RADIO and TELEVISION maintenance

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• New projection TV adapter gives 3 x 4-foot picture with direct-view receiver .....See Page 6

JULY 1950

PICTURE TUBE DATA CHART

MAGNETIC DEFLECTION AND FOCUS TELEVISION TYPE CATHODE-RAY TUBES

Type[1]	Socket	Dimensions (Inches) Overall Length	Diameter	Min. Useful Diameter	Deflection Angle (degrees)	Radius of Focus Curvature (Inches)	Envelope	Contact	Ion Trap Magnet	Max. Design Center Values Anode Volts	Grid No. 2 Volts	Comparative Operating Conditions** Focus* Current (Ma.)	Anode Volts	Neg. Grid No. 1 Cut Off Volts	Grid No. 2 Volts
10BP4 10BP4A[2]	12D	17⅜	10½	9	50	42	Glass[3]	Cavity	Double	12,000	410	132	12,000	33-77	300
10CP4	12D	16⅜	10½	9	50	42	Glass[3]	Ball	None	12,000	410	——	12,000	33-77	
10DP4[4,5]	12C	17⅜	10½	9	50	42	Glass	Cavity	None	12,000		——	12,000		
10EP4	12D	17⅜	10½	9	50	42	Glass	Ball	Double						
10FP4[6]	12D	17⅜	10½	9	50	42	Glass[3]	Cavity							
10MP4 10MP4A[2]	12G	17	10½	9⅛	52	42	Glass[3]								
12BP4	12D	17½	12	11	56	2[illegible]									
12KP4[6] 12KP4A[2]	12D	17⅜	12⅛	11⅛											
12LP4 12LP4A[2]	12D	18⅜	12⅛	11											
12QP4 12QP4A[2]	12D	17½	12⅛	11											
12RP4	12D	17½	12	11											
12TP4	12D	18⅜	12⅛	11											
12UP4 12UP4A[2]	12D	18⅜	12⅛	11											
12VP4 12VP4A[2]	12G	18	12⅛	11											
14BP4[5,6]	12D	16¾	9⅝x12½	12⅜ diag.	70										
14CP4[5,6]	12D	16⅜	9⅝x12⅝	12⅜ diag.	70										
14DP4[5,6]	12D	16⅜	9⅝x12⅝	12⅜ diag.	70										
14FP4[5,6]	12D	16½	9⅝x12½	12⅜ diag.											
15AP4	12D	20½	15½	14											
15CP4	12D	21½	15½	14											
15DP4	12D	20½	15½	14	57										
16AP4 16AP4A[2]	12D	22⅜	15⅜	14⅛	53										
16CP4	12D	21½	15⅜	15											
16DP4 16DP4A[2]	12D	20¼	15⅜	15											
16EP4 16EP4A[2]	12D	19⅜	15⅜	14⅛											
16FP4	12D	20¼	16⅛	15	62										
16GP4[5,6]	12D	17⅞	15⅜	14⅛	70										
16HP4 16HP4A[2]	12D	21⅛	15⅜	14½	60										
16JP4 16JP4A[2]	12D	20¾	16⅛	15	60										
16KP4[5,6]	12D	18⅜	11½x14¾	14⅜ diag.	70										
16LP4 16LP4A[2]	12D	22⅛	15⅞	14½											
16MP4 16MP4A[2]	12D	21¾	16⅛	14¾	60										
16QP4[5,6]	12D	19⅝	11½x14¾	15 diag.	70	diag.									
16RP4[5,6]	12D	18¾	11½x14¾	14⅜ diag.	70	diag.	27								
16SP4 16SP4A[2]	12D	17⅞	15⅜	14½	70		56⅝								
16TP4[5,6]	12D	18⅛	11½x14⅜	14⅞ diag.	70	diag.	27								
16UP4[5,6]	12D	18⅛	11½x14⅜	15 diag.	70	diag.									
16VP4[6]	12D	17⅝	15⅜	14½	70										
16WP4[6]	12D	17¾	15⅜	14½	70										
16XP4[5,6]	12D	18¾	11½x14¾	15 diag.	70	diag.									
16YP4[6]	12D	17⅞	15⅛	14½	70		56⅝								
17AP4[5,6]	12D	18⅜	12¾x15⅝	16 diag.	70	diag.	27								
19AP4 19AP4A[2]	12D	21½	18⅜	17⅜	66		28								
19DP4 19DP4A[2]	12D	21½	18⅜	17⅜	66		60	Glass[3]							
19EP4[5,6]	12D	21½	17x13⅝	17⅝ diag.	70	diag.	27	Glass[3]							
19FP4[6]	12D	22	18⅜	17⅜	66		60	Glass							
19GP4[6]	12D	21½	18⅜	17⅜	66		60	Glass							
20BP4	12D	28	20	18¾	54		30	Glass	Metal Cap						
22AP4 22AP4A[2]	12D	22⅞	21⅞	20¼	70		27	Metal	——	Single		410	108*	12,000	33-77	300

Notes:
1. All the types listed have heater values of 6.3 volts, 0.6 amps.
2. These types employ electrostatic focus.
3. "A" type indicates use of gray filter faceplate.
4. Type employs metal-backed screen.
5. Rectangular type.
6. Types other than "A" types employing gray filter face plate.

* Types employ RMA Focus Coil #109, all others RMA focus coil #106.

† Types have external conductive coating.

