12-VDC capacitor
C2—22-pF, 1000-VDC capacitor
C3, C6—68-pF, 1000-VDC capacitor
C4, C5—.01-uF, 200-VDC capacitor
D1—1N270 diode
J1—RCA phono jack, single whole mounting (Lafayette 99C6234 or equiv.)
L1—#28 enameled wire, 7-turns close-wound on ¼-in. ferrite-tuned coil form
L2—#28 enameled wire, 3-turns close-wound over ground end of L1
M1—1-mA miniature panel meter (Lafayette 99C5052 or equiv.)
Q1—2N3827 silicon transistor
R1—22,000-ohm, ½-watt resistor
R2—330-ohm, ½-watt resistor
R3—1000-ohm, miniature potentiometer (Lafayette 99C6142 or equiv.)
S1, S2—Miniature d.p.d.t. switch (Lafayette 99C6126 or equiv.)
1—Crystal socket (Lafayette 42C0901 or equiv.)
1—4x2⅛x1⅝-in. aluminum chassis box
Misc.—Wire, solder, nuts, screws, plastic tubing, perforated board, flea clips, lettering, spray paint, etc.

CB Rock Rater x 3

easily damaged by heat, care should still be taken while soldering it into the circuit. This same care should be applied to diode D1, which is also easily damaged by excessive heat and mechanical actions that might break its glass case.

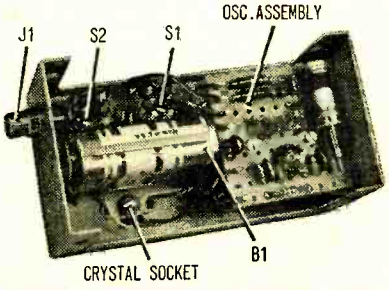
Note that for proper operation, coil L2 should be wound over the "cold" end of coil L1. In this case we mean the end connected to the junction of capacitor C3 and coil L1.



Majority of Rock Rater components are mounted on perf-board and wired following the schematic. Completed board assembly is then wired to chassis-mounted components and installed in chassis.

Particular care should be taken when wiring to observe polarity of components as indicated on the schematic. This is especially true for transistor Q1 and battery B1.

After the circuitry on the perforated board has been wired, carefully check it over for errors against the schematic.



Completed perf-board assembly is mounted in chassis by attaching it to the meter terminal screws. After wiring has been checked for errors and the battery installed, Rock Rater is ready for a trial run and calibration.

Completed Rock Rater has a professional appearance that lets it keep company with the snazziest of CB rigs. Here, it's befriending an all-channel Lafayette HB-525 CB rig. Don't they make a lovely couple?

Temporarily set the perforated board aside and install meter M1, switches S1, S2, the battery clip, and the crystal socket. Wire as you go along. Then mount the perforated board on the back of the meter terminals. Finish up the last of the interconnecting wiring between the board and the remainder of the components.

Testing and Calibration. Place selector switch S2 in the *meter* position. Adjust calibration potentiometer R3 to its minimum resistance position. Place a known good channel 9 transmit crystal, or other known good transmit crystal whose frequency is near the center of the band, in the crystal socket.

Turn Rock Rater on and tune coil L1 for a peak reading on the meter. Readjust the calibration potentiometer R3 as necessary to keep the meter from reading off scale as coil L1 is being peaked.

Once the coil has been peaked, adjust the calibration potentiometer for a ¾-scale reading (0.75 mA) on the meter. If you are not able to peak the coil, or to obtain an upscale meter reading, carefully recheck your work for possible errors. If the meter reads down-scale, reverse the meter's terminal connections.

When Rock Rater has been adjusted to read about ¾-scale with a known good crystal, this becomes your "average" good reading. Any crystal that fails to produce at least a ½-scale (0.5 mA) reading is suspect. Likewise, a crystal that exhibits an erratic or unstable meter reading should be considered defective. ■

MINI-MITE QRP

BY HOWARD S. PYLE, W7OE

■ QPR? An expression rapidly becoming popular in the dedicated Ham circles of low-power transmitter enthusiasts to describe flea-powered rigs . . . less than 10 watts input. And along with mini-cars, mini-skirts and the general trend to "mini" this and "mini" that, QRP Ham rigs are taking their place in the field of "Now you see it—now you don't."

Our little *Mini-Mite* really takes the cake with 15-, 20-, 40-, and 80-meter amateur CW bands instantly switchable from the front panel. The rig is adaptable to any type of antenna with no external matching units or similar gimmicks to fool with, and it provides instant choice of internal power source or external supply! In other words, *muchum en parvo,* or something like that, which, in the Italian language is supposed to mean "much in little." And all in an enclosure only 4 x 4 x 6 in. Want to hop on the QRP wagon?

Mini-Mite Autopsy. Let's play surgeon and start with the internal organs: they are as vital to *Mini-Mite* as the heart and lungs in a human. Unlike the human, however, this little jewel has four hearts; each a complete transmitter in its own right.

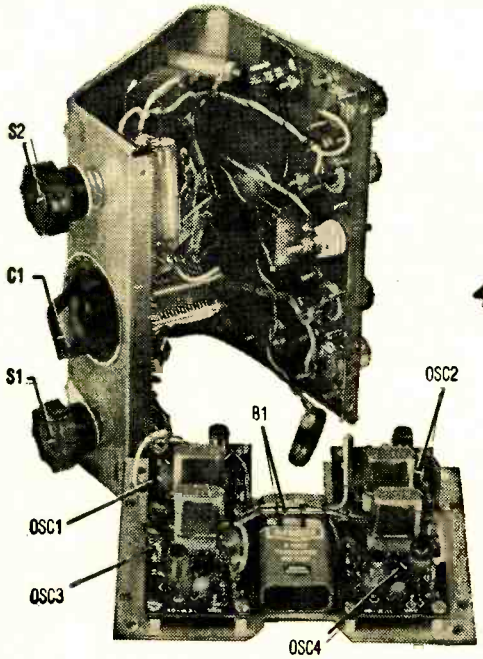
Basically, these "hearts" are the recently introduced of-

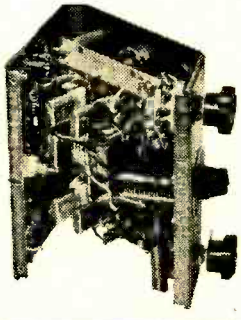
ferings of the International Crystal Manufacturing Co., and are known as the *OX Oscillator Kit*. Each is a self-contained transistor oscillator mounted on a neatly lettered printed circuit board only 1½-in. square! These are available for any frequency you want within a range of 300 to 60,000 kHz.

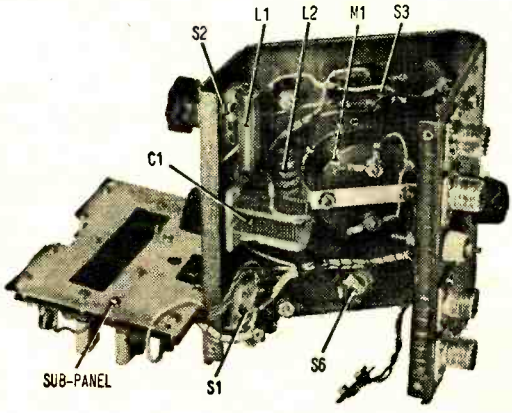
Fundamental crystals are used on all frequencies—you can use your own crystal or International's EX type—the choice is yours. Each complete oscillator kit costs but $2.35, which includes the transistor, printed circuit board and all components except the crystal. We stole a march on International as apparently these were designed solely for test oscillators with no thought of their communications possibilities.

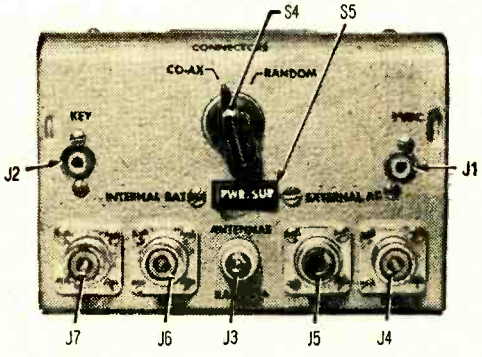
But with an input power of 1.2 watts using a 6-volt DC power source, and up to 1.8 watts with a 9-volt supply, the author has confirmed contacts of 1100 miles on 15 meters, 600 on 20 M, 300 on 40 M and 200 miles on 80 M. That's bad?

Making Mini-Mite. It will take you about twenty to thirty minutes to assemble and solder each kit from the simple instructions supplied. The four little units are then mounted on an aluminum sub-panel as shown in the photos. For those who want to duplicate the mechanical essentials of *Mini-Mite*, included is a dimensioned drawing of the sub-panel. This is really all the mechanical









A glance at schematic (above, far right) reveals that Mini-Mite actually consists of four separate oscillator assemblies (OSC1 through OSC4) powered by a single battery (B1). As photos show, oscillators and battery are mounted on sub-panel, balance of components on chassis box itself. Detail of aluminum sub-panel appears in drawing.

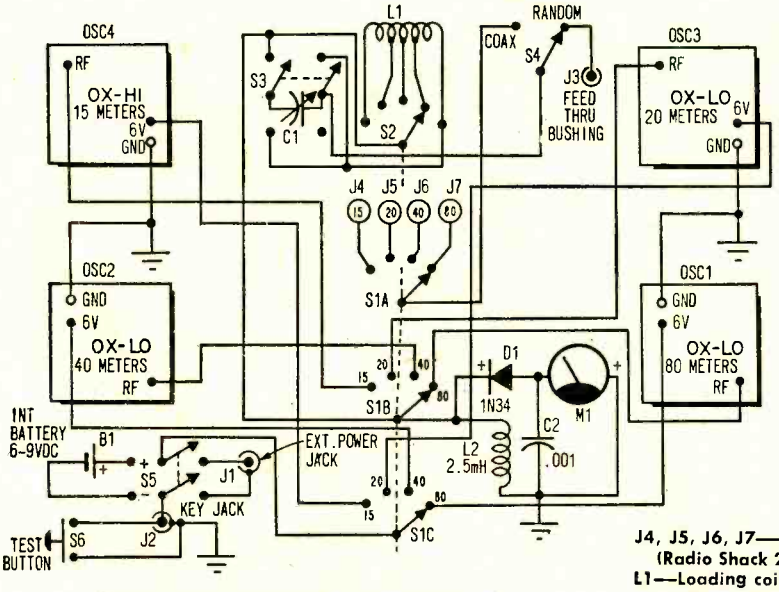
detail needed as any type of enclosure can be used and any parts of the non-critical type, such as switches, connectors, etc., that your junk-box may produce can be substituted. For these, you can easily work out your own component placement and drilling templates to match. Mounting screws and metal spacers are furnished with the oscillator kits, so no problem there.

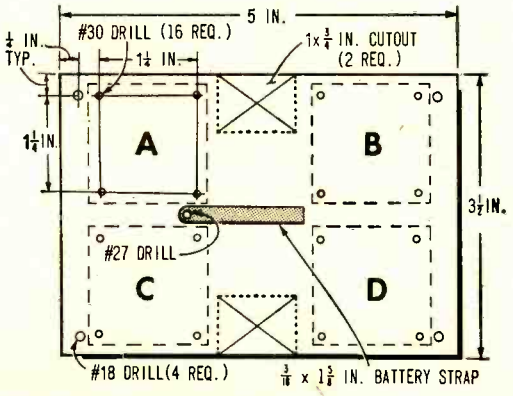
By using a sub-panel, wiring is perfectly straightforward and there's little of it as the schematic indicates. Make all the internal connections you can before securing the sub-panel to the enclosure. In the prototype, the sub-panel is mounted with four 1½-in. lengths of 8/32 threaded brass rod (most any hardware or Ham supply house carries it).

The sub-panel is spaced from the front panel with 1-in. spacers cut from ¼-in. copper tubing. An acorn nut on each end of the threaded rod holds the whole assembly firmly in place. The little 9-volt transistor battery, which serves as the internal power supply, is mounted on the sub-panel between the two pairs of oscillator boards. Incidentally, these batteries will last quite a while since current drain is only 20 mA and this, of course, is only in the "key down" condition.

The battery supply lets you take *Mini-Mite* with you on hunting, fishing and camping trips to keep contact with home base. Taking a couple of extra batteries along just to play it safe is a good idea if you're making an extended stay.

QRP Power. When using Mini-Mite at the home base, a conventional rectified AC





Schematic of Mini-Mite. Switch S1 selects any of four amateur bands—15, 20, 40, or 80 meters.

PARTS LIST

B1—9-VDC transistor battery (Eveready 216 or equiv.)
C1—100-uF variable capacitor (Lafayette 40C2885 or equiv.)
C2—.001-uF, 600-VDC capacitor
D1—1N34 diode
J1, J2—RCA-type phono jack, insulated mounting
J3—Feed-through connector, insulated (Lafayette 33C-3201 or equiv.)
J4, J5, J6, J7—75-ohm coax connector, SO-239 (Radio Shack 278-201 or equiv.)
L1—Loading coil, 72 turns #28 enameled wire on ⅜-in. form
M1—Field-strength meter (Shurite 8903Z or equiv.) (available from Shurite Meters, Box 1818, New Haven, Conn. 06508 at $4.50 postpaid)
Osc. 1, 2, 3, 4—OX oscillator kit, 3 OX-LO, 1 OX-HI (available from International Crystal, 10 N. Lee, Oklahoma City, Okla. 73102 at $2.35 ea. postpaid)
S1—3-pole, 4-throw single deck rotary switch
S2—5-position, 1-pole rotary switch (Lafayette 30C4013 or equiv.)
S3, S5—D.p.d.t. rotary or toggle switch
S4—S.p.s.t. rocker or toggle switch
S6—S.p.s.t. normally open pushbutton switch (Radio Shack 275-008 or equiv.)
Misc.—Wire, solder, 4x6x4-in. sloping-panel chassis box, decals, etc.

supply can be used to conserve the battery. Rather than build a little power box, the author used a *Radio Shack 22-023* regulated, variable-voltage transistorized DC power supply. This makes a perfect companion unit for *Mini-Mite* and will serve equally well as a power supply source for experimental transistorized equipment. This supply provides up to 20 VDC at 200 mA with exceptionally smooth control, and is more than adequate for most transistorized gear. Equipped with a meter that reads both volts and milliamperes, it makes a convenient way to check your power input instantly. Selection of either the internal battery power or the external AC source is accomplished by a d.p.d.t. rocker switch on the rear panel.

Note that *Mini-Mite* is equipped with four coax connectors and a feed-through insulator for antenna connections, all in line on the rear panel. This you can take or leave. It happens the author has four dipoles (one for each band) and preferred to leave *Mini-Mite* semi-permanently connected at the home station, hence the four coax connectors.

Any Old Antenna. The feed-through insulator provides for connection to any random length antenna for portable operation. The s.p.d.t. rotary switch in the top center of the rear panel, labelled *COAX* and *RANDOM,* permits switching any oscillator output to the feed-through insulator or to the series of coax connectors. The band selector switch on the front panel has one section which selects the appropriate coax connector for the band selected.

A second section on the band selector switch connects the positive lead from the power source to the oscillator assembly used for that band. The negative voltage is applied only when the hand key or test button is pressed; the power source, of course, remains idle at all other times. The third section on the band selector switch selects the RF output terminal on the desired oscillator and connects it to the radiating circuit.

While the oscillator functions on the fundamental of the crystal with no tuning adjustments, it does not necessarily mean that the most effective loading of the antenna will automatically result. This is particularly true when a random-length wire antenna is used in portable operation. Therefore, a means of resonating the antenna to the load will assist in getting maximum radiation characteristics. Accordingly, incorporated right in the *Mini-Mite* cabinet is an all-band L/C loading network that has proven most effective.

Not only has this L/C combination permitted resonating a random wire of reasonable length but has also proven to be of noticeable value when used with a frequency-conscious dipole or other conventional antenna.

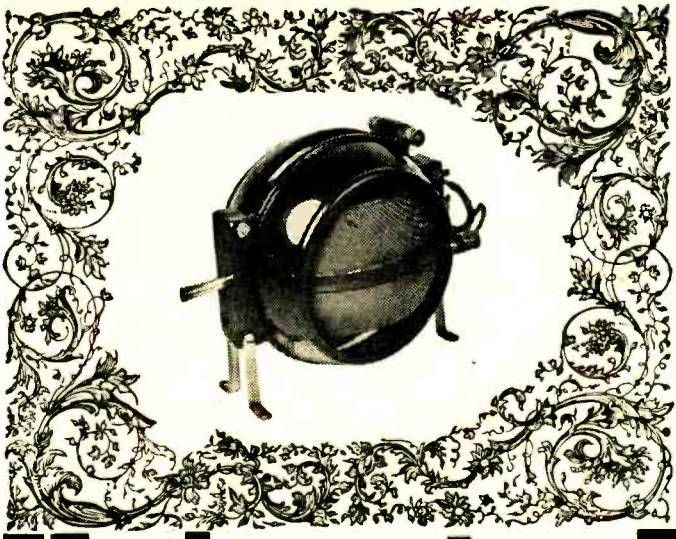
Robust Radiation. Provision is also made for switching the antenna tuning capacitor in series with the loading inductance or in parallel across it, by means of a d.p.d.t. toggle switch. The inductance is adjustable in four steps by tapping the coil and connecting the taps to a 5-point rotary switch (single pole). By choosing the proper amount of coil inductance in combination with the variable capacitor in either series or shunt connection, proper loading of the antenna circuit is easily obtained.

The coil consists of a total of 72 turns of #28 enameled wire wound on two 3/8-in. diameter forms (wooden dowels), 36 turns on each. Splitting the coil makes it possible to fit it comfortably into the available space. Since the halves of the coil are connected in series, it is in effect a single inductance. Taps were taken at approximately equal distances along the length of the winding.

The meter is a desirable asset in tuning the antenna network and a resonant condition is indicated by the highest reading. This peak will be fairly broad but will vary from about quarter to half full scale reading on the meter selected, depending on the input voltage from the power source.

The meter used is a special field strength meter made by Shurite. If not available from local supply sources, it can be ordered directly from the manufacturer (see Parts List).

From the foregoing description, it should be simple to work up a reasonable facsimile of our *Mini-Mite* and enjoy a heretofore relatively unexplored and exciting field. There's a great deal of excitement in trying for the amazing results possible with an input power considerably less than that required for a conventional radio dial lamp! We suggest that in your initial efforts in the QRP field, first establish local contacts to get the feel of mini-power. Once you've mastered the simple QRP techniques, you're ready to demonstrate what the QRP Amateur Radio Club International often use as an unofficial slogan . . . "*POWER* is no substitute for *SKILL!*" Go to it, and good DX! ■



The variometer may be gone, but it's not forgotten; here's how to make your own version of this novel device.

By Art Trauffer

Variometer Radio

■ Meet the variometer, an efficient variable-inductance commonly used in crystal and tube radios in the early '20s. The variometer opens up a new field of experimentation for modern hobbyists, although it is no stranger to old-timers in radio.

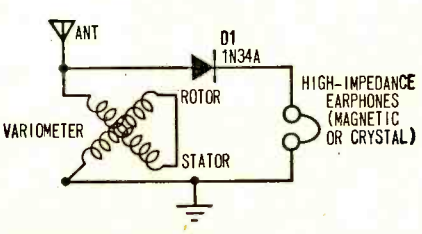
The photo shows one of the many factory-made variometers which were popular in the early '20s. It is simply a movable coil which rotates inside a stationary coil—the rotary coil and stationary coil are both wound in the same direction and are connected in series.

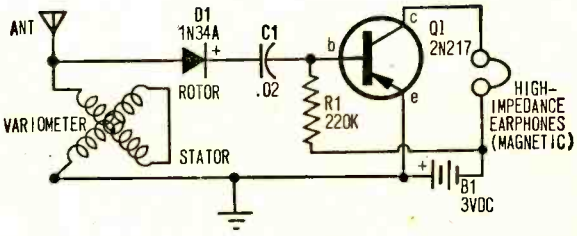
Some of the original variometers were round and molded from hard rubber or bakelite, and others were square and made of wood. Some had the stationary coil cemented to the inside surface of the outer form, and some had the stationary coil wound on the outside of the outer form as is the case with the variometer described in this article.

How It Does It. When the rotor coil and the stator coil of the variometer both carry current in the same direction, the magnetic field will be greatest and the inductance will be maximum. When the rotor coil is rotated through a half revolution so that its magnetic field opposes that of the stator coil, the resulting field will be small and the inductance minimum. Thus the inductance is continuously variable over a considerable range.

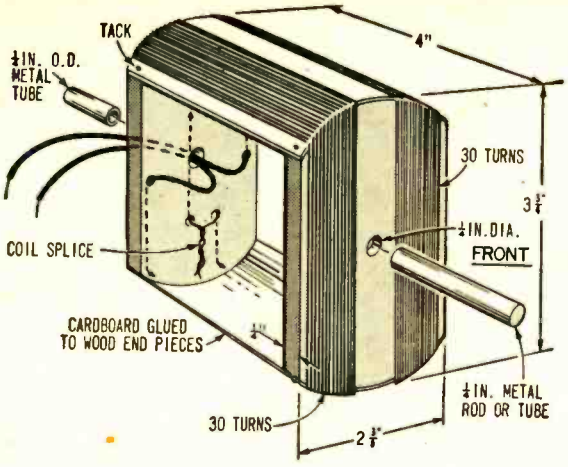
The drawings show the constructional details for the author's experimental variometer. With a little patience, it is easy to build and performs as well as the factory-made variometer.

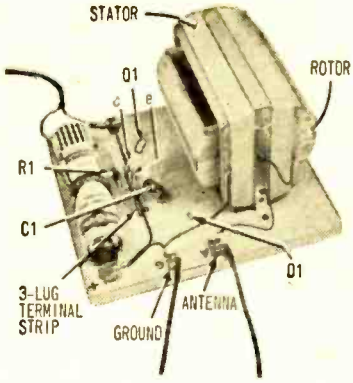
Be sure to wind the rotor and stator coils in the same direction, and connect them in *series.* *(Continued overleaf)*



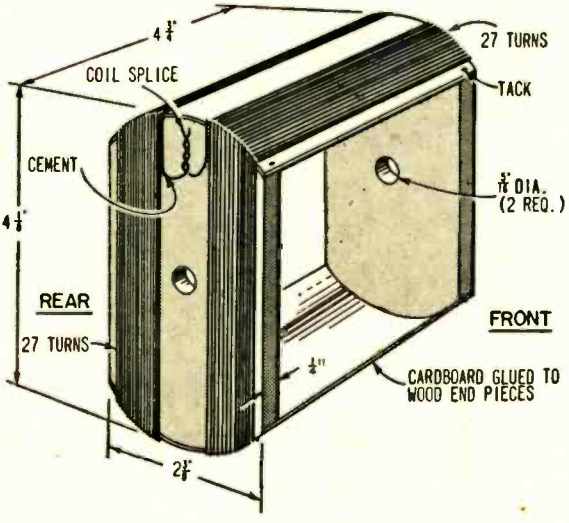


Two radio circuits in which the experimenter can use the variometer as a tuning device.





The homemade variometer rotor is shown above. The cardboard used in the curved sections should be of the poster-board variety. The stator at right is almost identical in construction but is somewhat larger. The author's transistorized experimental variometer radio is at upper right.



Rolling Your Own. The stator form consist of two wooden end pieces of the dimensions given. Cardboard is used for the curved body sections and is fastened with glue and tacks. The holes in the end pieces are made big enough to freely pass a ¼-in. rod. The stator coil is wound on the form as shown and consists of two sections of 27 turns each of #24 wire. The windings are held in place by glue, applied sparingly.

The rotor is virtually identical to the stator but is slightly smaller so that it will fit inside the stator. Construct the form to the dimensions given. Then drill the holes in the end pieces so that the ¼-in. rod or tube makes a snug fit. Wind the two sections of the rotor coil also using #24 wire, 30 turns per section. Attach flexible leads to the coil ends to allow the rotor to rotate.

Assemble the variometer by placing the rotor inside the stator and pressing the tube rotor shaft (through which the rotor leads will pass) in the one end and the tube or rod in the other. Placing fiber washers between rotor and stator will prevent the rotor winding rubbing on the stator. Pass the rotor leads through the tube and connect one rotor wire to one stator wire so the windings are in series. *(Continued on page 106)*

PARTS LIST

B1—2 size-D flashlight cells
C1—.02-uF capacitor
D1—1N34A germanium diode (or equiv.)
Q1—2N217 transistor
R1—220,000-ohm, ½-watt resistor
1—3-lug terminal strip
4—Fahnestock clips

BILL OF MATERIALS

1—¼-lb. spool #24 single-cotton-covered enameled magnet wire
1—20x2⅜x¼-in. hardwood strip (for wood end pieces)
1—¼ dia. (O.D.)x4-in. brass tube
1—⅜-in. wide metal strip for mounting angle brackets
1—¾-in. wide metal strip for making battery holder
12—Short round-head wood screws
1—8x7x¾-in. wood baseboard
Misc.—Tacks, thin cardboard, glue, hook-up wire, solder, etc.

CB BAND BUSTER

By Herb Friedman KBI9457

Break the CB sound barrier with this booming mike preamp

☐ If you think you're losing some of that precious CB power along the uncertain and sometimes sorry road leading from mike to antenna, chances are you're right! All CB transceivers have certain design characteristics built into them. Thing is, what the designers had in mind doesn't always work out when you're operating the rig.

Take this business of power, for example. Our Band-Buster is a mike preamplifier designed to make your signal top dog on the CB bands. It does this job handsomely by taking advantage of a couple of built-in transceiver characteristics which are flexible enough to permit Band-Buster to take over the reins and boost your talk power.

Two Tricks. First of all, CB transceivers are designed for *average* voice levels. The overall modulator gain is fixed so that a person speaking at an average

CB Band Buster

voice level—and at an average distance from the mike—will be able to modulate the transmitter 100%.

This is a good idea, but just who has an average voice, and what is an average mike distance? Your voice might just be somewhat weaker than average, or maybe you hold the mike 12 inches away rather than the more usual 6 inches. If this is true, your rig's modulation might never make it out of the basement.

The second factor to be considered is that nearly all modern transceivers limit modulation of the carrier to 100%. This means that even if you shout the modulation won't exceed 100% (or 90%, if that happens to be the rated maximum level).

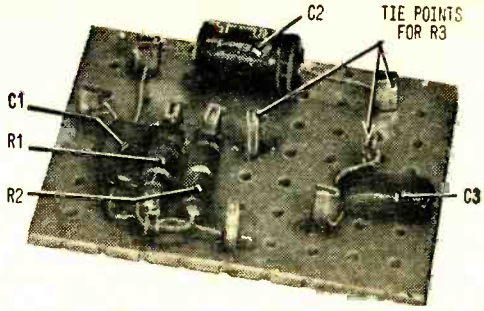
Some manufacturers make good use of this limiting feature by providing a *range boost* or DX boost circuit. This is simply additional amplification that boosts the level of modulation, while depending on the limiting feature to prevent overmodulation. In other words, more output power is obtained, but distortion is kept to a minimum.

With all this in mind, we can appreciate how the CB Band-Buster takes advantage of modern transceiver design. The mike preamplification increases your talk power to above average levels, while the built-in 100% modulation limit ensures that there will be no distortion of the transceiver output. Your voice will hit the front end with full force, but the unit's design will make sure that you don't overmodulate. Just turn up the volume and get all the advantages of a speech clipper!

FET Does It. A quick look at the schematic should convince you that your Band-Buster will do the job that you thought couldn't be done. The sock-it-to-me feature here is obviously Q1—an N-channel FET (field-effect transistor) that has a high input resistance and will therefore accept a high-impedance source like a ceramic or crystal mike.

Since the FET has an input impedance of tens of megohms, the mike's load will only be that of input resistor R1. Here R1 is 2.2 megohms, which is the usual load for a mike. However, if the mike you're using calls for a different value, R1 can be changed without affecting total performance.

Nominal gain for the Band-Buster is



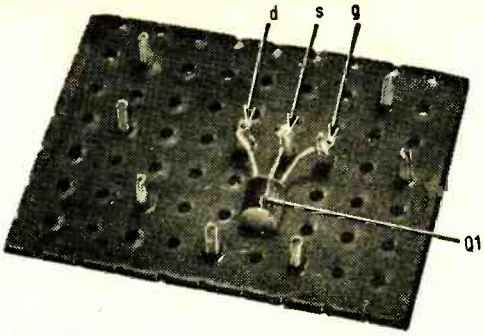
Components mount on top side of board. Capacitors C1 and C3 are flush to conserve space.

10 dB, while the frequency response is almost ruler-flat from 20 to 15,000 Hz. Even with high-output mikes, distortion is almost unmeasurable. Just make sure your transceiver's modulation is limited to 100% and you'll get all the talk power you want.

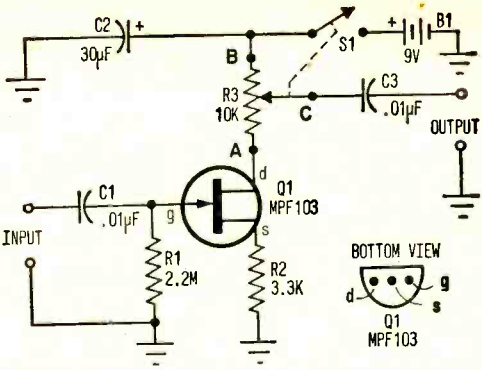
Though the preamplifier can be built into a small aluminum cabinet, it can also be installed directly in the microphone case, or even in the mike's base. Our photos show a custom installation in a good-quality CB base-station mike available from Lafayette Radio (see Parts List).

While the same installation techniques can be used with other microphones, the exact procedure will depend on the particular mike you choose. However, the perf-board assembly should be used in all instances. It's just a question of where to place the assembly and the volume control, whether it be in the microphone head or in the base.

Band-Buster's output level is set by adjusting R3—a miniature volume control with switch.



In author's model, Q1 (FET) mounts on underside of board. This side is covered with tape.



FET has high input resistance to match high-impedance mike. Value of R1 depends on mike.

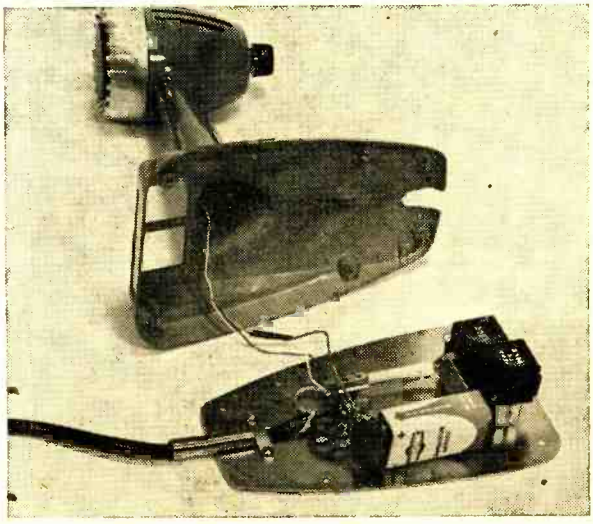
Perf Package. The Band-Buster assembly is wired on a 1¼ x 1½-in. section of perforated wiring board. Flea clips are used as tie points. To keep the assembly as small as possible, all components must be mounted flat on one side of the board. In the author's model, the FET is mounted on the *underside* with its flat side against the board. (The cover version shows Q1 mounted on the same side with other components.)

Mount and tack-solder all topside components, then install Q1 using full-length leads. To avoid heat damage, use a heat sink (such as an alligator clip) on Q1's leads when soldering. If you're going to install the Band-Buster in the mike case, volume control R3 must be the miniature type specified. A standard potentiometer and switch will probably not fit into any ordinary case.

The volume control's connecting leads are soldered to points A, B, and C in the schematic. Shielded connections should not be necessary as either a metal cabinet or the metal microphone case will do the job. However, if the mike's case is plastic and the Band-Buster is installed within, keep R3's leads as short as possible. Even then, it might be necessary to use shielded leads.

PARTS LIST FOR CB BAND-BUSTER

B1—9-V battery (Burgess 2U6 or equiv.)
C1, C3—.01-uF, 10-VDC disc capacitor
C2—30-uF, 10-VDC electrolytic capacitor
Q1—N-channel field-effect transistor (Motorola MPF103 or equiv.)
R1—2,200,000-ohm, ½-watt 10% resistor
R2—3300-ohm, ½-watt 10% resistor
R3—10,000-ohm miniature potentiometer with spst switch (Lafayette 32H7364 or equiv.)
S1—Spst switch (on R3)
Misc.—High-impedance mike (Lafayette 99H-4607 or equiv.), battery connector, perf board, flea clips (Vector T28, Lafayette 19H8302 or equiv.), solder, wire, hardware, etc.



Here, battery is mounted in base of mike. You may have to tape battery to outside of case.

The photos show how the Band-Buster was installed in the Lafayette mike. First, the front of the mike was removed and the microphone element was eased out of the case. Then the two connecting leads were unsoldered (excessive heat could ruin the element, so use a small soldering iron). Be sure to note which is the hot (insulated) lead. Finally, a ¼-in. hole was drilled in the back of the microphone case for volume control R3.

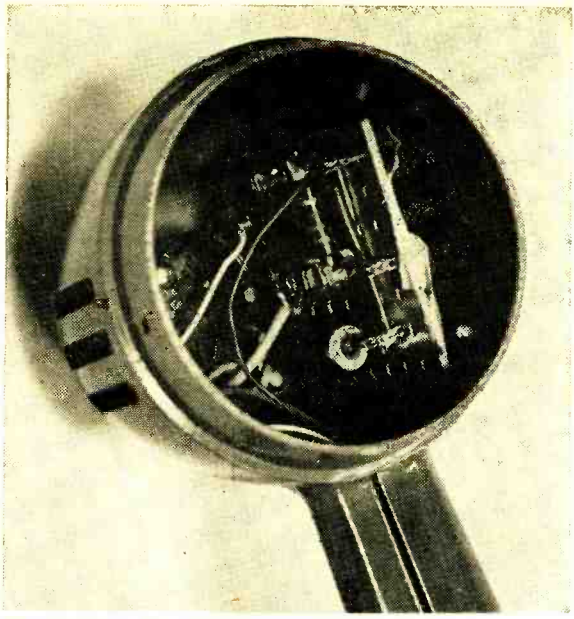
The control was then pre-wired to the perf-board assembly. The back of the perf-board (the FET side in the author's model) was covered with a layer of tape to prevent the tie points which stick through the board from shorting to the mike case. Finally, the original mike connecting leads were soldered to the Band-Buster *output* and new leads

CB Band Buster

were connected between the mike element and the preamp *input*. The entire assembly was then eased into the case.

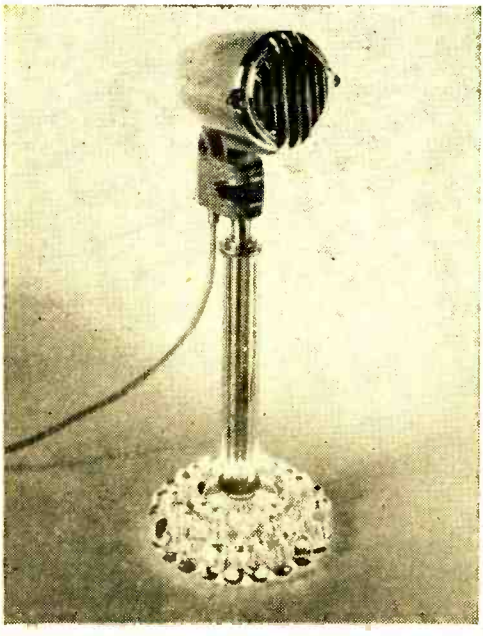
Battery in Base. The pre-wired B+ lead from S1 (on the back of R3) was fished down to the microphone base, where it was connected to battery B1's positive terminal. The battery's negative terminal was connected to the case to act as the system ground for both the mike and the switching leads. It required quite a bit of customizing to fit the battery into the base. We suggest that if the battery doesn't go into the base easily, you run the battery connection out of the unit and tape the battery to the case. You should get many months of service from your battery as the Band-Buster uses only 500 *u*A.

Best results are obtained if a modulation meter is used when you are adjusting or using the Band-Buster. First place the microphone at a comfortable working distance, then advance R3 (turning power *on*) until your rig peaks at 100% modulation. If your transceiver has built-in limiting you can give a little extra gain to obtain some of the benefits of speech clipping. Use a grease pencil, marking pen, or a piece of tape to mark the setting of R3's knob so that it can be easily reset whenever you use the mike. ■



Band-Buster assembly mounted in mike case. Only volume control R3 takes hardware.

Crystal Is as Crystal Does



■ Here's a mike stand that ought to bedazzle the shack of any lady ham or CBer. These crystal desk stands are made from discarded glass table lamps and cost next to nothing. A quick trip to a store, rummage sale, or perhaps your own attic should turn up just the lamp you need.

Remove the line cord and socket from the lamp. Since both lamp threads and mike threads are usually ⅝-27—which is standard for most pipe, the mike will screw onto the stand in a jiff. Most radio stores carry adapters and converters should you need to make any modifications.

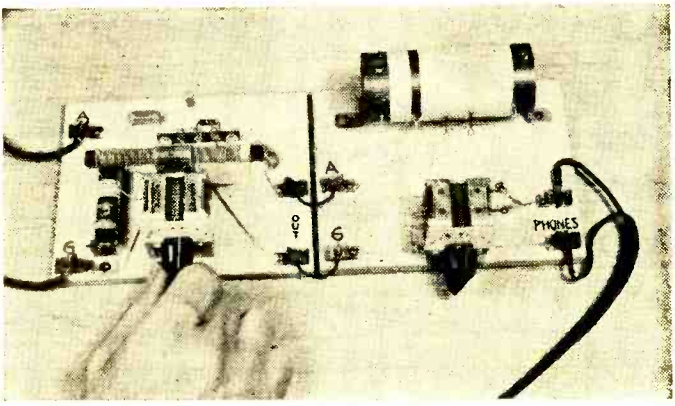
Small bits of felt or rubber cement on the bottom of the stand will protect surfaces from nasty scratches. And should your mike have connections in the mounting socket, don't panic. Just run your mike cable through the pipe in the lamp and attach the cable to the connector on top. A rubber pad under the base can be hollowed out so the cable will come out flush, natch.

—Art Trauffer ■

TRANSISTORIZED TRF AMPLIFIER STAGE

by Art Trauffer

Give your crystal detector rig half a chance to pick up DX stations by pepping up the input soup with a one transistor selective RF amp



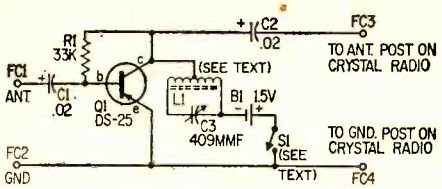
■ Want an extra boost of performance from your crystal radio? This tuned RF amplifier is the perfect new front end for your crystal set. There have been many construction projects for crystal radios, many of which include one or more stages of transistorized audio frequency amplification to boost the signal after detection. But this transistorized tuned radio-frequency amplifier stage will boost the signal before detection. This makes it possible to use a shorter antenna or just plain be ahead of the game before the signal is detected.

Matching Components. The amplifier stage was breadboarded to match the Allied Knight-Kit crystal set shown at the right of the amplifier in Fig. 1. Simplicity was the rule in building the amplifier which gives good results with only a 1.5 volt battery. The battery is connected in the circuit as shown in Fig. 2.

The components of the amplifier are mounted on a 6-inch by 4½-inch piece of ⅜-inch plywood and located as shown in Fig. 3. The 409 mmf variable capacitor, C3, is mounted using small angle brackets. Use short screws to secure the brackets to C3 so the screws don't touch the rotor plates. The ferrite core coil, L1, is mounted on the back of C3 using a strap of insulating material such as fibre, plastic or cardboard. Details of winding the coil will be given shortly.

Transistor Q1 is mounted on a 3-lug terminal strip by its own leads. Remember the heat sink when soldering the leads in place. Use long nose pliers if you don't have a heat sink. The battery can be quickly and easily mounted between two angle brackets that act as its holder. A neat trick to even get around the need for a switch to cut the battery out of the circuit is to insert a piece of insulating material between the negative end of the battery and the angle bracket (see Fig. 4).

Roll Your Own. The drawing of Fig. 5 shows you how to make the ferrite core coil,

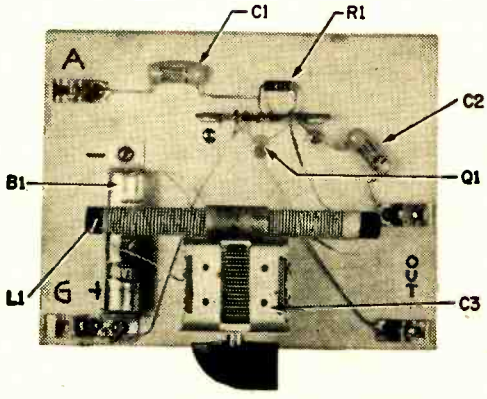


Simple? You bet it is! Only one tuned circuit is used to eliminate tracking error. Transistor Q1 is not critical. Almost any pnp unit rated at 2 mc., hfe 10 will do the job. Aside from units given in parts list, the following may be used for Q1: 2N247, 2N252, 2N274, 2N308-310, 2N315, 2N370-374, 2N384, 2N501, 2N504 and other pnp rf units.

PARTS LIST

B1—1.5-volt battery
C1, C2—.02 mf, 200-volt capacitors
C3—409 mmf variable capacitor (Allied Radio 13L524 or equiv.)
L1—Self-wound ferrite core coil (see text)
Q1—RF amplifier transistor (Delco DS-25, Lafayette 19R4220, or equiv.)
R1—33,000-ohm, ½-watt resistor
S1—See text
1—⅜" x 6" x 4½" plywood base board
Misc.—Fahnestock clips, terminal strip, pointer knob, solder lugs, Litz wire and ⅜" ferrite rod (see text), scrap sheet metal, hardware, hookup wire, solder, etc.

Estimated cost: $6.00
Estimated construction time: 2 hours



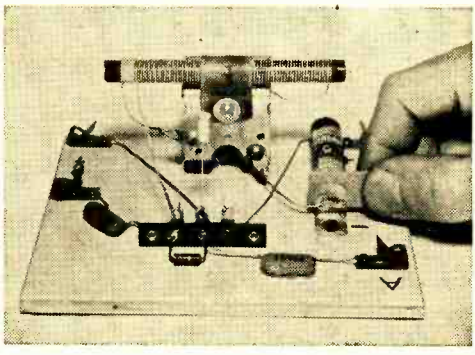


Photo above illustrates breadboard layout used by author. At left, piece of cardboard is used as switch to disconnect battery.

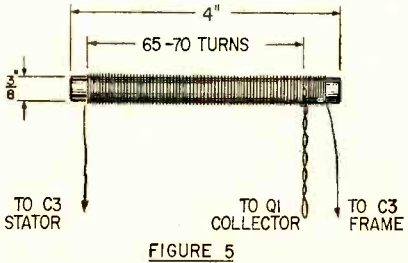


FIGURE 5

Detail drawing of fabricated coil L1. Make no substitutions and follow plan carefully.

L1. The coil works fine as an RF coil and you can also use it as an antenna coil in another project. A length of 10-38 Litz wire and a ⅜-inch diameter ferrite core was used in this project, but alternate materials can be used. For example, Belden 7-41 Litz (Lafayette 32G1485) can be wound on .33-inch ferrite core (Lafayette 32G6102). Or simply use No. 26 enameled cotton-covered magnet wire instead of Litz. Note from Fig. 5 that the first 10 turns of the coil are close-wound while the remainder of the turns are slightly spaced. Use Duco or coil cement to hold the wire at the ends of the coil and to secure the twisted tap to the collector of Q1 from the tenth turn on the coil.

Circuit Operation. The antenna input to the amplifier is through capacitor C1 which blocks DC and passes RF in case your antenna accidentally contacts a power line. Resistor R1 is the base bias resistor for transistor Q1. Coil L1 and variable capacitor C3 form the RF-tuning tank in the collector circuit of Q1. The collector is tapped close to the ground end of the coil to better match the transistor's low output impedance; this gives better selectivity. Capacitor C2 blocks DC and passes the amplified RF signal to the antenna post of your crystal radio.

As with a crystal radio, this RF amplifier works best with a good ground and a good outdoor antenna. TRF amplification can be increased a bit by using two AA batteries in series to provide 3 volts. Keep polarity in mind when wiring the circuit: the Delco DS-25 used in the project is a pnp transistor so negative terminal goes to the collector. ■

The CB Grabber

A hot little 1-transistor converter that lets you tune CB signals on any AM set—any time, anywhere!

By Charles Green, W6FFQ

■ Here is a double-fun project, the fun of building a simple solid-state converter and the fun of listening to the activity on the Citizens Band. Tabbed the CB Grabber, the one-transistor converter will work with any BC-band receiver tuned to 1550 kHz, or any quiet spot near this frequency. The converter tuning dial is tunable to cover all 23 channels for easy operation.

The BC receiver together with the CB Grabber forms a dual-conversion receiving system to separate the CB stations for better listening. No changes are required in the BC receiver, and the CB Grabber is powered with a self-contained battery.

It is easy to build the converter. Most of the resistors, capacitors and coils are mounted on the top of a perf-board box using breadboard construction.

Operation. The CB Grabber can be operated with almost any BC-band receiver that can be tuned to the converter output frequency (1550 kHz). The converter can even be connected to a battery-operated receiver for portable use.