7. All types employ a white flourescence material of medium persistence.

** These values are for comparison only and do not imply typical operating conditions.

Data based on latest information from RMA Data Bureau.

• Du Mont Teletrons

USING THE DATA CHART

Several important factors must be considered by the technician when using this tube data chart as an index to tube interchangeability.

Bulb Outline *(exclud... overall length)*

Tube pur... bulb outlines present no problem of int... t to chassis layout, unless the differ... that the two types in question would ...ign.

...a low focus ...t range ...ired.

...with the ...ouble to a ..., it

Conductive Coating

If a tube without external coating is replaced for a tube with external coating, a 500 to 1500 μμf. capacitor connected between the high-voltage output lead and ground will insure proper set operation.

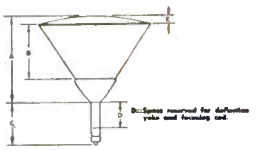
Bulb Contact

In general there are three types of connectors to the anode of television tubes, the cavity and ball connectors in all glass types, and the clip connector for types with a metal cone envelope. When making tube changes, the appropriate connector must be used.

Deflection Angle

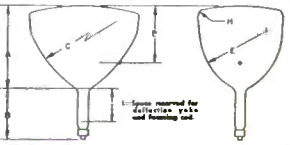
In practice, the same deflection yoke usually may be employed with all tube types having deflection angles of less than 66°. Types with deflection angles of 66° or over will require a wide-angle deflection yoke.

OUTLINES



METAL GLASS — ROUND TYPES

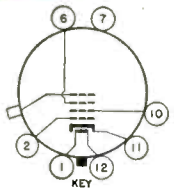
A	B	C	D	E
10¾	7½	8	4⅛ min.	¼
4¾	11	7⅝	4 min.	⅜
12¾	9⅝	6⅛	3⅜ max.	⅛
10¾	7⅝	6⅛	4 min.	½
14⅜	9½	7⅛	4½ min.	1⅛
15⅜	11⅝	7⅛	4⅜ min.	1⅛



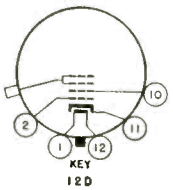
GLASS — RECTANGULAR TYPES

C	D	E	F	G	H	I	
17⅜	6⅝	8¼	∞	2⅜	¼	3¼	
17⅜	6⅜	8¼	∞	2⅜	¼	4¾ min.	
17⅜	6⅝	8¼	∞	2⅜	¼	5¼ min.	
17⅜	6⅜	8¼	∞	2⅜	¼	4⅝ min.	
18	6¾	9	∞	3¼	¼	4¾	
18	7⅜	9	∞	3¼	¼		
18	7⅜	9	∞	3¼	¼		
18	7⅜	9	∞	3¼	¼	4⅝ min.	
18	7⅜	9	∞	3⅜	¼	4⅝ min.	
18	7⅜	9	∞	3¼	¼		
60	7⅛**	13⅝	27°	2⅜	¼		
10	11¼	∞		2½	¼	3⅜	

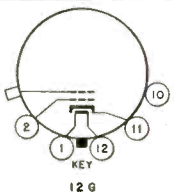
* Side adjacent to F has curvature radius of 21 inches.
** Anode contact is located on broad side.



12C



12D



12G

FREE!

THE COMPLETE TV-TUBE DATA CHART

All your TV-tube information at a glance... up-to-date listings of ALL standard types ... all-glass and metal-glass, round and rectangular ... dimensions and drawings ... electrical characteristics ... ion traps ... bulb contacts ... base diagrams ... etc.

ASK YOUR JOBBER FOR THE DU MONT TV TUBE DATA CHART. OR WRITE US ...

ALLEN B. DU MONT LABORATORIES, INC. · TUBE DIVISION · CLIFTON, N. J.

RADIO INDUSTRY NEWSLETTER

DECRIES LAXITY IN UHF STUDIES

FCC chairman Wayne Coy crystallized the major problems his committee is facing in a recent address to the RMA (now Radio and Television Manufacturers Association). Pulling no punches, Coy illuminated his discussion of color TV, UHF possibilities, and the freeze with strong criticism of laxity in experimentation on UHF, as well as on other current questions.

CAN'T GUESS ON BILLIONS

"We are now proposing," the FCC chairman said, "to quintuple the number of television channels by moving into the UHF. Here is a problem involving the expenditure of hundreds of millions of dollars by the public and by the radio industry. And yet in all America there were only half a dozen experimental UHF TV stations broadcasting programs last year and they were on the air for limited periods. A billion-dollar industry is no place for operation by guess."

FCC DIGS IN ON COLOR TV

The FCC is digging into its 12,000 pages of testimony and 300 exhibits gathered in nine months of hearings on color television. Final pleas from the proponents of the three basic systems, CBS, RCA and CTI, were entered, and a senate committee called for a decision "without unwarranted delay."

UHF BATTLE TO FOLLOW COLOR

The UHF controversy is not expected to be settled until after the color situation has cleared, although it may be that adoption of a color system will mean moving into the ultra-high section of the radio spectrum.

OSC. RADIATION WILL GET WORSE

Hitting neglect of what may be an important responsibility in incorporating oscillator-radiation limiters in TV and FM sets, Chairman Coy pointed out to the RMA that neither an FCC recommendation for limitation nor a "more lenient RMA proposal" has been met in practice, and that the interference caused by local oscillator radiation, grave enough today, may be extremely magnified when there are 20 to 30 million receivers operating.

MUST IMPROVE AURAL RADIO

Television is taking up most of the electronics limelight nowadays, but Wayne Coy's RMA statement included remarks on the need for a "strong, healthy and indeed improved system of aural broadcasting." Citing FM's "unchallenged superiority" over AM, he said that FM "has had a tough time . . . whenever a manufacturer sells a TV-only set, he is slamming the door on aural radio. The future of our aural broadcasting system is a matter . . . of urgent importance to the radio manufacturer."

TV USED ON BUS LINE; WHAT NEXT?

Continuing its sensational climb into all types of applications, television has been installed on a California bus line. The driver, of course, can't see the screen, but company officials report that passengers like the idea.

ATOM SCIENTISTS PERFECT STEREO-TV

Stereo, or three-dimensional television, has been developed by the Remote Control Engineering Division of the Atomic Energy Commission's Argonne National Laboratory in Chicago. Introduction of a third dimension in TV will permit the handling of radioactive material with much greater ease than straight video does, although ordinary television is good enough for routine operations. The engineers, working with Allen B. Du Mont Laboratories, based their system on a twin-lens viewing arrangement similar to human vision.

3-LB. TRANSCEIVER HAS 5-MILE RANGE

A pocket-sized handie-talkie weighing only three pounds is said to be in production in Argentina. Using subminiature tubes and flashlight batteries, the tiny transmitter-receiver has a reputed range of five miles. The chassis is carried in one coat pocket and the antenna in another.

WIRED TV FOR HOME DEVELOPED

A wired TV arrangement for home use has been devised in Canada, it is reported. The outfit consists of four cameras, weighing about 17 pounds each, a power unit, and a viewing screen. Daylight or ordinary home lighting is sufficient for normal operaiton, and the system is described as "relatively inexpensive and easy to install."

HURRY CALLS TO GO THRU RADIO CHANNEL

A radio paging service for doctors, using pocket receivers, is on the way in New York City. A telephone answering service will handle calls, repeating them at intervals over the transmitter. When a doctor hears himself being paged, he will get in touch with his office by telephone.

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RADIO and TELEVISION maintenance

JULY, 1950

FEATURES

DEPARTMENTS

DEVOTED TO SERVICE OF RADIO-AUDIO-VIDEO

SALES POWER?

"Plenty . . . with the G-E monogram on the job!"

"ANOTHER way to put it is *acceptance.* 'G-E' on my store window, on tube cartons, makes my customers want to buy!" Testimony like this is common when radio-TV servicemen talk shop. They've found — sales have shown them — that it's easy to market a tube product known favorably to millions. Just as *your* income, once you handle General Electric tubes, climbs because your public is pre-sold on G-E quality and value! . . . And you get plenty of help in acquainting prospects with your expert service facilities, as well as with your complete line of G-E tubes. General Electric signs, advertising aids, other attention-getters do an overtime job of bringing business to your door. Your G-E tube distributor will be glad to review for your benefit the folder describing the many colorful, effective, *tested* G-E sales helps, each a signpost along your road to bigger tube profits. See him today! *General Electric Company, Electronics Department, Schenectady 5, New York.*

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181-JA5

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PROJECTION TV ADAPTER

Converts an ordinary direct-view Receiver to a two-way projection or direct-view set

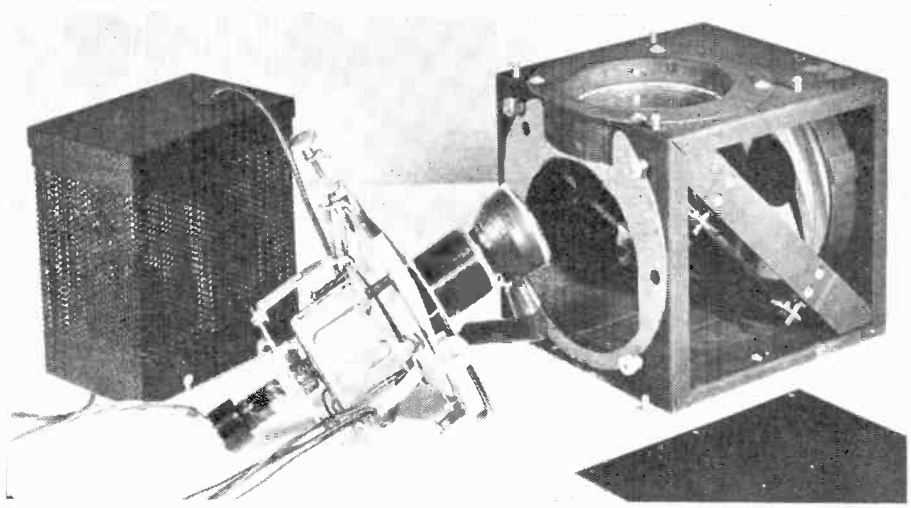
by L. J. A. VAN LIESHOUT
North American Philips Company, Inc.

IN 1936, when Philips first demonstrated projection television at the Olympia show in London, people didn't believe much in television, and didn't give such large pictures a second thought. Now, 14 years later, television pictures must be large to satisfy public demand.

When the Protelgram projection television system was ready for production, application engineers did not know in which direction its uses would develop. One outstanding basic fact was that the system could produce a picture of three by four feet from a 2½" tube, with practically the same brightness as a movie house performance, or could give a picture of 20 inch diameter with the brightness of a direct-view tube. Obviously, most of its applications would lie within the big picture field.