If the BC band receiver does not have terminals for an external antenna and ground, wind 5 turns of hook-up wire around the receiver loopstick and connect the turns to J2 on the CB Grabber with either coax or twisted pair wire.

Do not make any direct connections to the "hot chassis" type of AC/DC receiver—use .005-μF ceramic disc capacitors in series

CB Grabber

with each lead to the converter to prevent electrical shock.

For best results, use a rooftop CB whip fed with coax to J1 and a good external ground. Strong signals may be received with an inside antenna. Even a TV antenna can be used with some results.

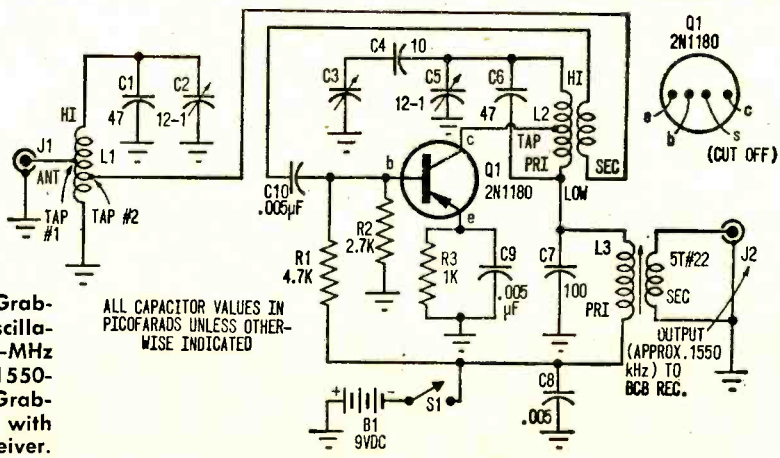
For long or continuous use, a larger external 9-volt battery can be connected to the converter in place of the internal 9-volt battery.

How It Works. CB signals are coupled from the antenna (via coax connector J1) to tap 1 on L1. Refer to the schematic diagram. Coil L1 and C1-C2 are a broadly tuned circuit centered at 27 MHz. The signals are coupled from tap 2 on L1 to the low-impedance base circuit of Q1. Transistor Q1 is also a tuned oscillator—look at its collector circuit in the schematic diagram. The oscillator circuit (L2, C3, C4, C5 and C6) is varied in frequency by tuning capacitor C3 and trimmer C5. Ceramic tubular capacitor C4, in series with C3, limits the capacitance variation possible with C3. Output frequency is set by C5 and L3.

The tuning capacitor adjusts the oscillator frequency to about 1550 kHz above the frequency of the incoming CB signals. This frequency difference is actually the first IF of this dual-conversion setup. (The second IF is that inside the broadcast receiver.) The first IF generated, in the collector circuit of Q1, is coupled (via L3 through J2) to the BC-band receiver input.

Battery B1 supplies power to the circuit—switch S1 controls it.

Construction. The converter, as shown in the illustrations, is built on a 6x3¾x2-in.



Schematic of the CB Grabber reveals simple oscillator that converts 27-MHz signals at J1 into 1550-kHz signals at J2. Grabber must be used with a broadcast-band receiver.

PARTS LIST FOR THE CB GRABBER

B1—9-volt battery (see text)
C1, C6—47-pF, ceramic disc capacitor, NPO
C2, C5—1-12 pF, mica trimmer capacitor (ARCO 420 or equiv.)
C3—1-15 pF variable capacitor, modified—one rotor blade removed (E. F. Johnson 149-1)
C4—10-pF ceramic tubular capacitor, NPO
C7—100-pF ceramic disc capacitor, NPO
C8, C9, C10—.005-uF ceramic disc capacitor
J1, J2—Phono jacks, one-hole mounting (Radio Shack 274-346 or equiv.)
L1—10 turns AWG 18 solid wire, ½-in. dia., spaced to 1-in., tapped at 1 turn and 3 turns from ground end (see drawing and text)
L2—Primary, 9 turns AWG 18 solid wire, ½-in. dia., spaced to 1 in., tapped 3¼ turns from low end (see drawing and text); secondary, 2 turns AWG 18 solid wire, ½-in. dia., spaced to 3/10-in. and covered with plastic sleeving (positioned ⅛-in. from L2 primary cold end (see text and drawing).
L3—Adjustable antenna coil (J. W. Miller 6300), modified, 5 turns AWG 22 hook-up wire wound as secondary winding (see text and drawing)
Q1—2N1180 transistor (RCA)
R1—4700-ohm, ½-watt resistor
R2—2700-ohm, ½-watt resistor
R3—1000-ohm, ½-watt resistor
S1—S.p.s.t. toggle switch (Radio Shack 275-602 or equiv.)
1—6 x 3¾ x 2-in. phenolic box and perf-board (Radio Shack 270-097 or equiv.)
Misc.—Push-in terminals for perf-board, aluminum for brackets, wire, solder, battery connector, machine screws and nuts, etc.

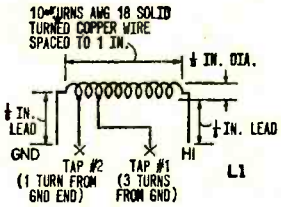
phenolic box with a perforated phenolic board top. Most of the resistors, capacitors and coils are mounted on the perf-board using push-in terminals. The tuning capacitor is mounted at the front of the box and input and output connectors J1 and J2 are mounted at the rear. A few easy-to-make aluminum brackets are used. The 9-volt battery, B1, is mounted inside the box.

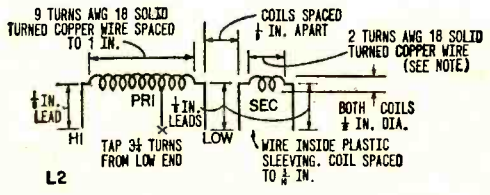
To start construction, remove the perf-board panel from the box and set it aside. Drill a ½-in. hole through the center of one side of the phenolic box. This hole is for S1. When mounting S1 use an internal-tooth lock washer between the switch body and the phenolic case. Using the internal-tooth lock washer this way prevents the switch from turning easily after the nut has been tightened (not too tight) on the shaft.

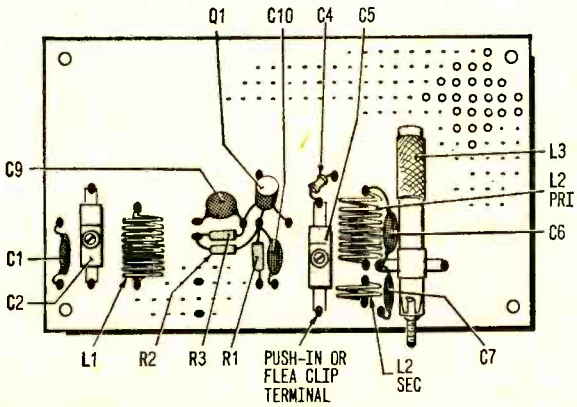
Any 9-volt battery that will fit into the box can be used. Here a NEDA 1604 was mounted to the rear of the box with the leads connected to S1 and brought out through a hole in the rear of the box. The larger the battery, the longer it will last (the 8.4-volt mercury batteries will last longer than carbon-zinc types). Make sure the battery is mounted securely and that there is at least ½-in. clearance to the bottom of the perf-board panel.

Watch Where You Put It! The sizes of the mounting brackets for the tuning capacitor and jacks are not critical, but their placement is critical. The tuning capacitor C3 should be mounted so that its bottom is approximately ¼-in. above the perf-board. The jacks J1 and J2 should be mounted approximately ¼-in. above the perf-board also. Position the tuning capacitor and jack brackets exactly as shown in the photo. The brackets are mounted with two screws and nuts for each bracket in holes drilled in the box front and rear sides. For easier tuning, remove one plate from the rotor of tuning capacitor C3.

Drawings at left and below give full details for winding coils L1 and L2; see photo on next page for placement of secondary winding on L3. Location of components on perf-board can also be seen on this photo as well as on the pictorial below.







Lay out and mount parts, soldering them to push-in (flea-clip) terminals, as shown in the illustration. Parts placement is critical because of the high operating frequency of the converter.

Before mounting Q1, locate and cut off the shield lead, as shown in the base diagram for the transistor on the schematic diagram. Wire the components as shown in the schematic diagram and photos. Do not connect the leads from the battery and S1 to the circuit wiring until all of the other wiring is completed and checked. Keep the wiring straight and as short as possible. Connect the taps on the coils as shown in the diagrams. Use stranded wire with a little slack bent in for the connections to C3 and the push-in terminal. This minimizes any microphonics while tuning C3. Make sure that the L2 secondary turns are wound in the same direction as the L2 primary turns.

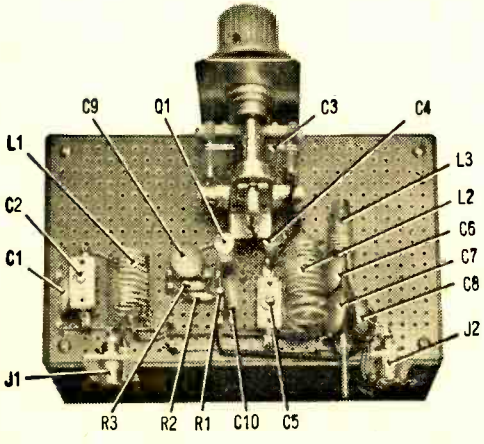
Alignment. Tune your BC-band receiver to a quiet spot on the dial as near to 1550 kHz as possible. Don't tune too close to any strong signal, as this will interfere with the operation of the CB Grabber—especially if

the BC-band receiver does not have a shielded input with antenna and ground connections.

Connect a signal generator to J1 and connect the output from J2 to the BC-band receiver (see earlier text covering *Operation*). Adjust the signal generator output frequency (about 1550 kHz) for maximum output from the BC-band receiver. Now set S1 to ON and adjust the tuning slug in L3 for maximum tone output from the BC-band receiver.

Rotate the tuning capacitor almost to its full capacitance position. Set the signal generator output frequency to 27 MHz. Now alternately adjust trimmer capacitors C2 and C5 until you hear the 27-MHz tone-modulated signal from the BC-band receiver. Adjust the trimmers for maximum tone output. If necessary push together or stretch apart the turns of coil L1 and the primary of L2.

Make sure the oscillator is operating at a frequency *above* the incoming CB frequency. Tune the signal generator for the IF image signal—it should be near to the 30-MHz calibration on the signal generator. If an image frequency cannot be found tune the signal generator to about 25.5 MHz. Should the signal be heard at this point you must retune trimmer C5. Readjust C5, turning the adjusting screw to increase the oscillator frequency—readjust the signal generator to check the frequency of the oscillator in the CB converter.



Here's the completed CB Grabber, all hooked up and rarin' to go. Needed: an antenna into jack J1, a lead to a BCB set from jack J2.

CB CHANNELS AND FREQUENCIES

Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	26.965	13	27.115
2	26.975	14	27.125
3	26.985	15	27.135
4	27.005	16	27.155
5	27.015	17	27.165
6	27.025	18	27.175
7	27.035	19	27.185
8	27.055	20	27.205
9	27.065	21	27.215
10	27.075	22	27.225
11	27.085	23	27.255
12	27.105		

For those willing to beg, borrow, or buy an accurate RF signal generator, here are exact frequencies in MHz for all the 23 CB channels.

After adjustment with the signal generator, connect an antenna to J1 and loosely couple the signal generator to the converter by connecting a lead from the generator output alongside the coil L1. Set the tuning capacitor C3 to its full capacitance position and adjust the signal generator to 26.965 MHz. Tune C3 slightly for the signal, if necessary, then adjust the signal generator to 27.255 MHz and tune C3 to near minimum capacitance until you hear the signal. If you cannot spread the CB band out like this, increase the value of C4.

An uncalibrated dial was used for the CB Grabber, but a cardboard calibrated dial can be used with the channels indicated. You can style the dial or the entire CB Grabber to suit your needs.

No Sig Gen? If you do not have a signal generator, connect an antenna to J1 and vary C2 and C6 for loudest signals in the CB frequencies. As a starter you can use a CB handie-talkie. Have someone hold down the *Transmit* switch while you make adjustments. Move the transceiver further and further away as you make the adjustments. Have your helper hold the *Transmit* switch down for 10 or 15 seconds then wait several minutes before repeating adjustments. This gives others a chance to make use of the frequencies. After your helper has moved 20 or 30 feet away from the converter and you can still hear the transmissions loud and clear you'll have to rely on CBers' broadcasts for a signal. This may be a tedious process since these signals are on and off. But a signal generator is best. ■

NO-TICKET RIG

Here's 4 bucks worth of transmitter that says you can get on the air, now!

By Steve Daniels, WB2G1F

□ Are you just itching to key that rig? Most Novices are. Trouble is, most people who are dying to get on the air need a little bit more code practice before they can take the exam and grab their ticket.

The No-Ticket Rig is designed with precisely this in mind. And while you won't DX (legally) any further than your front porch, you will have an AM transmitter that can pop the *dihs* and *dahs* into your portable radio with no trouble at all. In fact, you will be amazed at how loud and clear the signals are. A more pleasant way to bone up on theory simply ain't to be found.

Circuit Operation. Transistor Q1, resistor R1, and audio transformer T1 comprise an oscillator circuit that produces a constant audio tone. The base of Q1 is forward biased through R1, while the emitter is forward biased through the secondary of T1; as a result, the transistor conducts heavily.

When the transformer's core is saturated, current flow stops, and the transistor is cut off when the magnetic field in the core reverses. This cycle repeats itself at a rate determined by T1, Q1, and R1.

The audio signal from T1 is injected into the RF stage through the emitter of Q2, and resistor R2 which also supplies the base bias for Q2. This RF oscillator is similar to the audio stage except that an autotransformer is used rather than a coil having two separate windings. The lower half of L1 augments the forward bias to Q2.

The modulated RF carrier appears at the collector of Q2 where it is coupled to a long-wire antenna. The signal can be picked up by any nearby AM radio.

Construction. A 1¾-in. square chip of perf board should provide enough space for

all components. The adjustable antenna coil (loopstick) is mounted on one side of the case. You can use a larger board should things be too cramped, but all leads must be kept as *short* as possible.

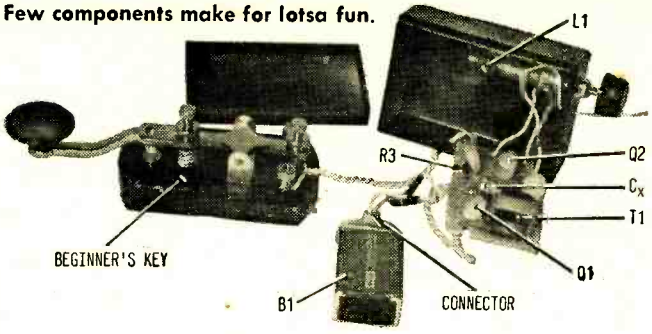
Wire the RF stage (Q2) first and bring out three leads for the loopstick. You will have to trim these to size later on. Then wire the audio oscillator, leaving an inch or so between L1's windings and T1. The core of the driver transformer may become over-saturated if these components are too close together.

Note that transistors Q1 and Q2 are not critical and that substitutes are available (see Parts List). Remember that the value of R2 (and perhaps R1) may require adjusting when a substitution is made.

When all the parts are mounted and wired, your key should be connected in series with the battery connector; it operates as a switch to bring power into the circuit. That nice twisted pair of leads in the author's model was obtained by securing two hookup wires in a vise and attaching the remaining leads to an electric drill. Turn on the drill for a few seconds and you have a cable.

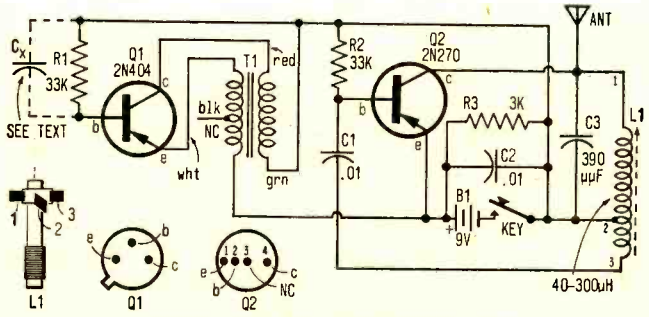
To mount the antenna coil, start by drilling a ¼-in. hole and then ream it out until the metal collar snaps snugly in place when the coil is pushed in. Make sure that the perf board, loopstick, and battery fit easily into the case. Connections should be as rugged as possible.

Few components make for lotsa fun.



Adjustment. With the battery connected (for better voltage regulation and longer life, a mercury battery can be used), attach a long-wire antenna (between 3 to 6 ft) to terminal 1 of the loopstick and close the case. Screw your key shut (for a constant tone) and tune across the BC band until you pick up your rig's signal. Adjust the slug of L1 to get the tone on a quiet part of the band. There's no point in trying to copy through QRM.

If the audio tone is too low, add C_x to the circuit as shown. Any value between .01 to .02 *u*F should do the trick. ■



PARTS LIST FOR NO-TICKET RIG

B1—9-V battery (Burgess 2U6 or equiv.)—see text
C1, C2—.01-uF disc capacitor
C3—390-pF disc capacitor
Cx—See text
L1—40-300 uH, miniature BCB antenna coil (Lafayette 34T8749 or equiv.)
Q1—Pnp germanium transistor (RCA, GE 2N-404; HEP-739 or equiv.)
Q2—Pnp germanium transistor (RCA 2N270; HEP-632 or equiv.)
R1, R2—33,000-ohm, ½-watt 5% resistor
R3—3000-ohm, ¼-watt 5% resistor
T1—10,000-ohm pri., 2000-ohm (CT) sec., miniature audio transformer (Lafayette 99-T6126 or equiv.)
1—3¼x2⅛x1⅛-in. utility box (Lafayette 99T8077 or equiv.)

Misc.—Telegraph key (Lafayette 99T2554 or equiv.), battery connector (Cinch-Jones 5D, Allied 18C5184; Lafayette 99T6287 or equiv.), perf board, push-in terminals, knob, wire, hardware, solder, etc.

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Metallurgical Eng'r'g Tech.
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Tool Engineering Tech.
Welding Engineering Tech.
Welding Process

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Math and Mechanics for Engineering Technicians
Math and Physics for Engineering Technicians
Modern Elementary Statistics

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Aircraft and Power Plant Mechanic
Hydraulic and Pneumatic Power
Industrial Engineering
Industrial Eng'r'g Tech.
Industrial Instrumentation
Machine Design
Quality Control
Safety Engineering Tech.
Tool Design
Vibration Analysis and Control

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Natural Gas Production and Transmission
Oil Well Technology
Petroleum Production Operator
Petroleum Production Engineering Technology
Petroleum Refinery Oper.

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Plastics Technician

PLUMBING, HEATING AND AIR CONDITIONING
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Air Conditioning Maint.
Domestic Heating with Gas and Oil
Heating
Heating & Air Conditioning with Drawing
Industrial Air Conditioning
Pipe Fitting Plumbing
Plumbing and Heating
Plumbing & Heating Est.
Practical Plumbing
Refrigeration and Air Conditioning Servicing

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Paper Machine Operator
Paper Making Pulp Making
Pulp & Paper Eng'r'g Tech.

SECRETARIAL
Clerk-Typist Commercial
Secretary, Engineering
Sec'y, Legal Sec'y, Medical
Secretary, Professional
Shorthand Stenographic
Typewriting

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Industrial Building Eng'r
Power Plant Engineering
Stationary Diesel Engines
Stationary Fireman
Stationary Steam Eng'r'g

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Textile Mill Supervision

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Traffic Management

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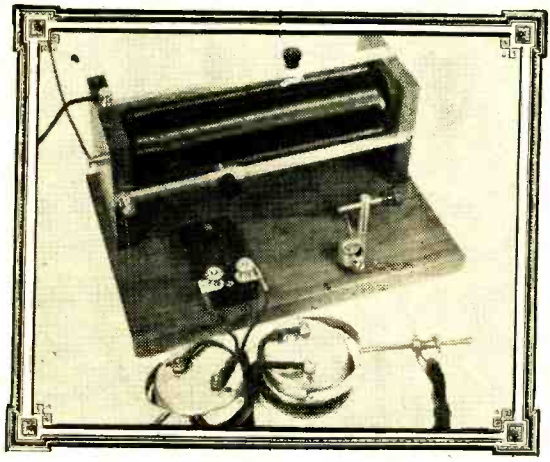
GENUINE

Wireless Receiving Apparatus

By Art Trauffer



- *DUAL-SLIDE TUNING CONTROL*
- *FULLY ADJUSTABLE CATSWHISKER*
- *SUPER-SENSITIVE CRYSTAL*

■ Lots of nostalgia and a little elbow grease are all that's needed to build this replica of a genuine "Wireless Receiving Apparatus" of the early days. Though much used in the spark gap transmitter days for receiving code, this type of receiver is still a good performer for broadcast reception in areas where a great deal of selectivity is not required. And, you'll have fun "tickling the galena" for a sensitive spot!

The historic slide-coil tuning method provides continuous variations in inductance without the use of coil taps or variable capacitors. The "catwhisker and galena" detector is styled after the famous 50¢ detector sold by Hugo Gernsback's company (Electro Importing Co.) 50 years ago. The phone condenser is a wood replica of the famous Murdock No. 358 Receiving Condenser, now a rare collector's item.

Two-Slide Tuning Coil. The drawings and photos show the details for the 2-slide tuning coil. The author's coil form was a 7¾-in. long piece of 2½-in. OD plastic rolling pin covered with black "Contact" adhesive plastic material—but you may find a Bakelite or fiber tube that size.

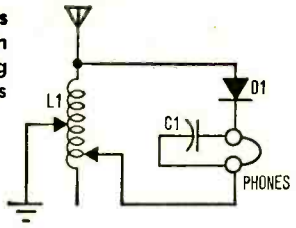
Enameled copper wire (#22) is used for winding the coil, then the enamel is carefully sanded off with fine sandpaper along the slider paths. (In the old days, they used green silk-covered copper wire for tuning coils, but since you may not be able to find this any more, white cotton-covered wire dyed green could be used. If this route is taken, be sure to give the winding a coat of shellac before sanding off the cotton insulation for the slider paths.) Also, make the sliders smooth so they don't cut grooves in the wire of the coil.

Crystal Detector. Check the drawings and photo for details on making the crystal detector. For the crystal holder, the author used an electrical fixture known as a ⅝- to ¼-adapter having a knurled outer surface, but you can use any brass cup of similar size, or turn one on a metal lathe.

When mounting the cup on the wood baseboard, use a screw the right length so you can put a compression spring between the cup and baseboard—this allows the cup to be revolved one full turn. If you make your own cup, drill the bottom mounting hole a little off-center so the cup revolves on an eccentric.

The author used #26 brass wire for the

Wire up your old-time wireless receiving apparatus as shown in schematic. Parts in this rig aren't critical and substitutions can be made as required.



MATERIALS LIST FOR RECEIVING APPARATUS

1—9 1/4 x 6 1/2 x 1/2-in. hardwood for baseboard

MATERIALS FOR TUNING COIL

2—3 1/2 x 3 x 1/2-in. hardwood for coil end pieces
1—2 1/2 OD by 7 3/4-in. long coil form (plastic, fiber, cardboard)
1—Spool #22 enameled copper wire
2—7/32-in. sq. by 8 3/4-in. long brass tubes for slider tracks
1—1/4-in. sq. brass tube for sliders
1—4-in. long by 3 1/8-in. wide by 1/64-in. thick spring brass for sliders
2—8/32 x 1/4-in. rh brass machine screws for sliders
2—Knobs for sliders
2—1/4-in. thick compoboard disc (outside disc dia. to equal inside dia. of coil form)
2—8/32 x 1-in. rh brass machine screws with hex nuts and ornamental nuts to fit
2—1/2-in. long rh steel wood screws
1—8/32 x 1 1/4-in. rh brass machine screw with hex nut and ornamental screw
1—5/8-in. long rh steel wood screw
4—1-in. long fh steel wood screws

MATERIALS FOR REPLICA OF MURDOCK NO. 358 PHONE CONDENSER

1—2 5/8 x 1 1/2 x 1/2-in. hardwood block
2—8/32 x 1-in. rh brass machine screws with washers, hex nuts and ornamental nuts to fit
2—7/8-in. long fh steel wood screws

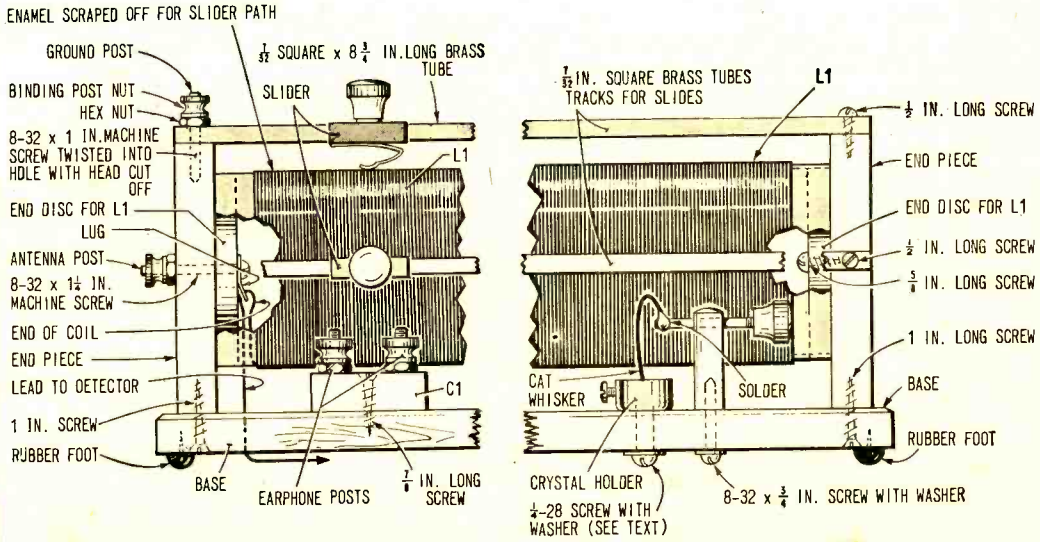
MATERIALS FOR CRYSTAL DETECTOR

1—1 1/4 x 3/8-in. dia. brass rod
1—1 1/2 x 1/8-in. dia. brass rod
1—Knob to fit 6/32 threads on catwhisker holder
1—2-in. length of small gauge brass wire for catwhisker
1—8/32 x 3/4-in. rh brass machine screw
1—5/8 to 1/4 adapter for electrical fixtures (see illus. and text)
1—6-32 x 3/8-in. rh brass screw
1—1/4-28 by about 3/4-in. rh brass machine screw (see text)
4—Small rubber tack bumpers for bottom of baseboard

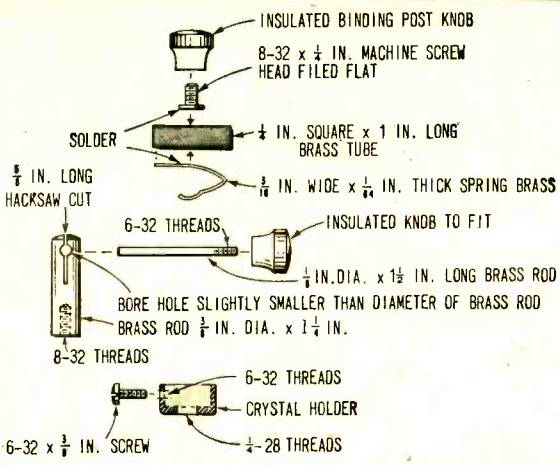
CIRCUIT COMPONENTS

C1—.0003-uF capacitor
D1—Mounted galena or silicon crystal (Available from Modern Radio Labs., 12041 Sheridan Lane, Garden Grove, Calif. 92640 at 75¢ ea., postpaid.)
Misc.—Hookup wire, solder, shellac or varnish, etc.

NOTE: rh is round head, fh is flat head.



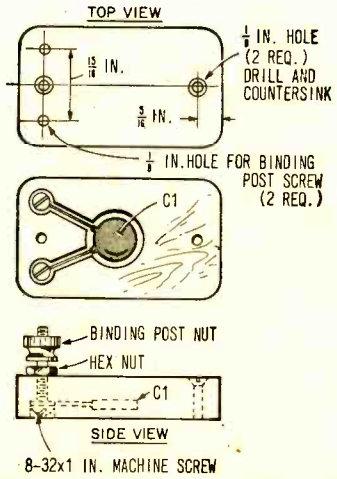
Assemble the finished coil, sliders, crystal, and condenser following detail drawing above.



Construction of sliders is shown at top. Below are details for making adjustable catwhisker assembly. Catwhisker wire is soldered to end of eighth-inch rod after rod is mounted in holder. Here, too, variations can be made as required.

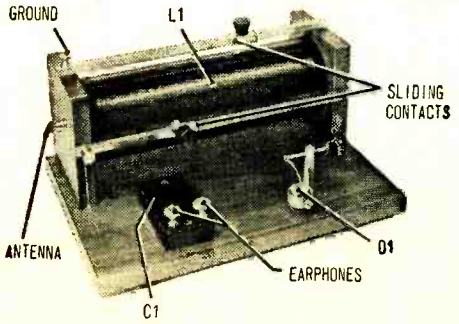
catwhisker, but steel, phosphor bronze, and tungsten wires were also used in the old days. The business end of the catwhisker wire should be pointed with a file. For the detector, you can use a mounted galena or silicon crystal.

Phone Condenser. Next, make the wood replica of the historic Murdock No. 358 Receiving Condenser used across the earphones. The wood block is gouged out on the under side and a small .0003-*u*F ceramic disc capacitor is inserted and wired to the binding posts, as shown. Actually, this phone capacitor does very little good and can be left out if desired, in which case simply use the wood block as a nostalgic dummy to connect the earphones to.



Replica of Murdock phone condenser is made from a wood block drilled to hold a small disc capacitor and phone binding posts. After block has been cut out, drilled, and sanded, paint it flat black for antique appearance.

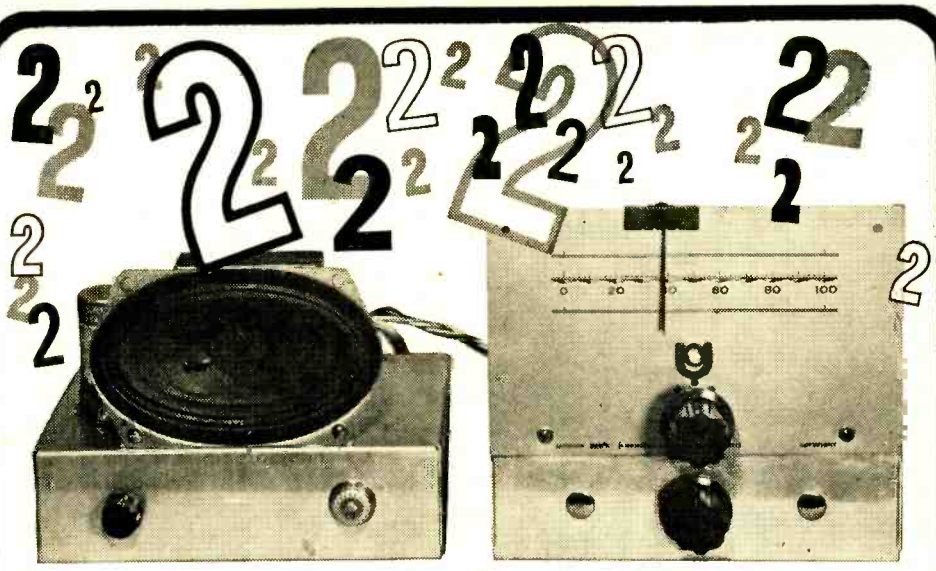
Hooking It Up. Wire the unit as shown in the schematic diagram. To make a neat job, most of the wiring is done underneath the baseboard. The wire lead from the "antenna" post and the start of the coil go through the baseboard via a small hole, as does the lead from one of the slides.



Completed receiving apparatus is good performer when outdoor antenna and ground are connected. It looks pretty snazzy, too.

If possible, use a long outdoor antenna, a cold water pipe ground, and a pair of sensitive high-impedance magnetic earphones (or crystal phones) for best results. The clips shown holding the earphone cord tips to the phone condenser binding posts is another old Murdock trick. Similar clips can readily be made from a couple of strips of light sheet-metal.

The finished unit works quite well and makes a decorative showpiece as well. And for the old-timers in the crowd, this one should bring back many fond remembrances. ■



Build TWOFER-FLEX

Here's a two-for-one BCB project! In addition to trying your hand with a reflex circuit, you wind up with a universal B-plus power supply.

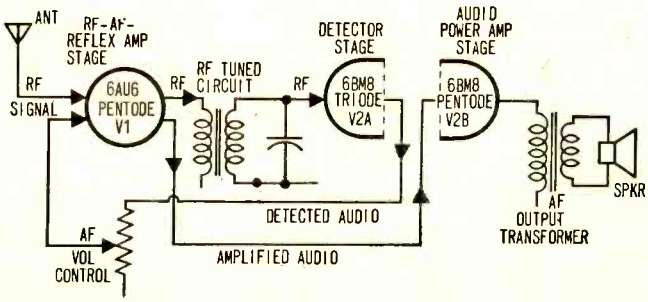
by Charles Green, W6FFQ

☐ Everyone is interested in getting something for nothing. How would you, as an experimenter, like to work with a circuit that gives the performance of four tubes but uses only two? It's easy if you use a reflex circuit, which was popular in the early days of radio when vacuum tubes and components were much more costly than they are now. Experimenting with reflex circuits is still interesting. By constructing our *Twofer-Flex* you can determine first hand how to achieve efficient circuits with fewer components.

Two for One. A tube can simultaneously amplify two different frequencies, such as RF and AF, if proper filtering is used. In this way we make one tube do the work of two.

The *Twofer-Flex* uses the reflex principle in a two-tube broadcast band receiver.

(Continued overleaf)



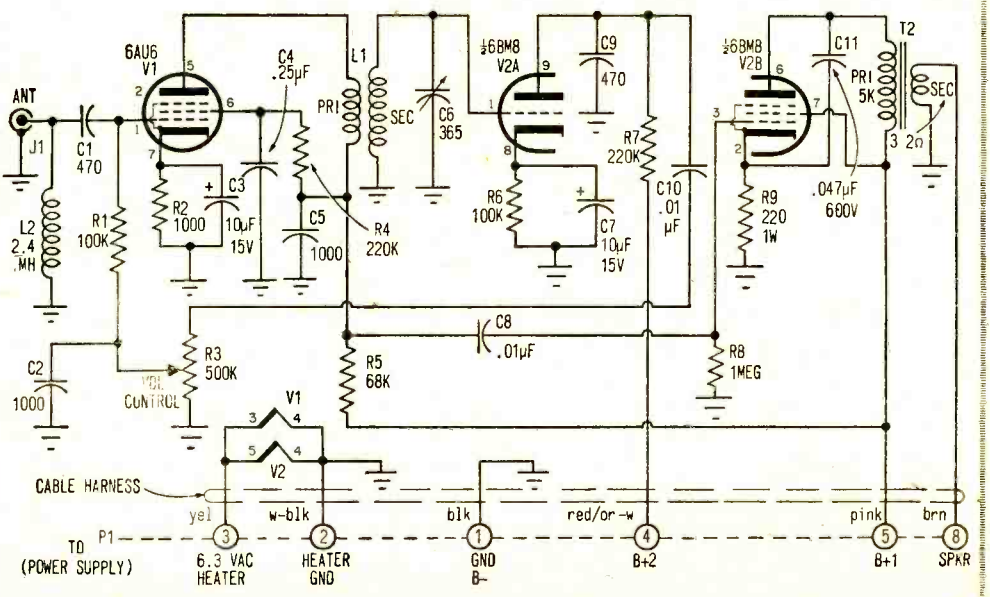
Block diagram showing signal flow and multiple function of tubes in reflex circuit. First tube serves both as an RF and then as an AF amplifier. Second tube serves as detector and output.

TWOFER-FLEX

By referring to the block diagram, you can see that a pentode (V1) acts both as an untuned RF amplifier and as an AF amplifier. The triode half (V2A) of the 6BM8 tube serves as a plate detector and the pentode half (V2B) of this tube is the AF power amplifier, which delivers sufficient power to drive the speaker.

Construction. We built the *Twofer-Flex* on two identical chassis, one containing the power supply and the other containing the RF breadboard. The power supply employs a conventional half-wave circuit, using a silicon diode and RC filtering. In addition to supplying high DC plate voltages, it also furnishes the 6.3 VAC for the tube heaters. Note that the speaker is mounted on the power-supply chassis.

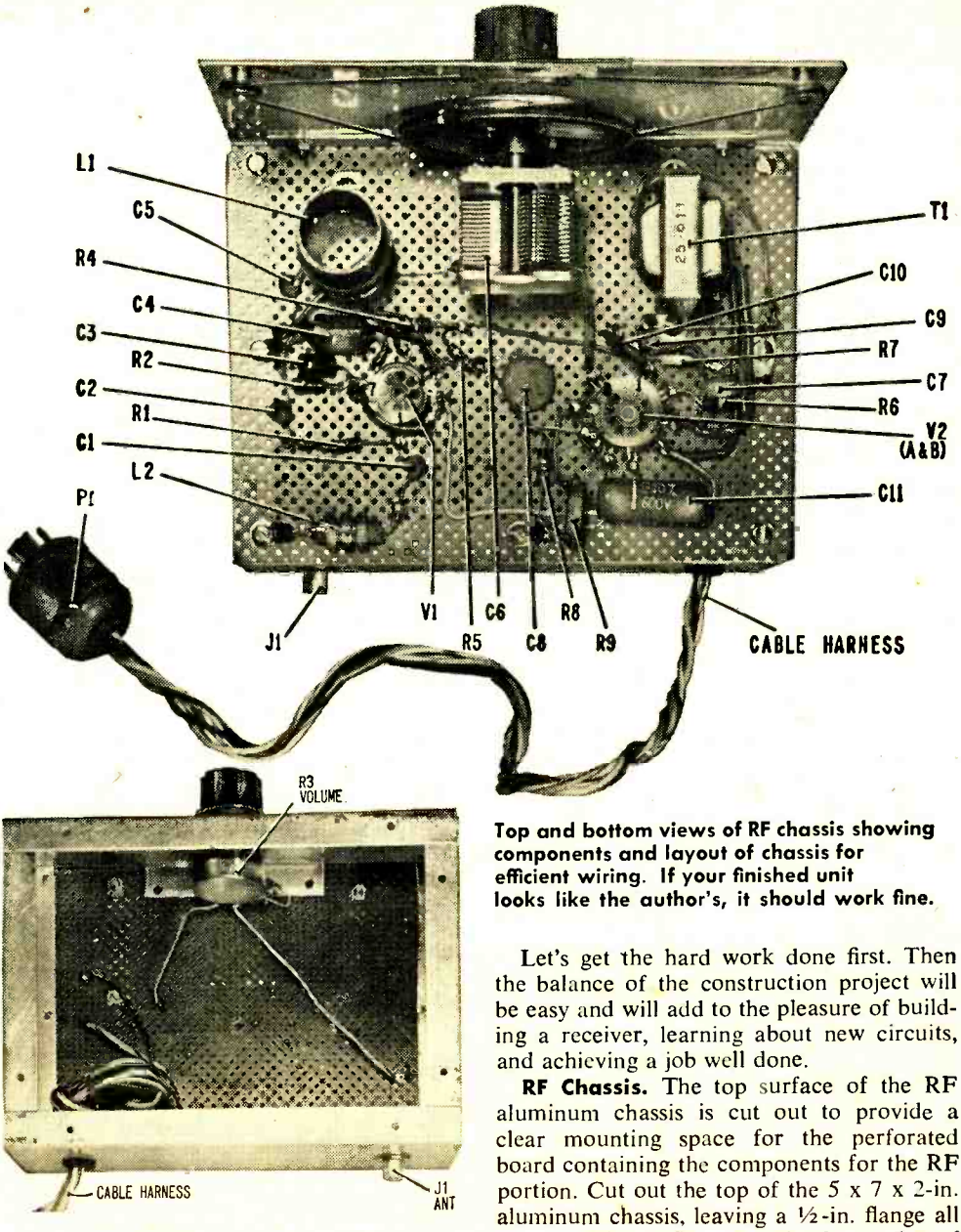
The RF breadboard is constructed on a standard perforated board employing push-in terminals to mount the components to the



PARTS LIST FOR TWOFER-FLEX RF BREADBOARD

C1, C9—470-pF, 1000-V ceramic disc capacitor
C2, C5—1000-pF, 100-V ceramic disc capacitor
C3, C7—10-uF, 15-V electrolytic capacitor
C4—.25-uF, 200-V paper capacitor
C6—365-pF variable capacitor (J.W. Miller 2111 or equiv.)
C8, C10—.01-uF, 1000-V ceramic disc capacitor
C11—.47-uF, 600-V paper capacitor
J1—Phono jack (Switchcraft 3501F jack or equiv.)
P1—Octal plug with cable connector shell (Amphenol 78R58 or equiv.)
L2—2.4-mH RF choke (J.W. Miller 4666 or equiv.)
R1, R6—100,000-ohm, ½-watt resistor
R2—1000-ohm, ½-watt resistor
R3—500,000-ohm audio taper potentiometer (Mallory U-48-1 or equiv.)
R4, R7—220,000-ohm, ½-watt resistor
R5—68,000-ohm, ½-watt resistor
R8—1-megohm ½-watt resistor
R9—220-ohm, 1-watt resistor
L1—Broadcast band RF coil (J.W. Miller 20RF or equiv.)
T2—Output transformer, 5000-ohm pri. to 3.2-ohm sec. (Allied 54C2064 or equiv.)
V1—6AU6 tube
V2—6BM8 tube
1—7 x 4¼-in. slide rule dial (J.W. Miller SL-16 or equiv.)
1—7-pin miniature printed circuit socket (Lafayette 33T8712 or equiv.)
1—9-pin miniature printed circuit socket (Lafayette 33T8713 or equiv.)
2—Aluminum chassis, 5 x 7 x 2-in. (Bud AC-402 or equiv.)
1—5 x 7-in. bottom plate for power supply chassis (Bud BPA1589 or equiv.)

Misc.—Push-in terminals, knobs, hook-up wire, hardware, solder, etc.



Top and bottom views of RF chassis showing components and layout of chassis for efficient wiring. If your finished unit looks like the author's, it should work fine.

board and to make the circuit connections to them. The full chassis width slide-rule dial, which is mounted on the front of the aluminum chassis base, serves both as a front panel and as an RF shield. Power for the RF breadboard as well as the AF from the output stage of the receiver is conveyed between the two chassis by a cable harness that is permanently wired to the RF board and plugged into the power-supply chassis.

Let's get the hard work done first. Then the balance of the construction project will be easy and will add to the pleasure of building a receiver, learning about new circuits, and achieving a job well done.

RF Chassis. The top surface of the RF aluminum chassis is cut out to provide a clear mounting space for the perforated board containing the components for the RF portion. Cut out the top of the 5 x 7 x 2-in. aluminum chassis, leaving a ½-in. flange all around. Slit the flange on the front edge of the chassis 1½-in. from each end and bend up two tabs, which are used to mount the slide-rule dial, as shown in our photo. Our chassis has two extra ⅜-in. holes in the front of the chassis 1½-in. from each end for future experimentation. These are not required for the *Twofer-Flex* receiver; therefore, it is not necessary to drill them.

Cut a 5 x 7-in. section of perforated board and mount it to the top flange of the chassis,

TWOFER-FLEX

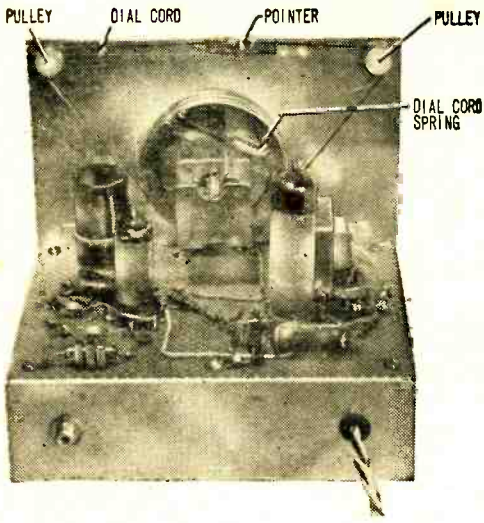
using sheet metal screws. Drill holes, if needed, to mount the receiver components to the perforated board.

Wiring and layout are critical even though the receiver operates in the broadcast band. For best results, follow the photos for the most convenient component layout.

A 2 x 1¼-in. aluminum strip is fastened to the front of the frame of tuning capacitor C6. This assembly is then fastened to a ½ x ½ x 1¼-in. aluminum angle section that has been mounted on the top of the front flange of the chassis. Mounting holes in the angle section to which this assembly is fastened are slotted in order to adjust the position of C6 for proper alignment with the slide rule dial hub.

The tube sockets are mounted on the perforated board with push-in terminals which are then soldered to the socket contact lugs. Position the sockets as shown in photo. If printed-circuit type sockets are not available, standard chassis mounting sockets can be used by cutting off the mounting flange or shell.

Cable Harness. Make up the cable harness by twisting and taping together 18-in. lengths of stranded hook-up wire, using colors shown in the schematic diagrams. Feed one end of the harness through a hole in the rear of the chassis base, knot it so that it will not slip out of the hole, and connect the various colored leads to the components. The free end of the cable harness is soldered to an 8-prong plug following the color code and pin arrangement of the schematic. A word of warning—be sure to slip the protective cover for the plug over the harness before soldering the wire leads to the plug pins.