The Duo-Vue unit, designed for alternate direct-view and projection use, is one of the many special applications of Protelgram projection television. Used with a direct-view receiver (10" or larger), it will produce a three by four-foot picture for about $200 list. With a selector switch, the operator of the unit can choose either the direct-view of the original set, or the projection afforded by the new device.

The author, L. J. A. van Lieshout, North American Philips Co.



View of power supply, 2-1/2 inch picture tube and optical assembly of Duo-Vue projection unit. Unit with its cabinet serves as a table when used with a table-model direct view receiver. Projection unit contains only projection tube, optical system, power supply, and auxiliary chassis with extra video amplification.

Connecting the unit into the receiver is relatively simple, but should be done carefully by a qualified technician.

Circuit Analysis

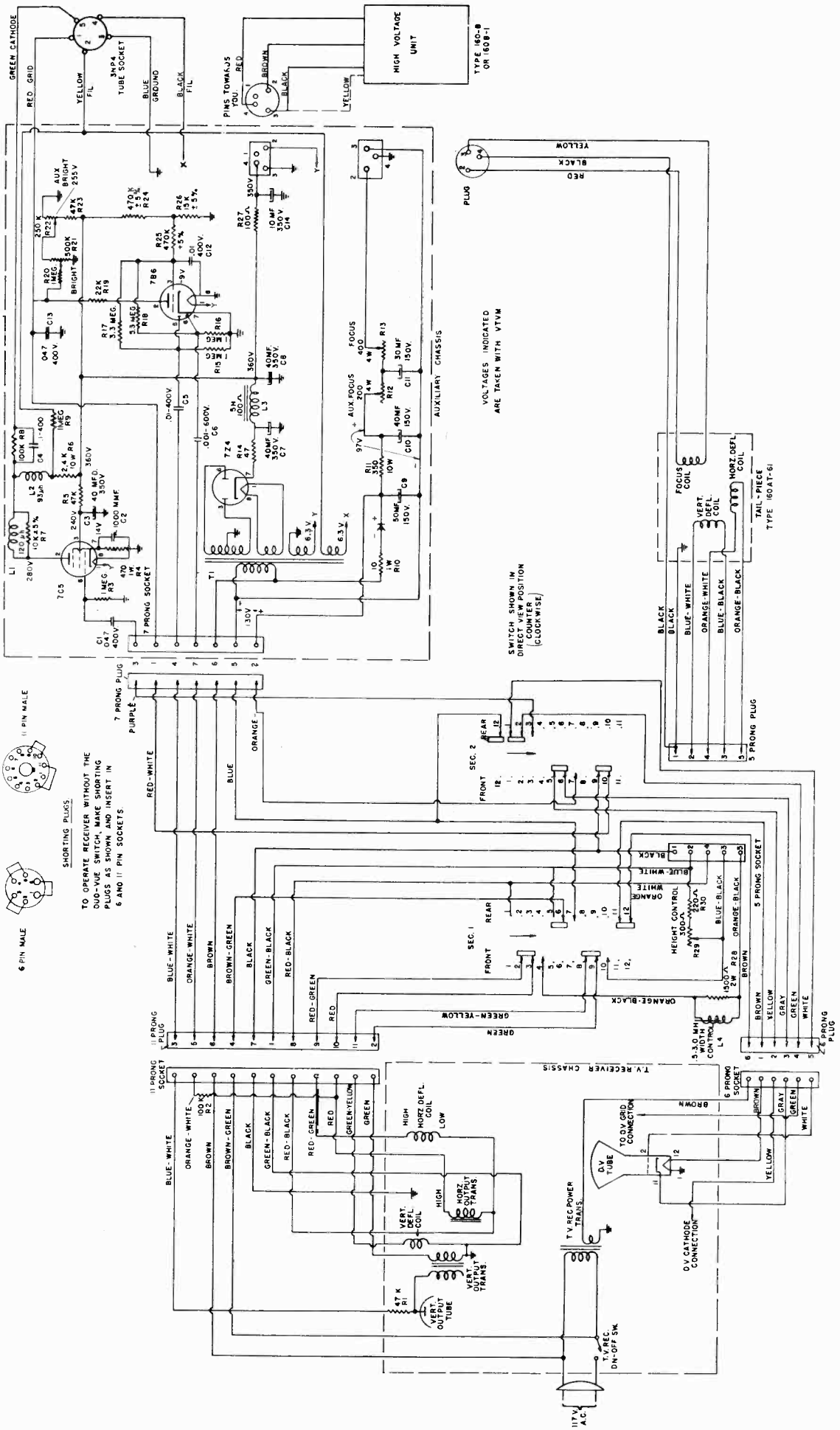
The unit contains a complete Protelgram system comprising an optical box, a tailpiece, a high-voltage supply and a 2½" projection tube type 3NP4; an auxiliary chassis containing (a) a video amplifier to compensate for the added lead length; (b) a supply of 350 volts DC at 50 ma; (c) a supply of 6.3 volts AC at 1.1 amp., and (d) a supply for a focus current range from 90 to 150 ma, (e) an automatic biasing circuit to cut off the 3NP4 beam current if receiver deflection circuits should fail and (f) a function switch, width and linearity controls and a tilt mechanism with which the projection box can be adjusted for the proper viewing angle.

The projection system is a very efficient Schmidt system adapted for television purposes. Adequate brightness, true definition and high contrast ratios can be obtained with it.

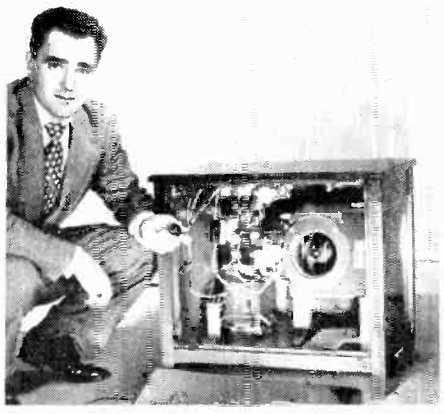
Extra Amplification

As is indicated on the schematic, a 7C5 tube is used as a video amplifier, giving gain of approximately 2, which is adequate for practically every 10", 12½" or 16" direct-view television chassis. In addition to compensating for the added cable and switch capacity in the Duo-Vue wiring, the video amplifier also increases the response in the 4 Mc region of the video signal. This results in increased fidelity of the 3 by 4-foot picture. Often the definition of the 3 by 4-foot picture is better than on the direct-wave tube, because of the improvement obtained through the 7C5

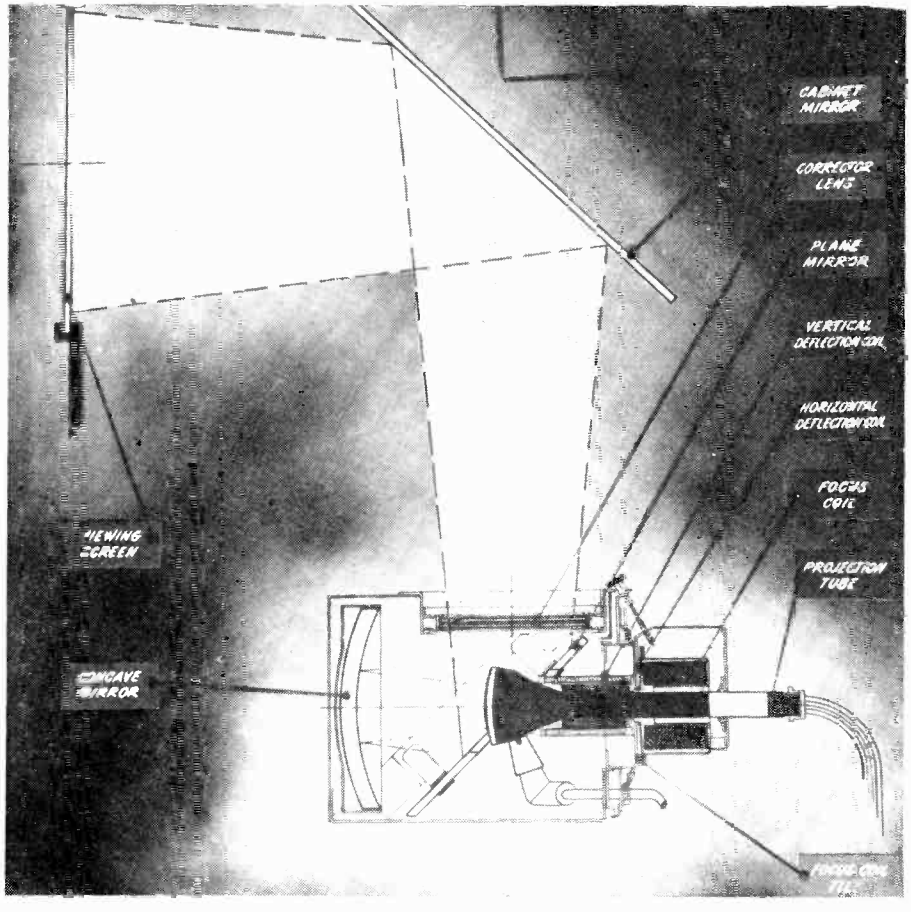
Opposite page: Schematic diagram of Duo-Vue unit. Note plug connections between projection system and receiver chassis, plug connections joining power unit, auxiliary chassis, projection tube.


GREEN CATHODE
RED GRID
YELLOW FIL
3NP4 TUBE SOCKET
BLUE GROUND
BLACK FIL
PINS TOWARDS YOU
RED
BROWN
BLACK
YELLOW
HIGH VOLTAGE UNIT
TYPE HG-8 OR 1608-1
AUX BRIGHT 235V
BRIGHT
7B6
7C5
7Z4
AUXILIARY CHASSIS
FOCUS
AUX FOCUS
VOLTAGES INDICATED ARE TAKEN WITH VTVM
PLUG
YELLOW
BLACK
RED
FOCUS COIL
VERT. DEFL. COIL
HORZ. DEFL. COIL
TAIL-PIECE TYPE 160AT-61
BLACK
BLUE-WHITE
ORANGE-WHITE
BLUE-BLACK
ORANGE-BLACK
5 PRONG PLUG
7 PRONG PLUG
7 PRONG SOCKET
SWITCH SHOWN IN DIRECT VIEW POSITION COUNTER CLOCK-WISE
11 PIN MALE
6 PIN MALE
SHORTING PLUGS
TO OPERATE RECEIVER WITHOUT THE DUO-VUE SWITCH, MAKE SHORTING PLUGS AS SHOWN AND INSERT IN 6 AND 11 PIN SOCKETS
PURPLE
ORANGE
RED-WHITE
BLUE
SEC. 2
SEC. 1
FRONT
REAR
HEIGHT CONTROL
WIDTH CONTROL
5 PRONG SOCKET
11 PRONG PLUG
11 PRONG SOCKET
6 PRONG PLUG
6 PRONG SOCKET
BROWN
YELLOW
GRAY
GREEN
WHITE
T.V. RECEIVER CHASSIS
HIGH HORZ DEFL. COIL
LOW
HORZ. OUTPUT TRANS
VERT. DEFL. COIL
VERT. OUTPUT TRANS
VERT OUTPUT TUBE
T.V. REC. POWER TRANS.
T.V. REC. ON-OFF SW.
117 V. A.C.
D.V. TUBE
TO D.V. GRID CONNECTION
D.V. CATHODE CONNECTION