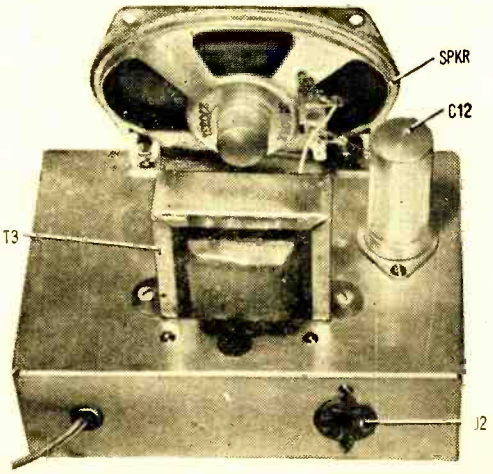


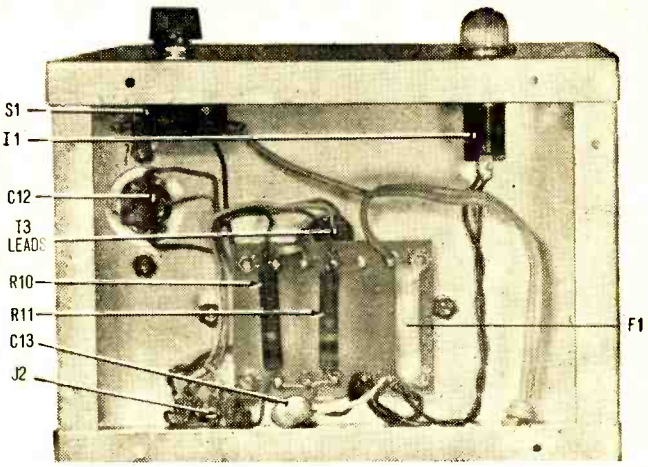
Rear view of RF chassis pointing out the various parts of the dial assembly and detailing the stringing of the dial cord.

Power Supply. The power supply, which is constructed on a 5 x 7 x 2-in. chassis identical to the RF chassis, is protected from accidental shorts by a 5 x 7-in. aluminum bottom plate. Small components are mounted on a terminal board and then to the chas-

PARTS LIST FOR TWOFER-FLEX POWER SUPPLY

C12A, B, C—Triple-section 40-30-20uF, 150-VDC electrolytic capacitor (Sprague TVL-3438 or equiv.)
C13—5000-pF, 1000-V ceramic disc capacitor
D1—1N2070 silicon diode
F1—1-amp pigtail fuse
I1—Neon lamp assembly (Dialco 52-0463 and NE-51H lamp, panel mounting or equiv.)
J2—Octal socket (Amphenol 78R58 or equiv.)
R10—1000-ohm, 2-watt, 10% resistor
R11—10,000-ohm, 2-watt, 10% resistor
SPKR—3 x 5-in. oval PM speaker, 3.2-ohm voice coil
S1—Spst power switch, rotary or toggle
T3—125-V, 50 mA with 6.3-V, 2-amp sec. power transformer (Allied 54C2064 or equiv.)
1—5 x 7 x 2 in. chassis
Misc.—Speaker grille, AC cord, bottom plate, grommets, etc.





Bottom view of power supply with protective cover removed showing location of mounting board containing components.

sis, using ½-in. spacers to raise it from the chassis metal. Locate the heavier components, drill their mounting holes, and fasten them to the chassis using rubber grommets to protect the T3 leads and the AC power cord. The speaker is mounted to the chassis with two ½-in. angle brackets fastened to the front top of the chassis. A piece of perforated board can be used to protect the speaker cone. Wire the components in accord with the power-supply schematic.

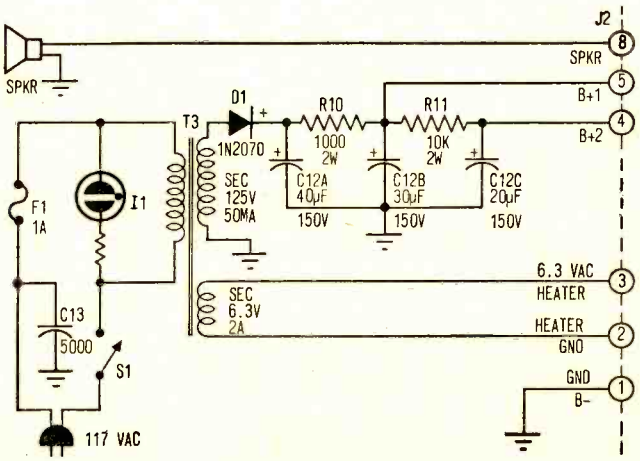
Operation. Now that the hard work has been completed, you're ready to check-out and enjoy the receiver. You will, of course need an antenna, which can be just a 6-ft. length of hook-up wire if you are located near stations producing strong signals. If you are in a fringe area, a good outside antenna and ground will be required.

With the tubes in their sockets, the antenna connected, the harness plugged into the power supply chassis, and the AC cord plugged into an outlet, you are all set to operate the receiver. When the power switch is turned on, pilot lamp I1 indicates AC power is flowing into the power supply. Allow the tubes time to warm up and then check AC and DC voltages with a VOM.

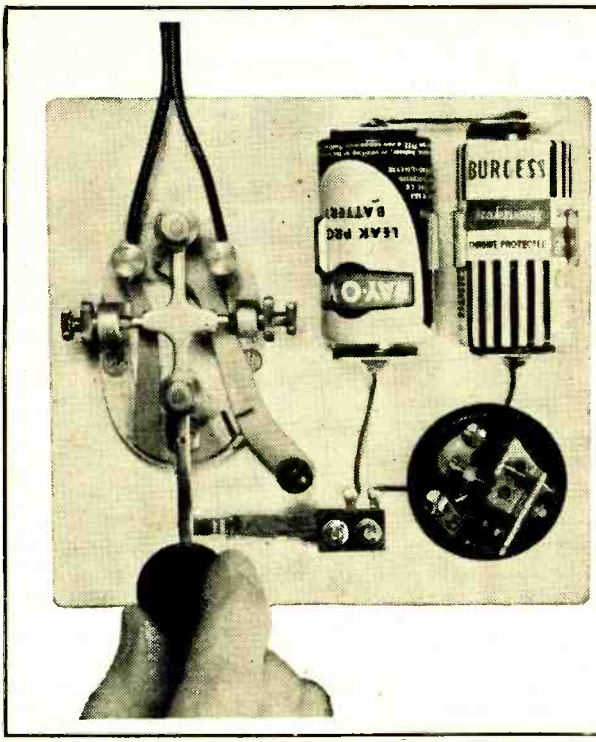
Tune the receiver to a local station and adjust the volume to a suitable level. Since there is only one tuned circuit in the *Twofer-Flex*, selectivity will not be as sharp as in receivers having multiple tuned circuits. The broad tuning and the use of a plate detector, which does not load a tuned circuit as do other types of detectors, accounts for the excellent tone of the *Twofer-Flex*.

The L1 primary winding should be positioned down over the coil lugs for maximum selectivity and minimum coupling. For higher selectivity, regeneration can be achieved by bringing the antenna lead near the top of T2. If there is too much coupling, oscillation will occur, which can be stopped by raising the antenna lead further from the top of the coil. ■

Power supply chassis layout. Parts location is not critical. However, power transformer should be located for free air circulation around it. Twofer-Flex is fitted with cable to be plugged into rear socket.



Power supply schematic. The circled numbers refer to output socket pin numbers. Before plugging in cable harness from RF chassis, make certain that cable wires are connected properly to match connections on this socket.



SIMPLE CODE MONITOR

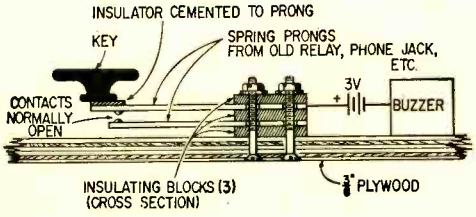
By Art Trauffer

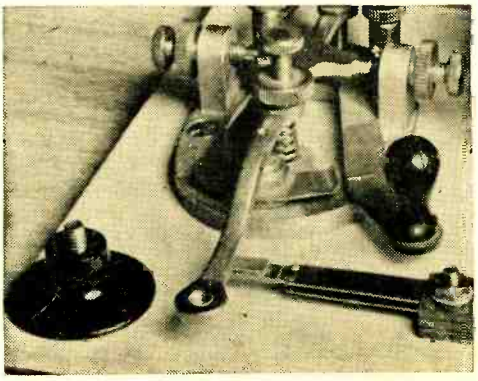
■ Most of us send better code when we can hear what we're sending. This code monitor, which is entirely independent of your receiver or transmitter and has no electrical connections to any of your equipment, is quickly rigged up using only three main components: first, a pair of prongs or reeds from an old phone jack, switch, or relay; secondly, a 3-volt supply (two D batteries); and, finally, a buzzer.

As shown in the photos and cross-section below, the monitor is actuated by the lever of your regular transmitter key. While the regular key operates your transmitter, it also closes the spring prongs of the old relay, activating the buzzer.

Monitor Mounting. Your transmitter key, monitor spring contacts, buzzer and battery are all mounted on a convenient surface; as shown here, they were mounted on a 6-inch square piece of ⅜-inch plywood. Prongs are mounted under the lever of your key close to the knob. A small piece of insulating material is cemented to the top spring prong to insulate it from the key. Adjust the monitor prongs so that they make contact just before the transmitter key contacts; then wire monitor in series and start sending! ■

The knob of the telegraph key at the right is removed to show how the key actuates the insulated top spring prong to make contact with the bottom prong, thereby completing buzzer circuit. Size of insulating blocks, below, is determined by height of the key.





the VHF extender

By Jim Kyle and Jim Speck
K5JKX W5PPE

Build this plug-in front end and extend your listening past that 30 mc dead end!

Any radio buff worthy of the name knows there's a world of excitement to be found in the VHF (very high frequency) range of the radio spectrum, but all too few of us have had a chance to get in on it. General-purpose receivers, for a number of good reasons, usually stop at about 30 megacycles—and the VHF receivers currently available as do-it-yourself projects or in military surplus hardly compare in performance with that we're used to on lower bands.

The VHF Extender is a device which can change all that for you, and let you get in on the fun for a minimum outlay of cash. Performance will be equal to that of your present SW receiver, since the purpose of the VHF Extender is simply to *extend* the frequency range of your present rig into the VHF region.

The VHF Extender can be used for any 4-megacycle-wide segment of the spectrum between 30 mc. and approximately 170 mc. and with only slight extra expense can be modified at will to cover a new slice should you tire of your first choice. This feature lets you listen to police, fire-department, aircraft-radio, or ham operators at will.

Theory Before Hookup. Before we get into the construction details of the VHF Extender, let's take a brief look at how it works. This will help you when it comes time to make the various parts-value choices needed in construction.

The VHF Extender is, primarily, a *new front end* for your receiver, which connects into the line between antenna and receiver itself. It translates the VHF signals down into the range covered by your existing receiver, so that while the on-the-air signal may be at a frequency of 136.040 mc. (for example), the signal fed into your existing receiver is at a frequency of 640 kc.—in the broadcast band.

Since the *translating* frequency is determined by a crystal-controlled oscillator, you can rely upon the dial calibration of your receiver. Thus should you be hunting a satellite signal at 136.050 mc., you could set your receiver dial to 1,050 kc. and use a 45-mc. crystal in the VHF Extender. Any signal appearing in the receiver would have to be a 136.050-mc. signal at the antenna

VHF Extender connects between antenna and receiver to expand your listening world.

VHF extender

(the 133.950-mc. *image* frequency is reduced greatly by the input RF amplifier circuit).

High performance in the critical VHF region is assured by the RF amplifier tube, a 6DS4 *Nuvistor*. The other tube, a type 6U8A, serves as both crystal oscillator and mixer. Power for the VHF Extender can be taken from the existing receiver, if it uses a transformer. Be sure to fuse the B+ (¼ a.) and 6.3-vac (1 a.) leads to the Extender.

Get Ready to Build. The only tools absolutely necessary to build the VHF Extender are a drill, a screwdriver, cutting pliers, and a soldering iron. A grid-dip oscillator can prove very useful, however, if you happen to have one on hand. With the *GDO*, you can get along without the coil tables, simply by dipping each coil to its proper frequency.

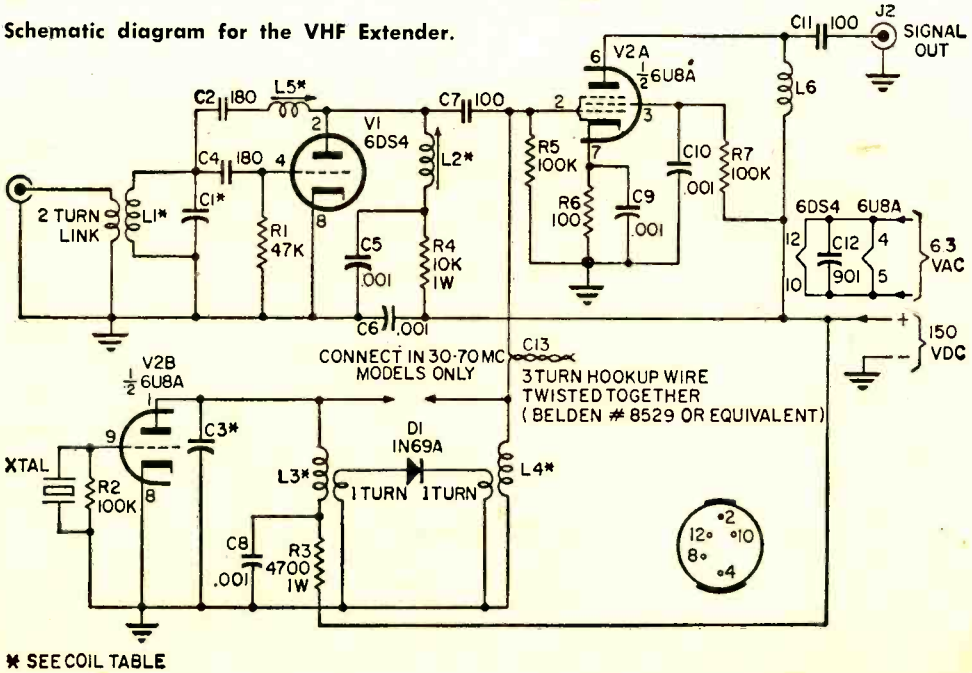
To determine the values to be used for XTAL frequency, L1/C1, L2, L3/C3, and L4, use the tables or follow these rules. L1/C1 must tune to the desired VHF frequency band. For satellite reception, for instance, they should tune to 136 mc. L2 should tune to this same frequency when installed in the circuit and with the 6DS4 plugged in. For input frequencies between 30 and 70 mc., the XTAL frequency should be equal to the frequency of the lower end of the desired VHF band, minus the frequency of the lowest desired output frequency. For best results, the 7-11 mc. portion of the existing receiver's coverage should be used, which would make the XTAL equal to input signal frequency minus 7 mc. For input frequencies between 70 and 170 mc., proceed as before but divide the result by three. For 136-mc. input and 7-mc. output, the XTAL frequency would be 136-7 or 129/3, or 43.0 mc. L3/C3 should tune to the XTAL frequency, whatever it is determined to be, and L4 should tune to three times XTAL frequency.

If you're using the coil table rather than a *GDO*, simply take the values shown there.

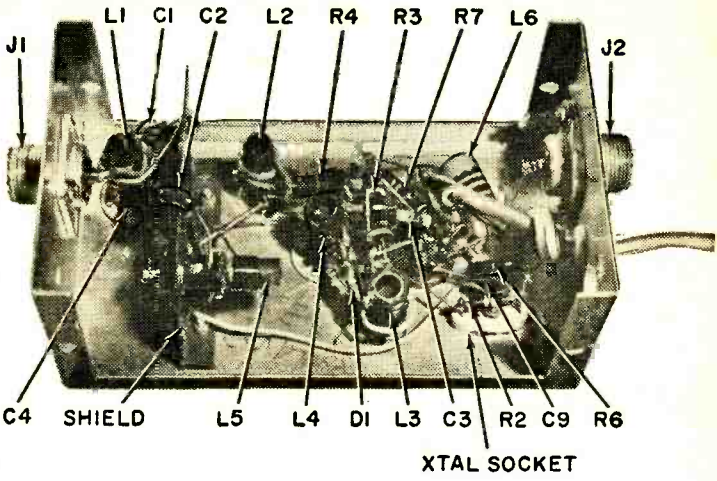
Putting It Together. The VHF Extender is built on a 2⅛" by 3" by 5¼" aluminum chassis box, using the long flat side for most parts installation as shown in the photograph. Lay out and drill the box as shown in the chassis detail drawing.

Next, select the necessary coils using data from the coil tables. Install each in its proper location. Mount the tube sockets. The 6DS4 Nuvistor socket is secured by crimping its lips over tightly against the chassis. Several short wires are then soldered to the lips, and later will be soldered to the shield plate across this socket.

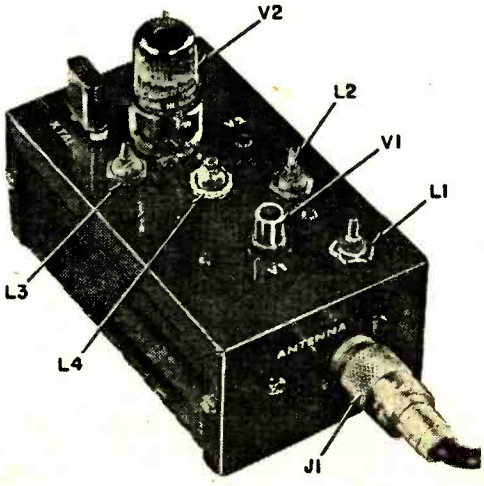
Schematic diagram for the VHF Extender.



* SEE COIL TABLE



The VHF Extender is an advanced project for the SWL experimenter. Part location is critical and should be followed closely. See photo at right and below. To make your unit identical with the author's, follow the detail drawings given in the article and follow the text without alterations.



Wire the filament leads as shown on the schematic diagram before installing the copper shield partition on the 6DS4 socket, and mount the two coax connectors, J1 and J2, in place. Then mount the partition (which must be made of copper or brass; this can usually be located at an auto-supply wholesaler under the name of 3-mil shim stock) and make the rest of the connections to the tube sockets. Refer to shield detail drawing to fabricate piece.

Note from the photos that all leads must be kept as short as possible and no wiring is "fancy". Everything must take the most direct route. This makes the lower layer of wiring tough to get to later on, so check and double check at every step to make certain your connections are correct. If your wiring looks like a tight-knit rats nest—you're doing a good job.

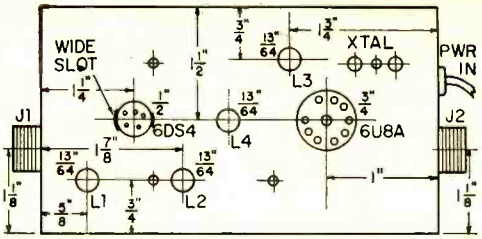
Wiring Differences. With all coils in place and all tube-socket-connections made, the final stages consist of wiring the coils in and connecting the links between them. Only two of these are particularly unusual. Note how the long lead from the 1N69A diode, D1, is used as its own coupling link to L3. The other end of the diode wraps around L4 in the same way. Diode D1 and L4 are omitted on the 30 to 70 mc. models; this is the "extra expense" mentioned earlier to switch to other frequency bands. The other unusual connection is the twisted-wire "gimmick", C13 coupling L4 to the 6U8A pentode's grid. In the 30-70 mc. model, this wire connects to the top of L3 instead of to L4 as shown in the schematic diagram. Be extremely careful that the two wires do not short-circuit together; they form a low-value capacitor through which oscillator voltage is injected into the mixer stages, V2A.

Turn It On. When all connections are complete and rechecked, you can apply power to the VHF Extender. The 6U8A filament should light immediately, and the 6DS4 should feel warm to the touch after a few seconds. If it is hot, remove power quickly and check wiring, espcially near L5.

If all proceeds well, connect a coaxial cable from the output jack of the VHF Extender to the antenna terminals of your receiver and tune to about 7 mc. Briefly disable the 6U8A mixer, V2A, of the VHF Extender by shorting pin 3 to ground with an insulated screwdriver. Noise output from

VHF extender

the receiver should diminish at the same time. If it does not, tune L3 until the noise rises sharply and suddenly. Adjust L3 carefully for maximum noise, then repeat the previous test. Don't be worried if a few 7-mc. shortwave signals come through during all this;



Detail drawing of chassis top part's layout.

COIL TABLE FOR 30-70 MC.

VHF Band (MC.)	L1, L2	C1 (mmf.)	L5	7-11 Mc. Output XTAL (mc.)	7-11 Mc. Output L3	7-11 Mc. Output C3 (mmf.)	BC-Band Output XTAL (mc.)	BC-Band Output L3	BC-Band Output C3 (mmf.)
30-34	20A156RBI	10	4205	23.000	20A106RBI	20	29.400	20A106RBI	20
34-38	20A156RBI	10	4205	27.000	20A106RBI	20	33.400	20A106RBI	15
38-42	20A106RBI	10	4204	31.000	20A106RBI	20	37.400	20A106RBI	15
42-46	20A106RBI	10	4204	35.000	20A106RBI	15	41.400	20A827RBI	15
46-50	20A687RBI	10	4204	39.000	20A106RBI	15	45.400	20A827RBI	10
50-54	20A687RBI	10	4204	43.000	20A827RBI	15	49.400	20A827RBI	10
54-58	20A687RBI	10	4204	47.000	20A827RBI	10	53.400	20A687RBI	10
58-62	20A687RBI	10	4204	51.000	20A827RBI	10	57.400	20A687RBI	10
62-66	20A687RBI	4.7	4203	55.000	20A687RBI	10	61.400	20A687RBI	4.7
66-70	20A687RBI	4.7	4203	59.000	20A687RBI	10	65.400	20A687RBI	4.7

Coil numbers are J. W. Miller Co. part numbers. Wind two-turn link of No. 22 hookup wire around grounded end of L1. BC-Band XTAL frequencies are for lowest megacycle of 4 Mc. VHF bands; add one mc. to XTAL for each higher megacycle desired. For instance, to cover 41-42 mc., table gives 37-4-mc. XTAL but this is upper megacycle of VHF band; add 3 mc. to XTAL frequency and use 40.400-mc. crystal.

COIL TABLE FOR 70-172 MC (7-11 MC OUTPUT)

XHF Band (MC.)	L1, L2	C1 (mmf.)	L5	7-11 Mc. Output Only (mc.)	L3	C3	L4
70-74	20A477RBI	4.7	4203	21.000	20A106RBI	27	20A156RBI
74-78	20A477RBI	4.7	4203	22.333	20A106RBI	20	20A156RBI
78-82	20A477RBI	4.7	4203	23.667	20A106RBI	20	20A156RBI
82-86	20A477RBI	4.7	4203	25.000	20A106RBI	20	20A106RBI
86-90	20A477RBI	4.7	4202	26.333	20A106RBI	20	20A106RBI
108-112	20A227RBI	4.7	4203	33.667	20A827RBI	15	20A106RBI
112-116	20A227RBI	4.7	4203	35.000	20A827RBI	15	20A106RBI
116-120	20A227RBI	4.7	4203	36.333	20A827RBI	15	20A827RBI
120-124	20A227RBI	4.7	4203	37.667	20A827RBI	15	20A827RBI
124-128	20A227RBI	4.7	4203	39.000	20A827RBI	15	20A827RBI
128-132	20A227RBI	4.7	4202	40.333	20A827RBI	15	20A827RBI
132-136	20A227RBI	4.7	10T#	41.667	20A827RBI	15	20A827RBI
136-140	20A227RBI	4.7	10T#	43.000	20A827RBI	15	20A827RBI
140-144	20A227RBI	4.7	8T#	44.333	20A827RBI	15	20A678RBI
144-148	20A227RBI	4.7	8T#	45.667	20A827RBI	15	20A687RBI
148-152	20A227RBI	4.7	8T#	47.000	20A687RBI	10	20A687RBI
152-156	20A227RBI	4.7	6T#	48.333	20A687RBI	10	20A687RBI
156-160	20A227RBI	4.7	6T#	49.667	20A687RBI	10	20A477RBI
160-164	20A227RBI	0	6T#	51.000	20A687RBI	10	20A477RBI
164-168	20A227RBI	0	5T#	52.333	20A687RBI	10	20A477RBI
168-172	20A227RBI	0	5T#	53.667	20A687RBI	10	20A477RBI

Coil numbers are J. W. Miller part numbers. L5, for bands above 132 mc. is wound on a Miller 4200 coil form with No. 24 wire, with the number of turns shown in the table. 0 value for C1 indicates part is not required.

COIL TABLE FOR 70-172 MC (BC-BAND OUTPUT)

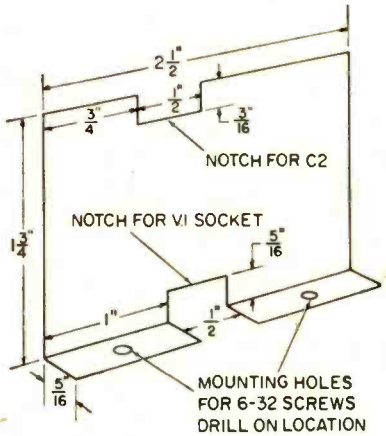
L1, L2, L5, and C1—same as given in Coil table for 70-172 mc. with 7-11 mc. output.

L3—J. W. Miller type 20A106RBI from 70 mc. to 86 mc.; 20A827RBI from 86 to 140 mc.; and 20A687RBI from 140 to 172 mc.

C3—20 mmf from 70 to 86 mc.; 15 mmf 86-140 mc.; and 10 mmf 140-172 mc.

L4—Miller 20A156RBI from 70-78 mc; 20A106RBI 78-112 mc; 20A827RBI 112-136 mc.; 20A687RBI 136-152 mc.; and 20A477RBI 152-172 mc.

XTAL—23.133 mc. for 70-71 mc.; 23.467 mc. for 71-72 mc.; 23.800 mc. for 72-73 mc.; 24.133 mc. for 73-74 mc.; 24.467 mc. for 74-75 mc.; etc., increasing by 333⅓ kc. for each megacycle increase of VHF band. For 136-137 mc. coverage (satellites) Xtal is 45.133 mc., and for 145-146 mc. (Novice portion of ham 2-meter band) use 48.133 mc. Output will be from 600 to 1600 kc. on BC band, with 600 kc. equal to lowest frequency in band (136.000 mc. on satellite band; 136.040-mc. satellite would come in at 640 on BC dial).



Detail drawing of the copper shield partition installed inside the VHF Extender. Dimensions may vary slightly depending upon how accurately Nuvistor socket is placed.

they won't when the bottom cover of the VHF Extender is in place.

Before proceeding, you will have to locate a signal in the VHF region you're interested in. Tune it in as best you can; it may have an extremely ragged or "whistling" sound which is due to regeneration in the 6DS4 stage of the VHF Extender. Adjust the slug of L5, using an insulated tuning tool, to remove all distortion. Then tune L1 and L2 for best signal strength. You may find that readjustment of L3 (and L4) will strengthen the signal still more.

Next, unsolder either end of the 100,000-ohm resistor, R4, in the 6DS4 plate circuit, while still tuned to the VHF signal. This adjustment is best made with the strongest VHF signal you can find. Readjust L5 until the signal (with resistor disconnected) is as weak as you can get it. *DO NOT READJUST*

(Continued on page 105)

PARTS LIST

C1, C3—See Coil Tables for values—select ceramic disc NPO type capacitor
C2, C4—180-mf., 300 WVDC or better, disc or tubular ceramic NPO type capacitor
C5, C8, C9, C10, C12—.001-mf., 1000 WVDC or better, disc type capacitor
C6—.001-mf., button-bypass, standoff capacitor (Erie Ceramicon 323X5U101M or equiv.)
C7, C11—100-mmf., 1000 WVDC or better, disc type capacitor
C13—Gimmick capacitor (See text)
D1—1N69A diode (Sylvania)
J1, J2—UHF coaxial connector, receptacle chassis type (Military No. SO-239 or 49194, Amphenol 83-1R, or equiv.)
L1, L2, L3, L4, L5—See Coil Tables
L6—RFC choke, 10-millihenry, ferrite core for 7-11 mc. output. Use 100,000, ½-watt resistor in place of RFC for BCB output
R1—47,000-ohm, ½-watt resistor
R2, R5, R7—100,000-ohm ½-watt resistor
R3—4700-ohm, 1-watt resistor
R4—10,000-ohm, 1-watt resistor
R6—100-ohm, ½-watt resistor
V1—6DS4 Navistor (RCA)
V2—6U8A tube (GE)
XTAL—See Coil Tables for value. Select type with .050-in. diameter pins spaced .486-in. apart, .01% (.005% preferred)
1—XTAL socket (National CS-7 or equiv.)
1—2½"x3"x5¼" aluminum chassis box (Bud CU-2106A or equiv.)
1—Nuvistor socket for 5-contact tube
1—9-pin miniature tube socket with tube shield base
Misc.—Cable, wire, hardware, grommet, dials, copper shield, cement, solder, etc.

Estimated cost: $20.00
Estimated construction time: 12 hours

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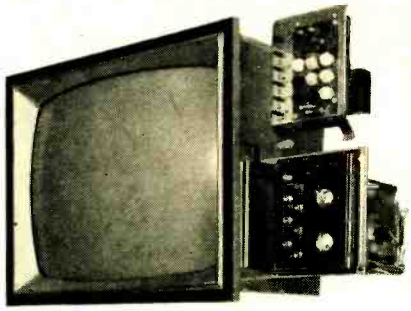
Over five years were spent in research and development to achieve the notably superior performance, improved convenience features, and ease of service now embodied in the new GR-270 and GR-370. They are premium quality receivers in the truest sense, and, we believe, the finest color TV's on today's market. Here's why . . .



Compare these features:

- Modular plug-in circuit board construction.
- MOSFET VHF tuner and 3-stage IF.
- Adjustable video peaking.
- Sound instantly, picture in seconds.
- Built-in Automatic Fine Tuning.
- Pushbutton channel advance.
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Exclusive solid-state circuitry design . . . total of 45 transistors, 55 diodes, 2 silicon controlled rectifiers; 4 advanced Integrated Circuits containing another 46 transistors and 21 diodes; plus 2 tubes (picture and high voltage rectifier) combine to deliver performance and reliability unmatched by conventional tube sets.

Exclusive design solid-state VHF tuner uses an MOS Field Effect Transistor for greater sensitivity, lower noise, and lower cross-modulation . . . gives you sharply superior color reception, especially under marginal conditions. Gold/Niborium contacts give better electrical connections and longer wear. Memory fine tuning, standard. Solid-state UHF tuner uses hot-carrier diode design for increased sensitivity.

3-stage solid-state IF has higher gain for better overall picture quality. Emitter-follower output prevents spurious signal radiation, and the entire factory-aligned assembly is completely shielded to prevent external interference.

Automatic Fine Tuning — standard on both sets. Just push a button and the assembled and aligned AFT module tunes in perfect picture and sound automatically . . . eliminates manual fine-tuning. Automatic between-channel defeat switch prevents tuner from locking in on stray signals between channels. AFT can be disabled for manual tuning.

VHF power tuning . . . scan through all VHF and one preselected UHF channel at the push of a button.

Built-in automatic degaussing keeps colors pure. Manual degaussing coil can be left plugged into the chassis and turned on from the front panel . . . especially useful for degaussing after the set is moved some distance.

Automatic chroma control eliminates color variations under different signal conditions.

Adjustable noise limiting and gated AGC keeps pulse-type interference to a minimum, maintains signal strength at constant level.

High resolution circuitry improves picture clarity and new adjustable video peaking lets you select the degree of sharpness and apparent resolution you desire.

"Instant-On". A push of the power switch on the front panel brings your new solid-state set to life in seconds. Picture tube filaments are kept heated for instant operation, and extended tube life. "Instant-On" circuit can be defeated for normal on-off operation.

Premium quality color picture tubes. Both the 227 sq. in. GR-270 and 295 sq. in. GR-370 use the new brighter bonded-face, etched glass picture tubes for crisper, sharper, more natural color. And the new RCA HiLite Matrix tube is a low cost option for the GR-370. See below.

Adjustable tone control lets you choose the sound you prefer . . . from deep, rich bass to clean, pronounced highs.

Hi-fi output permits playing the audio from the set through your stereo or hi-fi for truly lifelike reproduction. Another Heath exclusive.

Designed to be owner serviced. The new Heath solid-state color TV's are the only sets on the market that can be serviced by the owner. You actually can diagnose, trouble-shoot and maintain your own set.

Built-in dot generator and tilt-out convergence panel let you do the periodic dynamic convergence adjustments required of all color TV's for peak performance. Virtually eliminate technician service calls.

Snap-out glass epoxy circuit boards with transistor sockets add strength and durability and permit fast, easy troubleshooting and transistor replacement. Makes each circuit a module.

Built-in Volt-Ohm Meter and comprehensive manual let you check circuits for proper operation and make necessary adjustments. The manual guides you every step in using this built-in capability. Absolutely no knowledge of electronics is required.

Easy, enjoyable assembly . . . the Heathkit way. The seven-section manual breaks every assembly down into simple step-by-step instructions. With Heath's famous fold-out pictorials and simple, straightforward design of the sets themselves, anyone can successfully complete the assembly.

Heathkit Solid-State Modular Color TV represents a significant step into the future . . . with color receiver design and performance features unmatched by any commercially available set at any price! Compare the specifications. Then order yours today.

Kit GR-270, all parts including chassis, 227" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker, 114 lbs. **$489.95***

Kit GR-370, all parts including chassis, 295" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker. 127 lbs. **$559.95***

Kit GR-370MX, complete GR-370 with RCA matrix picture tube, 127 lbs. **$569.95***

GR-270 AND GR-370 SPECIFICATIONS — PICTURE TUBE SIZE: GR-370 Approximate Viewing Area: 295 Sq. In. GR-270 Approximate Viewing Area: 227 Sq. In. **DEFLECTION:** Magnetic, 90 degrees. **FOCUS:** Electrostatic. **CONVERGENCE:** Magnetic. **ANTENNA INPUT IMPEDANCE:** VHF 300 ohm balanced or 75 ohm unbalanced. UHF: 300 ohm balanced. **TUNING RANGE:** VHF TV channels 2 through 13. UHF TV channels 14 through 83. **PICTURE IF CARRIER:** 45.75 MHz. **SOUND IF CARRIER:** 41.25 MHz. **COLOR IF SUBCARRIER:** 42.17 MHz. **SOUND IF FREQUENCY:** 4.5 MHz. **VIDEO IF BANDWIDTH:** 3.58 MHz. **HI-FI OUTPUT:** Output impedance — 1 k ohm. Frequency response — ±1 dB 30 Hz to 10 kHz. Harmonic distortion — less than 1% at 1 kHz. Output voltage — 0.3 V rms nominal. **AUDIO OUTPUT:** Output impedance — 4 ohm or 8 ohm. Output power — 2 watts. **POWER REQUIREMENTS:** 110 to 130 volts AC, 60 Hz, 240 watts. **NET WEIGHT:** GR-370, 114 lbs.; GR-270, 101 lbs.

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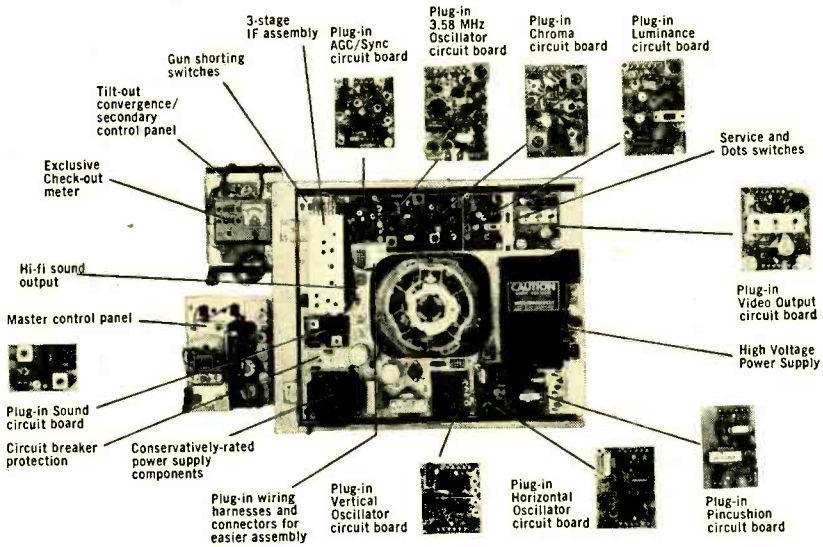

New Expedited 48-Hour No-Charge Warranty Service Plan for Solid-State TV Modules! Special service facilities have been established at the factory and all **Heathkit** Electronic Centers to expedite service and return of Solid-State TV circuit modules within two working days. During the 90-day warranty period, TV modules will be serviced or replaced with no charge for labor or parts. After the initial 90-day warranty period expires, TV modules will be serviced or replaced at a fixed charge of $5.00 per module for labor and parts for a period of two years from date of original kit purchase.

Add extra convenience and versatility to your new GR-270 or GR-370 Solid-State Color TV with this new ultrasonic remote control kit. Lets you turn the set on and off, adjust volume, change VHF channels and adjust color and tint from the comfort of your chair. Assembles and installs complete in just a few hours and the built-in meter on the receiver makes final adjustment a matter of minutes. **Kit GRA-70-6,** 6 lbs. **$64.95***

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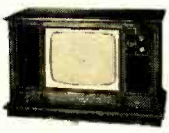
3 models in 295 sq. in.

Luxurious Mediterranean Cabinet . . . factory assembled of fine furniture grade hardwoods and finished in a flawless Mediterranean pecan. Statuary bronze trim handle. 30-1/32" H x 47" W x 17¾" D. **Assembled GRA-304-23,** 85 lbs. **$129.95***



Deluxe Early American Cabinet . . . factory assembled of a special combination of hardwoods & veneers and finished in classic Salem Maple. 29-21/32" H x 37¼" W x 19¾" D. **Assembled GRA-303-23,** 67 lbs. **$114.95***

Contemporary Walnut Cabinet . . . factory assembled of fine veneers & solids with an oil-rubbed walnut finish. 29-17/32" H x 35-13/16" W x 19⅞" D. **Assembled GRA-301-23,** 56 lbs. **$74.95***

3 models in 227 sq. in.

Exciting Mediterranean Cabinet . . . assembled using fine furniture techniques and finished in stylish Mediterranean pecan. Accented with statuary bronze handle. 27-31/32" H x 41⅞" W x 19-9/16" D. **Assembled GRA-202-20,** 70 lbs. **$114.95***

Contemporary Walnut Cabinet and Base Combination. Handsome walnut finished cabinet sits on a matching walnut base. **Cabinet** dimensions 20-31/32" H x 31-7/16" W x 18⅝" D. Base dimensions 7¾" H x 27¾" W x 18⅝" D. **Assembled GRA-203-20 Cabinet,** 45 lbs. **$49.95* GRS-203-6** above cab. w/ matching base, 58 lbs. **$59.95***

Handy Roll-Around Cart and Cabinet Combination. Features the GRA-203-20 walnut cabinet plus a walnut-trimmed wheeled cart with storage shelf. **Assembled GRA-203-20 Cabinet,** 45 lbs. . . . . **$49.95* GRA-204-20 Roll-Around Cart,** 18 lbs. . . . **$19.95* GRS-203-5, Cart & Cabinet Combo,** 58 lbs. **$59.95***

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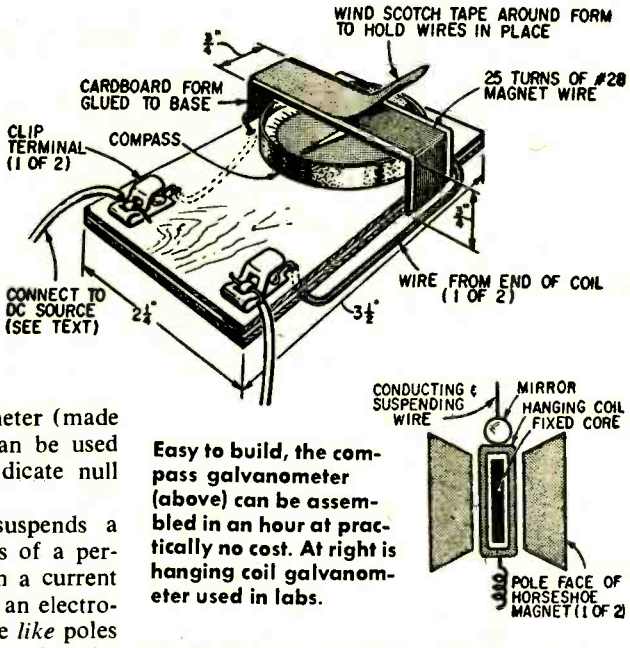
COMPASS GALVANOMETER

by T. A. BLANCHARD

Many electrical measuring instruments today are based on the design of the d'Arsonval *String Galvanometer*, but substitute a needle-suspended coil riding on jeweled bearings for the hanging coil employed in the original precise lab instrument.

The galvanometer is not often used to measure quantity of current flowing in a circuit, but rather to indicate the polarity and presence of small currents by comparison to null methods. The compass galvanometer (made from the illustration at right) can be used with a Wheatstone bridge to indicate null points.



Easy to build, the compass galvanometer (above) can be assembled in an hour at practically no cost. At right is hanging coil galvanometer used in labs.

The d'Arsonval instrument suspends a small coil between the pole faces of a permanent *horseshoe* magnet. When a current flows through the coil it becomes an electromagnet and its *like* poles repel the *like* poles of the horseshoe magnet, thus causing the coil to turn on the connecting wire. The strength of the current through the coil determines the extent of the coil's rotation.

A small pointer attached to the moving coil registers on a curved dial, or a tiny mirror is attached to the galvanometer string. A beam of light is aimed at the mirror, bouncing the beam off to a wall screen or chart to give great magnification of tiny current changes in a darkened room.

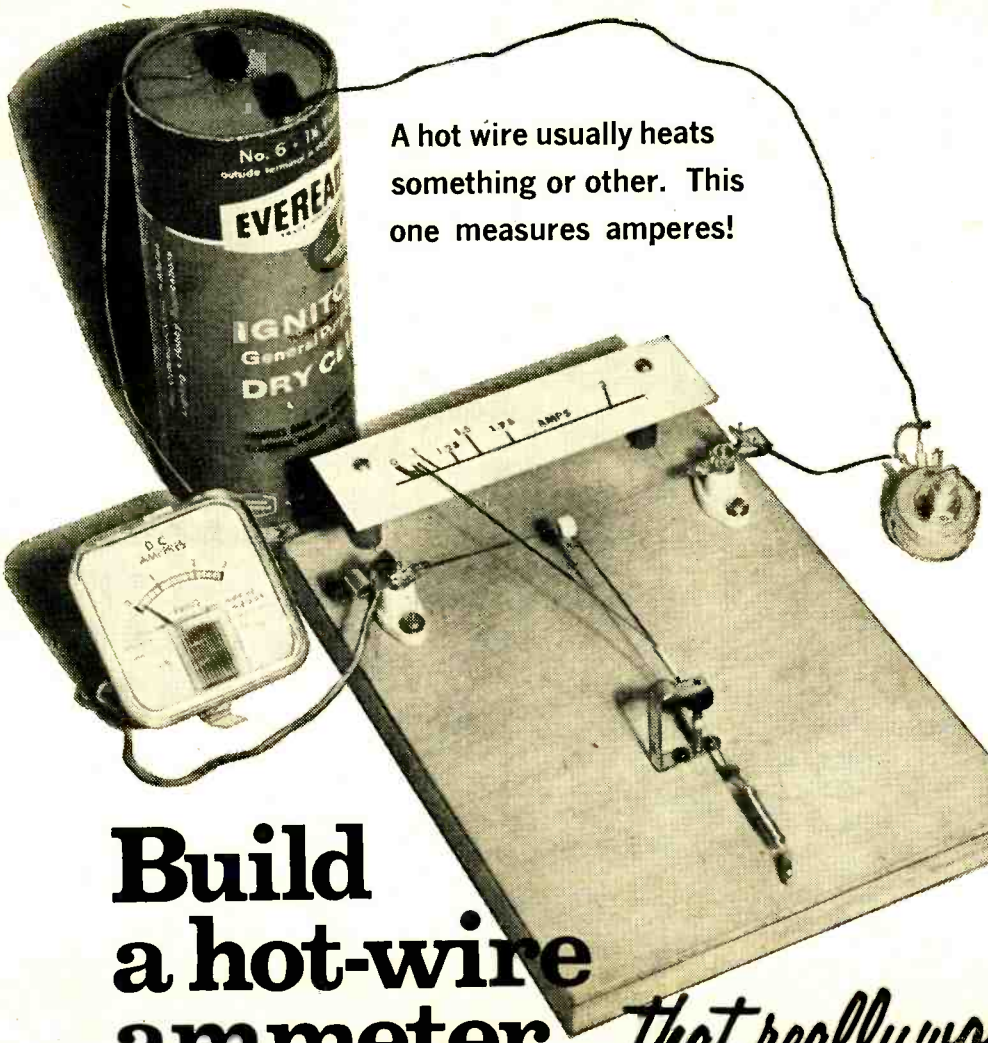
Making A Simple Galvanometer. A small amount of insulated magnet wire, any Boy Scout pocket compass and a 2¼ x 3½-in. scrap of plywood is what you need to make the compass galvanometer. Cut a strip of cardboard ¾-in. wide and 3¾-in. long. Score the cardboard ¾ in. from each end, with a dull knife blade and crease so the cardboard form resembles a C or bridge shape. Now glue the cardboard to the edges of the wood base. Do not use tacks!

Bind the cardboard with a rubber band until glue or cement dries. Wind 25 turns of #28 magnet wire around the cardboard. Heavier wire and fewer turns will work, too, with a slight drop-off in sensitivity.

Scotch tape is wound around the finished coil to keep the wire turns in place. Connect the ends of the coil to screw terminals or clips. Slip the compass under the coil in a position where its needle comes under the coil and parallel to the coil turns.

Connect the galvanometer in series with a flashlight battery and bulb, a buzzer or a toy motor, etc. When the circuit is closed, the compass needle will be drawn so that it is at right angles to the coil. A slow swing of the needle indicates the circuit is drawing little current. A rapid swing denotes an increase in current flow.

To show how sensitive this simple galvanometer is, connect what appears to be a dead flashlight cell across the terminals, immediately breaking the circuit. The compass needle will spin at a merry clip, indicating there is still some life in the "dead" cell. ■



A hot wire usually heats something or other. This one measures amperes!

Build a hot-wire ammeter *that really works*

by Charles Green, W6FFQ

IN THE early days of radio, hams were forced to be good constructors. Because of unavailability or excessive cost of commercial parts, they made capacitors and coils, and even built meters to measure the RF output of their transmitters.

The type of RF output meter that the old timers built is known as a Hot-Wire Ammeter. Operation of this ammeter is based on the physical expansion of a wire heated by current flowing through it. The wire is indirectly coupled to a pointer and dial to measure the flow of current. You can have fun building and experimenting with this type of ammeter.

Our model of a hot-wire ammeter is built on a wooden baseboard very much the same as those built in the old days and is designed for easy con-

hot-wire ammeter

struction. Most of the parts can be obtained in a hardware store. It can be calibrated easily with a DC ammeter and dry cell battery. We have included, also, an experiment board to show how the Hot Wire Ammeter reads current on an AC line with various lamp loads.

How It Works. When electric current flows through a resistance, heat is generated, as, for example, in an electric iron or toaster. If the resistance is a fine steel wire drawn taut between two supports, the generated heat will make the wire expand, causing it to stretch and sag. The Hot Wire Ammeter uses this stretching of a fine steel wire linked to a pointer to serve as a measure of the amount of electrical current flowing through it, which heats the wire.

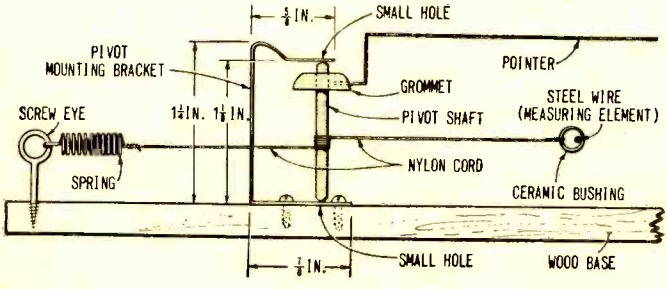
By referring to the *assembly drawing* you will note that our construction project follows closely the basic principle of a hot wire ammeter. A fine steel wire is tautly stretched between two fixed positions and has clips attached to connect it into an electrical circuit so that current flowing in the circuit can flow through the resistance wire. A ceramic bushing or bead, through which the steel wire passes, is held tightly against the wire by a spring-loaded nylon cord. When current flows the steel wire is heated and expands, thus reducing the pull against the bushing and its spring-loaded nylon cord. The cord has been tightly wrapped three or four turns around a short steel shaft that freely rotates on supporting pivots and is held taut by a spring at the end opposite to the bushing (or bead). A pointer fastened to this shaft changes its position on a calibrated scale, as the shaft is turned, to indicate current is flowing.

Since we are measuring, in a fixed length of steel wire, the relative mechanical reaction to expansion and/or contraction (caused by temperature changes created by current flowing in the wire) this instrument will react the same to either AC or DC current. The return to zero of the pointer depends on the natural expansion/contraction characteristic of the fine steel wire. Expansion and contraction may vary depending upon the quality of the steel. The meter is not usable near zero because small changes in current are not readily transferred to proportionate mechanical changes due to mechanical losses in our model.

Building the Hot-Wire Ammeter. The dimensions and construction of this Hot-Wire Ammeter are not critical and can be varied to suit the constructor's preference. Our model was built on a soft wood base 8 x 6 x ⅝-in. The current measuring range is dependent on the length, diameter and resistance of the steel wire through which current to be measured must flow.

Nail To Pivot Shaft. After fashioning a base make the moving element next. The shaft pivot is made from a 1⅛-in. long straight section of a smooth 8-penny box nail. Each end of the nail should be filed or ground to a point. Then make a metal bracket to fit the shaft with two small holes for the pivot points and two holes to mount the pivot assembly to the base as shown in the *assembly drawing*. Bend the bracket to fit and make sure that the pivot shaft can rotate freely.

Spring Making. The spring, that maintains tension on the nylon cord, was made by winding 0.015-in. diameter music wire for a length of ¾-in. on an 8-penny nail. The best way to wind the spring is to place a hand drill in a vise and fasten one end of the music wire tightly in the drill chuck along with a large diameter nail, a rod or drill shaft. Hold the other end of the wire perpendicular to the nail with pliers and slowly rotate the drill, thus winding the spring. Remove the spring from the nail and bend out a small end loop at each end of the spring to permit fastening it to the nylon drive cord at one



Detail drawings of Hot-Wire Ammeter, showing construction of pivot and pointer activated by nylon cord. As explained in text, spring (left) is constructed from length of music wire.

end and a screw eye in the wooden base at the other end.

Before installing the pivot shaft into its mounting bracket, force a ⅜-in. diameter rubber grommet, rubber washer or bumper on one end of the shaft and position it as shown in the detail drawing. It may be necessary to cement this to the shaft to prevent slippage. This should not be done until after assembly has been completed and the pointer has been installed. Place a small amount of grease in the pivot holes.

The Measuring Element. The measuring element we used is made from one strand of steel wire (0.01-in. diameter) extracted from a length of stranded picture wire, obtainable in a variety or hardware store. The diameter of the wire is not critical; however, the thinner the wire, the more sensitive will be the meter; a larger diameter wire will require more current to heat it. After slipping it through the ceramic bushing or bead, stretch the wire tightly between the lugs mounted on the stand-off insulators and solder it to the lugs, as shown in the assembly drawing.

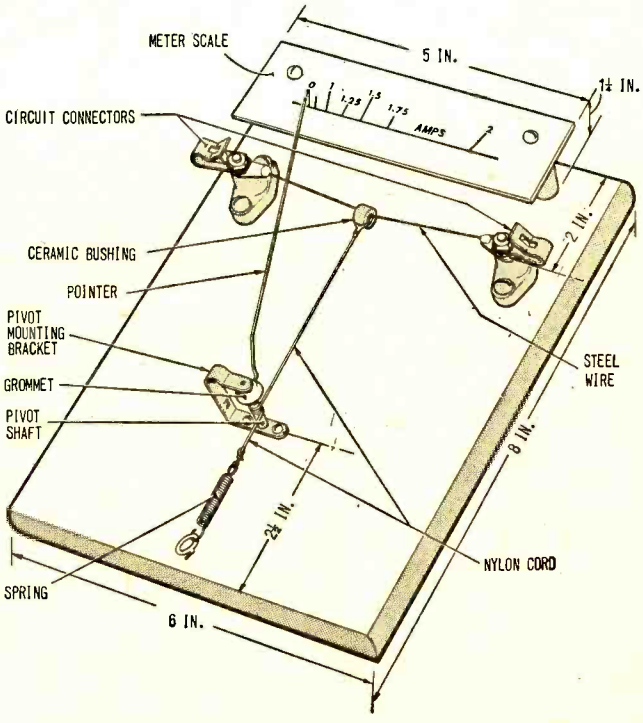
Tie one end of the nylon cord to the ceramic bushing, as shown, bring it down to the pivot shaft and wind it around the pivot shaft three turns in a clockwise direction. Fasten the other end of the line to one end of the spring and attach the other end of the spring to a screw eye on the base board. Make certain that both ends of the line are taut or the ammeter will not work. The eye screw is turned, as necessary, for minor adjustment of the line tension to zero the pointer. Cement the nylon tiepoints at each end of the line to keep from loosening. If the pointer reads below zero when a measurement is made, in all probability, you have wound the nylon cord around the pivot shaft in the wrong direction. Be sure it is wound as shown in the *assembly drawing.*

The Pointer. After all the components have been assembled, make the pointer from a length of #22 gauge bus wire and force one end into the rubber grommet on the pivot shaft. Form the pointer as shown in the drawing before inserting it into the rubber grommet and cement the pointer to the grommet after positioning it properly. Paint the end of the pointer black to make it easier to see the pointer against the scale background.

Calibration. To calibrate the Hot-Wire Ammeter you will need a DC ammeter, a 15-ohm rheostat (or potentiometer), and a DC source such as a #6 dry cell (1½ V).

The Hot-Wire Ammeter scale is made from a 5 x 1⅜-in. piece of white cardboard supported approximately 1¼-in. above the base by suitable bushings through which wood mounting screws pass to the wooden base. For a more professional look use DATAK instant letters to mark calibration points on scale.

Keep Wire Taut. Next make sure that the steel current measuring wire of the Hot-Wire Ammeter is taut, as should be both sections of the nylon wire. Set the pointer to zero by holding the pivot shaft with long-

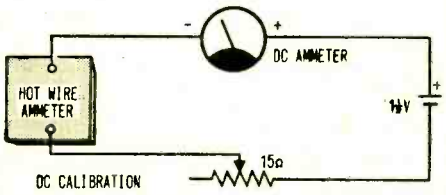


Assembly drawing for Hot-Wire Ammeter. Steel wire stretched between Fahnestock circuit connectors is measuring element: current flow causes it to expand, driving pointer up scale.

hot-wire ammeter

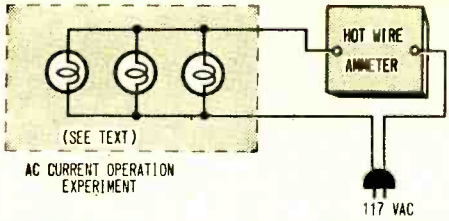
nose pliers and move the rubber grommet so that the pointer is at the left end of the scale. (To ensure that the pointer will not slide down the pivot shaft, it's a good idea to cement the grommet to the shaft after setting the pointer.)

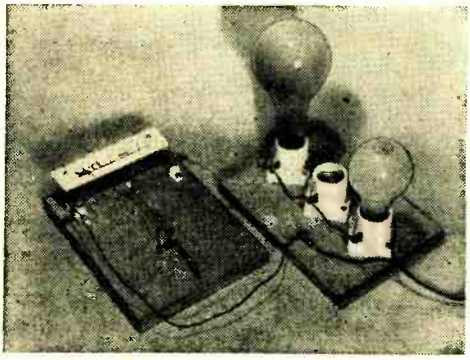
Connect the rheostat (adjusted for maximum resistance), battery, AC ammeter and



Hookup for calibrating Hot-Wire Ammeter.

the Hot-Wire Ammeter in a closed loop series circuit as shown in the schematic. Then adjust the rheostat so that the DC ammeter measures 2 amperes. Note the position of the pointer on the scale. You can add the lettering later. For other calibration points adjust the rheostat and mark the Hot-Wire Ammeter scale in accordance with the readings on the DC ammeter. There will be very little movement of the Hot-Wire Ammeter pointer between zero and approximately ½ ampere, then the meter pointer will move more and more non-linearly as the wire becomes hotter and hotter as a result of higher current passing through it.





Though essentially a DC device, Hot-Wire Ammeter will also measure AC current flow. In setup here, unit indicates current drawn by lamp bulbs of various wattages.

We calibrated the scale of our unit at ¼-ampere points from 1 to 2 amperes and at the ½-ampere point between zero and 1 ampere.

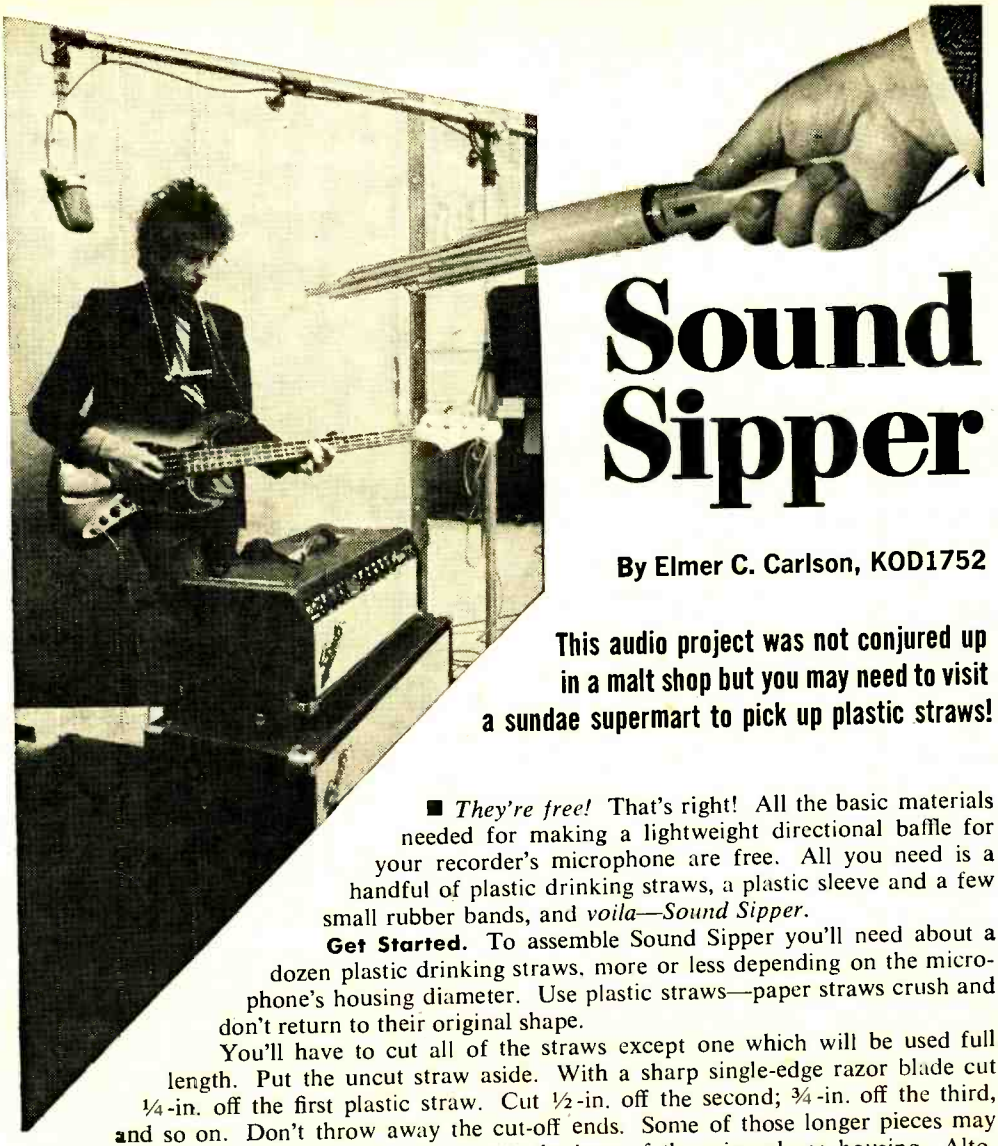
When all calibration points have been marked on the scale remove the battery, DC ammeter and rheostat from the Hot-Wire Ammeter. Dismount the scale and apply appropriate markings at each of the calibration points noted above and then remount

(Continued on page 105)

PARTS LIST FOR HOT WIRE AMMETER

2—1¼ x ⅜-in. fiber, ceramic or metal bushing for mounting meter scale (use one ¼-in. and one 1-in. to make required height) (Allied 47E4711 @ ¼-in. and 47E4716 @ 1-in. or equiv.)
1—¼ x ¼-in. fiber or ceramic bushing for terminating nylon cord (Allied 47E4657 or equiv.)
1—5 x 1⅜-in. piece, white cardboard for meter scale (see text)
4—Type 2 Fahnestock clips (Allied 47E1700 or equiv.)
3—Edison base lamp socket (Allied 60E7661 or equiv.)
1—8-penny smooth box-type nail (for pivot shaft—see text)
1—6-in. length nylon fish line—30-lb. test
1—⅜-in. diameter rubber grommet, faucet washer or bumper (see text and detail drawing)
1—3 x ⅜-in. strip, #16 or #18 gauge steel or aluminum for pivot mounting bracket (see text and detail drawing)
1—4 to 5-in. length of 0.01-in. diameter steel wire for hot wire measuring element (see text)
1—3 to 4-in. length of 0.015-in. diameter steel music wire for spring (see text)
2—8 x 6 x ⅜-in. soft wood block
1—6-ft. AC line cord (Allied 26E2854)
1—#6 battery, 1.5V (Allied 18E5641)
1—15-ohm, 4-watt rheostat (Allied 46E3400)

Misc.—Hardware, #22 gauge bus wire, solder, solder lugs, GE-RTV or Duco cement or Elmer's Glue, Datak press-on numerals of appropriate size (available from Allied Radio, Lafayette Radio or stationery supply store)



Sound Sipper

By Elmer C. Carlson, KOD1752

This audio project was not conjured up in a malt shop but you may need to visit a sundae supermart to pick up plastic straws!

■ *They're free!* That's right! All the basic materials needed for making a lightweight directional baffle for your recorder's microphone are free. All you need is a handful of plastic drinking straws, a plastic sleeve and a few small rubber bands, and *voila—Sound Sipper.*

Get Started. To assemble Sound Sipper you'll need about a dozen plastic drinking straws, more or less depending on the microphone's housing diameter. Use plastic straws—paper straws crush and don't return to their original shape.

You'll have to cut all of the straws except one which will be used full length. Put the uncut straw aside. With a sharp single-edge razor blade cut ¼-in. off the first plastic straw. Cut ½-in. off the second; ¾-in. off the third, and so on. Don't throw away the cut-off ends. Some of those longer pieces may be used as the "short" ends—those near the base of the microphone housing. Altogether, this version of Sound Sipper used 20 sections. But, you can use almost any mike with slight modification.

To make it easy on yourself, lay out the cut straws on a strip of masking tape as shown in the photo (see next page). The strip of masking tape keeps the straws from rolling all over and keeps them in their size-places position to make the job of assembling Sound Sipper easier.

For a temporarily-mounted Sound Sipper all you need is a few rubber bands looped around the upper parts of the baffle. About three rubber bands are all you need to keep the straws in their places. A couple of wraps of masking tape around the base completes the assembly. See what we mean? It's *Free!*

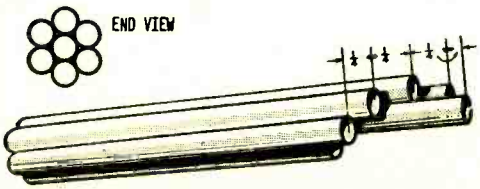
A Better Way. To make your Sound Sipper permanent you had better cement the polyethylene straws together. But, polyethylene is not the easiest plastic to cement. The Editors recommend you use Pliobond. Probably there are other cements, even some special-purpose cements, that will do a good job with polyethylene. But none of the other commonly available cements worked well when tested. *(Continued Overleaf)*

Start Sound Sipper's baffle with a core of seven straws as shown in the drawing. The longest straw, the uncut one, goes in the middle. The other six go around the long straw in the center. It won't matter which way the spiral of straws runs.

Cementing the straws together takes the longest part of the construction time. That's because you have to work in layers—longest straws first. Let one layer dry and then cement on another layer. Rubber bands do a good job of holding the drinking straws together while the cement sets.

Now comes the task of fitting the baffle onto the microphone. The straw assembly fits flush against the microphone grille with the end of the spiral pointing along the axis of the microphone. A white polyethylene sleeve salvaged from an empty deodorant bottle fits about the microphone housing and the straws. This plastic serves as a hood to mount the straws on the microphone. Stiff, durable cardboard can be used, or acetate, or other stiff plastic material. Use Pliobond to cement the straws to the white plastic hood. Rubber bands secure Sound Sipper to the mike unless you wish to make it a permanent attachment, then cement it, too!

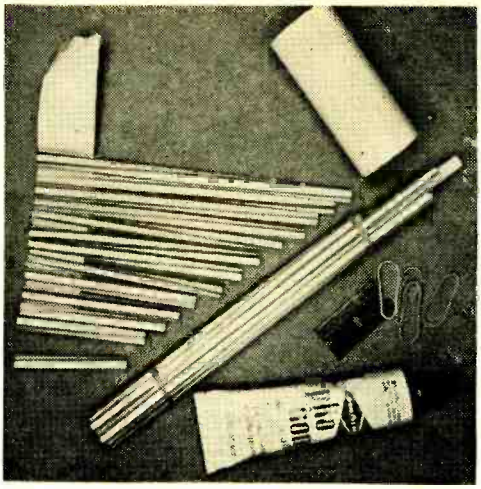
Some Tests. Without connecting a sensitive meter into the tape recorder circuitry you won't notice much difference in sound pickup over a 45° segment of space in front of the microphone. For best appraisal of Sound Sipper just tape record a quarter-minute with and without Sound Sipper in place in a slightly noisy room.



Like all projects, it's important to get a good start. The first seven straws are the most critical in forming the spiral.

The first test of Sound Sipper was made in an office using a portable radio as a sound source. Just tune in a news broadcast. Without Sound Sipper the microphone picked up much of the noise of the typewriters and adding machines. The office noise made it difficult to hear the audio from the radio set at low volume.

With Sound Sipper in place the voice from the radio came out much clearer on the second part of the recording. The constant clatter of the office machines wasn't annoying any longer.



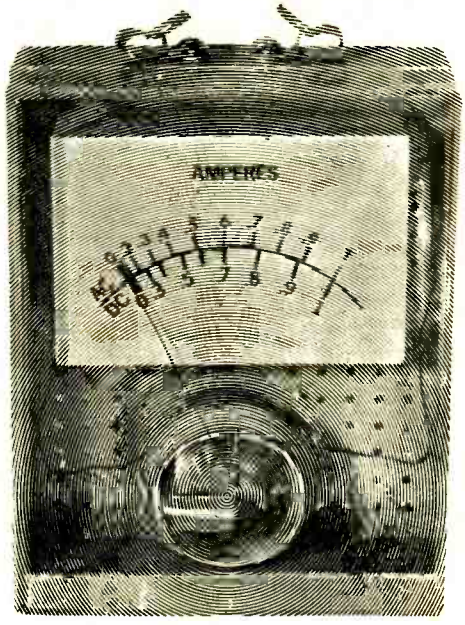
Here's what your workbench will look like part way through the construction. Straws are kept in place by sticking them to some masking tape. Other construction items are Pliobond cement, razor, rubberbands and white plastic hood. See photo below.

Outdoor tests proved much better than those conducted indoors. The reason was there were no walls to bounce the noise around the room. However, if used in a crowd such as a screaming football mob it is wiser to head for open spaces on the sidelines, if possible.

To make more accurate tests of the effectiveness of your Sound Sipper use a constant tone audio signal. Try 400 Hz from a modulated signal generator picked up by a radio. With a constant tone it will be easy to make relative measurements just using the recording level meter on the tape recorder. In time, you could plot a pickup pattern for Sound Sipper's microphone baffle that you assembled.

Sound Sipper doesn't make a pencil-sharp pickup like the pro jobs do. It can't compete with those parabolic dishes or yard-long baffles. But, it will reduce background noise considerably. What's more, you can stuff Sound Sipper in your pocket—it'll bend but won't break. And if you lose it, you won't cry over the cost. Just head back to the maltshop and pick up some more straws. ■

Here's the Sound Sipper all finished and ready to snoop out the sounds you want in.



Sn/Fe MOVING VANE AMMETER

Easy to build—works on AC and DC

by Charles Green, W6FFQ

When the first electric indicator was made by Hans Oersted in 1819 out of a magnetic compass and some wire, he could not have imagined that millions of meters that are its direct descendants would be in use wherever a low-cost rugged indicator is required. For example: as an ammeter in an automobile.

The iron vane electrical meter (ammeter or voltmeter as it's called today) is made in two general types: the polarized vane type—a magnet or an iron vane moving in a magnetic field, or, the repulsion vane type—two iron vanes repelling each other in an induced magnetic field created by the current flow being measured.

Our project uses the repulsion vane principle in an easy-to-build iron vane ammeter. This project will provide the reader the opportunity to combine education with the fun of building. This simple ammeter indicates from 0 to 1 ampere, AC or DC. A solenoid, two sections of a tin can, and a rubber band (in lieu of the conventional metal pivot and spiral spring) are the essential meter components housed in a plastic "P" box. Included in this article are experiments to help you better understand the repulsion vane action of this type of meter.

Vane Repulsion Experiments. Fig. 1 shows the components used in one experiment that can be performed to show how iron vanes move by magnetic repulsion. In our experimental hookup shown in the photo, the coil is made by random winding 200 turns of #22 enameled magnet wire on a 1¼-in. diameter cardboard coil form, about 1-in. long. This cardboard form can be made by cementing cardboard wound around a bottle having 1¼-in. diameter. Use plastic tape to hold the wire in place and leave 10-in. leads coming out of the coil. Remove about 1 in. of the enamel from the end of each lead.

Next, cut up a clean tin can to make two 1½ x ½-in. pieces. These will become the iron vanes in this experiment. Make sure the tin can is made from sheet iron and not from aluminum. Bend each iron piece about ½-in. from one end into a right angle.

MOVING VANE AMMETER

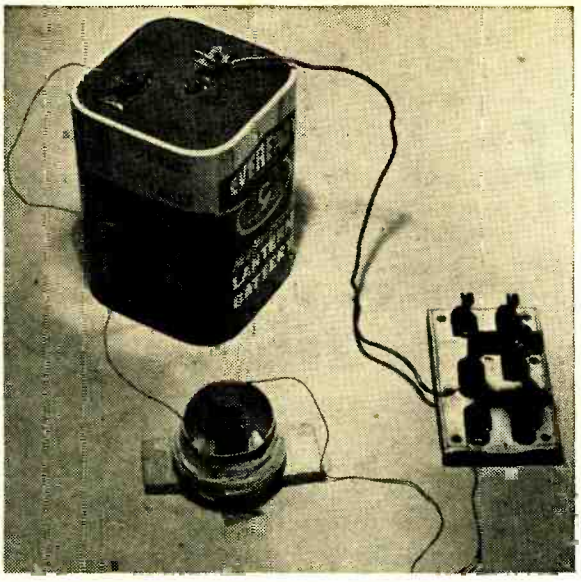


Fig. 1. Vane repulsion experiments demonstrate basic operation of moving-vane ammeter. Circuit works with 6-V battery or filament transformer.

Then make two 1 x 1 x ¼-in. wood blocks, and place them under the coil form about ¾ in. apart, as shown in the photo. Place the two sheet iron vanes inside the center of the coil, with the longer ends upright, and about ⅛-in. apart. Make sure they do not touch the wood blocks. The small ½-in. bends should be in the clear space between the blocks.

Connect the coil leads to a knife switch, and a 6-volt battery. Polarity isn't important, as the coil will work with the battery connected either way. See Fig. 2.

Close the switch and note that the two iron vanes repel each other. This is because the magnetic field of the coil magnetizes each iron vane with the same magnetic polarity; both north ends of the vanes are adjacent to one another, as well as both south ends. This is the reason why they repel one another. Fig. 3 explains this action.

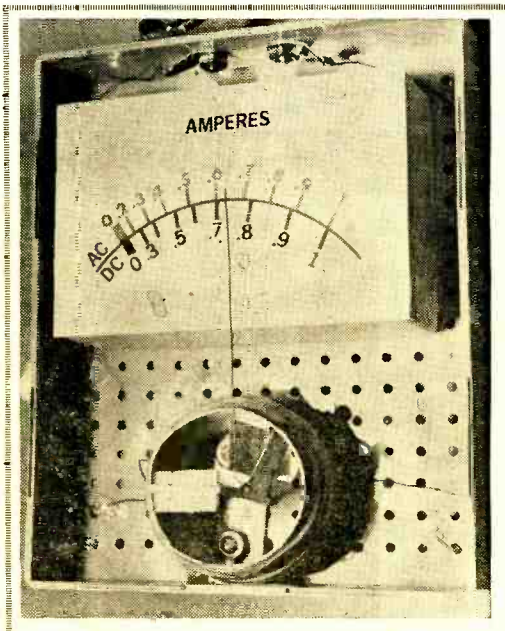
Repeat the experiment, but hold one of the vanes with a wood pencil (or other nonmagnetic item) so that it does not move. Observe that the free vane is still repelled by the fixed vane. It is this action, with one fixed, and one moving vane, that is used in iron vane meters.

Disconnect the battery, and replace it with a 6.3-V transformer (as in Fig. 2). Repeat the previous experiments with the transformer replacing the battery in the circuit, and observe that the iron vane is repelled in the same manner with AC as it is with DC. Even though the AC changes its direction of flow, the magnetic fields still magnetize the iron vanes in a similar manner.

Building the Meter. The iron vane ammeter is built into a 4⅝ x 3⅝ x 1½-in. plastic box supplied with a clear plastic lid. Use the same coil wound for the vane experiments for this meter unit (see the ammeter assembly drawing).

Start construction by making the vane bracket out of 0.05-in. or heavier sheet aluminum. Make the iron vanes from tin can sheet metal as indicated in Fig. 4. Use a rubber band that fits snugly over the bracket as shown, but not too tightly. It should be able to be twisted and then spring back easily. Mount the moving vane on the rubber band about ½-in. down from the top of the bracket, by bending a ⅛-in. lap of the bracket end around the rubber band.

Mount the bracket and the fixed vane in the bottom of the plastic box as shown in Fig. 5. Before tightening the mounting



Basic structure of moving-vane ammeter is shown in photo above and in detail drawing at right. Text describes how unit is calibrated for both AC and DC readings.

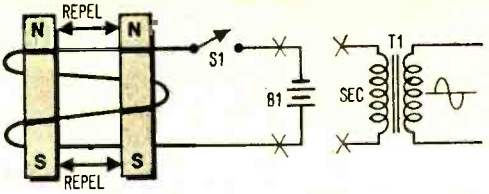


Fig. 2. Because of nature of hookup, iron vanes will always repel one another regardless of battery polarity. If desired, 6.3-V filament transformer (T1) can replace B1.

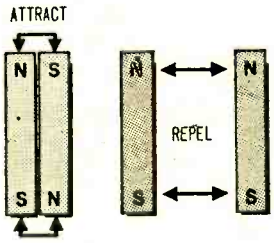


Fig. 3. Vanes can attract one another only when polarities differ. Here, polarities are always same, so vanes repel.

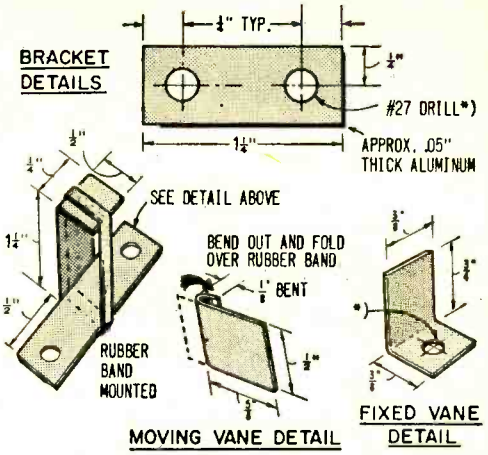
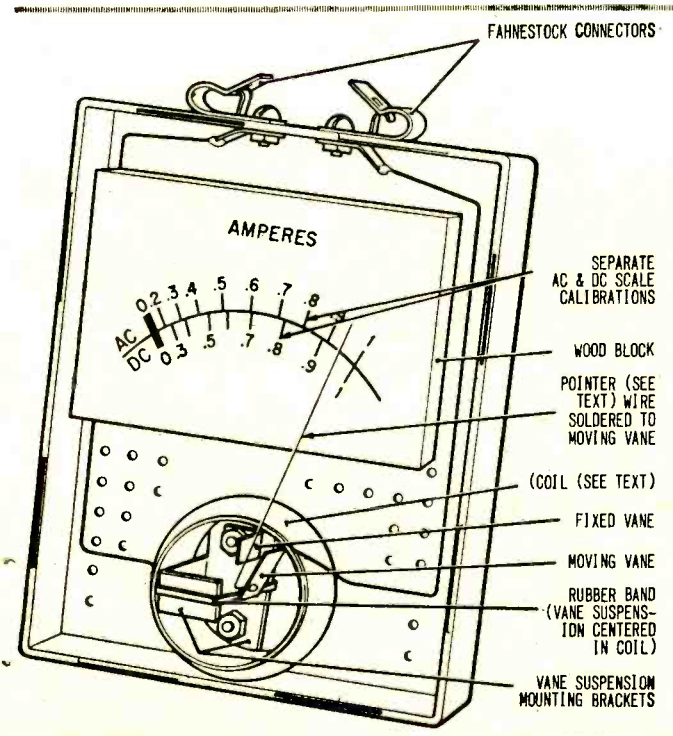


Fig. 4. Details of bracket, moving vane, and fixed vane. Bracket is made of 0.05-in. aluminum strip, vanes from tin can.

screws, shift the rubber band so that the top of the moving vane is even with the top of the fixed vane. Make sure that the rubber band is in the center of the bracket. Notch out the bottom of the left side of the coil form so that it will fit over the bracket base, and cement the coil form to the bottom of the box. Position it as shown in the drawing of Fig. 5.

Install Fahnestock clips on the plastic box as shown and connect them to the coil leads. Dress the coil leads to the sides of the box and hold the leads in place with a drop of cement. *(Continued overleaf)*



PARTS LIST FOR SN/FE MOVING VANE AMMETER

3—6-V batteries
1—Cardboard tube, 1¼-in. diam., 1-in. long (or cardboard sheet to make tube —see text)
¼ lb.—#22 enameled copper wire
2—Fahnestock clips
1—"P" plastic box, 4⅝ x 3⅝ x 1½-in. with clear plastic lid (Radio Shack 270-105 or equiv.)
1—Heavy rubber band for vane suspension (see text)
R1—200-ohm wirewound potentiometer (Mallory MR-200F with MR-1250 shaft, or equiv.)
T1—Filament transformer, 6.3-V, 1-A
1—3 x 2 x 1-in. wood block
Misc.—Tin can (iron only—see text), 0.05-in. or heavier aluminum strip, DC ammeter (0-1A), AC ammeter (0-1A), rubber feet, hardware, solder, etc.

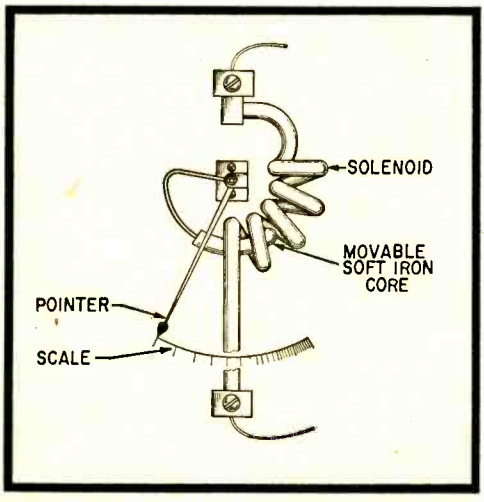
MOVING VANE AMMETER

Cement the scale, drawn on a sheet of paper, to a block of wood, 3 x 2 x 1-in. The wood block is bolted to the box bottom with two sheet metal or wood screws, positioned as shown in the drawing. Screw small rubber feet on each corner of the box.

Make a pointer for the meter from a straightened length of #22 enameled magnet wire, and solder one end to the moving vane as shown in the photo and drawing. Do not use too much heat as heat can damage the rubber band. Bend the wire to make a pointer for the meter scale and cut off the excess wire. The pointer is about 2¾-in. long. Place a small drop of cement inside the coil form to act as a vane stop and prevent the pointer from hitting the side of the box cover. Make sure that the pointer and vane swings freely and returns to a zero point.

Calibrating the Meter. You will need both a DC and an AC meter having 1-ampere ranges; a 200-ohm, wire-wound rheostat; and AC and DC power sources. Three 6-V batteries will serve as the DC source and a 6.3-V, 1-ampere filament transformer will do for the AC source.

Before calibrating, draw an arc on the meter scale and establish a zero point. The meter will have separate AC and DC calibrations as shown in the photo and drawing. If necessary, reposition the meter pointer by bending the top of the bracket.



Commercial moving-vane ammeters of yester-year were much like water meters. Note that device was accurate only if vertical.

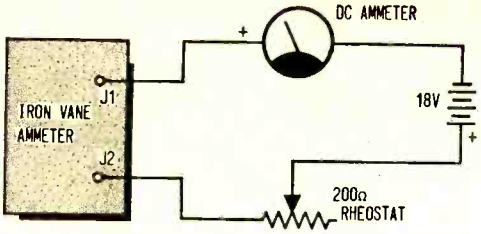


Fig. 6. Hookup for calibrating moving-vane ammeter for DC. See text for details.

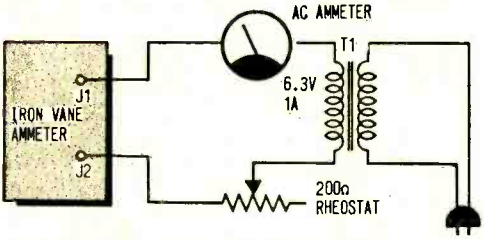


Fig. 7. Filament transformer and AC ammeter are required for easy AC calibration.

Adjust the rheostat to maximum resistance and connect it in series with the calibrated DC ammeter, 18-volt battery and the iron vane meter as shown in the circuit of Fig. 6. Adjust the rheostat and calibrate the iron vane meter according to the DC ammeter readings. Note that the iron vane meter will not respond near the zero position. Calibration of our unit was started at the 0.3 ampere position and was marked at every 0.1 ampere position to 1 ampere. Now connect the AC ammeter and filament transformer as shown in the circuit of Fig. 7 for the AC calibration. Be sure to set the rheostat to maximum resistance before beginning calibration. We started calibration of our unit at the 0.2 ampere point and continued as in the DC calibration. We used rub-on lettering to make the scale for the best appearance.

Operation. The use of a rubber band instead of the more conventional metal pivot and spiral spring makes for easier construction. But temperature changes and sagging and aging rubber may cause the meter indications to vary. The meter will still work as a good indicator for approximate current readings.