video stage. The 7Z4 rectifier is transformer-operated and serves as a supply for the amplifier and the high voltage unit. A completely isolated half-wave selenium rectifier handles the focus current required for the system. The 7B6, a dual diode-triode, is used in an automatic biasing circuit. Each diode receives either horizontal or vertical pulses from the deflection system. These rectified voltages from each diode are added and supplied to the control grid so that the resulting grid voltage during normal set operation is approximately minus 9 volts. The plate current of the triode section is, therefore, effectively cut off when the tube is operating in this condition. The plate of the triode section is connected to the 3NP4 grid, voltage is derived through a high impedance circuit of 1.0 megohm. It can be seen that a failure of either the horizontal or vertical sweeps will allow the triode grid to approach zero bias. The triode section will conduct and the 3NP4 grid voltage will be reduced to a point near zero. This will increase the 3NP4 bias beyond cut-off, reducing the possibility of sweep burns.



Rear view of the projection unit installed in its cabinet. Lens at right directs picture to movie screen set up behind the unit. Table-model TV receiver is mounted on the top surface. Controls and selector switch are on the front of the cabinet.



The Protelgram projection system as used in ordinary rear-projected TV sets. When arranged in the Duo-Vue setup, the picture tube and optical system at bottom are adjusted to project the picture directly from the corrector lens onto a movie screen. Rear projection on a screen may also be utilized. The optical system is an adaptation of the Schmidt system, with reflection first from a concave, magnifying mirror, then from a flat mirror through the corrector lens.

Selector Switch

A two-section ceramic range switch is used. It switches video, deflection coils, AC, picture tube bias, and direct view CRT grid, cathode and heater. In the case of video, it merely connects the video output of the set to the direct-view tube or to the input of the Duo-Vue amplifier. The switch is physically positioned at the center and extreme rear of the unit, which places it immediately under the direct-view tube socket in most receiver designs. This position is selected to reduce lead capacity. In "Direct View" position the direct-view tube is connected normally. In "Projection" position the direct-view heater, cathode and grid leads are opened, and bias voltage from the selenium rectifier is applied to the grid and cathode to cut off residual spot emission.

When switching from "Projection" to "Direct-View," the 3NP4 tube is biased by simply grounding its grid. The deflection energy is transferred from the direct-view to the Protelgram deflection coils by shorting type switches. This ensures ample load on the receiver output transformers at all points of the switching sequence.

The switch assembly is the central connector for all units. Two cables are installed in the TV receiver and fitted with connectors which, in turn, are mated to the switch assembly. The Duo-Vue chassis and projection deflection yoke are plug-connected to the switch.

A straightforward design has been developed in order to reduce field service. The Duo-Vue unit is electrically and mechanically adjusted at the factory. Even when replacement of the 3NP4 projection tube is required no major optical adjustments have to be made.

Use of Controls

The unit contains front panel brightness and focus knobs and auxiliary brightness and focus controls inside the cabinet. This method of design is selected to make the front panel controls of the venier type and simple to operate. Height and width controls for the projected picture are incorporated as service controls. These controls are of the attenuator type. This is made possible by the excellent deflection sensitivity of

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SWEEP-FREQUENCY GENERATORS

Analysis of various methods of wobbulator operation shows use of electromechanical and electronic frequency sweep modulation

By MORTON G. SCHERAGA
Allen B. Du Mont Laboratories

THE sweep-frequency generator, or "wobbulator," as it is often called, is a piece of test equipment that was rarely used by servicemen until the advent of FM and television receivers. These receivers have several wide-band amplifiers which must be aligned precisely in order to obtain good sound and picture. The sweep-frequency generator, in conjunction with an oscillograph, provides a means for rapidly aligning the wide-band video and sound IF amplifiers and the RF amplifiers of FM and TV sets.

The need for a sweep-frequency generator can be appreciated by studying the response curve of a wide-band amplifier. The response curve of a properly aligned video IF stage shows that the gain is approximately constant over a band of frequencies from about 22 to 25 Mc and falls to about 50% at 26.4 Mc, the video IF carrier frequency. At 21.9 Mc, the frequency of the sound carrier, the amplitude is greatly attenuated.

If a signal generator and vacuum tube voltmeter were used to check the shape of this response curve, many points on the curve would have to be measured individually and then plotted on paper. If the shape were not correct, an adjustment would have to be made in the amplifier and the procedure repeated. This is time-consuming, and very impractical for rapid servicing.

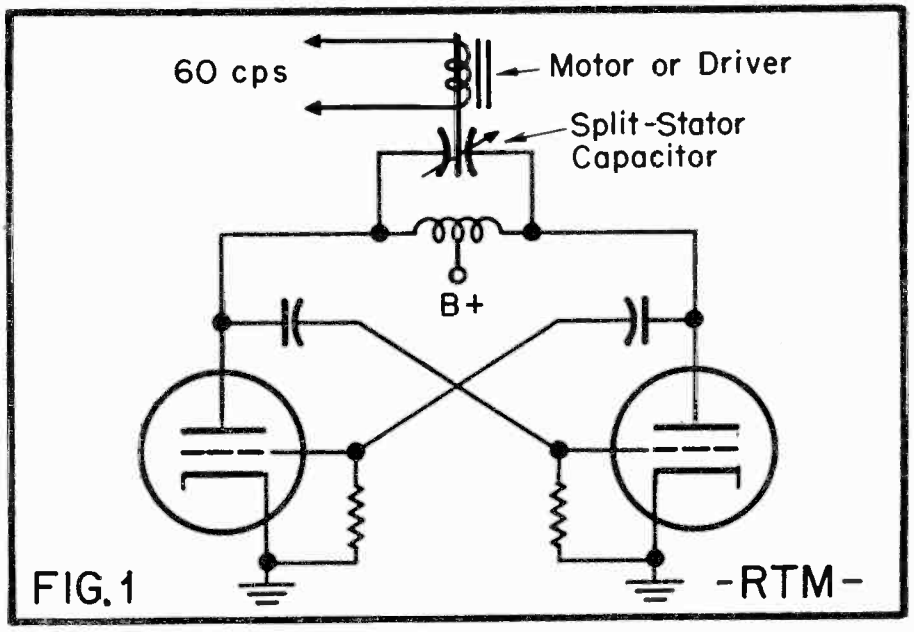
Complete Curve on Scope

In a wobbulator, the output voltage is constant in amplitude, but varies over a wide range of frequencies. If this varying-frequency signal is fed to a wide-band amplifier whose output is detected and fed to an oscillograph, a complete response curve is obrained on the oscillograph screen. If the shape of the curve is incorrect, an adjustment can be made in the amplifier, while immediately noting its effect on the pattern on the screen. Thus, the wobbulator is really a special form of signal generator. Instead of making the serviceman rotate the frequency dial manually to check a wide band of frequencies, the built-in circuits of the wobbulator very rapidly vary the generator frequency.

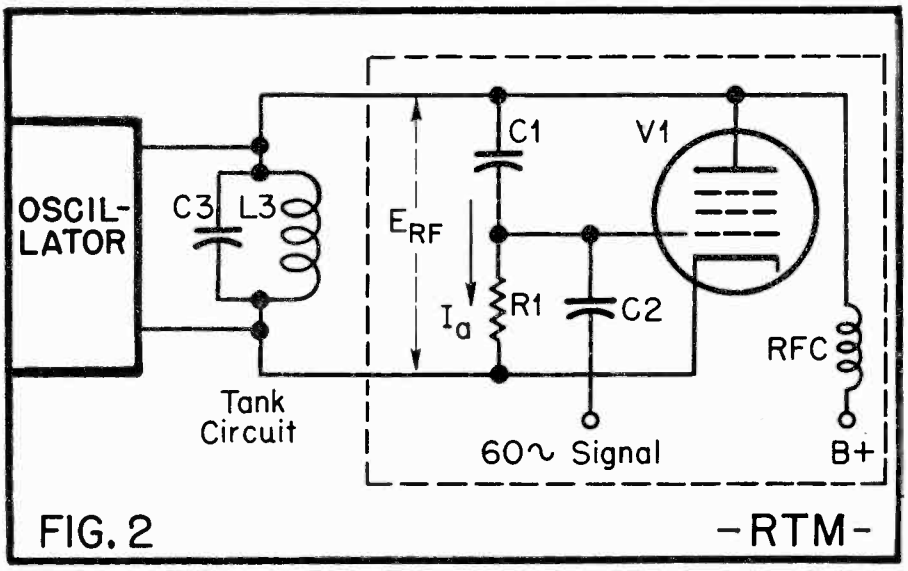
Generating Sweep Frequency

In order to vary the frequency of most oscillators, it is necessary to change some part of the tuned circuit. Of several methods by which the tuned circuit can be varied, commercial wobbulators have employed: (1) a rotating capacitor, (2) a vibrating capacitor, (3) a vibrating inducter, and (4) a reactance tube.

In the rotating capacitor method, an 1800 or 3600 rpm synchronous motor drives the rotor of a small, continuously variable air capacitor that forms part of the tuned circuit of the oscillator. As the capacitor is rotated, its capacitance continuously changes from a minimum to a maximum. Since it is connected in the tank circuit, the frequency of the oscillator also varies during each cycle of the capacitor. If the capacitor is rotated at 3600 rpm (60 revolutions per



Rotating capacitor method of varying oscillator frequency. The motor, an 1800 or 3600 rpm synchronous type, drives the rotor of a continuously variable condenser. Capacitance varying constantly from minimum to maximum modulates oscillator frequency at 60 cycles.



Typical reactance-tube frequency modulator. The pentode, V_1, is used as a variable capacitance, with current leading voltage by 90°. The amount of frequency deviation depends on the instantaneous value of the 60-cycle signal applied to the control grid of the tube.

second), the frequency of the oscillator will change from a minimum to a maximum sixty times per second.