Try using the ammeter to check the current of household light bulbs. The ammeter, together with the vane repulsion experiments, will also make a good science fair project. ■

WHITE'S RADIO LOG

An up-to-date Directory of North American AM, FM, and TV Stations, including special sections on World-Wide Shortwave Stations and Emergency Stations for Selected Areas

WHITE'S RADIO LOG CONTENTS FOR 1970-1971

WHITE'S

RADIO LOG

U. S. FM Stations by Call Letters

Call	Location	Freq.
KABC-FM	Los Angeles, Calif.	
KABI-FM	Abilene, Kan.	98.3
KABL-FM	San Francisco, Cal.	
KACA	Prosser, Wash.	
KACE-FM	Riverside, Calif.	
KACO	St. Louis, Mo.	107.7
KADI	St. Louis, Mo.	
KADL	Pine Bluff, Ark.	94.9
KADO	Texarkana, Ark.	107.1
KADX	Denver, Colo.	
KAFE-FM	Santa Fe, N. M.	97.3
KAFF-FM	Flagstaff, Ariz.	92.9
KAFI	Auburn, Calif.	
KAFM	Salina, Kans.	
KAGH-FM	Crossett, Ark.	
KAIM-FM	Honolulu, Hawaii	
KAJS	Newport Beach, Calif.	
KAKC-FM	Tulsa, Okla.	92.9
KAKI	San Antonio, Tex.	
KALA	Davenport, Ia.	
KALB-FM	Alexandria, La.	
KALH	Denver, Colo.	
KALL-FM	Salt Lake City, Utah	
KALW	San Francisco, Calif.	
KALX	Berkeley, Cal.	
KAMB	Merced, Cal.	
KAMS	Mammoth Springs, Ark.	95.1
KANG	Angwin, Cal.	
KANS-FM	Larned, Kan.	
KANT-FM	Lancaster, Calif.	
KANU	Lawrence, Kans.	
KANW	Albuquerque, N.Mex.	
KAOL-FM	Carrollton, Mo.	
KAPB-FM	Marksville, La.	97.7
KARD	Wichita, Kan.	
KARK	Little Rock, Ark.	
KARL-FM	Carlsbad, Cal.	
KARM-FM	Fresno, Calif.	
KASC	Conway, Ark.	
KASD	Aberdeen, S. D.	90.1
KASE	Austin, Tex.	100.7
KASF	Alamosa, Colo.	90.9
KASI-FM	Ames, Iowa	107.1
KASU	Jonesboro, Ark.	
KATN-FM	Boise, Ida.	
KATY-FM	San Luis Obispo, Calif.	
KAUS-FM	Austin, Minn.	99.9
KAVI-FM	Rocky Ford, Colo.	
KAVR-FM	Apple Valley, Cal.	102.3
KAWB	McKinney, Tex.	95.3
KAWL-FM	York, Neb.	
KAWY	Casper, Wyo.	
KAYD	Beaumont, Tex.	97.5
KAYN	Tucson, Ariz.	94.9
KBAD-FM	Carlsbad, N. M.	92.1
KBAY	San Jose, Cal.	
KBBB-FM	Borger, Tex.	
KBBI	Los Angeles, Calif.	
KBBK-FM	Boise, Ida.	
KBBL	Riverside, Cal.	
KBBW	San Diego, Cal.	
KBBX	Seattle, Wash.	
KBBY	Ventura, Calif.	95.1
KBCA	Los Angeles, Calif.	
KBCL-FM	Shreveport, La.	
KBEE-FM	Modesto, Calif.	
KBEM-FM	Minneapolis, Minn.	88.5
KBER-FM	San Antonio, Tex.	
KBEW-FM	Blue Earth, Minn.	
KBEY	Kansas City, Mo.	
KBFC	Forrest City, Ark.	93.5
KBFL	Buffalo, Mo.	
KBFM	Lubbock, Tex.	
KBGH-FM	Memphis, Tex.	
KBGL	Pocatello, Ida.	88.7
KBHF	Bozeman, Mont.	
KBHS-FM	Hot Springs, Ark.	
KBIA-FM	Columbia, Mo.	
KBIG-FM	Los Angeles-Avalon, Cal.	104.3
KBIM-FM	Roswell, N.Mex.	
KBIQ	Edmonds, Wash.	
KBJC	Great Bend, Kan.	91.9
KBKB	San Diego, Cal.	101.5
KBKN	Broken Arrow, Okla.	92.1
KBLE-FM	Seattle, Wash.	
KBMF-FM	Spearman, Tex.	
KBMI-FM	St. Louis, Mo.	90.7
KBMO-FM	Benson, Minn.	93.5
KBMR-FM	Bismarck, N.D.	94.5
KBNM	Albuquerque, N.M.	
KBNO	Houston, Tex.	
KBOA-FM	Kennett, Mo.	
KBOB	West Covina, Cal.	
KBOC	Ogden, Utah	
KBOE-FM	Oskaloosa, Iowa	
KBOI-FM	Boise, Ida.	
KBOO	Portland, Ore.	
KBOS	Tulare, Cal.	94.9
KBOX-FM	Dallas, Tex.	
KBOY-FM	Medford, Oreg.	
KBPI	Denver, Colo.	
KBPK	Buena Park, Cal.	90.1
KBPO	Beaumont, Tex.	
KBRF-FM	Fergus Falls, Minn.	103.3
KBRI-FM	Brinkley, Ark.	102.3
KBRK-FM	Brookings, S.D.	101.7
KBRO-FM	Bremerton, Wash.	
KBSB	Bemidji, Minn.	91.9
KBTC-FM	Houston, Mo.	
KBTM-FM	Jonesboro, Ark.	
KBUC-FM	Terrell Hills, Tex.	106.3
KBUS-FM	Terrell Hills, Tex.	
KBUR-FM	Burlington, Ia.	
KBUY-FM	Ft. Worth, Tex.	
KBUZ-FM	Mesa, Ariz.	
KBVR	Corvallis, Ore.	
KBXL-FM	Caldwell, Ida.	94.1
KBYE-FM	Oklahoma City, Okla.	98.9
KBYU-FM	Provo, Utah	
KCAB-FM	Dardanelle, Ark.	
KCAL-FM	Redlands, Calif.	
KCAW-FM	Port Arthur, Tex.	93.3
KCBH	Beverly Hills, Calif.	
KCBL-FM	Greeley, Colo.	91.5
KCBM	Chico, Cal.	93.7
KCBS-FM	San Francisco, Calif.	
KCCD	Dallas, Tex.	102.9
KCCE	Weatherford, Okla.	
KCCM-FM	Moorhead, Minn.	91.1
KCCO-FM	Lawton, Okla.	98.1
KCDR-FM	Cedar City, Utah	
KCEE-FM	Tucson, Ariz.	
KCES	Eufaula, Okla.	
KCFA-FM	Spokane, Wash.	
KCFM	St. Louis, Mo.	
KCFR	Denver, Colo.	90.1
KCHF-FM	Sioux Falls, S.D.	93.5
KCHO	Chico, Cal.	91.1
KCHV-FM	Conchella, Cal.	
KCIL	Houma, La.	
KCIM-FM	Carroll, Ia.	
KCIV	The Dalles, Ore.	104.5
KCJB-FM	Minot, N.D.	
KCJC	Kansas City, Kan.	
KCKN-FM	Kansas City, Kan.	
KCLC	St. Charles, Mo.	89.9
KCLO-FM	Leavenworth, Kans.	
KCLU-FM	Rolla, Mo.	
KCMA	San Francisco, Cal.	
KCMI	Los Angeles, Calif.	
KCMS-FM	Manitou Springs, Colo.	
KCMW	Warrensburg, Mo.	90.9
KCNA	Henderson, Nev.	94.1
KCNT	Hastings, Neb.	88.1
KCOB-FM	Newton, Iowa	95.9
KCOE-FM	Cedar Rapids, Iowa	90.5
KCOM	Omaha, Nebr.	
KCOR-FM	San Antonio, Tex.	101.9
KCPR	San Luis Obispo, Cal.	91.3
KCPS	Tacoma, Wash.	
KCPX-FM	Salt Lake City, Utah	
KCRA-FM	Sacramento, Calif.	
KCRC-FM	Enid, Okla.	
KCRF-FM	Winnsboro, La.	95.9
KCRW	Santa Monica, Calif.	
KCSB-FM	Santa Barbara, Cal.	91.5
KCSC	Edmond, Okla.	
KCSM	San Mateo, Calif.	
KCSU-FM	Ft. Collins, Colo.	
KCTA-FM	Sinton, Tex.	
KCTC	Sacramento, Cal.	96.1
KCTS-FM	Minneapolis, Minn.	
KCUE-FM	Red Wing, Minn.	
KCUI	Pella, Ia.	
KCUR-FM	Kansas City, Mo.	
KCWM	Ft. Worth, Tex.	
KCWS-FM	Ellensburg, Wash.	
KDAF-FM	Kansas City, Mo.	
KDB-FM	Santa Barbara, Calif.	
KDBS-FM	Alexandria, La.	
KDCR	Sioux Center, Iowa	91.3
KDDD-FM	Dumas, Tex.	
KDEF-FM	Albuquerque, N.Mex.	
KDES-FM	Palm Spgs., Calif.	
KDEW-FM	DeWitt, Ark.	96.7
KDFC	San Francisco, Calif.	
KDEF-FM	Albuquerque, N.M.	
KDEX-FM	Dexter, Mo.	102.3
KDFM	Walnut Creek, Cal.	
KDHL-FM	Faribault, Minn.	
KDHS	Modesto, Cal.	90.5
KDIC	Grinnell, Iowa	107.1
KDIG	San Diego, Cal.	
KDJW-FM	Amarillo, Tex.	
KDKA-FM	Pittsburgh, Pa.	
KDLA-FM	De Ridder, La.	
KDLK-FM	Del Rio, Tex.	
KDLO-FM	Watertown, S.D.	
KDLR-FM	Devils Lake, N.D.	
KDMC	Corpus Christi, Tex.	
KDMI	Des Moines, Iowa	
KDNA	St. Louis, Mo.	102.5
KDNC-FM	Spokane, Wash.	
KDNO	Delano, Cal.	98.5
KDNT-FM	Denton, Tex.	
KDOL-FM	Mojave, Cal.	
KDOT-FM	Scottsdale, Ariz.	100.7
KDPS	Des Moines, Iowa	
KDSN-FM	Denison, Iowa	107.1
KDSU	Fargo, N.D.	
KDSX-FM	Denison-Sherman, Tex.	
KDUO	Riverside, Calif.	
KDUX	Aberdeen, Wash.	104.7
KDUZ-FM	Hutchinson, Minn.	107.1
KDVR	Sioux City, Iowa	
KDVS	Davis, Cal.	91.5
KEAR	San Francisco, Calif.	
KEAX	National City, Calif.	
KEBC	Oklahoma City, Okla.	
KEBJ	Phoenix, Ariz.	
KEBR	Sacramento, Calif.	
KEBS-FM	San Diego, Cal.	89.5
KECR	El Cajon, Calif.	
KEDC-FM	Northridge, Cal.	
KEDP	Las Vegas, N.M.	
KEEL-FM	Shreveport, La.	93.7
KEEY-FM	Minneapolis-St. Paul, Minn.	102.1
KEEZ	San Antonio, Tex.	
KEFC	Waco, Tex.(s)	
KEFM	Nacagdoches, Tex.	103.3
KEFW	Honolulu, Hawaii	
KEHG-FM	Fosston, Minn.	107.1
KEIR	Dallas, Tex.	
KELA-FM	Centralia, Wash.	
KELD-FM	El Dorado, Ark.	
KELE	Lamesa, Tex.	100.3
KELO-FM	Sioux Falls, S.D.	
KELT	Harlingen, Tex.	
KEMO	St. Louis, Mo.	
KENA-FM	Mena, Ark.	101.7
KENW-FM	Portales, N.M.	88.9
KERI	Bellingham, Wash.	
KERR	Salinas, Cal.	
KERS	Sacramento, Cal.	
KESD	Brookings, S.D.	
KESG-FM	Los Angeles, Cal.	96.3
KESM-FM	El Dorado, Mo.	107.1
KETO-FM	Seattle, Wash.	
KETX-FM	Livingston, Tex.	92.1
KEWB	Redding, Cal.	104.3
KEWC-FM	Cheney, Wash.	
KEWI-FM	Topeka, Kan.	
KEXL	San Antonio, Tex.	104.5
KEYC-FM	Mankato, Minn.	
KEYN-FM	Wichita, Kan.	
KEZE	Anaheim, Calif.	
KFAB-FM	Omaha, Nebr.	
KFAC-FM	Los Angeles, Calif.	
KFAD	Cleburne, Tex.	94.9
KFAM-FM	St. Cloud, Minn.	
KFBC-FM	Cheyenne, Wyo.	97.9
KFBD-FM	Waynesville, Mo.	
KFBK-FM	Sacramento, Cal.	92.5
KFCA	Phoenix, Ariz.	91.5
KFGQ-FM	Boone, Ia.	99.3
KFH-FM	Wichita, Kan.	97.9
KFIG	Fresno, Cal.	
KFJB-FM	Marshalltown, Ia.	
KFJZ	Fort Worth, Tex.	
KFKF-FM	Bellevue, Wash.	
KFLA-FM	Scott City, Kan.	
KFLY-FM	Corvallis, Ore.	
KFMA	Jerome, Ida.	92.7
KFMB-FM	San Diego, Calif.	
KFMC	Provo, Utah	96.1
KFMD	Dubuque, Ia.	
KFMF	Ft. Collins, Colo.	93.3
KFMG	Des Moines, Ia.	
KFMH	Muscatine, Iowa	99.7
KFMK	Houston, Tex.(s)	
KFML-FM	Denver, Colo.	
KFMM	Tucson, Ariz.	
KFMN	Abilene, Tex.	
KFMP	Cape Girardeau, Mo.	102.9
KFMQ	Lincoln, Nebr.	
KFMR	Fremont, Cal.	
KFMS	San Francisco, Cal.	106.1
KFMU	Kansas City, Mo.	
KFMV	Magnolia, Ark.	
KFMX	San Diego, Calif.	
KFMY	Eugene, Oreg.	
KFNB	Oklahoma City, Okla.	
KFNE	Big Springs, Tex.	
KFNW-FM	Fargo, N.D.	
KFOA	Honolulu, Hawaii	
KFOG	San Francisco, Calif.	
KFON	Sparks, Nev.	98.3
KFOX-FM	Los Angeles, Cal.	
KFRD-FM	Rosenberg, Tex.	104.9
KFRE-FM	Fresno, Calif.	
KFRN-FM	Brownwood, Tex.	99.3
KFSG	Los Angeles, Cal.	96.3
KFTM-FM	Ft. Morgan, Colo.	
KFUO-FM	Clayton, Mo.	
KFWT-FM	Ft. Worth, Tex.	
KFXM	Jackson, Miss.	
KFYR-FM	Bismarck, N.D.	
KGAF-FM	Gainesville, Tex.	
KGBC-FM	Galveston, Tex.	106.5
KGBI-FM	Omaha, Neb.	100.7
KGBN-FM	Caldwell, Idaho	
KGBS-FM	Los Angeles, Cal.	
KGCC	Denison, Tex.	89.7
KGEC	Palm Springs, Cal.	
KGFM	Bakersfield, Cal.	
KGHO-FM	Hoquiam, Wash.	
KGIW-FM	Alamosa, Colo.	93.5
KGLA	Los Angeles, Calif.	
KGLT	Bozeman, Mont.	
KGMB-FM	Honolulu, Hawaii	
KGMR-FM	Jacksonville, Ark.	100.3
KGMO-FM	Cape Girardeau, Mo.	100.7
KGMR-FM	Jacksonville, Ark.	100.3
KGNC-FM	Amarillo, Tex.	
KGNO-FM	Dodge City, Kan.	
KGO-FM	San Francisco, Calif.	
KGOU	Norman, Okla.	106.3
KGOY	Bethany, Okla.	104.9
KGPO	Grants Pass, Oreg.	
KGRC	Hannibal, Mo.	92.9
KGRD-FM	Las Cruces, N.M.	
KGRE	Greeley, Colo.	
KGRI-FM	Henderson, Tex.	
KGVR	St. Louis, Mo.	107.7
KGUD-FM	Santa Barbara, Cal.	99.9
KGUS	Hot Springs, Ark.	97.5
KGVM-FM	Idaho Falls, Ida.	
KGVW-FM	Belgrade, Mont.	
KHAK-FM	Cedar Rapids, Iowa	
KHAR-FM	Anchorage, Alaska	
KHBL	Plainview, Tex.	
KHBM-FM	Monticello, Ark.	
KHBR-FM	Hillsboro, Tex.	102.5
KHBT	Humboldt, Iowa	97.7
KHCB-FM	Houston, Tex.	105.7
KHEN-FM	Henryetta, Okla.	
KHEP-FM	Phoenix, Ariz.	
KHER	Longview, Tex.	105.7
KHFI-FM	Austin, Tex.	
KHFM	Albuquerque, N.Mex.	
KHGM	Houston, Tex.	102.9
KHIQ	Sacramento, Calif.	
KHJ-FM	Los Angeles, Cal.	101.1
KHKA	Hillsboro, Mo.	88.9
KHOF	Los Angeles, Calif.	
KHOM	Houma, La.	
KHOW-FM	Denver, Colo.	95.7
KHOZ-FM	Harrison, Ark.	
KHPC	Brownwood, Tex.	
KHQ-FM	Spokane, Wash.	
KHRU	Clayton, Mo.	88.1
KHSC	Arcata, Cal.	90.5
KHSI-FM	Hemet, Cal.	
KHTC	Helena, Mont.	89.5
KHVH-FM	Honolulu, Hawaii	
KHVR	Bijou, Calif.	
KHYI	Fremont, Calif.	
KICC	International Falls, Minn.	91.5
KICD-FM	Spencer, Ia.	
KICS-FM	Hastings, Neb.	
KID-FM	Idaho Falls, Ida.	
KIEM	Eureka, Calif.	
KIFG-FM	Iowa Falls, Ia.	
KIFM	Bakersfield, Cal.	96.5
KIHI	Tulsa, Okla.	
KIKK-FM	Houston, Tex.	95.7
KIKS-FM	Lake Charles, La.	
KILR-FM	Estherville, Iowa	95.9
KILT-FM	Houston, Tex.	
KIMP-FM	Mt. Pleasant, Tex.	
KINB	Poteau, Okla.	107.3
KIND-FM	Independence, Kan.	
KING-FM	Seattle, Wash.	
KINK	Portland, Ore.	101.9
KINS-FM	Eureka, Cal.	96.3
KINT-FM	El Paso, Tex.	97.5
KIOI	San Francisco, Cal.	101.3
KIOS-FM	Omaha, Neb.	91.5
KIOU	Corpus Christi, Tex.	
KIRO-FM	Seattle, Wash.	
KISA	Kansas City, Mo.	
KISS	San Antonio, Tex.	
KISW	Seattle, Wash.	
KIT-FM	Yakima, Wash.	
KITE-FM	San Antonio, Tex.	
KITT	San Diego, Calif.	
KITY	San Antonio, Tex.	
KIVE-FM	Glendive, Mont.	96.5
KIVY-FM	Crockett, Tex.	92.7
KIXI-FM	Seattle, Wash.	
KIXL-FM	Dallas, Tex.(s)	
KIXY	San Angelo, Tex.	94.7
KIZZ-FM	El Paso, Tex.	102.1
KJAE	Lakewood, Colo.	107.5
KJAK	Oklahoma City, Okla.	100.5
KJAM-FM	Madison, S.D.	
KJAN-FM	Atlantic, Ia.	
KJAX	Stockton, Cal.	
KJAZ	Alameda, Calif.	
KJCK-FM	Junction City, Kan.	
KJEF-FM	Jennings, La.	
KJEM-FM	Okla. City, Okla.	
KJET-FM	Beaumont, Tex.	
KJFF	Jefferson City, Mo.	106.9
KJIB	Portland, Ore.	99.5
KJLH	Long Beach, Cal.	
KJLM	San Diego, Calif.	

Call	Location	Freq.
KJML	Sacramento, Calif.	
KKND	Jamestown, N.D.	
KJPO	Fresno, Calif.	
KJRG-FM	Newton, Kans.	
KJRL	Liberal, Kan.	
KJSB	Houston, Tex.	
KJSK-FM	Columbus, Neb.	
KKAI	Kailua, Hawaii	96.3
KKEA	Hilo, Hawaii	97.9
KKEG	Fayetteville, Ark.	92.1
KKFM	Colorado Springs, Colo.	
KKHI-FM	San Francisco, Cal.	
KKIT-FM	Taos, N.M.	
KKMA	Pryor, Okla.	104.5
KKNU	Fresno, Cal.	102.7
KKOP	Redondo Beach, Cal.	
KKUP	Cupertino, Cal.	91.5
KKWB	Breckenridge, Minn.	104.9
KKWS	Wadena, Minn.	
KLAW	Lawton, Okla.	
KLAY-FM	Tacoma, Wash.	
KLBK-FM	Lubbock, Tex.	
KLBS-FM	Los Banos, Cal.	
KLCC	Eugene, Ore.	
KLCN-FM	Blytheville, Ark.	
KLCO-FM	Poteau, Okla.	
KLDG-FM	Hobbs, N.M.	95.7
KLEA-FM	Lovington, N.M.	
KLEB-FM	Golden Meadow, La.	
KLEF	Houston, Tex.	
KLEM-FM	LeMars, Ia.	
KLEN-FM	Killeen, Tex.	93.3
KLEX-FM	Lexington, Mo.	106.3
KLFD-FM	Litchfield, Minn.	95.3
KLGA-FM	Algona, Iowa	92.7
KLGS	Los Gatos, Cal.	
KLFM	Beverly Hills, Calif.	
KLIL	Ukiah, Cal.	
KLIN-FM	Lincoln, Neb.	107.3
KLIQ-FM	Portland, Ore.	
KLIB-FM	Denver, Colo.	
KLIS	Palestine, Tex.	94.3
KLIZ-FM	Brainerd, Minn.	95.7
KLJC	Kansas City, Mo.	88.5
KLJT	Lake Jackson, Tex.	
KLLU	Riverside, Cal.	89.7
KLMO-FM	Longmont, Colo.	
KLOA-FM	Ridgecrest, Calif.	
KLOH-FM	Pipestone, Minn.	98.7
KLOL-FM	Houston, Tex.	101.1
KLOM-FM	Lompoc, Cal.	92.7
KLON	Long Beach, Calif.	
KLOQ	Lyons, Kan.	105.5
KLOR-FM	Ponca City, Okla.	
KLOV-FM	Loveland, Colo.	
KLPW-FM	Union, Mo.	101.7
KLRO	San Diego, Calif.	
KLSN	Seattle, Wash.	
KLSS	Mason City, Ia.	
KLTB	Bolivar, Mo.	
KLUR	Wichita Falls, Tex.	
KLWN-FM	Lawrence, Kan.	
KLYD-FM	Bakersfield, Cal.	94.1
KLYK	Longview, Wash.	105.5
KLYN-FM	Lynden, Wash.	
KLYQ-FM	Hamilton, Mont.	95.9
KLYX	Clear Lake City, Tex.	102.1
KLZ-FM	Denver, Colo.	
KMAG-FM	Ft. Smith, Ark.	
KMAK-FM	Fresno, Calif.	
KMAP	Albuquerque, N.M.	100.3
KMAQ-FM	Maquoketa, Ia.	
KMAX	Sierra Madre, Calif.	
KMBR-FM	Kansas City, Mo.	
KMCP	Portland, Oreg.	
KMED-FM	Medford, Ore.	93.7
KMEO-FM	Phoenix, Ariz.	
KMER	Fresno, Calif.	
KMET	Los Angeles, Cal.	
KMFA	Austin, Tex.	
KMFB-FM	Mendocino, Cal.	
KMFL-FM	Marshall, Mo.	102.9
KMFM	San Antonio, Tex. (s)	
KMFS	Memphis, Tex.	
KMHL-FM	Marshall, Minn.	
KMHT	Marshall, Tex.	
KMIH	Mercer Island, Wash.	90.1
KMJ-FM	Fresno, Calif.	
KMLB-FM	Monroe, La.	
KMMK	Little Rock, Ark.	
KMND-FM	Mesa, Ariz.	
KMOD	Tulsa, Okla.	
KMOT-FM	Minot, N.D.	93.7
KMOX-FM	St. Louis, Mo.	
KMPL-FM	Sikeston, Mo.	97.7
KMPX	San Francisco, Calif.	
KMRC-FM	Morgan City, La.	
KMSM	Rolla, Mo.	
KMSU	Mankato, Minn.	90.5
KMTS	Moberly, Mo.	90.1
KMTY-FM	Clovis, N.M.	99.1
KMUL-FM	Muleshoe, Tex.	
KMUW	Wichita, Kans.	
KMWT	Mineral Wells, Tex.	95.9
KMWX-FM	Yakima, Wash.	107.3
KMYC-FM	Marysville, Calif.	
KMYO-FM	Little Rock, Ark.	
KMUZ	Santa Barbara, Calif.	
KNBO	New Boston, Tex.	95.9
KNBR-FM	San Francisco, Calif.	
KNBT	New Braunfels, Tex.	92.1
KNBU	Baldwin, Kan.	
KNBY-FM	Newport, Ark.	
KNCT-FM	Killeen, Tex.	91.3
KNCV	Rochester, Minn.	101.7
KNDA	St. Louis, Mo.	
KNDR	Chickasha, Okla.	
KNDX	Yakima, Wash.	
KNEB-FM	Scottsbluff, Neb.	94.1
KNED-FM	McAlester, Okla.	
KNEI-FM	Waukon, Iowa	103.9
KNEU	El Centro, Cal.	98.5
KNEV	Reno, Nev.	
KNEW-FM	Scottsbluff, Nebr.	
KNFB	Nowata, Okla.	
KNFM	Midland, Tex.	
KNHS	Torrance, Cal.	
KNIK-FM	Anchorage, Alaska	
KNIR-FM	New Iberia, La.	99.1
KNIS	Carson City, Nev.	94.7
KNIX-FM	Phoenix, Ariz.	
KNJO	Thousand Oaks, Calif.	
KNLT	Truekee, Cal.	101.7
KNNU	Tulare, Cal.	106.7
KNOB	Long Beach, Cal.	97.9
KNOC-FM	Natchitoches, La.	
KNOE-FM	Monroe, La.	
KNOF	St. Paul, Minn.	
KNOK-FM	Ft. Worth, Tex.	
KNOS	Marshall, Mo.	91.7
KNRO	Conroe, Tex.	106.9
KNTO	Wichita Falls, Tex.	
KNTU	Denton, Tex.	88.5
KNUE	Tyler, Tex.	101.5
KNUJ-FM	New Ulm, Minn.	
KNUS	Dallas, Tex.	
KNWA	Fayetteville, Ark.	
KNWC-FM	Sioux Falls, S.D.	
KNWS-FM	Waterloo, Iowa	
KNX-FM	Los Angeles, Calif.	
KNXR	Rochester, Minn.	
KOA-FM	Denver, Colo.	
KOAP	Portland, Ore.	91.5
KOB-FM	Albuquerque, N.M.	
KOBC	Joplin, Mo.	91.1
KOBH-FM	Hot Springs, S.D.	
KOBS	Orange, Tex.	105.5
KOCM	Newport Beach, Cal.	
KOCN	Pacific Grove, Cal.	104.9
KOCV	Odessa, Tex.	
KOCY-FM	Oklahoma City, Okla.	
KODA-FM	Houston, Tex.	
KOFA	Yuma, Ariz.	91.5
KOFM	Oklahoma City, Okla.	
KOFO-FM	Ottawa, Kan.	
KOGM-FM	Tulsa, Okla.	
KOGO	San Diego, Calif.	
KOIL-FM	Omaha, Neb.	
KOIN-FM	Portland, Oreg.	
KOIT	San Francisco, Cal.	
KOKE-FM	Austin, Tex.	
KOKH	Oklahoma City, Okla.	
KOL-FM	Seattle, Wash.	
KOLA	San Bernardino, Cal.	99.9
KOLM-FM	Rochester, Minn.	
KONA-FM	Kennewick, Wash.	105.3
KONG-FM	Visalia, Calif.	
KONI-FM	Spanish Fork, Utah	
KOOI	Jacksonville, Tex.	106.5
KOOL-FM	Phoenix, Ariz.	
KOPR-FM	Great Falls, Mont.	
KORA-FM	Bryan, Tex.	
KORE-FM	Springfield-Eugene, Ore.	
KORD-FM	Richland, Wash.	102.7
KORK-FM	Las Vegas, Nev.	
KORU	Tulsa, Okla.	
KOSE-FM	Osceola, Ark.	
KOSI-FM	Denver, Colo.	
KOSO	Patterson, Cal.	93.1
KOST	Los Angeles, Cal.	
KOSU-FM	Stillwater, Okla.	
KOSY-FM	Texarkana, Ark.	102.5
KOTE	Lancaster, Cal.	106.3
KOTN-FM	Pine Bluff, Ark.	92.3
KOTO	Alamagordo, N.M.	
KOVF-FM	Kearney, Neb.	91.3
KOWN-FM	Escondido, Cal.	
KOYL-FM	Odessa, Tex.	
KOYN-FM	Billings, Mont.	93.3
KOZE-FM	Lewiston, Idaho	
KOZN	Omaha, Neb.	94.1
KPAC-FM	Port Arthur, Tex.	
KPAM-FM	Portland, Ore.	97.1
KPAN-FM	Hereford, Tex.	106.3
KPAT-FM	Berkeley, Calif.	
KPCS	Pasadena, Cal.	89.3
KPDQ-FM	Portland, Ore.	93.7
KPEL-FM	Lafayette, La.	
KPEN	Los Altes, Cal.	97.7
KPER	Gilroy, Cal.	94.3
KPFA	Berkeley, Cal.	94.1
KPFB	Berkeley, Calif.	
KPFK	Los Angeles, Calif.	
KPFT	Houston, Tex.	90.1
KPGY	Ames, Iowa	91.9
KPIK-FM	Colorado Springs, Colo.	
KPIP	Roseville, Cal.	93.5
KPLC-FM	Lake Charles, La.	
KPLT-FM	Paris, Tex.	
KPLU	Tacoma, Wash.	
KPLX	San Jose, Cal.	
KPFM	Portland, Oreg.	
KPGM	Los Altos, Calif.	
KPLA	Plainview, Tex.	93.7
KPLR-FM	St. Louis, Mo.	
KPLU-FM	Tacoma, Wash.	88.5
KPMT	Oxnard, Cal.	
KPNW-FM	Eugene, Ore.	99.1
KPOC-FM	Pocahontas, Ark.	103.9
KPOI-FM	Honolulu, Hawaii	
KPOK-FM	Portland, Ore.	98.5
KPOL-FM	Los Angeles, Calif.	
KPPC-FM	Pasadena, Calif.	
KPPS-FM	Parsons, Kans.	
KPQ-FM	Wenatchee, Wash.	
KPRI	San Diego, Calif.	
KPRM-FM	Park Rapids, Minn.	103.7
KPRN	Seattle, Wash.	
KPSD	Dallas, Tex.	
KPSR	Los Altos, Cal.	91.5
KPRS-FM	Kansas City, Mo.	
KPSD	Dallas, Tex.	
KPSR	Los Altos, Cal.	
KPUL-FM	Pullman, Wash.	104.9
KPUP	Kingsville, Tex.	97.7
KPWD	Plentywood, Mont.	
KPWN	Parowan, Utah	90.9
KQED-FM	San Francisco, Cal.	88.5
KQFM	Portland, Oreg.	
KQIP	Odessa, Tex.	
KQMU	Salt Lake City, Utah	94.1
KQRS-FM	Golden Valley, Minn.	
KQTY	Wichita, Kan.	
KQUE	Houston, Tex.	
KQV-FM	Pittsburgh, Pa.	
KQWB-FM	Moorhead, Minn.	
KQXX	McAllen, Tex.	
KQYN	Twentynine Palms, Cal.	95.7
KRAA	Little Rock, Ark.	94.1
KRAB	Seattle, Wash.	
KRAM-FM	Las Vegas, Nev.	
KRAV	Tulsa, Okla.	
KRAZ	Farmington, N.M.	96.9
KRBE	Houston, Tex.	
KRBI-FM	St. Peter, Minn.	
KRBM	Pendleton, Ore.	90.9
KRBT	Woodland, Cal.	102.5
KRCB-FM	Council Bluffs, Ia.	
KRCC	Colorado Springs, Colo.	
KRCH	St. Louis, Mo.	
KRCS	San Bernardino, Cal.	
KRCW	Santa Barbara, Calif.	
KRDO-FM	Colorado Springs, Colo.	95.1
KREB	Monroe, La.	
KREM-FM	Spokane, Wash.	
KREP	Santa Clara, Cal.	
KRES	Moberly, Mo.	
KREX-FM	Grand Junction, Colo.	
KRFM	Phoenix, Ariz.	
KRFO-FM	Owatonna, Minn.	
KRHM	Los Angeles, Calif.	
KRIL	El Dorado, Ark.	
KRIT	Clarien, Iowa	
KRKH-FM	Lubbock, Tex.	
KRKY	Denver, Colo.	
KRLD-FM	Dallas, Tex.	
KRMD-FM	Shreveport, La.	
KRMG-FM	Tulsa, Okla.	
KRMS-FM	Osage Beach, Mo.	
KRNT-FM	Des Moines, Ia.	
KRNU	Lincoln, Neb.	90.3
KRNW	Boulder, Colo.	
KRNY-FM	Kearney-Holdrege, Nebraska	
KROA	Aurora, Neb.	
KROB-FM	Robstown, Tex.	
KROC-FM	Rochester, Minn.	
KRON-FM	San Francisco, Calif.	
KROS-FM	Clinton, Iowa	
KROW	Santa Barbara, Calif.	
KROY-FM	Sacramento, Calif.	
KRPM	San Jose, Cal.	98.5
KRRC	San Jose, Calif.	
KRSA-FM	Salinas, Cal.	
KRSI	Minneapolis, Minn.	
KRSI-FM	St. Louis Park, Minn.	
KRSL-FM	Russell, Kan.	
KRSN-FM	Los Alamos, N.Mex.	
KRSP-FM	Salt Lake City, Utah	103.5
KRST	Albuquerque, N.M.	
KRUS-FM	Ruston, La.	
KRVM	Eugene, Oreg.	
KRVN-FM	Lexington, Neb.	93.1
KRVS-FM	Lafayette, La.	
KRWG	University Park, N.M.	90.7
KRWL-FM	Carson City, Nev.	97.3
KRVS-FM	Lafayete, La.	
KRXL	Kirksville, Mo.	
KRYT-FM	Colorado Springs, Colo.	
KSAM-FM	Huntsville, Tex.	
KSAN	San Francisco, Cal.	94.9
KSBY-FM	San Luis Obispo, Cal.	
KSCO	Santa Cruz, Calif.	
KSBW-FM	Salinas, Calif.	
KSDB-FM	Manhattan, Kans.	
KSDO-FM	San Diego, Cal.	
KSDS	San Diego, Calif.	
KSEA	San Diego, Calif.	
KSEL-FM	Lubbock, Tex.	
KSEO-FM	Durant, Okla.	
KSET-FM	El Paso, Tex.	94.7
KSFA-FM	Nacogdoches, Tex.	
KSFV	San Fernando, Cal.	106.3
KSFX	San Francisco, Calif.	
KSGM-FM	Ste. Genevieve, Mo.	
KSHE	Crestwood, Mo.	
KSHN	Sherman, Tex.	96.7
KSIB-FM	Creston, Ia.	
KSIS-FM	Sedalia, Mo.	
KSIX-FM	Corpus Christi, Tex.	93.9
KSJM	Jamestown, N.D.	
KSJO-FM	San Jose, Calif.	
KSJR-FM	Collegeville, Minn.	
KSJS	San Jose, Cal.	90.7
KSKU	Hutchinson, Kan.	102.1
KSJT	San Angelo, Tex.	
KSL-FM	Salt Lake City, Utah	
KSLH	St. Louis, Mo.	
KSLM-FM	Salem, Ore.	105.1
KSLO-FM	Opelousas, La.	
KSMA-FM	Santa Maria, Calif.	
KSMB	Lafayette, La.	
KSNM	Santa Fe, N.M.	
KSNN-FM	Pocatello, Ida.	93.7
KSOM-FM	Ontario, Cal.	
KSOO-FM	Sioux Falls, S.D.	
KSOP-FM	Salt Lake City, Utah	
KSOR	Ashland, Ore.	90.1
KSOZ	Point Lookout, Mo.	
KSPC	Claremont, Calif.	
KSPI-FM	Stillwater, Okla.	
KSPL-FM	Diboll, Tex.	95.5
KSPN	Aspen, Colo.	97.7
KSPR-FM	Springdale, Ark.	104.9
KSRF	Santa Monica, Calif.	
KSRN	Reno, Nev.	
KSRT	Tracy, Cal.	
KSTE	Emporia, Kans.	
KSTI-FM	Springfield, S.D.	88.5
KSTN-FM	Stockton, Calif.	107.3
KSTP-FM	Minneapolis, Minn.	94.5
KSTU	Centerville, Utah	105.5
KSUI	Iowa City, Iowa	
KSVP-FM	Artesia, N.M.	
KSWC	Winfield, Kan.	
KSWH	Arkedelphia, Ark.	88.1
KSWM-FM	Aurora, Mo.	
KSYM-FM	San Antonio, Tex.	90.3
KSYN	Joplin, Mo.	
KTAC-FM	Tacoma, Wash.	
KTAI	Kingsville, Tex.	91.9
KTAL-FM	Texarkana, Tex.	98.1
KTAP	Tucson, Ariz.	
KTAR-FM	Phoenix, Ariz.	
KTBC-FM	Austin, Tex.	
KTBT	Garden Grove, Cal.	
KTCF	Cedar Falls, Iowa	
KTCR-FM	Minneapolis, Minn.	
KTCS-FM	Ft. Smith, Ark.	
KTCU-FM	Ft. Worth, Tex.	
KTEA-FM	Midwest City, Okla.	
KTEC	Oretech, Oreg.	
KTEN-FM	Ada, Okla.	93.3
KTEP	El Paso, Tex.	88.5
KTFC	Sioux City, Ia.	
KTFM	San Antonio, Tex.	102.7
KTGR-FM	Columbia, Mo.	
KTHO-FM	Tahoe Valley, Cal.	
KTIB-FM	Thibodaux, La.	
KTIM	San Rafael, Calif.	
KTIS-FM	Minneapolis, Minn.	
KTJO-FM	Ottawa, Kans.	
KTLQ-FM	Tahlequah, Okla.	
KTMS-FM	Santa Barbara, Calif.	97.5
KTNM-FM	Tucumcari, N.M.	92.7
KTNT-FM	Tacoma, Wash.	
KTOC-FM	Jonesboro, La.	
KTOD-FM	Sinton, Tex.	
KTON-FM	Belton, Tex.	106.3
KTOP	Topeka, Kan.	
KTOY	Tacoma, Wash	
KTQM-FM	Clovis, N.M.	
KTRB-FM	Modesto, Calif.	
KTRM-FM	Beaumont, Tex.	
KTSC-FM	Pueblo, Colo.	90.5
KTSM-FM	El Paso, Tex.	99.9
KTSR	Kansas City, Mo.	
KTTS-FM	Springfield, Mo.	
KTTT-FM	Columbus, Neb.	93.5
KTUH	Honolulu, Hawaii	90.5
KTW-FM	Seattle, Wash.	
KTWD	Spokane, Wash.	
KTWN	Anoka, Minn.	107.9
KTXJ-FM	Jasper, Tex.	
KTXN-FM	Victoria, Tex.	98.7
KTWR	Tacoma, Wash.	
KTXR-FM	Springfield, Mo.	
KTXT-FM	Lubbock, Tex.	
KTYM-FM	Inglewood, Calif.	
KUAC	College, Alaska	104.7
KUAM-FM	Agana, Guam	
KUCI	Irvine, Cal.	89.9
KUCR	Riverside, Cal.	
KUCV	Lincoln, Neb.	
KUER	Salt Lake City, Utah	
KUID	Moscow, Ida.	
KUDE-FM	Oceanside, Cal.	102.1
KUDL-FM	Kansas City, Kan.	98.1
KUER	Salt Lake City, Utah	
KUFM	Missoula, Mont.	
KUHF	Houston, Tex.	88.7
KUKI-FM	Ukiah, Cal.	
KULP-FM	El Campo, Tex.	96.9
KUMD-FM	Duluth, Minn.	
KUMN	Albuquerque, N.M.	

ELECTRONICS COMES ALIVE AS YOU LEARN BY DOING WITH CUSTOM TRAINING EQUIPMENT

Nothing is as effective as learning by doing. That's why NRI puts so much emphasis on equipment, and why NRI invites comparison with equipment offered by any other school, at any price. NRI pioneered and perfected the use of special training kits to aid learning at home. You get your hands on actual parts like resistors, capacitors, tubes, condensers, wire, transistors and diodes. You build, experiment, explore, discover. You start right out building your own professional vacuum tube voltmeter with which you learn to measure voltage and current. You learn how to mount and solder parts, how to read schematic diagrams. Then, you progress to other experimental equipment until you ultimately build a TV set, an actual transmitter or a functioning computer unit (depending on the course you select). It's the practical, easy way to learn at home—the priceless "third dimension" in NRI's exclusive Electronic TV-Radio training method.

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Lesson texts are a necessary part of training, but only a part. NRI's "bite-size" texts are as simplified, direct and well-illustrated as half a century of teaching experience can make them. The amount of material in each text, the length and design, is precisely right for home-study. NRI texts are programmed with NRI training kits to make things you read come alive. As you learn, you'll experience all the excitement of original discovery. Texts and equipment vary with the course. Choose from major training programs in TV-Radio Servicing, Industrial Electronics and Complete Communications. Or select one of seven special courses to meet specific needs. Check the courses of most interest to you on the postage-free card and mail it today for your free catalog.

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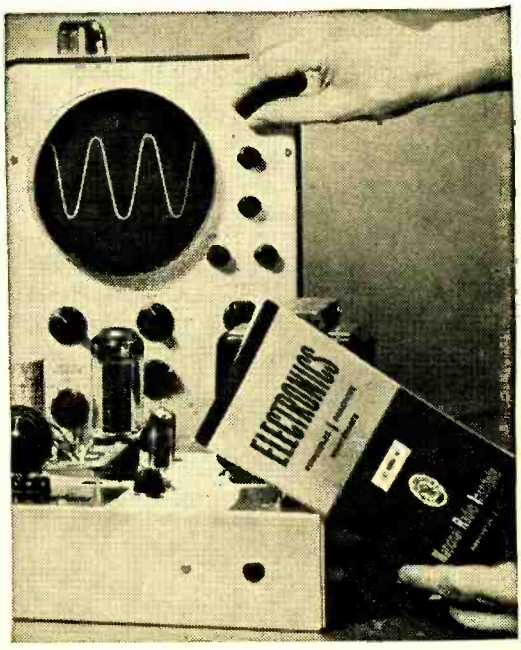

WHITE'S RADIO LOG

Call	Location	Freq.
KUNC-FM	Greeley, Colo.	91.5
KUNF	La Canada, Cal.	88.9
KUOA-FM	Siloam Springs, Ark.	
KUOI-FM	Moscow, Ida.	89.3
KUDP	Stockton, Calif.	
KUOR-FM	Redlands, Cal.	
KUOW	Seattle, Wash.	
KUPD-FM	Tempe, riz.	
KUPK-FM	Garden City, Kan.	
KURL-FM	Billings, Mont.	
KUSC	Los Angeles, Calif.	
KUSD-FM	Vermillion, S.Dak.	
KUSN-FM	St. Joseph, Mo.	
KUSU-FM	Logan, Utah	
KUT-FM	Austin, Tex.	
KUTE	Glendale, Cal.	101.9
KUVR-FM	Holdrege, Neb.	97.7
KUWR	Laramie, Wyo.	
KVBC	Grand Forks, N.D.	
KVCL-FM	Winnfield, La.	
KVCR	San Bernardino, Calif.	
KVEE-FM	Conway, Ark.	
KVEG-FM	Las Vegas, Nev.	92.3
KVEN-FM	Ventura, Calif.	
KVEZ	San Mateo, Cal.	
KVFM	San Fernando, Calif.	
KVFS	Vacaville, Cal.	95.3
KVGM	Bellingham, Wash.	92.9
KVHS	Concord, Cal.	91.1
KVIL-FM	Highland Park-Dallas, Tex.	
KVLV-FM	Fallon, Nev.	
KVMG-FM	Cochran, Ga.	
KVMN	Pueblo, Colo.	
KVOA-FM	Tucson, Ariz.	
KVOD	Denver, Colo.	99.5
KVOE-FM	Emporia, Kan.	
KVOP-FM	Plainview, Tex.	
KVOR-FM	Colorado Springs, Colo.	
KVOX-FM	Moorhead, Minn.	
KVPC	Fairfield, Iowa	89.5
KVPI-FM	Ville Platte, La.	
KVRF	Vermillion, S.D.	
KVRO	Stillwater, Okla.	
KVSC	St. Cloud, Minn.	
KVSR	Rapid City, S.D.	97.9
KVTT	Dallas, Tex.	
KVWM	Show Low, Ariz.	
KWAM-FM	Memphis, Tenn.	101.1
KWAR	Waverly, Iowa	
KWAT-FM	Watertown, S.D.	96.1
KWAV	Monterey, Cal.	
KWAW	Webster City, Iowa	95.9
KWAX	Eugene, Oreg.	
KWBE-FM	Beatrice, Neb.	
KWBI	Morrison, Colo.	91.1
KWBU	Waco, Tex.	
KWCR-FM	Ogden, Utah	
KWDM	Des Moines, Ia. (s)	
KWED-FM	Seguin, Tex.	105.3
KWEH	Camden, Ark.	
KWFC	Springfield, Mo.	
KWFM	Tucson, Ariz.	92.9
KWG-FM	Stockton, Calif.	
KWGN-FM	Abernathy, Tex.	
KWGO-FM	Abernathy, Tex.	
KWGS	Tulsa, Okla.	89.5
KWHG	Lincoln, Neb.	
KWHI-FM	Brenham, Tex.	
KWHO-FM	Salt Lake City, Utah	
KWHP	Edmund, Okla.	97.7
KWIC	Salt Lake City, Utah	
KWIL-FM	Albany, Ore.	107.9
KWIQ-FM	Moses Lake, Wash.	100.3
KWIX	St. Louis, Mo.	
KWIZ-FM	Santa Ana, Calif.	
KWJB-FM	Globe, Ariz.	
KWKC-FM	Abilene, Tex.	
KWKH-FM	Shreveport, La.	
KWKI	Kansas City, Mo.	
KWKO	Anchorage, Alaska	102.1
KWLM-FM	Willmar, Minn.	
KWLW	San Angelo, Tex.	
KWMF-FM	Walnut Creek, Cal.	
KWMR	Cedar Rapids, Iowa	88.9
KWMT-FM	Ft. Dodge, Ia.	
KWMU	St. Louis, Mo.	90.7
KWNS-FM	Pratt, Kan.	
KWNT-FM	Davenport, Ia	
KWOA-FM	Worthington, Minn	95.1
KWOC-FM	Poplar Bluff, Mo.	
KWOE-FM	Clinton, Okla.	106.9
KWPM-FM	West Plains, Mo.	
KWSB-FM	Gunnison, Colo.	
KWST	Los Angeles, Cal.	105.9
KWTO-FM	Springfield, Mo.	
KWTX-FM	Waco, Tex.	97.5
KWWC-FM	Columbia, Mo.	
KWWL-FM	Waterloo, Iowa	107.9
KWWM	Stephenville, Tex.	98.3
KWWR-FM	Mexico, Mo.	
KWXI	Ft. Worth, Tex.	97.1
KWXY-FM	Cathedral City, Cal.	103.1
KWYN-FM	Wynne, Ark.	92.7
KXEL-FM	Waterloo, Iowa	
KXFM	Santa Maria, Cal.	99.1
KXIC-FM	Iowa City, Ia.	
KXIT-FM	Dalhart, Tex.	95.9
KXKX	Lodi, Cal.	97.7
KXL-FM	Portland, Ore.	95.5
KXLU	Los Angeles, Cal.	88.9
KXLY-FM	Spokane, Wash.	
KXOA	Sacramento, Calif.	
KXRA-FM	Alexandria, Minn.	
KXTC	Glendale, Ariz.	92.3
KXTR	Kansas City, Mo.	
KXXK	Dallas, Tex.	
KXYZ-FM	Houston, Tex.	
KYEA	West Monroe, La.	98.3
KYED	Pasadena, Tex.	92.5
KYEM	Bartlesville, Okla.	100.1
KYEW	Phoenix, Ariz.	
KYFM	Bartlesville, Okla.	100.1
KYLE-FM	Temple, Tex.	
KYMS	Santa Ana, Cal.	
KYNO-FM	Fresno, Cal.	95.5
KYSS-FM	Missoula, Mont.	100.1
KYSD	Waynesville, Mo.	102.3
KYSM-FM	Mankato, Minn.	
KYTE	Livermore, Cal.	101.7
KYZM-FM	Cape Girardeau, Mo.	102.9
KZAK-FM	Tyler, Tex.	
KZAP	Sacramento, Cal.	98.5
KZEL-FM	Eugene, Ore.	
KZFM	Corpus Christi, Tex.	
KZOM	Oklahoma City, Okla.	
KZSU	San Mateo, Cal.	90.1
KZUN-FM	Opportunity, Wash.	
WAAA-FM	Winston-Salem, N.C.	
WAAF	Worcester, Mass.	
WAAM-FM	Parkersburg, W.Va.	
WAAV	Wilmington, N.C.	102.7
WAAZ-FM	Crestview, Fla.	
WABC-FM	New York, N.Y.	
WABD-FM	Ft. Campbell, Ky.	107.9
WABE	Atlanta, Ga.	
WABF-FM	Fairhope, Ala.	
WABI-FM	Bangor, Maine	
WABX-FM	Detroit, Mich.	
WABZ-FM	Albemarle, N.C.	
WACG-FM	Augusta, Ga.	90.7
WACO-FM	Waco, Tex.	99.9
WACT-FM	Tuscaloosa, Ala.	
WADB	Point Pleasant, N.J.	95.9
WADM-FM	Decatur, Ind.	
WADV	Buffalo, N.Y.	106.5
WAEF	Cincinnati, O.	
WAEL-FM	Maricao, P.R.	96.1
WAER	Syracuse, N.Y.	
WAEW-FM	Crossville, Tenn.	
WAFB-FM	Baton Rouge, La.	98.1
WAFM	Angola, Ind.	100.1
WAGY-FM	Forest City, N.C.	
WAHR	Huntsville, Ala.	
WAIC	Springfield, Mass.	
WAIN-FM	Columbia, Ky.	
WAJC	Indianapolis, Ind.	
WAJM	Montgomery, Ala.	
WAJP	Joliet, Ill.	93.5
WAJR-FM	Morgantown, W.Va.	
WAKE-FM	Valparaiso, Ind.	
WAKM	Bedford, Pa.	
WAKN-FM	Aiken, S.C.	
WAKO-FM	Lawrenceville, Ill.	
WAKR-FM	Akron, Ohio	
WAKW	Cincinnati, O.	
WALD-FM	Walterboro, S.C.	100.9
WALK-FM	Patchogue, N.Y.	
WALL-FM	Middletown, N.Y.	
WALM-FM	Marshall, Mich.	104.9
WALP	Corinth, Miss.	90.5
WAMC	Albany, N.Y.	
WAMF	Amherst, Mass.	89.5
WAMO-FM	Pittsburgh, Pa.	105.9
WAMU-FM	Washington, D.C.	
WANG-FM	Coldwater, Mich.	
WANS-FM	Anderson, S.C.	
WANY-FM	Albany, Ky.	
WANZ	Sebring, Fla.	
WAOV-FM	Vincennes, Ind.	
WAPC-FM	Riverhead, N.Y.	
WAPI-FM	Birmingham, Ala.	94.5
WAPL-FM	Appleton, Wis.	
WAPS	Akron, Ohio	
WAQB-FM	Atlantic Beach, Fla.	104.9
WARC	Meadville, Pa.	
WARD-FM	Johnstown, Pa.	
WARI-FM	Abbeville, Ala.	
WARK	Little Rock, Ark.	
WARN-FM	Fort Pierce, Fla.	
WARP	Due West, S.C.	
WARU-FM	Peru, Ind.	
WASA-FM	Havre De Grace, Md.	
WASH	Washington, D.C.	
WASK-FM	Lafayette, Ind.	
WATH-FM	Athens, O.	
WATM-FM	Atmore, Ala.	104.1
WATO-FM	Oak Ridge, Tenn.	
WATR-FM	Waterbury, Conn.	
WATZ-FM	Alpena, Mich.	93.5
WAUG-FM	Augusta, Ga.	
WAUK-FM	Waukesha, Wis.	
WAUP	Akron, Ohio	
WAUR	Aurora, Ill.	107.9
WAUS-FM	Berrien Springs, Mich.	90.9
WAVA-FM	Arlington, Va.	
WAVO-FM	Decatur, Ga.	
WAVT-FM	Pottsville, Pa.	101.9
WAVY-FM	Portsmouth, Va.	
WAWA-FM	Milwaukee, Wis.	
WAWK-FM	Kendallville, Ind.	
WAWR-FM	Bowling Green, O.	
WAWW	Murray, Ky.	
WAWZ-FM	Zarephath, N.J.	
WAYL	Minneapolis-St. Paul, Minn.	
WAYZ-FM	Waynesboro, Pa.	
WAZL-FM	Hazelton, Pa.	
WAZY-FM	Lafayette, Ind.	
WBAA-FM	W. Lafayette, Ind.	
WBAB-FM	Babylon, N.Y.	
WBAG-FM	Burlington-Graham, N.C.	93.9
WBAI	New York, N.Y.	
WBAL-FM	Baltimore, Md.	
WBAP-FM	Ft. Worth, Tex.	
WBAQ	Greenville, Miss.	97.9
WBAW-FM	Barnwell, S.C.	
WBAY	Green Bay, Wis.(s)	
WBBA-FM	Pittsfield, Ill.	
WBBB-FM	Burlington-Graham, N.C.	101.1
WBBC	Jackson, Mich.	
WBBI-FM	Abingdon, Va.	
WBBM-FM	Chicago, Ill.	
WBBO-FM	Forest City, N.C.	
WBBQ-FM	Augusta, Ga.	
WBBR-FM	E. St. Louis, Ill.	
WBBW-FM	Youngstown, Ohio	
WBBY	Westerville, O.	103.9
WBCB-FM	Levittown-Fairless Hills, Pa.	
WBCH-FM	Hastings, Mich.	100.1
WBCI-FM	Williamsburg, Va.	96.5
WBCL-FM	South Beloit, Ill.	
WBCM-FM	Bay City, Mich.	
WBCN	Boston, Mass.	
WBCO-FM	Bucyrus, O.	
WBCR-FM	Beloit, Wis.	
WBDG	Indianapolis, Ind.	
WBEA	Elyria, O.	
WBEN-FM	Buffalo, N.Y.	
WBET-FM	Brockton, Mass.	
WBEU-FM	Beaufort, S.C.	
WBEV-FM	Beaver Dam, Wis.	95.3
WBEX-FM	Chillicothe, Ohio	
WBEZ	Chicago, Ill.	
WBFB	Rochester, N.Y.	92.5
WBFG	Detroit, Mich.	
WBFI	Southampton, N.Y.	95.3
WBFM	Seneca, S.C.	
WBFO	Buffalo, N.Y.	
WBGM-FM	Tallahassee, Fla.	
WBGO	Newark, N.J.	
WBGU	Bowling Green, Ohio	
WBHT-FM	Brownsville, Tenn.	
WBIE-FM	Marietta, Ga.	
WBIL	Biloxi, Miss.	93.7
WBIR-FM	Knoxville, Tenn.	103.5
WBIV	Wethersfield Township, N.Y.	107.7
WBIZ-FM	Eau Claire, Wis.	
WBJC	Baltimore, Md.	
WBJH	Trenton, N.J.	
WBKE-FM	North Manchester, Ind.	89.5
WBKV-FM	West Bend, Wis.	
WBKW	Beckley, W.Va.	
WBKY	Lexington, Ky.	
WBLK-FM	Buffalo, N.Y.	
WBLR-FM	Batesburg, S.C.	
WBLY-FM	Springfield, Ohio	102.9
WBMD-FM	Catonsville, Md.	
WBMI-FM	Hartford-Meridan, Conn.	95.7
WBMP	Elwood, Ind.	
WBMR	Telford, Pa.	
WBMT-FM	Oneida, Tenn.	
WBNC-FM	Conway, N.H.	
WBNL-FM	Boonville, Ind.	
WBNQ	Bloomington, Ill.	
WBNS-FM	Columbus, Ohio	
WBNY	Buffalo, N.Y.	96.1
WBOB-FM	Galax, Va.	98.1
WBOC-FM	Salisbury, Md.	104.7
WBOE	Cleveland, Ohio	
WBON	Milwaukee, Wis.	
WBOR	Brunswick, Maine	
WBOS	Brookline, Mass.	92.9
WBOW-FM	Terre Haute, Ind.	
WBPZ-FM	Lock Haven, Pa.	
WBRB-FM	Mt. Clemens, Mich.	
WBRC	Birmingham, Ala.	
WBRD-FM	Bradenton, Fla.	
WBRE-FM	Wilkes-Barre, Pa.	
WBRK-FM	Pittsfield, Mass.	
WBRN-FM	Big Rapids, Mich.	
WBRS	Waltham, Mass.	
WBRU	Providence, R.I	
WBSM-FM	New Bedford, Mass.	
WBST	Muncie, Ind.	
WBT-FM	Charlotte, N.C.	
WBTC-FM	Houston, Mo.	
WBTM-FM	Danville, Va.	103.3
WBTO-FM	Linton, Ind.	93.5
WBTR-FM	Carrollton, Ga.	92.1
WBUF	Buffalo, N.Y.	92.9
WBUK	Columbus, O.	96.3
WBUR	Boston, Mass.	
WBUT-FM	Butler, Pa.	
WBVA	Woodbridge, Va.	
WBVB	Union City, Pa.	
WBVP-FM	Beaver Falls, Pa.	
WBWC	Berea, Ohio	
WBYO	Boyertown, Pa.	107.5
WBYU	New Orleans, La.	95.7
WBYS-FM	Canton, Ill.	98.5
WBZ-FM	Boston, Mass.	
WBZI	Xenia, O.	
WCAC	Anderson, S.C.	
WCAL-FM	Northfield, Minn.	
WCAO-FM	Baltimore, Md.	
WCAR-FM	Detroit, Mich.	
WCAS	Knoxville, Tenn.	
WCAU-FM	Philadelphia, Pa.	
WCBC	Memphis, Tenn.	91.1
WCBE	Columbus, Ohio	
WCBK-FM	Martinsville, Ind.	102.3
WCBL-FM	Benton, Ky.	
WCBS-FM	New York, N.Y.	
WCBU	Peoria, Ill.	88.3
WCBW	Columbia, Ill.	
WCBY-FM	Cheboygan, Mich.	105.1
WCCA	McComb, Miss.	94.1
WCCC-FM	Hartford, Conn.	106.9
WCCF-FM	Punta Gorda, Fla.	92.7
WCCM-FM	Lawrence, Mass.	
WCCN-FM	Neillsville, Wis.	
WCCO-FM	Minneapolis, Minn.	102.9
WCCV-FM	Charlottesville, Va.	
WCCW-FM	Traverse City, Mich.	
WCDL-FM	Carbondale, Pa.	94.3
WCDR-FM	Cedarville, O.	
WCED-FM	Duhois, Pa.	
WCEF-FM	Parkersburg, W.Va.	
WCEH-FM	Hawkinsville, Ga.	103.9
WCEM-FM	Cambridge, Md.	
WCEN-FM	Mt. Pleasant, Mich.	
WCER-FM	Charlotte, Mich.	
WCFM	Williamstown, Mass.	
WCFW	Chippewa Falls, Wis.	105.5
WCHA-FM	Chambersburg, Pa.	
WCHD	Detroit, Mich.	
WCHK-FM	Canton, Ga.	
WCHN-FM	Norwich, N.Y.	
WCHO-FM	Washington Court House, O.	105.5
WCHQ-FM	Camuy, P.R.	102.9
WCHR	Trenton, N.J.	94.5
WCHS-FM	Charleston, W.Va.	96.1
WCIL-FM	Carbondale, Ill.	101.5
WCIS-FM	Moss Point, Miss.	
WCJM	W. Point, Ga.	
WCJW	Cleveland, O.	
WCKS	Cocoa Beach, Fla.	
WCKW	La Place, La.	
WCLE-FM	Cleveland, Tenn.	
WCLI-FM	Corning, N.Y.	
WCLO-FM	Janesville, Wis.	
WCLT-FM	Newark, Ohio	
WCLV	Cleveland, O.	
WCLW-FM	Mansfield, Ohio	
WCMC-FM	Wildwood, N.J.	
WCME-FM	Brunswick, Maine	
WCMF-FM	Rochester, N.Y.	
WCMI-FM	Ashland, Ky.	
WCMJ	Chester, S.C.	99.3
WCMN-FM	Arecibo, P.R.	
WCMO	Marietta, Ohio	
WCMS-FM	Norfolk, Va.	
WCMT-FM	Martin, Tenn.	101.7
WCMU-FM	Mt. Pleasant, Mich.	
WCMX	Ft. Wayne, Ind.	101.7
WCNA-FM	Scottsboro, Ala.	
WCNB-FM	Connersville, Ind.	
WCNE	Batavia, O.	88.7
WCNH-FM	Quincy, Fla.	
WCNW-FM	Fairfield, O.	
WCOA-FM	Pensacola, Fla.	
WCOD-FM	Hyannis, Mass.	
WCOF-FM	Immokalee, Fla.	
WCOH-FM	Newnan, Ga.	
WCOL-FM	Columbus, Ohio	
WCOM-FM	Urbana, O.	
WCON-FM	Cornelia, Ga.	
WCOP-FM	Boston, Mass.	
WCOR-FM	Lebanon, Tenn.	107.3
WCOS-FM	Columbia, S.C.	
WCOU-FM	Lewiston, Maine	
WCOV-FM	Montgomery, Ala.	92.3
WCOW-FM	Sparta, Wis.	
WCPA-FM	Clearfield, Pa.	
WCPC-FM	Houston, Miss.	93.3
WCPO-FM	Cincinnati, Ohio	
WCPS-FM	Tarbor, N.C.	
WCRA-FM	Effingham, Ill.	
WCRB-FM	Waltham, Mass.	
WCRD	Bluffton, Ind.	
WCRF	Cleveland, O.	
WCRM-FM	Clare, Mich.	
WCRS-FM	Greenwood, S.C.	
WCRT-FM	Birmingham, Ala.	
WCRX	Springfield, Mass	

Call	Location	Freq.
WCSC-FM	Charleston, S.C.	
WCSI-FM	Columbus, Ind.	101.5
WCSM-FM	Celina, O.	
WCSQ	Central Square, N.Y.	
WCST-FM	Berkley Springs, W.Va.	93.5
WCSU-FM	Wilberforce, O.	
WCTC-FM	New Brunswick, N.J.	
WCTM	Eaton, Ohio	
WCTO	Brentwood, N.Y.	94.3
WCTS-FM	Minneapolis, Minn.	
WCTT-FM	Corbin, Ky.	
WCTW-FM	New Castle, Ind.	
WCTX	Palmyra, Pa.	92.1
WCUE-FM	Akron, O.	
WCUF	Akron, Ohio	
WCUL	Culpeper, Va.	103.1
WCUM-FM	Cumberland, Md.	
WCUY-FM	Cleveland Hts., Ohio	
WCWA-FM	Toledo, O.	
WCWC-FM	Ripon, Wis.	
WCWM	Williamsburg, Va.	
WCWP	Brookville, N.Y.	
WCWS	Wooster, O.	
WCYC	Chicago, Ill.	88.7
WCYN-FM	Cythiana, Ky.	102.3
WDAC	Lancaster, Pa.	
WDAE-FM	Tampa, Fla.	100.7
WDAF-FM	Kansas City, Mo.	
WDAL-FM	Meridian, Miss.	101.3
WDAN-FM	Danville, Ill.	
WDAO	Dayton, Ohio	
WDAR-FM	Darlington, S.C.	
WDAS-FM	Philadelphia, Pa.	
WDAY-FM	Fargo, N.D.	
WDBL-FM	Springfield, Tenn.	
WDBM-FM	Statesville, N.C.	96.9
WDBO-FM	Orlando, Fla.	
WDBQ-FM	Dubuque, Iowa	
WDCC	Neenah-Menasha, Wis.	99.3
WDCX	Buffalo, N.Y.	
WDDE	Hamden, Conn.	
WDDS-FM	Syracuse, N.Y.	
WDEA-FM	Ellsworth, Me.	
WDEB-FM	Jamestown, Tenn.	
WDEC-FM	Americus, Ga.	
WDEE-FM	Detroit, Mich.	93.1
WDEF-FM	Chattanooga, Tenn.	
WDEH-FM	Sweetwater, Tenn.	
WDEN-FM	Macon, Ga.	105.3
WDEQ-FM	DeGraff, O.	
WDET-FM	Detroit, Mich.	
WDFM	State College, Pa.	
WDGC-FM	Downers Grove, Ill.	88.3
WDHA-FM	Dover, N.J.	
WDHF	Chicago, Ill.	
WDHS	Gaston, Ind.	91.1
WDIO-FM	Duluth, Minn.	
WDIX-FM	Orangeburg, S.C.	
WDJC	Birmingham, Ala.	93.7
WDJF	Westport, Conn.	107.9
WDJK	Atlanta, Ga.	
WDJR	Oil City, Pa.	
WDKC	Albany, N.Y.	
WDKD-FM	Kingstree, S.C.	
WDKN-FM	Dickson, Tenn.	
WDLB-FM	Marshfield, Wis.	
WDLC-FM	Port Jervis, N.Y.	96.7
WDMB-FM	Statesville, N.C.	
WDMJ-FM	Marquette, Mich.	
WDMP-FM	Dodgeville, Wis.	107.1
WDMW	Menomonie, Wis.	
WDNC-FM	Durham, N.C.	
WDNH	Dover, N.H.	97.5
WDOC-FM	Prestonsburg, Ky.	
WDOD-FM	Chattanooga, Tenn.	
WDOK	Cleveland, O.	
WDOL-FM	Athens, Ga.	
WDOM	Providence, R.I.	
WDOR-FM	Sturgeon Bay, Wis.	
WDOV-FM	Dover, Del.	
WDQN-FM	Duquoin, Ill.	95.9
WDRC-FM	Hartford, Conn.	102.9
WDRK-FM	Greenville, Ohio	
WDRM	Decatur, Ala.	
WDSC-FM	Dillon, S.C.	
WDSK-FM	Cleveland, Miss.	92.7
WDSU-FM	New Orleans, La.	
WDTM	Detroit, Mich.	
WDTR	Detroit, Mich.	
WDUB	Granville, Ohio	
WDUK	Havana, Ill.	99.3
WDUN-FM	Gainesville, Ga.	106.7
WDUQ	Pittsburgh, Pa.	
WDUX-FM	Waupaca, Wis.	
WDUZ-FM	Green Bay, Wis.	
WDVL-FM	Vineland, N.J.	92.1
WDVR	Philadelphia, Pa.	
WDWD	Dawson, Ga.	92.1
WDWS-FM	Champaign, Ill.	
WDXE-FM	Lawrenceburg, Tenn.	
WDXL-FM	Lexington, Tenn.	
WDYL	Chester, Va.	92.1
WDYN	Chattanooga, Tenn.	89.7
WEAF	Leaksville, N.C.	94.5
WEAI	Jacksonville, Ill.	100.5
WEAS-FM	Savannah, Ga.	
WEAT-FM	West Palm Beach, Fla.	104.5
WEAU-FM	Eau Claire, Wis.	
WEAV-FM	Plattsburgh, N.Y.	
WEAW-FM	Evanston, Ill.	105.1
WEBN-FM	Cincinnati, O.	
WEBQ-FM	Harrisburg, Ill.	
WEBR-FM	Buffalo, N.Y.	94.5
WECI	Richmond, Ind.	
WECW	Elmira, N.Y.	
WEDA-FM	Grove City, Pa.	
WEDR-FM	Miami, Fla.	
WEEC	Springfield, O.	100.7
WEED-FM	Rocky Mount, N.C.	
WEEF-FM	Highland Park, Ill.	
WEEI-FM	Boston, Mass.	
WEEP-FM	Pittsburgh, Pa.	
WEER-FM	Warrenton, Va.	
WEEX-FM	Easton Pa.	99.9
WEFA	Waukegan, Ill.	
WEFG	Winchester, Va.	
WEFM	Chicago, Ill.	
WEGO-FM	Concord, N.C.	
WEHH-FM	Elmira, N. Y.	
WEIC-FM	Charleston, Ill.	
WEIV	Ithaca, N.Y.	
WEJL-FM	Scranton, Pa.	
WEKT	Hammondsport, N.Y.	98.3
WEKU-FM	Richmond, Ky.	88.9
WEKZ-FM	Monroe, Wis.	
WELD-FM	Tupelo, Miss.	
WELF	Glen Ellyn, Ill.	
WELG	Elgin, Ill.	103.9
WELL-FM	Freeport, Ill.	98.5
WELO-FM	Tupelo, Miss.	
WELP-FM	Easley, S.C.	
WELR-FM	Roanoke, Ala.	95.3
WELV-FM	Ellenville, N.Y.	99.3
WEMC	Harrisonburg, Va.	
WEMU	Ypsilanti, Mich.	
WENC-FM	Whiteville, N.C.	99.1
WEND-FM	Ebensburg, Pa.	
WENN-FM	Birmingham, Ala.	107.7
WENY-FM	Elmira, N.Y.	
WEOK-FM	Poughkeepsie, N.Y.	
WEOL-FM	Elyria, Ohio	
WEPM-FM	Martinsburg, W.Va.	
WEPS	Elgin, Ill.	
WEQR	Goldsboro, N.C.	
WERE-FM	Cleveland, Ohio	
WERH-FM	Hamilton, Ala.	
WERI-FM	Westerly, R.I.	
WERM	Wapakoneta, Ohio	
WERS	Boston, Mass.	
WERT-FM	Van Wert, Ohio	
WESA-FM	Charleroi, Pa.	
WESC-FM	Greenville, S.C.	
WESO-FM	Southbridge, Mass.	100.1
WESP	Charlotte Amalie, V.I.	101.1
WESR-FM	Tasley, Va.	103.3
WEST-FM	Easton, Pa.	
WESU	Middletown, Conn.	88.1
WETA-FM	Washington, D.C.	90.9
WETL	South Bend, Ind.	
WETN	Wheaton, Ill.	88.1
WEVC	Evansville, Ind.	
WEVD-FM	New York, N.Y.	
WEVP-FM	River Falls, Wis.	106.3
WEXI	Arlington Heights, Ill.	
WEYA	Bayamon, P.R.	94.7
WEZK	Knoxville, Tenn.	
WEZL	Charleston, S.C.	103.5
WEZR	Manassas, Va.	
WEZS	Richmond, Va.	103.7
WEZY-FM	Cocoa, Fla.	
WFAA-FM	Dallas, Tex.	
WFAH-FM	Alliance, Ohio	
WFAN-FM	Washington, D.C.	
WFAS-FM	White Plains, N.Y.	
WFAU-FM	Augusta, Maine	
WFAV	Cordele, Ga.	98.3
WFAW	Fort Atkinson, Wis.	
WFBC-FM	Greenville, S.C.	
WFBE	Flint, Mich	
WFBG-FM	Altoona, Pa.	
WFBM-FM	Indianapolis, Ind.	
WFBS-FM	Winston-Salem, N.C.	
WFCI	Franklin, Ind.	
WFCJ	Miamisburg, Ohio	
WFCR	Amherst, Mass.	
WFDD-FM	Winston-Salem, N.C.	
WFDR-FM	Manchester, Ga.	
WFDS-FM	Baltimore, Md.	
WFDT	Columbia City, Ind.	106.3
WFEM	Ellwood City, Pa.	92.1
WFFF-FM	Columbia, Miss.	
WFFV	Front Royal, Va.	103.9
WFHC-FM	Henderson, Tenn.	
WFID	Rio Piedras, P. R.	
WFIG	Sumter, S.C.	
WFIL-FM	Philadelphia, Pa.	
WFIM	Elkhart, Ind.	100.7
WFIN-FM	Findlay, Ohio	
WFIU	Bloomington, Ind.	
WFIW-FM	Fairfield, Ill.	
WFIZ	Conneaut, O.	105.0
WFKO	Kokomo, Ind.	100.5
WFLA-FM	Tampa, Fla.	
WFLN-FM	Philadelphia, Pa.	
WFLO	Farmville, Va.	
WFLR-FM	Dundee, N.Y.	95.9
WFLS-FM	Fredericksburg, Va.	93 3
WFLW-FM	Monticello, Ky.	
WFLY	Troy, N.Y.	
WFMA	Rocky Mount, N.C.	
WFMB	Springfield, Ill.	
WFME	Newark, N.J.	
WFMF	Chicago, Ill.	
WFMG	Gallatin, Tenn.	
WFMH-FM	Cullman, Ala.	
WFMI	Montgomery, Ala.	
WFMK	East Lansing, Mich.	99.1
WFML	Washington, Ind.	
WFMM-FM	Baltimore, Md.	
WFMN	Fitchburg, Mass	104.5
WFMQ	Lebanon, Tenn.	
WFMS	Indianapolis, Ind.	
WFMT	Chicago, Ill.	
WFMU	East Orange, N.J.	
WFMW-FM	Madisonville, Ky.	
WFMX	Statesville, N.C.	
WFMZ	Allentown, Pa.	
WFNY	Racine, Wis.	
WFOB-FM	Fostoria, O.	96.7
WFOG	Suffolk, Va.	92.9
WFOL	Hamilton, Ohio(s)	
WFON	Fond du Lac, Wis.	
WFOR-FM	Hattiesburg, Miss.	
WFOS	Chesapeake, Va.	
WFOY-FM	St. Augustine. Fla.	
WFPG	Atlantic City, N.J.	
WFPK	Louisville, Ky.	
WFPL	Louisville, Ky.	
WFRB-FM	Frostburg, Md.	
WFRE	Frederick, Md.	99.9
WFRI	Auburn, Ala.	97.7
WFRL-FM	Freeport, Ill.	
WFRO-FM	Fremont, Ohio	
WFSC-FM	Franklin, N. C.	
WFST-FM	Caribou, Maine	
WFSU-FM	Tallahassee, Fla.	
WFTG-FM	London, Ky.	103.9
WFTL-FM	Ft. Lauderdale, Fla.	
WFTM-FM	Maysville, Ky.	
WFTW-FM	Walton Beach, Fla.	
WFUL-FM	Fulton, Ky.	
WFUR-FM	Grand Rapids, Mich.	
WFUV	New York, N.Y.	
WFVA-FM	Fredericksburg, Va.	
WFYC-FM	Alma, Mich.	
WFYN-FM	Key West, Fla.	
WFZZ	Clanton, Ala.	97.7
WGAL-FM	Lancaster, Pa.	
WGAN-FM	Portland, Me.	
WGAT-FM	Gate City, Va.	104.9
WGAU-FM	Athens, Ga.	95.5
WGAY	Washington, D.C.	
WGBA-FM	Columbus, Ga.	
WGBE-FM	Columbus, Ga.	
WGBH-FM	Cambridge, Mass.	
WGBI-FM	Scranton, Pa.	
WGBM	Viroqua, Wis.	
WGCB-FM	Red Lion, Pa.	
WGGO	Buford, Ga.	102.3
WGGR-FM	Wellsboro, Pa.	97.7
WGCS	Goshen, Ind.	
WGEA-FM	Geneva, Ala.	93.5
WGEE-FM	Indianapolis, Ind.	
WGEM-FM	Quincy, Ill.(s)	
WGER-FM	Bay City, Mich.	102.5
WGET-FM	Gettysburg, Pa.	
WGEV	Beaver Falls, Pa.	
WGFA-FM	Watseka, Ill.	94.1
WGGC	Glasgow, Ky.	
WGGL-FM	Houghton, Mich.	
WGGM	Taylorville, Ill.	95 1
WGGR	Duluth, Minn.	105.1
WGH-FM	Newport News, Va.	
WGHM-FM	Skowhegan, Me.	107.1
WGHN-FM	Grand Haven, Mich.	92.1
WGHQ-FM	Kingston, N.Y.	
WGHS	Glen Ellyn, Ill.	88.5
WGIG-FM	Brunswick, Ga.	
WGIL-FM	Galesburg, Ill.	
WGIM-FM	Medford, Wis.	99.3
WGIR-FM	Manchester, N. H.	
WGKA-FM	Atlanta, Ga.	
WLGB-FM	Port Washington, Wis.	100.1
WGLC-FM	Mendota, Ill.	
WGLD-FM	Oak Port, Ill.	102.7
WGLF	Tallahassee, Fla.	104.1
WGLM	Richmond, Ind.	
WGLN	Sylvania, O.	105.5
WGLS-FM	Glassboro, N. J.	
WGLT	Normal, Ill.	
WGMR-FM	Tyrone, Pa.	
WGMS-FM	Washington, D.C.	
WGMZ	Flint, Mich.(s)	
WGNB	St. Petersburg, Fla.	
WGNC-FM	Gastonia, N.C.	
WGNE-FM	Panama City, Fla.	98.5
WGNR	Oneonta, N.Y.	103.9
WGNU-FM	Granite City, Ill.	
WGOH-FM	Grayson, Ky.	
WGOS-FM	Miami, Fla.	
WGOV-FM	Valdosta, Ga.	
WGPA-FM	Bethlehem, Pa. (from Ga.)	
WGPC-FM	Albany, Ga.	
WGPL	Winston-Salem, N.C.	93.1
WGPS	Greensboro, N.C.	
WGR-FM	Buffalo, N.Y.	
WGRE	Greencastle, Ind.	
WGRN	Greenville, Ill.	
WGRP-FM	Greenville, Pa.	
WGSU	Genesco, N.Y.	
WGSY	Peru, Ill.	100.9
WGTB-FM	Washington, D.C.	
WGTS-FM	Takoma Park, Md.	
WGUC	Cincinnati, Ohio	
WGUL-FM	New Port Richey, Fla.	105.5
WGUS-FM	Augusta, Ga.	
WGVE	Gary, Ind.	
WGVL	Gainesville, Fla.	105.5
WGWR-FM	Asheboro, N.C.	
WGYL	Vero Beach, Fla.	93.5
WHA-FM	Madison, Wis.	
WHAD	Delafield, Wis.	
WHAG-FM	Halfway, Md.	
WHAI-FM	Greenfield, Mass.	
WHAL-FM	Shelbyville, Tenn.	102.9
WHAS-FM	Louisville, Ky.	
WHAV-FM	Haverhill, Mass.	
WHBB-FM	Selma, Ala.	
WHBC-FM	Canton, Ohio	
WHBF-FM	Rock Island, Ill.	
WHBI	Newark, N.J.	
WHBM-FM	Xenia, Ohio	
WHBN-FM	Harrodsburg, Ky.	99.3
WHBQ-FM	Memphis, Tenn.	
WHCI	Hartford City, Ind.	
WHCL-FM	Clinton, N.Y.	
WHCN-FM	Hartford, Conn.	105.9
WHCU-FM	Ithaca, N.Y.	
WHDH-FM	Boston, Mass.	
WHDL-FM	Allegheny, N.Y.	
WHEN-FM	Syracuse, N.Y.	
WHEW	Fort Meyers, Fla.	101.9
WHFB-FM	Benton Harbor, Mich.	
WHFD	Archibald, O.	
WHFH	Flossmoor, Ill.	
WHFI	Birmingham, Mich.	
WHFM	Rochester, N.Y.	
WHFS	Bethesda, Md.	
WHGC	Princeton, W. Va.	95.9
WHGM	Bellwood, Pa.	103.9
WHHI	Highland, Wis.	
WHHO-FM	Hornell, N. Y.	105.3
WHHS	Havertown, Pa.	
WHHY-FM	Montgomery, Ala.	
WHIC-FM	Hardinsburg, Ky.	94.3
WHIL-FM	Medford, Mass.	
WHIM-FM	Providence, R.I.	
WHIO-FM	Dayton, Ohio	
WHIZ-FM	Zanesville, Ohio	100.9
WHKK	Erlanger, Ky.	
WHKW	Chilton, Wis.	
WHKY-FM	Hickory, N. C.	
WHLA	Holmen, Wis.	
WHLB-FM	Virginia, Minn.	107.1
WHLD-FM	Niagara Falls, N.Y.	
WHLF-FM	South Boston, Va.	
WHLI-FM	Hempstead, N.Y.	
WHLM-FM	Bloomsburg, Pa.	
WHLS-FM	Port Huron, Mich.	
WHLT-FM	Huntington, Ind.	
WHMA-FM	Anniston, Ala.	
WHMD	Marinette, Wis.	
WHME	South Bend, Ind.	
WHMP-FM	Northampton, Mass.	
WHMS	Hialeah, Fla.	
WHNC-FM	Henderson, N.C.	
WHNR	McMinnville, Tenn.	103.9
WHO-FM	Des Moines, Iowa	
WHOD-FM	Jackson, Ala.	
WHOH	Hamilton, Ohio	
WHOK-FM	Lancaster, Ohio	
WHOM-FM	New York, N.Y.	
WHOO-FM	Orlando, Fla.	
WHOP-FM	Hopkinsville, Ky.	
WHOV	Hampton, Va.	
WHP-FM	Harrisburg, Pa.	
WHPE-FM	High Point, N.C.	
WHPH	Hanover, N.J.	
WHPK-FM	Chicago, Ill	
WHPR	Highland Park, Mich.	
WHRB-FM	Cambridge, Mass.	
WHRF-FM	Riverhead, N.Y.	
WHRN	Albany, N.Y.	
WHRM	Wausau, Wis.	
WHRS	Boynton Beach, Fla.	91.7
WHRW	Binghamton, N.Y.	
WHSA	Highland Twp., Wis.	
WHSB	Alpena, Mich.	
WHSD	Hinsdale, Ill.	88.5
WHSL-FM	Wilmington, N.C.	97.3
WHSP-FM	Winchester, Mass.	91.9
WHSY-FM	Hattiesburg, Miss.	
WHTC-FM	Holland, Mich.	
WHTG-FM	Eatontown, N.J.	106.3
WHUB-FM	Cookeville, Tenn.	
WHUC-FM	Hudson, N.Y.	
WHUN-FM	Huntingdon, Pa.	
WHUS-FM	Storrs, Conn.	91.7
WHVT	Hendersonville, Tenn.	92.1
WHVW-FM	Hyde Park, N.Y.	97.7
WHWB-FM	Rutland, Vt.	98.1
WHWC	Colfax, Wis.	
WHWE	Howe, Ind.	89.7
WHYL-FM	Carlisle, Pa.	
WHYN-FM	Springfield, Mass.	
WHYP-FM	North East, Pa.	102.3
WIAA	Interlochen, Mich.	88.3
WIAC-FM	San Juan, P.R.	102.5
WIAI	Danville, Ill.	99.1
WIAL	Eau Claire, Wis.	
WIAM-FM	Williamston, N.C.	103.7
WIAN	Indianapolis, Ind.	
WIBA-FM	Madison, Wis.	
WIBF-FM	Jenkintown, Pa.	

WHITE'S RADIO LOG

Call	Location	Freq.
WIBM-FM	Jackson, Mich.	
WIBO	Waverly, O.	100.9
WIBQ-FM	Utica, N.Y.	
WIBW-FM	Topeka, Kan.	
WICB	Ithaca, N.Y.	
WICH-FM	Norwich, Conn.	
WICN	Worcester, Mass.	90.5
WICO-FM	Salisbury, Md.	94.3
WICR	Indianapolis, Ind.	
WIFC	Wausau, Wis.	95.5
WIFE-FM	Indianapolis, Ind.	
WIFF-FM	Auburn, Ind.	
WIFI	Philadelphia, Pa.	
WIFN	Franklin, Ind.	
WIGL	Miami, Fla.	107.5
WIGS-FM	Gouverneur, N.Y.	
WIHS	Middletown, Conn.	104.9
WIKI-FM	Chester, Va.	
WIKY-FM	Evansville, Ind.	
WIL-FM	St. Louis, Mo.	
WILE-FM	Cambridge, O.	
WILL-FM	Urbana, Ill.	
WILO-FM	Frankfort, Ind.	
WILS-FM	Lansing, Mich.	
WILY-FM	Centralia, Ill.	
WIMA-FM	Lima, Ohio	
WINA-FM	Charlottesville, Va.	
WINE-FM	Brookfield, Conn.	95.1
WINK-FM	Ft. Myers, Fla.	
WIOD-FM	Miami, Fla.	
WIOV	Ephrata, Pa.	105.1
WIPR-FM	San Juan, P.R.	
WIQT-FM	Horseheads, N.Y.	100.9
WIRB-FM	Enterprise, Ala.	96.9
WIRQ	Rochester, N.Y.	
WISA-FM	Isabela, P.R.	101.5
WISL-FM	Shamokin, Pa.	95.3
WISM-FM	Madison, Wis.	
WISN-FM	Milwaukee, Wis.	
WISU	Terre Haute, Ind.	
WISZ-FM	Glen Burnie, Md.	
WITH-FM	Baltimore, Md.	
WITL-FM	Lansing, Mich.	
WITN-FM	Washington, N. C.	
WITT	Tuscola, Ill.	93.5
WITZ-FM	Jasper, Ind.	
WIUC	Winchester, Ind.	
WIUM	Macomb, Ill.	91.3
WIUP-FM	Indiana, Pa.	91.3
WIUS	Christiansted, V.I.	
WIVA-FM	Aguadilla, P.R.	100.5
WIVC	Peoria, Ill.	
WIVE-FM	Ashland, Va.	
WIVI-FM	Cristiansted, St. Croix, V.I.	
WIVK-FM	Knoxville, Tenn.	
WIVY-FM	Jacksonville, Fla.	
WIXK-FM	New Richmond, Wis.	107.1
WIXL-FM	Newton, N. J.	
WIXN-FM	Dixon, Ill.	
WIXX-FM	Ft. Lauderdale, Fla.	
WIZO-FM	Franklin, Tenn.	100.1
WIZR-FM	Johnstown, N.Y.	104.9
WIZZ-FM	Streator, Ill.	
WJAC-FM	Johnstown, Pa.	
WJAS-FM	Pittsburgh, Pa.	
WJAT-FM	Swainsboro, Ga.	
WJAX-FM	Jacksonville, Fla.	
WJAZ	Albany, Ga.	
WJBL-FM	Holland, Mich.	
WJBM-FM	Jerseyville, Ill.	
WJBO-FM	Baton Rouge, La.	
WJBR	Wilmington, Del.	
WJCD-FM	Seymour, Ind.	
WJCR	University Heights, O.	88.9
WJCW-FM	Johnson City, Tenn.	
WJDX-FM	Jackson, Miss.	
WJEH-FM	Gallipolis, Ohio	
WJEJ-FM	Hagerstown, Md.	
WJER-FM	Dover, O.	101.7
WJFM	Grand Rapids, Mich.	
WJGA-FM	Jackson, Ga.	
WJGS	Houghton, Mich.	
WJHL-FM	Johnson City, Tenn.	
WJHA	Miami, Fla.	96.3
WJIB	Boston, Mass.	
WJIG-FM	Tullahoma, Tenn.	
WJIM-FM	Lansing, Mich.	
WJIT-FM	San Juan, P.R.	93.7
WJIV	Cherry Valley, N.Y.	
WJIZ	Albany, Ga.	
WJJD-FM	Chicago, Ill.	
WJJM-FM	Lewisburg, Tenn.	94.3
WJLE-FM	Smithville, Tenn.	101.7
WJLK-FM	Asbury Park, N.J.	
WJLM	Salem, Va.	93.5
WJLN	Birmingham, Ala.	
WJMC-FM	Rice Lake, Wis.	
WJMD	Bethesda, Md.	
WJMI	Jackson, Miss.	
WJMK	Plainfield, Ind.	
WJML	Petoskey, Mich.	
WJMR-FM	New Orleans, La.	97.1
WJMS-FM	Evansville, Ind.	94.7
WJMX-FM	Florence, S.C.	
WJNS-FM	Yazoo, City, Miss.	92.1
WJOF	Athens, Ala.	
WJOI-FM	Florence, Ala.	
WJOL-FM	Joliet, Ill.	
WJON-FM	St. Cloud, Minn.	101.7
WJOY-FM	Burlington, Vt.	
WJPA-FM	Washington, Pa.	
WJR-FM	Detroit, Mich.	
WJRH	Easton, Pa.	
WJRS-FM	Jamestown, Ky.	103.1
WJSK	Lumberton, N. C.	102.3
WJSM-FM	Martinsburg, Pa.	
WJSV	Morristown, N.J.	90.5
WJTN-FM	Jamestown, N.Y.	
WJTO-FM	Bath, Me.	95.3
WJVL	Janesville, Wis.	99.9
WJVM	Sterling, Ill.	
WJWS-FM	Ridgeway, Pa.	
WJZZ	Bridgeport, Conn.	
WKAI-FM	MaComb, Ill.	
WKAJ-FM	Saratoga Springs, N.Y.	102.3
WKAK	Kankakee, Ill.	99.9
WKAL-FM	Rome, N.Y.	95.9
WKAQ-FM	San Juan, P.R.	104.7
WKAR-FM	E. Lansing, Mich.	
WKAT	Miami, Fla.	
WKAY-FM	Glasgow, Ky.	
WKAZ-FM	Charleston, W.Va.	
WKBC-FM	N. Wilkesboro, N.C.	
WKBI-FM	Ridgeway, Pa.	
WKBJ-FM	Milan, Tenn.	
WKBL-FM	Covington, Tenn.	
WKBN-FM	Youngstown, Ohio	
WKBR-FM	Manchester, N.H.	95.5
WKBV-FM	Richmond, Ind.	
WKCI	Hamden, Conn.	101.3
WKCQ	Berlin, N.H.	
WKCR-FM	New York, N.Y.	
WKCS	Knoxville, Tenn.	
WKCU-FM	Corinth, Miss.	
WKDA-FM	Nashville, Tenn.	
WKDE-FM	Altavista, Va.	105.5
WKDN-FM	Camden, N.J.	
WKEE-FM	Huntington, W.Va.	
WKEI-FM	Kewanee, Ill.	
WKES	Chattanooga, Tenn.	88.9
WKET-FM	Kettering, Ohio	
WKEU-FM	Griffin, Ga.	
WKEY-FM	Covington, Va.	
WKFM	Chicago, Ill.	
WKFR-FM	Battle Creek, Mich.	
WKGO	Cumberland, Md.	106.1
WKHM-FM	Jackson, Mich.	
WKIC-FM	Hazard, Ky.	
WKIS-FM	Orlando, Fla.	
WKIX-FM	Raleigh, N.C.	
WKJB-FM	Mayaguez, P. R.	
WKJC	Welch, W.Va.	106.3
WKJF	Pittsburgh, Pa.	
WKJG-FM	Ft. Wayne, Ind.	
WKKD-FM	Aurora, Ill.	
WKKY-FM	Erlanger, Ky.	
WKLA-FM	Ludington, Mich.	106.3
WKLC-FM	St. Albans, W.Va.	
WKLD	Oneonta, Ala.	97.7
WKLN	Cullman, Ala.	
WKLR	Toledo, O.	99.9
WKLS	Atlanta, Ga.	
WKMH-FM	Dearborn, Mich.	
WKMO	Kokomo, Ind.	
WKMS-FM	Murray, Ky.	91.3
WKNA	Charleston, W. Va.	
WKNC-FM	Raleigh, N.C.	
WKNE-FM	Keene, N.H.	
WKNR-FM	Dearborn, Mich.	
WKNT-FM	Kent, O.	
WKOC	Kankakee, Ill.	
WKOF	Hopkinsville, Ky.	
WKOK-FM	Sunbury, Pa.	
WKOP-FM	Binghamton, N.Y.	
WKOX-FM	Framingham, Mass.	
WKOZ-FM	Kosciusko, Miss.	
WKPE-FM	Cocoa Beach, Fla.	104.1
WKPS	New Wilmington, Pa.	
WKPT-FM	Kingsport, Tenn.	
WKRC-FM	Cincinnati, Ohio	
WKRG-FM	Mobile, Ala.	
WKRT-FM	Cortland, N.Y.	
WKRX	Louisville, Ky.	
WKSL	Greencastle, Pa.	
WKSM	Tabor City, N.C.	104.9
WKSN-FM	Jamestown, N. Y.	
WKSU-FM	Kent, Ohio	
WKTA	McKenzie, Tenn.	
WKTL	Struthers, O.	
WKTM	N. Charleston, S.C.	
WKTM-FM	Mayfield, Ky.	
WKTN-FM	Kenton, O.	
WKUB	Manitowoc, Wis.	
WKUZ	Wabash, Ind.	95.9
WKVI-FM	Knox, Ind.	99.3
WKVM-FM	San Juan, P.R.	
WKWK-FM	Wheeling, W.Va.	
WKWL	Belvidere, Ill.	104.9
WKYC-FM	Cleveland, O.	
WKYF-FM	Greenville, Ky.	
WKYV-FM	Vicksburg, Miss.	106.7
WKYW	Frankfort, Ky.	
WKYX-FM	Paducah, Ky.	
WKZN	Kenosha, Wis.	96.9
WLAC-FM	Nashville, Tenn.	
WLAD-FM	Danbury, Conn.	
WLAE	Hartford, Conn.	
WLAG-FM	La Grange, Ga.	104.1
WLAN-FM	Lancaster, Pa.	
WLAP-FM	Lexington, Ky.	
WLAT-FM	Conway, S.C.	
WLAV-FM	Grand Rapids, Mich.	
WLAY-FM	Muscle Shoals, Ala.	
WLBC-FM	Muncie, Ind.	104.1
WLBE-FM	Leesburg, Fla.	106.7
WLBG-FM	Laurens-Clinton, S.C.	
WLBH-FM	Mattoon, Ill.	
WLBJ-FM	Bowling Green, Ky.	
WLBK-FM	DeKalb, Ill.	
WLBR-FM	Lebanon, Pa.	
WLCC	Lincoln, Ill.	88.7
WLCK-FM	Scottsville, Ky.	
WLCM-FM	Lancaster, S.C.	
WLCY-FM	Tampa, Fla.	94.9
WLDM	Oak Park, Mich.	
WLDR	Traverse City, Mich.	101.9
WLEC-FM	Sandusky, Ohio	
WLEN	Adrian, Mich.	
WLEO-FM	Ponce, P. R.	
WLET-FM	Toccoa, Ga.	
WLEW-FM	Bad Axe, Mich.	
WLEX	Lexington, Ky.	98.1
WLFM	Appleton, Wis.	
WLGN-FM	Logan, O.	98.3
WLIB-FM	New York, N.Y.	
WLIH-FM	New London, Wis.	
WLIL-FM	Lenoir City, Tenn.	
WLIN	Detroit, Mich.	
WLIP-FM	Kenosha, Wis.	95.1
WLIR	Hicksville, N. Y.	
WLIU	Lincoln University, Pa.	88.7
WLIV-FM	Livingston, Tenn.	
WLJC	Beattyville, Ky.	
WLJM	Gadsden, Ala.	
WLKR-FM	Norwalk, Ohio	
WLKW-FM	Providence, R.I.	
WLLH-FM	Lowell, Mass.	
WLLL-FM	Lynchburg, Va.	98.3
WLMC	Okeechobee, Fla.	
WLNA-FM	Peekskill, N.Y.	
WLNG-FM	Sag Harbor, N.Y.	
WLNH-FM	Laconia, N.H.	
WLNO	London, Ohio	
WLNR-FM	Lansing, Ill.	
WLOA-FM	Braddock, Pa.(s)	
WLOB-FM	Portland, Maine	
WLOC-FM	Munfordville, Ky.	102.3
WLOE-FM	Eden, N.C.	
WLOI-FM	La Porte, Ind.	
WLOL-FM	Minneapolis, Minn.	
WLOM	Chattanooga, Tenn.	
WLOP-FM	Jessup, Ga.	105.5
WLOQ	Winter Park, Fla.	
WLOS-FM	Ashville, N.C.	99.9
WLOV-FM	Washington, Ga.	100.1
WLOW-FM	Aiken, S.C.	
WLPL-FM	Baltimore, Md.	92.3
WLPO-FM	La Salle, Ill.	
WLPR	Mobile, Ala.	
WLRJ	Roanoke, Va.	92.3
WLRS	Louisville, Ky.	
WLRW	Champain, Ill.	94.5
WLS-FM	Chicago, Ill.	
WLSM-FM	Louisville, Miss.	
WLSN	Elizabethton, Tenn.	99.3
WLSU	La Crosse, Wis.	88.9
WLTA-FM	Atlanta, Ga.	
WLTI	Lowell, Mass.	
WLTL	La Grange, Ill.	88.1
WLUR	Lexinton, Va.	91.5
WLUV-FM	Loves Park, Ill.	
WLVE	Baraboo, Wis.	94.9
WLVH	Hartford, Conn.	93.7
WLVL	Louisville, Ky.	
WLVP	Franklin, N.J.	
WLXN	Lexington, N.C.	94.1
WLYC-FM	Williamsport, Pa.	
WLYK-FM	Milford, O.	107.1
WLYN-FM	Lynn, Mass.	101.7
WMAI-FM	Panama City, Fla.	
WMAJ-FM	State College, Pa.	
WMAL-FM	Washington, D.C.	
WMAQ-FM	Chicago, Ill.	
WMAR-FM	Baltimore, Md.	106.5
WMAS-FM	Springfield, Mass.	
WMAZ-FM	Macon, Ga.	
WMBC-FM	Columbus, Miss.	103.1
WMBD-FM	Peoria, Ill.	
WMBI-FM	Chicago, Ill.	
WMBN-FM	Petoskey, Mich.	
WMC-FM	Memphis, Tenn.	
WMCB-FM	Michigan City, Ind.	
WMCD	Statesboro, Ga.	
WMCF	Stuart, Fla.	
WMCO	New Concord, Ohio	
WMCU	Miami, Fla.	89.7
WMDC-FM	Hazelhurst, Miss.	100.9
WMDD-FM	Fajardo, P.R.	
WMDE	Greensboro, N.C.	
WMDR	Moline, Ill.	96.9
WMEB-FM	Orono, Maine	
WMEH-FM	Bangor, Me.	90.9
WMER	Celina, O.	94.3
WMEV-FM	Marion, Va.	
WMFC-FM	Monroeville, Ala.	98.5
WMFD-FM	Wilmington, N.C.	100.9
WMFG-FM	Hibbing, Minn.	106.3
WMFJ-FM	Daytona Beach, Fla.	
WMFM	Madison, Wis.	
WMFP	Ft. Lauderdale, Fla.	
WMFR-FM	High Point, N.C.	
WMGE	Danville, Ky.	107.1
WMGM	Atlantic City, N.J.	
WMGR-FM	Bainbridge, Ga.	
WMGW-FM	Meadville, Pa.	
WMHC	South Hadley, Mass.	
WMHE	Toledo, Ohio	
WMHR	Syracuse, N.Y.	102.9
WMHS	Morrison, Ill.	
WMIC-FM	Sandusky, Mich.	
WMIL-FM	Milwaukee, Wis.	
WMIV	S. Bristol, N.Y.	
WMIX-FM	Mt. Vernon, Ill.	
WMJR	Ft. Lauderdale, Fla.	
WMKC	Oshkosh, Wis.	
WMKY-FM	Morehead, Ky.	90.3
WMLP	Milton, Pa.	100.9
WMLS-FM	Sylacauga, Ala.	
WMLW	Milwaukee, Wis.	
WMNC-FM	Morganton, N.C.	92.1
WMMR	Philadelphia, Pa.	
WMMS	Cleveland, O.	100.7
WMNA-FM	Gretna, Va.	
WMNB-FM	North Adams, Mass.	
WMNI-FM	Columbus, Ohio	
WMOA-FM	Marietta, O.	
WMOB-FM	Mobile, Ala.	97.5
WMOD	Washington, D.C.	98.7
WMOP-FM	Ocala, Fla.	
WMOR-FM	Morehead, Ky.	92.1
WMOT	Murfreesboro, Tenn.	89.5
WMOU-FM	Berlin, N.H.	
WMPH	Wilmington, Del.	91.7
WMPI	Scottsburg, Ind.	
WMPL-FM	Hancock, Mich.	
WMPS-FM	Memphis, Tenn.	
WMPT-FM	South Williamsport, Pa.	99.3
WMRA	Harrisonburg, Va.	91.1
WMRF-FM	Lewistown, Pa.	95.9
WMRI	Marion, Ind.	106.9
WMRN-FM	Marion, Ohio	
WMRV	Endicott, N.Y.	105.5
WMRP-FM	Flint, Mich.	
WMRY	E. St. Louis, Ill.	
WMSG-FM	Oakland, Md.	
WMSH-FM	Elizabethtown, Pa.	
WMSK-FM	Morganfield, Ky.	
WMSP	Harrisburg, Pa.	
WMSR-FM	Manchester, Tenn.	
WMST-FM	Mt. Sterling, Ky.	105.5
WMT-FM	Cedar Rapids, Ia.	96.5
WMTH	Park Ridge, Ill.	
WMTI	Norfolk, Va.	
WMTL-FM	Leitchfield, Ky.	
WMTM-FM	Moultrie, Ga.	
WMTN-FM	Morristown, Tex.	
WMTS-FM	Murfreesboro, Tenn.	
WMTW-FM	Mt. Washington, N.H.	
WMUA	Amherst, Mass.	
WMUB	Oxford, Ohio	
WMUH	Allentown, Pa.	
WMUK	Kalamazoo, Mich.	
WMUL	Huntington, W.Va.	
WMUM	Palm Beach, Fla.	97.9
WMUS-FM	Muskegon, Mich.	106.9
WMUU-FM	Greenville, S.C.	
WMUZ	Detroit, Mich.	
WMVA-FM	Martinsville, Va.	
WMVB-FM	Millville, N.J.	
WMVG-FM	Milledgeville, Ga.	
WMVO-FM	Mt. Vernon, O.	93.7
WMVR-FM	Sidney, Ohio	
WMYB-FM	Myrtle Beach, Fla.	
WMZK	Detroit, Mich.	97.9
WNAP	Indianapolis, Ind.	93.1
WNAS	New Albany, Ind.	
WNAT-FM	Natchez, Miss.	
WNAU-FM	New Albany, Miss.	
WNAV-FM	Annapolis, Md.	
WNAZ-FM	Nashville, Tenn.	
WNBC-FM	New York, N.Y.	
WNBD-FM	Daytona Beach, Fla.	
WNBF-FM	Binghamton, N.Y.	
WNBH-FM	New Bedford, Mass.	
WNBI-FM	Park Falls, Wis.	
WNBX	Andalusia, Ala.	
WNCI	Worthington-Columbus, O.	97.9
WNCN	New York, N.Y.	
WNCO-FM	Ashland, Ohio	
WNCQ	Watertown, N.Y.	97.5
WNCR	Cleveland, O.	99.5
WNCT-FM	Greenville, N.C.	
WNDA	Huntsville, Ala.	
WNDB-FM	Daytona Beach, Fla.	94.5
WNDU-FM	South Bend, Ind.	
WNDY	Crawfordsville, Ind.	
WNES-FM	Central City, Ky.	
WNEW-FM	New York, N.Y.	
WNEX-FM	Macon, Ga.	
WNFM	Naples, Fla.	
WNGC	Athens, Ga.	95.5
WNGO-FM	Mayfield, Ky.	94.7

Call	Location	Freq
WNGT	Wingate, N.C.	89.1
WNHC-FM	New Haven, Conn.	99.1
WNHS	Manchester, N.H.	101.1
WNHV-FM	White River Junction, Vt.	95.7
WNIB	Chicago, Ill.	
WNIK-FM	Arecibo, P.R.	106.5
WNIL-FM	Niles, Mich.	95.3
WNIU	DeKalb, Ill.	89.5
WNJC-FM	Senatobia, Miss.	90.1
WNLA-FM	Indianola, Miss.	105.5
WNNT-FM	Warsaw, Va.	
WNOB	Cleveland, Ohio	
WNOE-FM	New Orleans, La.	101.1
WNOF	St. Paul, Minn.	
WNOK-FM	High Point, N.C.	
WNON	Lebanon, Ind.	
WNOR-FM	Norfolk, Va.	
WNOS-FM	High Point, N.C.	
WNOW-FM	York, Pa.	
WNPQ	New Philadelphia, O.	95.5
WNRE	Circleville, O.	107.1
WNRG-FM	Grundy, Va.	
WNSL-FM	Laurel, Miss.	
WNTE	Mansfield, Pa.	89.5
WNTH	Winnetka, Ill.	
WNTI	Hackettstown, N.J.	
WNUB-FM	Northfield, Vt.	
WNUR	Evanston, Ill.	89.3
WNUS-FM	Chicago, Ill.	
WNUW	Milwaukee, Wis.	99.1
WNVA-FM	Norton, Va.	106.3
WNXT-FM	Portsmouth, O.	
WNYC-FM	New York, N.Y.	
WNYE	New York, N.Y.	
WNYN-FM	Canton, O.	
WNYR-FM	Rochester, N.Y.	
WOAB	Ozark, Ala.	
WOAK	Royal Oak, Mich.	
WOAP-FM	Owosso, Mich.	
WOAY-FM	Oak Hill, W.Va.	
WOBC	Oberlin, O.	
WOBM	Toms River, N.J.	
WOBN	Westerville, Ohio	
WOBT-FM	Rhinelander, Wis.	
WOC-FM	Davenport, Iowa	
WOCB-FM	W. Yarmouth, Mass.	
WOCH-FM	North Vernon, Ind.	
WOCN-FM	Miami Beach, Fla.	94.9
WOCO	Oconto, Wis.	107.1
WODL-FM	Carbondale, Pa.	
WOFM	Greeneville, Tenn.	
WOGM	Bellefontaine, O.	98.3
WOHS-FM	Shelby, N.C.	
WOI-FM	Ames, Iowa	
WOIA-FM	Ann Arbor, Mich.	102.9
WOIV	De Ruyter, N.Y.	
WOKK-FM	Meridian, Miss.	
WOKU-FM	Greensburg, Pa.	
WOKZ-FM	Alton, Ill.	
WOLA-FM	Carolina, P.R.	107.7
WOLD-FM	Marion, Va.	
WOLI	Ottawa, Ill.	
WOMA	Tallahassee, Fla.	
WOMC	Detroit, Mich.	104.3
WOMI-FM	Owensboro, Ky.	
WOMP-FM	Bellaire, Ohio	
WONC	Naperville, Ill.	89.1
WONE-FM	Dayton, O.	
WONF	Pensacola, Fla.	
WONO-FM	Syracuse, N.Y.	
WOOD-FM	Grand Rapids, Mich.	
WOOF-FM	Dothan, Ala.	
WOOD-FM	DeLand, Fla.	
WOOR	Oxford, Miss.	97.5
WOPI-FM	Bristol, Tenn.	
WOR-FM	New York, N.Y.	
WORA-FM	Mayaguez, P.R.	
WORJ-FM	Mt. Dora, Fla.	107.7
WORM-FM	Savannah, Tenn.	101.7
WORO	Corozal, P.R.	92.5
WORX-FM	Madison, Ind.	
WOSC-FM	Fulton, N.Y.	104.7
WOSE	Oswego, N.Y.	
WOSH-FM	Oshkosh, Wis.	
WOSU-FM	Columbus, Ohio	
WOTW-FM	Nashua, N.H.	
WOUB-FM	Athens, Ohio	
WOUR	Utica, N.Y.	
WOVV	Ft. Pierce, Fla.	
WOW-FM	Omaha, Nebr.	
WOWI-FM	Norfolk, Va.	102.9
WOXR	Oxford, Ohio	
WOYE-FM	Mayaguez, P.R.	
WPAA	Andover, Mass.	
WPAB-FM	Ponce, P.R.	
WPAC-FM	Patchogue, N.Y.	
WPAD-FM	Paducah, Ky.	
WPAG-FM	Ann Arbor, Mich.	107.1
WPAP-FM	Panama City, Fla.	92.5
WPAT-FM	Paterson, N.J.	
WPAY-FM	Portsmouth, Ohio	
WPBC-FM	Richfield, Minn.	
WPBF	W. Palm Beach, Fla.	
WPBS	Philadelphia, Pa.	98.9
WPOE-FM	Paris, Ky.	96.7
WPDM-FM	Potsdam, N.Y.	
WPDR-FM	Portage, Wis.	
WPEA	Exeter, N.H.	
WPEG	Concord, N.C.	97.9
WPEL-FM	Montrose, Pa.	
WPEN-FM	Philadelphia, Pa.	
WPEX-FM	Pensacola, Fla.	
WPFB-FM	Middletown, Ohio	
WPFK	Los Angeles, Cal.	
WPFM	Portsmouth, N.H.	
WPFR	Terre Haute, Ind.	102.7
WPGA-FM	Perry, Ga.	
WPGC	Bradbury Hts., Md.	
WPGF-FM	Burgaw, N.C.	
WPGI	Pittsburgh, Pa.	
WPGM-FM	Danville, Pa.	96.7
WPGU	Urbana, Ill.	
WPHS	Warren, Mich.	
WPIC-FM	Sharon, Pa.	
WPIT-FM	Pittsburgh, Pa.	
WPIX-FM	New York, N.Y.	
WPJB-FM	Providence, R.I.	
WPKE-FM	Pikeville, Ky.	
WPKM	Tampa, Fla.	
WPKN	Bridgeport, Conn.	89.5
WPKY-FM	Princeton, Ky.	104.9
WPLB	Greenville, Mich.	
WPLM-FM	Plymouth, Mass.	
WPLN	Nashville, Tenn.	
WPLO-FM	Atlanta, Ga.	
WPMP-FM	Pascagoula, Miss.	
WPNA	Philadelphia, Pa.	94.1
WPOK-FM	Pontiac, Ill.	103.1
WPOR-FM	Portland, Me.	
WPOS-FM	Holland, O.	
WPPA-FM	Pottsville, Pa.	
WPQR-FM	Uniontown, Pa.	99.3
WPRB	Princeton, N.J.	
WPRE-FM	Prairie du Chien, Wis.	94.3
WPRK	Winter Park, Fla.	
WPRM	San Juan, P.R.	98.5
WPRO-FM	Providence, R.I.	
WPRP-FM	Ponce, P.R.	105.1
WPRS-FM	Paris, Ill.	
WPRT-FM	Prestonburg, Ky.	
WPSR	Evansville, Ind.	
WPTF-FM	Raleigh, N.C.	
WPTH	Fort Wayne, Ind.	
WPTN-FM	Cookeville, Tenn.	
WPTW-FM	Piqua, Ohio	
WPUV-FM	Pulaski, Va.	
WPVR	Roanoke, Va.	94.9
WPWT	Philadelphia, Pa.	
WQAL	Philadelphia, Pa.	
WQBS-FM	San Juan, P.R.	99.9
WQDC-FM	Midland, Mich.	
WQFM	Milwaukee, Wis.	
WQFS	Greensboro, N.C.	90.7
WQIK-FM	Jacksonville, Fla.	
WQIX	Horseheads, N.Y.	100.9
WQLT	Florence, Ala.	
WQMF	Babylon, N.Y.	
WQME	Greensboro, N.C.	97.1
WQMS	Hamilton, Ohio	
WQMU	Indiana, Pa.	103.1
WQMV	Vicksburg, Miss.	
WQNZ	Natchez, Miss.	95.1
WQRB	Pittsfield, Mass.	
WQRS-FM	Detroit, Mich.	
WQSB	Albertville, Ala.	
WQSM	Fayetteville, N.C.	98.1
WQST	Forest, Miss.	
WQSU	Selinsgrove, Pa.	
WQTC-FM	Two Rivers, Wis.	
WQTI	Dunn, N.C.	103.1
WQWK	State College, Pa.	96.7
WQXE	Elizabethtown, Ky.	106.3
WQXI-FM	Smyrna, Ga.	
WQXM	Clearwater, Fla.	97.9
WQXR-FM	New York, N.Y.	
WQXY-FM	Baton Rouge, La.	
WRAC-FM	Racine, Wis.	100.7
WRAD-FM	Radford, Va.	
WRAJ-FM	Anna, Ill.	
WRAK-FM	Williamsport, Pa.	102.7
WRAL-FM	Raleigh, N.C.	
WRAR-FM	Tappahannock, Va.	
WRAS	Atlanta, Ga.	88.5
WRAY-FM	Princeton, Ind.	
WRBB	Boston, Mass.	91.7
WRBD-FM	Pompano Beach, Fla.	102.7
WRBJ-FM	St. Johns, Mich.	
WRBL-FM	Columbus, Ga.	
WRBN-FM	Warner Robins, Ga.	101.7
WRBR	South Bend, Ind.	
WRBS	Baltimore, Md.	
WRC-FM	Washington, D.C.	
WRCH-FM	New Britain, Conn.	100.5
WRCJ	Reading, O.	89.3
WRCK-FM	Sheffield, Ala.	106.3
WRCM	Jacksonville, N.C.	
WRCO-FM	Richland Center, Wis.	
WRCP-FM	Philadelphia, Pa.	
WRCS-FM	Ahoskie, N.C.	99.3
WRCU-FM	Hamilton, N.Y.	90.1
WRDB-FM	Reedsburg, Wis.	104.9
WRDL	Ashland, O.	89.5
WRDR	Egg Harbor, N.J.	104.9
WRDX	Salisbury, N.C.	106.5
WREC-FM	Memphis, Tenn.	
WRED	Youngstown, Ohio	
WREK	Atlanta, Ga.	
WREO-FM	Ashtabula, Ohio	
WRFK	Richmond, Va.	
WRFL	Winchester, Va.	
WRFM	New York, N.Y.	
WRFS-FM	Alexander City, Ala.	
WRFW	River Falls, Wis.	88.7
WRFY-FM	Reading, Pa.	
WRGA-FM	Rome, Ga.	
WRHO	Oneonta, N.Y.	89.5
WRHS	Park Forest, Ill.	
WRIG-FM	Wausau, Wis.	
WRIO-FM	Cape May, N.J.	101.7
WRIP-FM	Rossville, Ga.	
WRIT-FM	Milwaukee, Wis.	
WRIU	Kingston, R.I.	
WRJR	Lewiston, Maine	
WRKB-FM	Kannapolis, N.C.	
WRKC	Wilkes-Barre, Pa.	88.5
WRKD-FM	Rockland, Me.	
WRKO-FM	Boston, Mass.	
WRLB	Long Branch, N.J.	
WRLD-FM	Lanett, Ala.	
WRLM	Taunton, Mass.	93.3
WRLS-FM	Hayward, Wis.	
WRLX	Auburn, N.Y.	106.9
WRMC-FM	Middlebury, Vt.	
WRMF-FM	Titusville, Fla.	98.3
WRMI-FM	Morris, Ill.	
WRMU	Alliance, O.	91.1
WRNA	Charlotte, N.C.	
WRNJ	Atlantic City, N.J.	
WRNL-FM	Richmond, Va.	
WRNO	New Orleans, La.	
WRNS	Kinston, N.C.	95.1
WRNW	Mount Kisco, N.Y.	
WROA-FM	Gulfport, Miss.	
WROC-FM	Rochester, N.Y.	
WROI	Rochester, Ind.	
WROK-FM	Rockford, Ill.	
WROM-FM	Rome, Ga.	
WROR	Boston, Mass.	98.5
WROW-FM	Albany, N.Y.	
WROY-FM	Carmi, Ill.	
WRPC	San German, P.R.	95.1
WRPI	Troy, N.Y.	
WRPM-FM	Poplarville, Miss.	
WRPN-FM	Ripon, Wis.	
WRR-FM	Dallas, Tex.	
WRRH	Franklin Lakes, N.J.	
WRRN	Warren, Pa.	
WRRZ-FM	Clinton, N.C.	
WRSA	Decatur, Ala.	
WRSE-FM	Elmhurst, Ill.	
WRSJ-FM	Bayamon, P.R.	
WRSL-FM	Stanford, Ky.	
WRST-FM	Oshkosh, Wis.	
WRSV	Skokie, Ill.	
WRSW-FM	Warsaw, Ind.	
WRTC-FM	Hartford, Conn.	
WRTG	Thomasville, Ga.	107.1
WRTI-FM	Philadelphia, Pa.	
WRTM	Blountstown, Fla.	
WRTS	E. Liverpool, O.	
WRTV	Blountstown, Fla.	102.3
WRUF-FM	Gainesville, Fla.	
WRUN-FM	Utica, N.Y.	104.3
WRUR	Rochester, N.Y.	88.5
WRUS-FM	Russelville, Ky.	101.1
WRUV	Burlington, Vt.	
WRUW-FM	Cleveland, O.	
WRVA-FM	Richmond, Va.	
WRVB-FM	Madison, Wis.	
WRVG	Georgetown, Ky.	
WRVI	Winnebago, Ill.	95.3
WRVM	Suring, Wis.	
WRVO	Oswego, N.Y.	89.9
WRVP	New York, N.Y.	
WRWC	S. Beloit, Ill.	
WRWR	Port Clinton, Ohio	
WRXO-FM	Roxboro, N.C.	
WSAB	Mt. Carmel, Ill.	
WSAC-FM	Ft. Knox, Ky.	
WSAE	Spring Arbor, Mich.	
WSAF-FM	Sarasota, Fla.	
WSAI-FM	Cincinnati, O.	94.1
WSAJ-FM	Grove City, Pa.	89.5
WSAL-FM	Logansport, Ind.	
WSAM-FM	Saginaw, Mich.	
WSAU-FM	Wausau, Wis.	
WSB-FM	Atlanta, Ga.	
WSBA-FM	York, Pa.	
WSBC-FM	Chicago, Ill.	
WSBF-FM	Clemson, S.C.	
WSBM	Saginaw, Mich.	106.3
WSBT-FM	South Bend, Ind.	
WSCB	Springfield, Mass.	
WSCC	Somerset, Ky.	
WSCH	Aurora, Ind.	99.3
WSCI-FM	Platteville, Wis.	
WSCT-FM	Berkeley Springs, W.V.	
WSDM	Chicago, Ill.	
WSEA	Georgetown, Del.	93.5
WSEI	Olney, Ill.	92.9
WSEK	Somerset, Ky.	
WSEL-FM	Pontotoc, Miss.	
WSEN-FM	Baldwinsville, N.Y.	
WSEO-FM	Kalamazoo, Mich.	
WSET	Nashville, Tenn.	
WSEV-FM	Sieverville, Tenn.	
WSFM	Harrisburg, Pa.	99.3
WSFW-FM	Seneca Falls, N.Y.	99.3
WSGM	Staunton, Va.	
WSHA	Raleigh, N.C.	88.9
WSHJ	Southfield, Mich.	
WSHR	Lake Ronkonkoma, N.Y.	
WSHS	Floral Park, N.Y.	
WSHU	Fairfield, Conn.	
WSHY	Shelbyville, Ill.	104.9
WSIE	Edwardsville, Ill.	88.7
WSIM-FM	Salem, Ind.	
WSIP-FM	Paintsville, Ky.	98.9
WSIU	Carbondale, Ill.	
WSIV-FM	Pekin, Ill.	
WSIX-FM	Nashville, Tenn.	
WSJC-FM	Magee, Miss.	107.5
WSJG	Hallandale, Fla.	
WSJM-FM	St. Joseph, Mich.	
WSJS-FM	Winston-Salem, N.C.	
WSLI-FM	Jackson, Miss.	
WSLM-FM	Salem, Ind.	
WSLN	Delaware, Ohio	
WSLS-FM	Roanoke, Va.	
WSLU	Canton, N.Y.	
WSM-FM	Nashville, Tenn.	95.5
WSMC	Collegedale, Tenn.	
WSMD-FM	Waldorf, Md.	
WSMI-FM	Litchfield, Ill.	
WSMJ	Greenfield, Ind.	
WSMR	Dayton, O.	89.3
WSMT-FM	Sparta, Tenn.	
WSMU-FM	Starkville, Miss.	106.3
WSNJ-FM	Bridgeton, N.J.	
WSOC-FM	Charlotte, N.C.	
WSOM-FM	Salem, Ohio	
WSON-FM	Henderson, Ky.	
WSOR	Ft. Meyers, Fla.	95.3
WSOU	S. Orange, N.J.	
WSOY-FM	Decatur, Ill.	
WSPA-FM	Spartanburg, S.C.	
WSPB-FM	Sarasota, Fla.	
WSPD-FM	Toledo, Ohio	
WSPE	Springville, N.Y.	
WSPK	Poughkeepsie, N.Y.	
WSPO	Columbus, O.	
WSPT-FM	Stevens Point, Wis.	
WSRC-FM	Durham, N.C.	
WSRF-FM	Ft. Lauderdale, Fla.	
WSRS	Worcester, Mass.	
WSRW-FM	Hillsboro, Ohio	
WSSU	Superior, Wis.	
WSSV-FM	Petersburg, Va.	
WSTC-FM	Stamford, Conn.	
WSTK	Woodstock, Ill.	
WSTM	St. Mathews, Ky.	
WSTN	Florence, S.C.	103.1
WSTO	Owensboro, Ky.	96.1
WSTP-FM	Salisbury, N.C.	
WSTR-FM	Sturgis, Mich.	99.3
WSTS	Laurinburg, N. C.	96.5
WSTU-FM	Stuart, Fla.	
WSTV-FM	Steubenville, Ohio	
WSTW	Wilmington, Del.	97.3
WSUB-FM	Groton, Conn.	105.5
WSUP	Platteville, Wis.	
WSUS	Stevens Point, Wis.	89.9
WSUW	Whitewater, Wis.	
WSVA-FM	Harrisonburg, Va.	
WSVB	Tamaqua, Pa.	
WSVL-FM	Shelbyville, Ind.	
WSVS-FM	Crewe, Va.	
WSWG	Greenwood, Miss.	
WSWN-FM	Belle Glade, Fla.	
WSWW-FM	Platteville, Wis.	
WSYR-FM	Syracuse, N.Y.	
WTAD-FM	Quincy, Ill.	
WTAE-FM	Pittsburgh, Pa.	
WTAM	Gulfport, Miss.	102.3
WTAN-FM	Clearwater, Fla.	
WTAP-FM	Parkersburg, W. Va.	
WTAR	Norfolk, Va.	
WTAS	Crete, Ill.	
WTAW-FM	College Station, Tex.	
WTAX-FM	Springfield, Ill.	
WTAY-FM	Robinson, Ill.	101.7
WTBO-FM	Cumberland, Md.	
WTBS	Cambridge, Mass.	
WTCA-FM	Plymouth, Ind.	
WTCH-FM	Shawano, Wis.	
WTCM-FM	Traverse City, Mich.	
WTCO-FM	Campbellsville, Ky.	
WTCV	Memphis, Tenn.	104.5
WTCW-FM	Whitesburg, Ky.	103.9
WTCX	St. Petersburg, Fla.	
WTDL-FM	Lake City, Fla.	94.3
WTES-FM	Buffalo, N.Y.	
WTFM	Lake Success, N.Y.	
WTGI	Hammond, La.	
WTGN	Lima, O.	
WTGR-FM	Myrtle Beach, S. C.	101.7
WTHI-FM	Terre Haute, Ind.	
WTHM-FM	Lapeer, Mich.	
WTHS	Miami, Fla.	
WTIB	Iuka, Miss.	104.9
WTIC-FM	Hartford, Conn.	96.5
WTID-FM	Norfolk, Va.	
WTIM-FM	Taylorsville, Ill.	92.7
WTIO	Charleston, W. Va.	
WTJS-FM	Jackson, Tenn.	
WTJU	Charlottesville, Va.	
WTLC-FM	Indianapolis, Ind.	105.7
WTLN-FM	Apopka, Fla.	95.3
WTMA-FM	Charleston, S.C.	
WTMB-FM	Tomah, Wis.	
WTMJ-FM	Milwaukee, Wis.	94.5
WTNC-FM	Thomasville, N.C.	
WTNS-FM	Coshocton, O.	
WTNT-FM	Tallahassee, Fla.	

Call	Location	Freq.
WTOA	Trenton, N.J.	
WTDC-FM	Savannah, Ga.	
WTOD-FM	Toledo, Ohio	
WTOF	Canton, Ohio	
WTOP-FM	Washington, D.C.	
WTOS	Wauwatosa, Wis.	
WTOT-FM	Marianna, Fla.	
WTOW-FM	Baltimore, Md.	
WTPA-FM	Harrisburg, Pa.	
WTPC	Elsah, Ill.	89.7
WTPR-FM	Paris, Tenn.	
WTRE-FM	Greensburg, Ind.	
WTRF-FM	Wheeling, W.Va.	
WTRO-FM	Dyersburg, Tenn.	100.1
WTRS	Dunnellon, Fla.	102.3
WTSB-FM	Lumberton, N.C.	
WTSD	Waterford, Mich.	106.3
WTSR	Trenton, N.J.	89.7
WTSV-FM	Claremont, N.H.	
WTTC-FM	Towanda, Pa.	
WTTF-FM	Tiffin, Ohio	
WTTN-FM	Watertown, Wis.	
WTTR-FM	Westminster, Md.	
WTTV-FM	Bloomington, Ind.	
WTUN	Selma, Ala.	100.1
WTVL-FM	Waterville, Me.	
WTVR-FM	Richmond, Va.	
WTVY-FM	Dothan, Ala.	95.5
WTWC	Urbana, Ill.	
WTWX	Guntersville, Ala.	95.9
WTYD	New London, Conn.	100.9
WTZE-FM	Tazewell, Va.	100.1
WUAG	Greensboro, N. C.	
WUAZ	Henderson, Ky.	103.1
WUCB-FM	Chicago, Ill.	
WUHS	Urbana, O.	91.7
WUHY-FM	Philadelphia, Pa.	
WUJC	University Heights, O.	88.9
WUKP	Prestonsburg, Ky.	89.1
WULA-FM	Eufala, Ala.	92.7
WULX-FM	Richmond, Ind.	
WUMD	Duluth, Minn.	89.1
WUNC	Chapel Hill, N.C.	
WUNH	Durham, N.H.	
WUOA	Tuscaleosa, Ala.	95.7
WUOM	Ann Arbor, Mich.	
WUOT	Knoxville, Tenn.	
WUPR-FM	Utuado, P.R.	104.1
WUPY	Lynn, Mass.	
WUSC-FM	Columbia, S.C.	
WUSF	Tampa, Fla.	
WUSD	Springfield, O.	
WUST-FM	Bethesda, Md.	
WUSV	Scranton, Pa.	
WUVT-FM	Blacksburg, Va.	90.7
WUWM	Milwaukee, Wis.	
WVAC	Adrian, Mich.	
WVAF-FM	Charleston, W.Va.	
WVAM-FM	Altoona, Pa.	
WVBC	Bethany, W.Va.	
WVBR-FM	Ithaca, N.Y.	
WVBU-FM	Lewisburg, Pa.	
WVCA-FM	Gloucester, Mass.	
WVCC	Linesville, Pa.	101.7
WVCL-FM	Winnfield, La.	
WVCM	Carrollton, Ky.	
WVCR	Loudenville, N.Y.	
WVEC-FM	Hampton, Va.	
WVEM	Springfield, Ill.	
WVFC	Benton, Ill.	98.3
WVFM	Lakeland, Fla.	
WVFV	Dundee, Ill.	
WVGR	Grand Rapids, Mich.	104.1
WVHC	Hempstead, N.Y.	
WVHI	Evansville, Ind.	
WVIC-FM	E. Lansing, Mich.	94.9
WVIK	Rock Island, Ill.	90.9
WVIP-FM	Mount Kisco, N.Y.	
WVIS	Terre Haute, Ind.	
WVJP-FM	Caguas, P.R.	103.3
WVKC	Galesburg, Ill.	90.5
WVLE	Kaukauna, Wis.	104.9
WVLK-FM	Lexington, Ky.	
WVLR	Sauk City, Wis.	
WVMG-FM	Cochran, Ga.	96.7

Canadian FM Stations by Call Letters

Call	Location	MHz
CBF-FM	Montréal, Que.	95.1
CBFL-FM	Maniwaki, Que.	98.9
CBHM-FM	Richibucto, N.B.	98.5
CBL-FM	Toronto, Ont.	94.1
CBM-FM	Montreal, Que.	100.7
CBO-FM	Ottawa, Ont.	103.3
CBU-FM	Vancouver, B.C.	105.7
CBUF-FM	Vancouver, B.C.	97.7
CBW-FM	Winnipeg, Man.	98.3
CFBC-FM	Saint John, N.B.	98.9
CFCA-FM	Kitchener, Ont.	105.3
CFFM-FM	Kamloops, B.C.	98.3
CFFM-FM-1	Savona, B.C., Rebroadcasting the programs of Station CFFM-FM, Kamloops, B.C.	101.9
CFFM-FM-2	Clearwater, B.C., Rebroadcasting the programs of Station CFFM-FM, Kamloops, B.C.	92.7
CFFM-FM-3	Merritt, B.C., Rebroadcasting the programs of Station CFFM-FM, Kamloops, B.C.	103.9
CFFM-FM-4	Clinton, B.C., Rebroadcasting the programs of Station CFFM-FM, Kamloops, B.C.	106.5
CFFM-FM-5	Mount Timothy, B.C. Rebroadcasting the programs of Station CFFM-FM-4, Clinton, B.C.	99.7
CFGL-FM	Laval, Que.	105.7
CFMC-FM	Saskatoon, Sask.	103.9
CFMO-FM	Ottawa, Ont.	93.9
CFMQ-FM	Regina, Sask.	92.1
CFMS-FM	Victoria, B.C.	98.5
CFPL-FM	London, Ontario	95.9
CFQR-FM	Montreal, Que.	92.5
CFRC-FM	Kingston, Ont.	91.9
CFRN-FM	Edmonton, Alta.	100.3
CFRW-FM	Winnipeg, Man.	94.3
CHEC-FM	Lethbridge, Alta.	100.9
CHEX-FM	Peterborough, Ont.	101.5
CHFI-FM	Toronto, Ont.	98.1
CHFM-FM	Calgary, Alta.	95.9
CHFX-FM	Halifax, N.S.	96.1
CHGB-FM	La Pocatière, Que.	102.9
CHIC-FM	Brampton, Ont.	102.1
CHIN-FM	Toronto 4, Ont.	100.7
CHLT-FM	Sherbrooke, Que.	102.7
CHQM-FM	Vancouver, B.C.	103.5
CHRC-FM	Quebec, Que.	98.1
CHSC-FM	St. Catharines, Ont.	105.7
CHUM-FM	Toronto, Ont.	104.5
CHYM-FM	Kitchener, Ont.	96.7
CJAT-FM	Trail, B.C.	106.7
CJET-FM	Smiths Falls, Ont.	101.1
CJBQ-FM	Belleville, Ont.	97.1
CJBR-FM	Rimouski, Que.	101.5
CJCA-FM	Edmonton, Alta.	99.5
CJCB-FM	Sydney, N.S.	94.9
CJFM-FM	Montreal, Que.	95.9
CJIC-FM	Sault Ste. Marie, Ont.	100.5
CJMS-FM	Montreal, Que.	94.3
CJOB-FM	Winnipeg, Man.	97.5
CJOV-FM	Kelowna, B.C.	104.7
CJOY-FM	Guelph, Ont.	106.1
CJRT-FM	Toronto, Ont.	91.1
CJSS-FM	Cornwall, Ont.	104.5
CJUS-FM	Saskatoon, Sask.	89.7
CKAT-FM	North Bay, Ont.	93.7
CKBY-FM	Ottawa, Ont.	105.3
CKCH-FM	Hull, Que.	94.9
CKCL-FM	Truro, N.S.	100.9
CKCY-FM	Sault Ste. Marie, Ont.	104.3
CKDS-FM	Hamilton, Ont.	95.3
CKFM-FM	Toronto 7, Ont.	99.9
CKGB-FM	Timmins, Ont.	94.5
CKGM-FM	Westmount, Que.	97.7
CKLC-FM	Kingston, Ont.	98.3
CKLG-FM	Vancouver, B.C.	99.3
CKLW-FM	Windsor, Ont.	93.9
CKOK-FM	Penticton, B.C.	97.1

Canadian AM Stations By Call Letters

Call	Location	kHz
CBA	Moncton, N.B.	1070
CBAF	Moncton, N.B.	1300
CBD	Saint John, N.B.	1110
CBDR	Schefferville, P.Q.	1230
CBE	Windsor, Ont.	1550
CBF	Montreal, Que.	690
CBG	Gander, Nfld.	1450
CBH	Halifax, N.S.	860
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
CBNA	St. Anthony, Nfld with Studios at St. John's, Nfld.	600
CBNM	Marystown, Nfld with Studios at St. John's, Nfld.	740
CBO	Ottawa, Ont.	910
CBOF	Ottawa, Ont.	1250
CBR	Calgary, Alta.	1010
CBT	Grand Falls, Nfld.	540
CBU	Vancouver, B.C.	690
CBV	Québec, Que.	980
CBW	Winnipeg, Man.	990
CBX	Edmonton, Alta.	740
CBY	Corner Brook, Nfld.	990
CBZ	Fredericton, N.B.	970
CJBC	Toronto, Ont.	860
CFAB	Windsor, N.S.	1450
CFAC	Calgary, Alta.	960
CFAM	Altona, Man.	950
CFAR	Flin Flon, Man.	590
CFAX	Victoria, B.C.	1070
CFBC	Saint John, N.B.	930
CFBR	Sudbury (Ont.)	900
CFBV	Smithers, B.C.	1230
CFCB	Corner Brook, Nfld.	570
CFCF	Montreal 15, Que.	600
CFCH	Callander, Ont.	600
CFCL	Timmins, Ont.	620
CFCN	Calgary, Alta.	1060
CFCO	Chatham, Ont., with another Studio at Wallaceburg, Ont.	630
CFCP	Courtenay, B.C.	1440
CFCW	Camrose, Alta.	790
CFCY	Charlottetown, P.E.I.	630
CFDA	Victoriaville, Que.	1380
CFDR	Dartmouth, N.S.	790
CFFB	Frobisher Bay, N.W.T.	1200
CFGB	Happy Valley, Nfld.	1340
CFGM	Richmond Hill, Ont.	1310
CFGP	Grande Prairie, Alta.	1050
CFGR	Gravelbourg, Sask.	1230
CFGT	Alma, Que.	1270
CFJC	Kamloops, B.C.	910
CFJR	Brockville, Ont.	1450
CFKC	Creston, B.C. with another Studio at Nelson, B.C.	1340
CFLD	Studio at Station CFBV, Smithers, B.C.	1400
CFLH	Studio at Station CFCL, Timmins, Ont.	1340
CFLK	Studio at Station CFCL, Timmins, Ont.	1230
CFLM	La Tuque, Que.	1240
CFLS	Levis, Que.	1240
CFLV	Valleyfield, Que.	1370
CFMB	Montreal, Que.	1410
CFML	Cornwall, Ontario	1110
CFMR	Fort Simpson, N.W.T.	1490
CFNB	Fredericton, N.B.	550
CFNL	Fort Nelson, B.C. with another studio at Fort St. John, B.C.	590
CFNS	Saskatoon, Sask.	1170
CFOB	Fort Frances, Ont.	800
CFOM	Ville Vanier, Que.	1340
CFOR	Orillia, Ont.	1570
CFOS	Owen Sound, Ont.	560
CFOX	Pointe Claire, Que.	1470
CFPA	Port Arthur, Ont.	1230
CFPL	London, Ont.	980
CFPR	Prince Rupert, B.C.	860
CFQC	Saskatoon, Sask.	600
CFRA	Ottawa, Ont.	580
CFRB	Toronto 7, Ont.	1010
CFRC	Kingston, Ont.	1490
CFRG	Gravelbourg, Sask.	710
CFRN	Edmonton, Alta.	1260
CFRS	Simcoe, Ont.	1560
CFRW	Winnipeg, Man.	1470
CFRY	Portage la Prairie, Man.	920
CFSL	Weyburn, Sask.	1190
CFSX	Stephenville, Nfld.	910
CFTJ	Galt, Ontario	1110
CFTK	Terrace, B.C.	590
CFVR	Abbotsford, B.C.	1240
CFWB	Campbell River, B.C.	1490
CFWH	Whitehorse, Y.T.	570
CFYK	Yellowknife, N.W.T.	1340
CHAB	Moose Jaw, Sask.	800
CHAD	Amos, Que.	1340
CHAK	Inuvik, N.W.T.	860
CHAM	Hamilton, Ont.	1280
CHAT	Medicine Hat, Alta.	1270
CHCM	St. John's, Nfld.	560
CHEC	Lethbridge, Alta.	1090
CHED	Edmonton, Alta.	630
CHEF	Granby, Que.	1450
CHER	Sydney, Nova Scotia	950
CHEX	Peterborough, Ont.	980
CHFA	Edmonton, Alta.	680
CHFC	Churchhill, Mass.	1230
CHFI	Toronto, Ont.	680
CHGB	La Pocatière, Que. with another Studio at Baie St. Paul, Que.	1310
CHIC	Brampton, Ont.	790
CHIN	Toronto, Ont.	1540
CHIR	Leamington, Ont.	730
CHLC	Saguenay Co., Que.	580
CHLN	Trois-Rivières, Que.	550
CHLO	St. Thomas, Ont.	1570
CHLT	Sherbrooke, Que.	630
CHML	Hamilton, Ont.	900
CHNC	New Carlisle, Que.	610
CHNO	Sudbury, Ont.	900
CHNS	Halifax, N.S.	960
CHOK	Sarnia, Ont.	1070
CHOO	Ajax, Ont.	1390
CHOV	Pembroke, Ont.	1350
CHQW	Welland, Ont.	1470
CHQB	Powell River, B.C.	1280
CHQM	Vancouver, B.C.	1320
CHQR	Calgary, Alta.	810
CHQT	Edmonton, Alta.	1110
CHRC	Québec, Que.	800
CHRD	Drummondville, Que.	1480
CHRL	Roberval, Que.	910
CHRS	Jacques-Cartier, Que.	1090
CHRT	at Riviere du Loup, Que.	1450
CHSC	St. Catharine's, Ont.	1220
CHSJ	Saint John, N.B.	1150
CHSM	Steinbach, Man. Studio at Station CFAM, Altona, Man.	1250
CHTK	Prince Rupert, B.C.	560
CHTM	Thompson, Man.	610
CHUB	Nanaimo, B.C.	1570
CHUC	Cobourg, Ont.	1450
CHUM	Toronto 7, Ont.	1050
CHVD	Dolbeau, Que.	1230
CHWK	Chilliwack, B.C.	1270
CHWO	Oakville, Ont.	1250
CHYM	Kitchener, Ont.	1490
CHYR	Leamington, Ont.	710
CJAD	Montreal, Que.	800
CJAF	Cabano, Que.	1240
CJAT	Trail, B.C.	610
CJAV	Port Alberni, B.C.	1240
CJBC	Toronto, Ont.	860
CJBM	Causapscal, Que., with Studio at Rimouski, Que.	1450
CJBQ	Belleville, Ont.	800
CJBR	Rimouski, Que.	900
CJCA	Edmonton, Alta.	930
CJCB	Sydney, N.S.	1270
CJCH	Halifax, N.S.	920
CJCJ	Woodstock, N.B.	920
CJCN	Grand Falls, Nfld.	680
CJCS	Stratford, Ont.	1240
CJDC	Dawson Creek, B.C.	1350
CJDV	Drumheller, Alta.	910
CJEM	Edmundston, N.B.	570
CJMD	Chibougamau, Que., with another studio at Dolbeau, Que.	1240
CJET	Smiths Falls, Ont.	630
CJFP	Rivière-du-Loup, Que.	1400
CJFX	Antigonish, N.S.	580
CJGX	Yorkton, Sask.	940
CJIB	Vernon, B.C.	940
CJIC	Sault Ste. Marie, Ont.	1050
CJJC	Langley, B.C.	850
CJKL	Kirkland Lake, Ont.	560
CJLM	Joliette, Que.	1350
CJLS	Yarmouth, N.S.	1340
CJLX	Fort William, Ont.	800
CJME	Regina, Sask.	1300
CJMS	Montreal, Que.	1280
CJMT	Chicoutimi, Que.	1420
CJNB	North Battleford, Sask.	1050
CJNR	Blind River, Ont.	730
CJOB	Winnipeg, Man.	680
CJOC	Lethbridge, Alta.	1220
CJOE	London, Ont.	1290
CJON	St. John's, Nfld	930
CJOR	Vancouver, B.C.	600
CJOX	Grand Bank, Nfld.	710
CJRC	Ottawa, Ont.	1150
CJOY	Guelph, Ont.	1460
CJRL	Kenora, Ont.	1220
CJRN	Niagara Falls, Ont.	1600
CJRP	Quebec, Que.	1060
CJRS	Sherbrooke, Que.	1510
CJRW	Summerside, P.E.I.	1240
CJSA	Ste. Agathe des Monts, Que.	1230
CJSL	Estevan, Sask.	1280
CJSN	Shaunavon, Sask.	1490
CJSO	Sorel, Que.	1320
CJSS	Cornwall, Ont.	1220
CJTR	Trois-Rivières, Que.	1150
CJTT	New Liskeard, Ont.	1230
CJVI	Victoria, B.C.	900
CJVR	Melfort, Sask.	1420
CJWA	Wawa, Ont.	1240
CJYR	Edson, Alta.	970
CKAC	Montréal, Que.	730
CKAD	Middleton, N.S.	1350
CKAP	Kapuskasing, Ont.	580
CKAR	Huntsville, Ont.	630
CKAR-1	Parry Sound, Ont.	1340
CKAY	Duncan, B.C.	1500
CKBB	Barrie, Ont.	950
CKBC	Bathurst, N.B.	1360
CKBI	Prince Albert, Sask.	900
CKBL	Matane, Que.	1250

Call	Location	kHz
CKBM	Montmagny, Que.	1490
CKBS	St. Hyacinthe, Que.	1240
CKBW	Bridgewater, N.S.	1000
CKCB	Barrie, Ont.	1400
CKCH	Hull, Que.	970
CKCK	Regina, Sask.	620
CKCL	Truro, N.S.	600
CKCM	St. John's, Nfld.	620
CKCN	Sept-Iles, Que.	560
CKCQ	Quesnel, B.C.	570
CKCR	Salmon Arm, B.C.	1340
CKCV	Québec, Que.	1280
CKCW	Moncton, N.B.	1220
CKCY	Sault Ste. Marie, Ont.	920
CKDA	Victoria, B.C.	1220
CKDH	Amherst, N.S.	900
CKDM	Dauphin, Man.	730
CKDR	Dryden, Ont.	900
CKDY	Digby, N.S.	1420
CKEC	New Glasgow, N.S.	1320
CKEK	Cranbrook, B.C.	570
CKEN	Kentville, N.S.	1490
CKEY	Toronto, Ont.	590
CKFH	Toronto, Ont.	1430
CKFL	Lac Megantic, Que. with another Studio at Thetford Mines, Que.	1340
CKGA	Grenfell Heights, Grand Falls, Nfld.	730
CKGB	Timmins, Ont.	680
CKGF	Grand Forks, B.C. with other Studios at Penticton and Osoyoos, B.C.	1340
CKGM	1310 Greene Ave., Westmount, Que.	980
CKGN	Ste-Anne-des-Monts, Que., Studio at Station CKBL Matane, Que.	1340
CKJD	Sarnia, Ont.	1250
CKJL	Saint-Jérome, Que.	900
CKKC	Nelson, B.C.	1390
CKKR	Rosetown, Sask.	1330
CKKW	Kitchener, Ont.	1320
CKLB	Oshawa, Ont.	1350
CKLC	Kingston, Ont.	1380
CKLD	Thetford Mines, Que.	1230
CKLG	Vancouver, B.C.	730
CKLM	Montreal, Que.	1570
CKLS	La Sarre, Que.	1240
CKLW	Windsor, Ont.	800
CKLY	Lindsay, Ont.	910
CKML	Mont Laurier, Que.	610
CKMP	Midland, Ont.	1230
CKMR	Newcastle, N.B.	790
CKNB	Campbellton, N.B.	950
CKNL	Fort St. John, B.C.	560
CKNR	Elliott Lake, Ont.	1340
CKNW	New Westminister, B.C.	980
CKNX	Wingham, Ont.	920
CKOC	Hamilton, Ont.	1150
CKOK	Penticton, B.C.	800
CKOM	Saskatoon, Sask.	1250
CKOO	Osoyoos, B.C.	1240
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
CKPM	Ottawa, Ont.	1440
CKPR	Port Arthur, Ont.	580
CKPT	Peterborough, Ont.	1420
CKQR	Castlegar, B.C.	1230
CKRB	Beauce, Que.	1460
CKRC	Winnipeg, Man.	630
CKRD	Red Deer, Alta.	850
CKRM	Regina, Sask.	980
CKRN	Rouyn, Que.	1400
CKRS	Jonquière, Que.	590
CKRW	Whitehorse, Y.T.	610
CKSA	Lloydminster, Alta.	1080
CKSB	Saint-Boniface, Man.	1050
CKSL	London, Ont.	1410
CKSM	Shawinigan, Que.	1220
CKSO	Sudbury, Ont.	790
CKSW	Swift Current, Sask.	1400
CKTB	St. Catharines, Ont.	610
CKTK	Kitimat, B.C.	1230
CKTS	Sherbrooke, Que.	900
CKUA	Edmonton, Alta.	580
CKVD	Val-d'Or, Que.	900
CKVL	Verdun, Que.	850
CKVM	Ville-Marie, Que.	710
CKVN	Vancouver, B.C.	1410
CKWL	Williams Lake, B.C.	920
CKWS	Kingston, Ont.	960
CKWW	Windsor, Ont.	580
CKWX	Vancouver, B.C.	1130
CKX	Brandon, Man.	1150
CKXL	Calgary, Alta.	1140
CKXR	Salmon Arm, B.C.	580
CKY	Winnipeg, Man.	580
CKYL	Peace River, Alta.	610
CKYR	Jasper, Alta. with Studio at CTYR Edson, Alta.	1450
VOAR	St. John's, Nfld.	1230
VOCM	St. John's, Nfld.	590
VOWR	St. John's, Nfld.	800

White's World-Wide Shortwave Stations

DXing is a hobby. It is a chance to travel via the imagination to exotic places. It is an entertainment, a diversion, an escape from the routine. Most of all, shortwave listening is, and should be, fun!

But broadcasting reflects the real world around us. Sometimes that world, through which the Four Horsemen of the Apocalypse —Conquest, War, Famine and Death—too often ride, intrudes upon the hobby aspects of SWL'ing. During the year, ear-witness accounts of the fall of Biafra, the Peruvian earthquake aftermath and the continuing strife in Indo-China were received by DXers.

But some of these instances go almost unnoticed. One such was reported recently by San Francisco listener, Bill Sparks.

One evening, about 0300 GMT, Sparks was listening to Radio Balmaceda, 9,570 kHz., from Santiago, Chile. There was nothing unusual about the programs, mostly music and Spanish language announcements. But suddenly things changed.

An unexpected voice, in English, interrupted the regular program. The Radio Balmaceda announcer had an important message. A one-month-old child was critically ill. There was an urgent need for gamma globulin, but none was available in the city of Santiago. An appeal was made to the station's English speaking audience. The request for help was repeated a short time later, this time in French as well, and Sparks was able to tape record the message.

He called the local chapter of the American Red Cross and within minutes was explaining the situation—and replaying his tape—to a relief worker in San Francisco. Arrangements were made to refer the request to the New York Red Cross office.

The rest, unfortunately, Sparks has not learned, but presumably the much needed gamma globulin was flown to Santiago, as requested, by LAN, the Chilean national airline. Hopefully, the story had a happy ending.

Up North. For many U.S. listeners, our nearest foreign neighbor is Canada. And everyone is familiar with its powerful international voice, Radio Canada. Almost as well known is the Canadian Broadcasting Corporation's domestic service for listeners in the far north and arctic regions.

But there are eight other shortwave stations in Canada to test your DX prowess. Several are easy catches; others are considerably harder to log. One, in fact, has eluded the author for over 23 years!

Readily heard is CFRX, a one kilowatt shortwave station of the Standard Broadcasting Corporation, a privately owned operation at Toronto. It transmits on 6,070 kHz., 24 hours a day, relaying the medium wave CFRB, 1010 kHz. Because it rebroadcasts the AM broadcast band signals, some DXers mistakenly call it CFRB, but 't'ain't so!

Almost as easily heard in some parts of the United States is CFCW, 6,005 kHz., which relays the programs of Montreal's BCB'er, CFCF on 600 kHz. This, reportedly, is one of the oldest stations in Canada.

Two private, commercial shortwave stations

This Issue's Shortwave Contributors

Kris Lemna (Indiana), Bill Eddings (Pennsylvania), Henry Michalenka (Rhode Is.), Bill Sparks (California), Gregg Calkin (Canada), Michael Macken (Massachusetts), Gerry Dexter (Wisconsin), Del Hirst (Texas), A. R. Niblack (Indiana), Everett Slosman (New York), Grady Ferguson (North Carolina), F. Earle Hall (Massachusetts), Martin Potter (Canada), Dan Ferguson (Florida), Michael Seth (New York), Bob Padula (Australia), Art Glover (Washington), Woody Seymour Jr. (North Carolina), Stewart MacKenzie (California), Jack Hudson (Alabama), Charles Pilkington (Washington), Chris Lobdell (Massachusetts), Alvin Sizer (Connecticut), Craig Koukol (Illinois), American SWL Club, 1506 Dresser St., Santa Ana, California, Newark News Radio Club, 215 Market St., Newark, N.J., North American SW Association, Box 989, Altoona, Pennsylvania.

White's Emergency Radio Station Listings for OHIO—PART 2

SCIENCE AND ELECTRONICS furnishes this exclusive listing of Pacific Northwest emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. We have and will be publishing similar lists devoted to different metropolitan areas in forthcoming issues so that you'll be able to accumulate a sizable array of this difficult-to-obtain data. Refer to the index on page 87 for our 1970/1971 program of emergency radio station listings.

If you desire to obtain similar lists from other areas in the United States that have not been published in this magazine, then we suggest you write to Communications Research Bureau, Box 56, Commack, N.Y. 11725. They may have a list of emergency radio services that covers your locality. Include a stamped, self-addressed envelope with your request. Why not write to them today!

All frequencies are megahertz (MHz) unless otherwise noted. Symbols used are: CD—Civil Defense; FD—Fire Department; LG—Local Government; PD—Police Department; SD—Sheriff or County PD.

Lima	PD	KQA818	39.42
	PD	mobile	39.26
	PDC	KQD729	39.58
	PDC	mobile	39.42
	FD	KDE248	46.10
	FD	KDE248	46.22
Lisbon	PDC	KQA358	39.64
	FDC	KE0366	154.07
Lodi	PD	mobile	39.58
	PD		460.075
	PD		460.30
	LG	KJF745	154.115
	FD	KLL608	46.38
Logan	PD	KQC870	39.58
	PDC	KDQ224	39.58
	FD	KDN600	46.42
London	PD	KDB456	39.58
	PDC	KQA389	39.58
	FD	KDK813	33.86
Londonderry	FDC	KAX771	154.13
	FDC	KQK69	154.445
Lorain	PD	KQB349	155.25
	LG	KJU212	153.755
	LG	KBG528	154.965
	LG	KJR254	155.955
	FD	KGW644	154.355
	FD	KQA502	154.355
Loudonville	PD	KFI590	39.42
	PD	KFI590	39.58
	FD	KQI226	154.07
Louisville	PD	KQB774	155.61
	LG	KDX482	155.715
Lynchburg	PD	mobile	39.58
	FD	KQE413	33.94
Lyndhurst	PD	KFG492	155.535
	PD	mobile	39.42
	PD	mobile	39.48
	LG	KDQ284	46.54
	FD	KCJ824	154.19
McArthur	PD	KAS750	39.58
	PDC	KQD410	39.58
	LGC	KBV805-6	46.58
	LGC	KBV809	46.58
McClure	PD	KLR439	39.58
	FD	KCL534	154.13
McComb	PD	KJZ870	39.58
	FD	KQH418	154.25
McConnelsville	PDC	KQD750	39.50
	FD	KBH343	33.86
Macedonia	PD	KDV364	39.58
	LG	KDR724	45.44
	FD	mobile	33.86
Madeira	PD	mobile	39.58
	LG	KL0351	39.18
Magnolia	PD	KDS656	39.58
	PD	mobile	39.50
Mansfield	PD	KQB751	155.13
	PD	mobile	154.89
	PDC	KFR606	39.58
	PDC	KQB346	39.58
	LG	KJD336	154.995
	FD	KDG383	153.77
	FD	KDC383	154.25
	FDC	KDS693	154.25
Mantua	PD	mobile	39.56
	PD	mobile	39.58
	FD	KLD709	154.13
Maple Hts	PD	KQA935	39.42
	LG	walkie	39.06
	FD	KCJ947	46.46
Marblehead	PD	mobile	39.52
	FD	KQG605	33.86
Mariemont	PD	mobile	39.58
	FD	KPB852	33.58
	FD	KFB852	33.82
Marietta	PD	KQB389	39.58
	PDC	KQH450	39.58
	LG	KFB862	155.745
	FD	KQF277	46.14
Marion	PD	KQA754	39.58
	PDC	KQI821	39.58
	FD	KDE254	33.82
Martins Ferry	PD	KQA250	155.61
	LG	KJS862	154.995
	FD	KDZ379	154.43
Marysville	PD	KEY914	39.58
	PDC	KQA877	39.58
	FD	KQH277	154.25
Mason	PD		39.58
	LG	KEU953	45.48
Massillon	PD	KQB740	155.13
	PD	mobile	154.89
	LG	KCU298	155.895
Maumee	LG	KDS639	154.98
	FD	KDY388	33.74
Mayfield	PD	KJI469	39.42
	PD	KJI469	39.58
	LG	KJI598	39.18
	FD	KDP466	154.19
Mayfield Hts	PD	KJF743	39.48
	PD	mobile	39.42
	LG	KDY275	46.54
	FD	KCT274	154.19
Mechanicsburg	PD	KQF335	155.13
	PD	mobile	154.89
	FD	KQH258	153.89
Medina	PDC	KQA940	39.58
	PDC	KZE93	465.20
	PDC	KZE93	465.30
	LG	KDF547	45.48
	LGC	KBS695	45.12
Mendon	PD	mobile	155.13
	FD	mobile	154.31
Mentor	PD	KQH380	39.58
	LG	KEY944	153.98
	FD	KGP773	46.14
Mentor/Lake	PD	KQF442	39.58
	FD	KDG264	46.14
Miamisburg	PD	KQA248	155.13
	FD	KQG938	154.19
Middleburg Hts	PD	KLM691	39.02
	FD	KLI266	46.10
Middlefield	PD	mobile	39.58
	FD		27.275
Middletown	PD	KQB625	155.73
	PD	mobile	159.03
Mifflin	PD	mobile	39.58
	FD	KQI231	154.07
Milan	PD	KQE353	39.58
	LG	KDT232	45.28
Mill Creek Pk	PD	KLF780	158.91
	PD	KLF780	159.09
Millersburg	PD	mobile	39.58
	PDC	KQA522	39.58
	LGC	KBN826	45.36
Millford Twp	FD	KBH766	154.31
	FD	KJP302	154.31
	FD	mobile	154.37
Millville	PD	mobile	39.42
	FD	KBH769	154.31
Mineral Ridge	PD	KDZ412	155.13
	FD	KQI501	33.78
Minerva	PD	KQC342	155.61
	PD	mobile	155.85
Mingo Jct	PD	KQB530	155.61
	PD	mobile	155.85
Minster	PD	KBP648	155.13
	PD	KBP648	155.85
	PD	KDE83	155.85
	FD	KBR506	153.89
	FD	KBR506	154.37
	FD	KDG32	153.89
Mogadore	PD	KGL219	39.58
	FD	KBK519	33.86
Monroeville	PD	KQB724	39.58
	PD	KQB724	39.66
	PD	KQC534	39.58
	FD	KDZ335	46.06
Montpelier	PD	KGK697	39.58
	FD	KCL525	154.25
Morane	PD	KQK575	155.13
	PD	mobile	154.89
	FD	KDR697	154.13
Mt Gilead	PD	KFY437	39.58
	PDC	KQD279	39.58
	FD	KDG879	33.86
Mt Sterling	PD	KQD670	39.58
	FD	KDR792	33.86
Mt Vernon	PDC	KQB523	39.58
	PDC	KQB523	39.72
	LG	KQI461	158.76
	FDC	KQH940	33.86
Munroe Falls	PDC	KGB328	39.58
	PDC	KGB328	39.62
	LG	KQR370	158.835
	LG	mobile	155.145
	LGC	KQI806	155.76
	LGC	KLV952	453.45
	FDC	KBS943	33.86
Munson Twp	PDC	KQA980	39.58
	PDC	KQA980	39.78
	PDC	mobile	39.42
	FDC	KBP402	46.14
Napoleon	PD	mobile	39.58
	PDC	KQA838	39.58
	LG	KFI576	155.835
	FD	KCX392	154.13
New Albany	PD	KQH703	39.58
	FD	KDN471	33.86
Newark	PD	KQB527	155.19
	PD	mobile	159.03
	PDC	KBG751	39.58
	LG	walkie	39.06
	LG	KQI400	154.10
	LG	KVX76	155.985
	LGC	KEX22	153.86
	LGC	KOJ406	158.76
	FD	KQH903	153.89
	FD	KQH903	154.37
	FDC	KQH904	33.86
New Boston	PD	mobile	154.95

	PD	mobile	155.19
	LG	KIZ221	155.895
	FD	mobile	33.78
New Bremen	PD	KBP649	155.13
	PD	KBP649	155.85
	PD	KDE84	155.85
	LG	KBS929	156.00
	FD	KBR507	153.89
	FD	KBR507	154.37
	FD	KDG33	153.89
Newburg Hts	PD	mobile	39.42
	FD		46.46
New Carlisle	PD	KQH378	39.58
	FD	KQH413	154.07
Newcomerstown	PD	KQC757	39.58
	FD	KDT259	33.94
New Conrad	PD	mobile	39.58
	FD	KDP455	33.90
New Lebanon	PD	KGW745	155.37
	LG	KGT493	153.755
New Lexington	PD	KEL339	39.58
	PDC	KQE296	39.58
New Miami	PD	mobile	155.97
	PD	mobile	156.21
	FD	KBH756	154.37
New Paris	PD	KQH551	155.13
	PD	mobile	154.89
	FDC	KQH305	154.19
New Philadelph	PD	KQF513	39.58
	PD	mobile	39.34
	LG	KDN962	45.28
	FD		33.94
New Richmond	PD	KQB763	39.58
	FD	KGK723	33.94
New Rome	PD	KJN841	39.58
	FD	KQJ699	33.86
Newton Falls	PD	KQE774	155.565
	FD	KLD806	33.78
Niles	PD	KQC386	155.13
	LG	KDV818	154.98
	FD	KQH988	33.78
No Bend	PD	KQI286	155.13
	PD	mobile	154.89
No Canton	PD	KQD999	155.61
	LG	KFG430	158.925
	FD	KQJ556	154.43
Northn Hills	FD	KDO235	33.58
	FD	KDO235	33.90
Northfield	PD	KJR328	155.13
	PDC	KCI519	39.58
	PDC	KCI519	39.62
	PDC		460.10
	PDC		460.175
	PDC		460.25
	PDC		460.425
	FD	KEY974	33.86
Northfield Ctr	PD	KJR328	155.13
	FD	KQI236	33.86
No Hampton Twp	LG	KJY824	45.20
	FD	KBU675	154.37
No Jackson	LG	KEO410	154.085
	FD	KEP606	154.07
No Madison	PD	KDN420	39.58
	PD	KDN420	155.13
	FD	KJW615	46.14
No Olmstead	PD	KQB904	155.61
	LG	KFI562	158.94
	FD	KAP972-3	154.25
No Randall	PD	mobile	39.42
	FD	mobile	46.46
No Ridgeville	PD	KDC952	39.52
	PD	mobile	155.61
	FD	KQG240	154.37
No Royalton	PD	mobile	39.02
	LGC	KUH88	458.60
	LGC	KUH88	458.70
	FD		46.10
Norton	PD	KDR481	155.61
	FD	KBK520	33.86
Norwalk	PD	KQB293	39.58
	PDC	KQE658	39.58
	LG	KGP728	155.955
	FD	KDV301	46.06
Norwood	PD	KQB254	159.21
	PD	mobile	154.71
Oak Harbor	PD	mobile	39.58
	PDC	KJD286	39.58
	LG	KDX934	155.10
	FD	KQG574	33.86
	FDC	KJB226	33.86
Oakwood	PD	KDZ380	39.42
	PD	KJW588	39.58
	LG	KQH930	153.86
	LG	KQH930	158.88
Oberlin	PD	KQB700	39.58
	FD	KCZ901	154.37
Obetz	PD	KJI366	39.58
	PD	KJI366	39.66
	FD	KBP769	33.86
Ontario	PD	KQK287	39.58
	LG	KLE918	154.10
	FD	KDG897	153.77
	FD	KDG897	154.25
Orange Vlg	PD	mobile	39.42
	FD	mobile	46.46
Oregon	PD	KQH330	155.13
	PD	mobile	154.89
	PD	KLX907	460.10
	LG	KDU547	155.085
	FD	KQE372	33.74
Orrville	PD	KQD207	155.61
	FD	KQH504	154.43
Ottawa	PDC	KEO352	39.58
	PDC	KQA553	39.58
	FDC	KQH926	154.25
Ottawa Hills	PD	KQB522	155.73
	FD	KDN991	154.25
Overpeck	LGC	KQK356	45.36
	FD	KBH768	154.37
Oxford	PD	KQD393	155.13
	PD	mobile	154.89
Univ	PD	KQF677	155.31
	FD	KDN424	154.37
Painesville	PD	KQA595	39.58
	PDC	KQB593	39.58
	LGC	KDQ213	158.805
	LGC	mobile	154.115
	FD	KAT772	46.14
Parma	PD	KQB344	39.02
	PD	KQB344	39.12
	PD	mobile	39.26
	PD	mobile	39.34
	LG	walkie	39.06
	LGC	KQY763	453.60
	LGC	KQY763	453.70
	FD	KQH508	46.10
	FD	KQH511	46.10
	LG	KDT361	46.52
Parma Hts	PD	KQE704	39.02
	FD	KDU554	155.88
Paulding	PDC	KQE459	39.58
	LG	KQW301	154.10
	FDC	KAP971	154.385
Payne	PD	KJY690	39.58
	FD	KJA956	154.385
Pepper Pike	PD	mobile	39.42
	LG	KDU582	46.54
	FD	KCZ531	154.19
Perkins Twp	PD	KQH206	39.58
	FD	KDB435	46.06
Perry Twp	LG	KLK639	155.775
	FD	KFZ830-1	33.82
Perrysburg	PD	KQB507	39.58
	LG	KDS638	158.82
Piqua	PD	KQB521	155.19
	LG	KFO922	158.865
	LG	KGU985	158.865
	FD	KBK982	154.19
Plain City	PD	KFO924	39.58
	FD	KBV843	154.25
Plain Twp	LG	KFG430	158.925
	FD	KDN471	33.86
Plymouth	PD	KCI719	39.58
	PD	KCI719	39.66
Pomeroy	PDC	KQB230	39.58
	LG	KDR422	45.08
Port Clinton	PD	KQB417	39.58
	FD	KQG606	46.06
Portsmouth	PD	KQB739	155.19
	PD	mobile	154.95
	PDC	KBP310	39.10
	LG	KCZ865	158.76
	FD	KCY614	33.78
Porter Twp	FD	KQK503	33.74
	FD	mobile	33.86
Powell	PD	KQJ609	39.46
	PD	KQJ609	39.58
Prarie Twp	LG	KDY357	45.36
	FD	KQJ699	33.86
Ravenna	PD	mobile	39.58
	PDC	KQA937	39.58
	FD	KBR491	154.13
Reynoldsburg	PD	KQH329	39.42
	PD	KQH329	39.86
	LG	KQJ232	156.00
	FD	KCN341	33.86
Richfield	LG	KRA522	453.225
	FD	KBK521	33.86
Richmond	PD	KQH290	39.46
	PD	KQH290	39.58
	FD	KDQ228	33.94
Richmondale	FDC	KAX770	154.13
	FDC	KBP61	154.445
Richmond Hts	PD	KDP461	39.42
	LG	KJG931	46.54
	FD	KDP462	154.19
Rittman	PD	KQF486	39.58
	LG	KBM667	45.16
	FD	KQG924	154.43
Riveredge Twp	PD		155.61
	FD	mobile	154.25
Rockford	PD	mobile	155.13
	PD	mobile	154.31
Rocky River	PD	KQB420	155.61
	PD	mobile	155.85
	LG	KEL438	156.00
	FD	KAP969	153.83
	FD	KAP969	154.25
Rossford	PD	KQA394	155.13
	FD	KQH527	153.89
Sabina	PD	KQF651	39.58
	PD	KQF651	39.66
	FD	KCN572	33.94
St Clairsville	PD	KEO375	39.58
	FD	KBI976	33.94
	FDC	KDQ248	33.94
St Henry	PD	mobile	155.13
	FD	mobile	154.31
St Marys	PD	KBP651	155.13
	PD	mobile	155.85
	LG	KBR366	156.00
	FD	KBQ213	153.89
	FD	KBQ213	154.37
St Paris	PD	KQH239	39.58
	PD	KQH239	155.13
	FD	KQH240	153.89
Salem	PD	KQA748	155.61
	LG	KLK637-9	155.755
Sandusky	PD	KQB580	39.58
	PDC	KAR695	39.58
	LG		155.865
	LG		453.50
	LG		453.925
	FD	KDN990	46.06
Sebring	PD	KQB701	155.61
	PD	mobile	155.85
	LG	KEP581	154.965
Seven Hills	PD	KJD941	39.02
	PD	mobile	39.12
	PD	mobile	39.22
	PD	mobile	39.42
	FD	KDP448	46.10
Seville	PD	mobile	39.58
	FD	KCT228	46.38
Shadyside	PD	KQG925	155.61
	FD	KUA760	154.43
Shaker Hts	PD	KQA520	39.42
	PD	mobile	39.34
	FD	KQF750	46.46
	FD	KQG952	46.46
	FD	mobile	153.83
Sheffield	PD	KFM481	155.61
	FD	KDB498	154.37
Sheffield Lk	PD	KQD551	155.61
	FD	KBD555	154.37
Sheffield Twp	PD	mobile	155.61
	FD	KDN487	154.37
Shelby	PD	KQA505	39.58
	PD	KQA505	155.13
	PD	mobile	154.89
	FD	KDE299	154.25
Sidney	PD	KQA571	159.21
	PD	mobile	154.71
	PDC	KQG875	39.58
	LG	KDQ309	154.10
	FDC	KJS686	154.415
	FDC	KYT23	154.01
Silver Lake	PD	mobile	155.49
	LG	KCI974	155.055
Silverton	PD	mobile	159.15
	LG	KCY572	158.76
Smithville	PD	KQG385	39.58
	FD	KDV379	154.43
Solon	PD	KQE340	39.42
	PD	mobile	39.58
	FD	KCR965	46.46
S Euclid	PD	KQB506	39.98
	LGC	KUH70	458.35
	FD	KDE300	154.19
	FD	KDE300	154.83
	PD	mobile	39.74
S Zanesville	PD	KGT633	39.58
	PD	KGT633	39.66
Springboro	PD	KJC961	39.58
	FD	KQG738	153.89
Springfield	PD	KAU441	159.09
	PD	KAU447	159.09
	PD	mobile	154.77
	PDC	KQC425	39.58
	FD	KQD688	154.01
	FD	KQD688	154.37

WHITE'S EMERGENCY SECTION

Spring Valley	PD	mobile	39.58
	FD	KDZ324	154.07
Steubenville	PD	KQB350	154.65
	LG	KFM477	154.115
	FD	KQA392	154.31
Stow	PD	KQJ267	155.19
	FD	KQD794	154.37
Streetsboro	PD	KJY907	39.52
	PD	KJY907	39.58
Strongsville	PD	KQD617	39.02
	FD	KCY595	46.10
Stryker	PD	KAX362	39.58
	LG	KLS522	27.275
Sugarcreek Twp	PD	KLR390	39.54
	FD	KQI690	154.07
Sunbury	PD	KQE931	39.58
	FD	KCS491	33.86
Sylvania	PD	KQG242	37.10
	PD	mobile	37.02
Tallmadge	PD	KQE297	155.61
Tiffin	PD	KQB396	39.58
	PDC	KLR434	39.58
	FD	KDG346	46.06
	FDC	KLY955	46.06
Toledo	PD	KQA463	158.79
	PD	mobile	155.97
	PD	mobile	156.15
Univ.	PD	KDX528	155.31
	PDC	KQB424	37.02
	PDC	KQB424	37.10
	LGC	KQJ268	453.35
	FD	KQA726	153.95
	FD	KQA726	154.19
	FDC	KQD484	33.74
Trenton	PD	mobile	39.42
	FD	KBH758	154.37
Trotwood	PD	KQF992	155.13
	FD	KDX497	154.19
	FD	KQG237	154.19
Troy	PD	KQA460	39.58
	PDC	KQA892	39.58
	PDC	mobile	37.04
	FD	KDA683	154.19
	FDC	KEP537	154.19
Twinsburg	PD	KQG401	39.58
	PD	mobile	39.42
Uniopolis	FD	KBR508	153.89
	FD	KBR508	154.37
	FD	KDG34	153.89
Unity	PD	KGL530	39.50
	FD	KET280	154.25
Univ Hts	PD	KQA394	39.42
	FD	KCJ680	46.46
Upr Arlington	PD	KQE223	460.025
	FD	KCW709	33.86
	FD	KCW709	33.98
	FD	KJS524	460.575
Upr Sandusky	PDC	KQB573	39.58
	FD	KQG933	154.43
Urbana	PD	KQA422	39.58
	PD	KQA422	39.66
	PDC	KQH535	39.58
	FD	KCW649	33.98
	FDC	KQG936	153.89
Vandalia	PD	KQM560	155.625
	PD	KQF235	155.13
	PD	mobile	154.89
	LG	KJF947	153.80
Van Wert	PD	KQB395	155.61
	PDC	KQD588	39.58
	FD	KDR762	154.31
Vermillion	PD	KFR744	39.58
	LG	KFR666	154.98
	FD	KDG311	154.37
Versailles	PD	KFB885	39.58
	FD	KQG860	154.19
Wadsworth	PD	KQA532	155.61
	FD	KDV706	154.01
	FD	KGR275	154.01
Wapakoneta	PD	KBP650	155.13
	PD	KBP650	155.85
	PD	KDE85	155.85
	PDC	KQD678	39.58
	PDC	KQD678	155.13
	PDC	KQD678	155.85
	FD	KBR509	153.89
	FD	KBR509	154.37
	FD	KDH45	153.89
	FDC	KJD341	153.89
	FDC	KJD341	154.37
Warren	PD	KQB414	39.58
	PD	KQB414	39.72
	PDC	KBU294	39.58
	FD	KQA757	154.19
Warrensville Hts	PD	KQD618	39.42
	PD	KQD618	39.58
	FD	KCU280	46.46
Washington	PD	KQC760	39.50
	FD	KCP546	33.94
Washington CH	PD	KQC760	155.13
	PDC	KBU637	155.37
Waterville	PD	KQG330	37.10
	FD	KDO323	33.74
Wauseon	PDC	KQA890	39.58
	FD	KCR967	33.82
Waverly	PDC	KCJ827	39.58
	LG	KLX827	155.925
	FD	KUA798	33.94
Waynesville	PD	KFT634	39.48
(Dundee)	FD	KFT634	39.58
Weathersfld Tp	FD	KQH988	33.78
Wellington	PD	KQD268	39.58
	PD	KQD268	39.66
	FD	KQD203	154.37
Wellston	PD	KQC804	39.58
	PD	KQC804	39.66
	LG	KDU537	155.10
Wellsville	PD	KQA939	39.58
	PD	KQA939	39.66
	FD	KDL806	154.07
W Alexandria	PD	KIZ228	155.13
	PD	mobile	154.89
	FD	KQG233	154.19
W Carrollton	PD	KQE331	155.13
	PD	mobile	154.89
Westerville	PD	KQB975	39.42
	PD	KQB975	39.58
	LG	KJU962	155.04
	FD	KCL758	33.86
W Jefferson	PD	KDD957	39.58
	FD	KQK569	33.86
Westlake	PD	KQB519	155.61
	PD	mobile	155.85
	FD	KAP970	154.25
W Milton	PD	KQD872	39.58
	PD	KQD872	155.13
	FD	KQC891	154.19
W Salem	PD	KQI691	39.58
	FD	KQH270	154.43
W Union	PD	KQN207	155.13
	PD	mobile	154.89
	PDC	KQE823	39.58
	FD	KET280	154.25
W View Vlg	PD	KJS746	155.61
	PD	mobile	39.58
	PD	mobile	155.565
	FD	mobile	154.25
Whitehall	PD	KQE956	39.32
	PD	KQE956	39.42
	PD	mobile	39.34
	PD	mobile	39.58
	FD	KCI512	33.86
Wickliffe	PD	KQB603	39.58
	LG	KLR271	39.10
	FD	KQF388	46.14
	FD	KQF388	154.25
Willard	PD	KQA455	39.58
	FD	KDN490	46.06
Willoughby	PD	KQB602	39.58
	FD	KCT682	46.14
Willoughby Hls	PD	KQG455	39.58
	LG	KLG654	45.60
	FD	KJL712	46.14
Willowick	PD	KQB597	39.58
	LG	KDN989	45.48
	FD	KCW378	46.14
Wilmington	PD	KQD582	39.58
	PDC	KFM347	39.58
	FD	KBE474	33.94
Windham	PD	KQG868	39.58
	FD	KBR487	154.13
Woodlawn	PD	mobile	39.14
	PD	mobile	39.30
	PD	mobile	39.82
	FD	mobile	33.58
	FD	mobile	33.90
Woodville	PD	KQC694	39.58
	FD	KDQ317	46.06
Wooster	PD	KQA876	155.61
	FD	KBP404	154.43
Worthington	PD	KLK725	156.21
	LG	KDY266	158.835
	FD	KQK535	33.86
Xenia	PD	KQB680	453.20
	PDC	KQA485	39.58
	LG	KQK543	155.775
	LG	KPI28	458.10
Yellow Sprgs	PD	KAU700	155.13
	PD	mobile	39.58
	PD	mobile	154.89
	LG	KCI687	153.92
	LG	KCI687	155.145
	FD	KQI233	154.07
Youngstown	PD	KQB422	158.73
	PD	mobile	158.91
	PD	mobile	159.03
	FD	KQG300	153.83
	FD	KQG300	154.01
	FD	KQG300	154.37
Zanesville	PD	KQB900	154.785
	PDC	KQG384	39.58
	PDC	KLG600	39.76
	LG	KFN641	158.775
	FD	KBL988	33.98

Bookmark

(Continued from page 18)

circuits work—tone-generating, keying, "voicing", and special effects systems—plus how to locate and correct defects in any section. The heavily illustrated oversized text contains many troubleshooting hints as well as typical organ troubles and their related causes. Also included are simple step-by-step tuning methods which do not require musical training to perform. A 36-page foldout section includes numerous typical organ schematics. Published by Tab Books, Blue Ridge Summit, Pa. 17214.

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Ham Traffic

Continued from page 22

valuable today as when it was written years ago.

If a few items seem a bit odd in this modern day, they should remind all of us that we enjoy our operating privileges today because of the solid foundation laid by others who came before us. The attitudes expressed in the Amateur's Code are timeless.

Let's all remember it took a lot of work to preserve ham radio for us in the days after World War I when government and industry tried to kill it. We're now entering a new crisis period in ham radio—when government is again giving us indifferent treatment, and when business enterprises are so intent on making a buck that they often lose sight of maintaining the solid technical force necessary for everyone to make several bucks tomorrow.

Nevertheless, let's all be proud to be hams . . . to live up to the heritage which we have . . . and to tell the world the true value of ham radio. There's nothing like it, and there can never be a replacement. ■

Hot-Wire Ammeter

Continued from page 80

it. It is much easier to position the Datak characters this way.

AC Operation Experiment. The Hot-Wire Ammeter will indicate AC current as well as DC current. You can experiment with its AC operation by measuring the AC current drawn by lamp bulbs connected to the AC line.

Make an experiment board with three surface mounting lamp sockets fastened to a wood base and connected in parallel as in the schematic drawing. The Hot-Wire Ammeter is connected in series with one side of the lamp sockets and one side of the AC line cord. The other side of the line cord is connected to the open paralleled lamp socket connections.

You can experiment with the Hot-Wire Ammeter by connecting the lamps as shown in the AC Calibration Guide Table and measuring their current drain. The table is based on a nominal line voltage of 117 volts. Your hot-wire ammeter should read currents as tabulated in guide below.

AC CALIBRATION GUIDE TABLE

Approx. AC Current (Amps)	Lamps Connected (Watts)	Calculated value (Watts)
0.5	60	(57.5)
1	100 and 15	(115)
1.25	100 and 40	(143.75)
1.5	100 and 75	(172.5)
1.75	100 and 100	(200.25)
2	100, 100, and 25	(230)

Science Fair. The Hot-Wire Ammeter is a good project for any Science Fair student. However, just building a project is not enough. Some original research and a well prepared paper go hand-in-hand with any project. So do the job well, and if you become a winner, let us know. Give us all the facts and a photograph, if possible, and we'll get you in print! ■

VHF Extender

Continued from page 71

ANY OTHER COILS. Then reconnect resistor R4, put on the bottom plate, and you're ready to enjoy the VHF Extender.

Switching Bands. To change to another frequency band, should you tire of your first choice, replace the crystal with one of proper frequency (see coil tables) and retune the VHF Extender as described above. If the move in frequency is not very far, you

may not need to change the coils. However, if the frequency change is more than half a dozen megacycles or so, you will probably have to replace L1, L2, L5, and possibly L4.

To change from low-band to high-band operation, you must either add D1 and L4.

Don't be alarmed at the thought of using the VHF Extender and a standard shortwave receiver to listen to the FM signals of most commercial VHF communications gear. The VHF gear must now use restricted bandwidth for its transmissions, and as a result you can get very clean copy from the FM signal with an AM receiver simply by tuning a trifle to one side of the signal itself.

Going Mobile. And the VHF Extender can be used with auto radios, too, by using the "BC-Band" component values in the coil tables and supplying 150 volts DC from an external supply. ■

Variometer Radio

Continued from page 42

Variometer Radio. One diagram shows the variometer used in a crystal radio. This hook-up is beautiful in its simplicity and performs well when used with a good water pipe ground, and an outdoor antenna at least 50 feet long. A variometer is not very selective when used alone in a tuned circuit, but it is fine for the many localities where there are only a few local or strong broadcast stations.

The other diagram shows the variometer used in a diode-transistor radio, the transistor providing one stage of audio amplification. No battery switch is used—you cut the current by pulling out one of the earphone cord tips.

You might want to try other experiments, such as connecting a 365-pF variable capacitor across the variometer, or in series with the antenna lead to increase selectivity and tuning range.

In any case, resurrection of this quaint variable inductor can be both an interesting and informative way to spend a few hours. And the use of a little imagination can undoubtedly find a variety of other uses for this oldie, but goody. ■

One-Tube Multibander

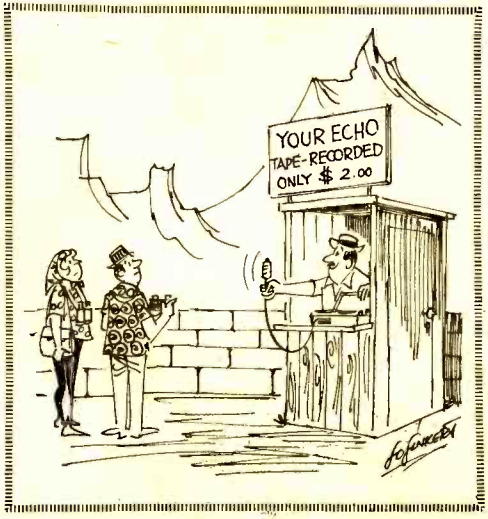
Continued from page 27

rigid and as short as possible. Tuning range for the coil is: L2A, 600 to 1850 kHz; L2B, 1500 to 4500 kHz; L2C, 4.4 to 14 MHz; L2D, 11.5 to 38 MHz.

Operation and Calibration. Plug in the desired frequency coil, turn on the set and allow it a few minutes to warm up. Set the main tuning capacity and the bandspread scale to zero. Turn the volume control all the way up and plug a pair of high-impedance phones into J2. Adjust the regen control to the point just before the set breaks into oscillation. Then, using a signal generator, tune the coil slug until you hear the signal generator; its frequency setting should agree with those given in the preceeding paragraph. The other coils can be calibrated in the same manner.

For the local broadcast stations, use 25 feet of hook-up wire for an antenna. For reception of weaker stations, use a long, high outside antenna and a cold-water pipe ground.

Tune the main capacitor for signals while adjusting R2. If there is too much regeneration, the circuit will oscillate and stations will come in as whistles. If whistles occur, turn the regen control back below the point of oscillation. With a little more practice at using this rig, you'll find around-the-world reception an everyday occurrence. ■



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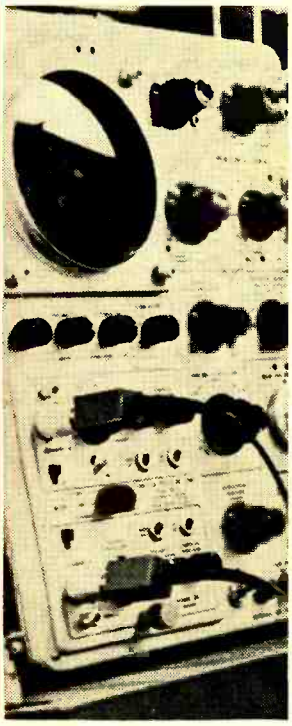


In today's electronics boom the demand for men with technical education is far greater than the supply of graduate engineers. Thousands of real engineering jobs are being filled by men without engineering degrees—provided they are thoroughly trained in basic electronic theory and modern application. The pay is good, the future is bright... and the training can now be acquired at home—on your own time.

THE ELECTRONICS BOOM has created a new breed of professional man—the non-degree engineer. Depending on the branch of electronics he's in, he may "ride herd" over a flock of computers, run a powerful TV transmitter, supervise a service or maintenance department, or work side by side with distinguished scientists on a new discovery.

But you do need to know more than soldering connections, testing circuits and replacing components. You need to really know the fundamentals of electronics.

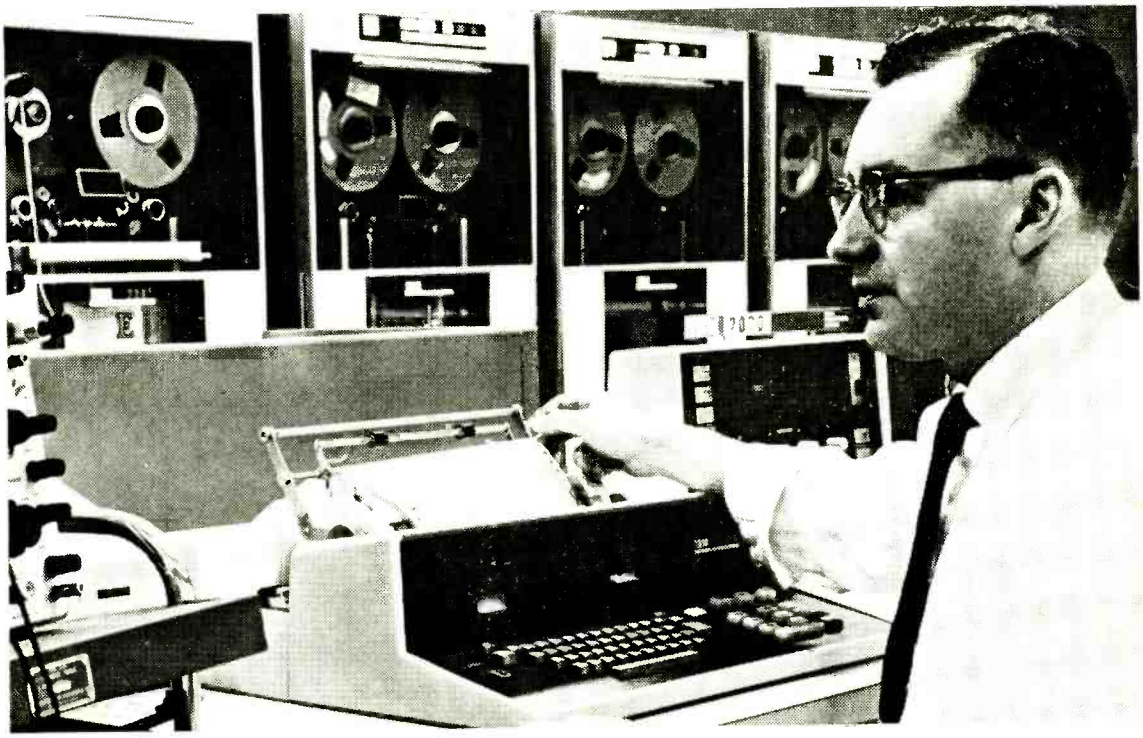
How can you pick up this necessary knowledge? Many of today's non-degree engineers learned their electronics at home. In fact, some authorities feel that a home study course is the *best* way. *Popular Electronics* said:

"By its very nature, home study develops your ability to analyze and extract information as well as to strengthen your sense of responsibility and initiative."

Cleveland Method Makes It Easy

If you do decide to advance your career through home study, it's best to pick a school that *specializes* in the home study method. Electronics is complicated enough without trying to learn it from texts and lessons that were designed for the classroom instead of the home.

Cleveland Institute of Electronics concentrates on home study exclusively. Over the last 30 years it has developed tech-



niques that make learning at home easy, even if you once had trouble studying. Your instructor gives the lessons and questions you send in his undivided personal attention—it's like being the only student in his "class." He not only grades your work, he analyzes it. And he mails back his corrections and comments the same day he gets your lessons, so you read his notations while everything is still fresh in your mind.

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- ☐ **Electronics Engineering**

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EX-43

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BUILD 20 RADIO

and Electronics Circuits

PROGRESSIVE HOME RADIO-T.V. COURSE

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Training Electronics Technicians Since 1946

Now Includes

- ★ 12 RECEIVERS
- ★ 3 TRANSMITTERS
- ★ SQ. WAVE GENERATOR
- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ SCHOOL INQUIRIES INVITED
- ★ Sold In 79 Countries

YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

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 low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

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.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

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 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 Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator 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 Circuitry." 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 twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, 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 and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. 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 Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

Progressive "Edu-Kits" Inc., 1189 Broadway, Dept. 563NN, Hewlett, N.Y. 11557

FREE EXTRAS

• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

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 trouble 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.

FROM OUR MAIL BAG

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."

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 Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

UNCONDITIONAL MONEY-BACK GUARANTEE

Please rush my expanded "Edu-Kit" to me, as indicated below:
Check one box to indicate choice of model

- ☐ Regular model $34.95.
- ☐ Superior model $39.95 (same as regular model except with superior parts and tools plus valuable Radio & TV Tube Checker).

Check one box to indicate manner of payment

- ☐ I enclose full payment. Ship "Edu-Kit" post paid.
- ☐ I enclose $5 deposit. Ship "Edu-Kit" C.O.D. for balance plus postage.
- ☐ Send me FREE additional information describing "Edu-Kit."

Name .....

Address .....

City & State ..... Zip .....

PROGRESSIVE "EDU-KITS" INC.
1189 Broadway, Dept. 563NN, Hewlett, N. Y. 11557