The vibrating capacitor method employs a special driver unit, similar to a PM loudspeaker with the cone removed, to vary a split-stator, concentric capacitor. The capacitor is connected in a circuit similar to that shown in Fig. 1. The voice-coil of the driver unit is fed with a 60-cycle sine-wave voltage, so that the capacitor vibrates sixty times per second and changes the frequency from minimum to maximum at the same rate.

The vibrating inductor method employs a driver unit similar to the vibrating capacitor type. A disk of metal is mounted on the vibrator instead of a capacitor. The oscillator coil is wound in a spiral shape, and the metal disk is located close to, and parallel to the coil. As the metal disk vibrates towards and away from the coil, the coupling varies, thereby changing the effective inductance of the oscillator coil and producing the required frequency modulation.

Electronic Modulation

All of the above methods of frequency modulation utilize an electromechanical method of varying the oscillator frequency. It is possible to produce the effect of a varying inductance or capacitance by electronic means, using a reactance tube. A typical circuit is shown in Fig. 2. A pentode, V_1, is used as a variable capacitance. The circuit operates as follows: An RF voltage, E_{rf}, is developed across the oscillator tank circuit, L_3-C_3, and is applied to the series combination C_1-R_1. The size of C_1 is chosen so that it has a reactance of about ten times R_1 at the operating frequency of the oscillator. Thus the effect of R_1 is neglible as compared to the reactance of C_1 and for all practical purposes the series combination becomes purely capacitive.

Due to E_{rf}, a current, I_a, flows through C_1-R_1. Since this circuit is capacitive, I_a leads E_{rf} by 90°. This leading current produces a voltage drop I_aR_1 across R_1. This voltage drop also leads E_{rf} by 90°. It is noted that the voltage I_aR_1 is applied directly to the grid circuit of reactance tube V_1. Therefore, the drop across R_1 is the operating grid voltage for V_1. Since this grid voltage is leading by 90°, and because the plate current of a tube is in phase with its grid voltage, it follows then that the plate current is also leading by 90°.

When the current in a circuit leads the voltage by 90°, the circuit acts like a capacitance. This is exactly the behavior of the reactance tube. It acts like a capacitance because the current flowing through the tube leads the voltage across the tank circuit by 90°. The reactance tube is in parallel with the tank circuit of the oscillator, and the magnitude of its capacitance changes the oscillator frequency. It remains now only to vary the effective capacitance of the reactance tube in order to modulate the frequency of the oscillator. In the circuit of Figure 2, this is done by applying a 60-cycle sine-wave signal directly to the grid of V_1. On the positive half cycle of the applied wave, the plate current increases, corresponding to an increase in shunt capacitance, and the oscillator frequency decreases. The negative peak of the modulating signal causes a decrease in plate current, the shunt capacitance represented by V_1 also decreases, and the oscillator frequency increases. Thus the amount of frequency deviation depends upon the instantaneous value of the 60-cycle signal which is applied to the grid of the reactance tube.

Beat-Frequency Oscillators

These methods of generating sweep frequencies, however, have the shortcoming of not being able to produce a constant frequency deviation over a wide range of center frequencies. For example, if the sweep oscillator is designed for the alignment of the RF channels in a television receiver, its center frequency must be varied from 54 to 216 Mc. To align each of the 12 channels in this range properly, the center frequency should deviate plus and minus 5 Mc. It is difficult to obtain this deviation over a wide range of center frequencies with the sweep generator methods just described. The deviation problem is overcome in many commercial instruments by using a beat method of obtaining the desired sweep frequency range. In this method, the frequency modulated oscillator is operated at a single center frequency, and an auxiliary oscillator is tuned for different center frequencies. The outputs of the two oscillators are then mixed to produce the desired sweep frequency signal. For example, if the center frequency of the frequency modulated oscillator is 114 Mc, and the variable oscillator tunes from 37 to 112 Mc, the sum frequency varies from 114 plus 37, or 151 Mc, to 114 plus 112, or 226 Mc, with a deviation equal to that of the frequency modulated oscillator.

Sweep and Modulating Voltages

Two types of voltages are used to modulate the oscillator's frequency, a sine wave and a sawtooth. When a sine wave is used, a sine wave is also used as the horizontal time base on the oscillograph. In this case, the pattern shown in Fig. 3(a) is obtained on the oscillograph when the wobbulator signal is fed through a wide-band amplifier. The two response curves do not

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MULTIPLE ANTENNA SYSTEM *solves Service Shop, Hotel and Apartment House Installation Problems*

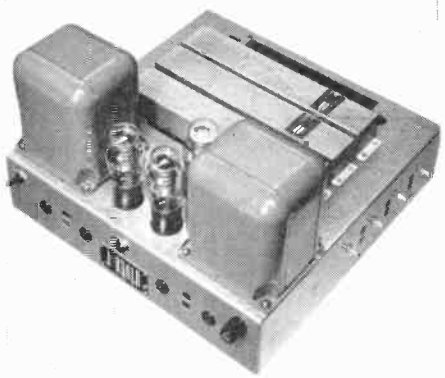


Fig. 1. Top view of control chassis used in the Mul-TV system. Individual channel gain controls are shown on the front of the chassis, output jacks on right side.

by MILTON J. SHAPP
President, Jerrold Electronics Corporation

ONE of the largest hotels in Atlantic City, more than 60 miles from the nearest television transmitters in Philadelphia, now advertises—and delivers—good TV reception for its guests. A prominent dealer in Brooklyn is demonstrating 225 television receivers simultaneously to customers with a clear, snow-free and ghostless picture from each of the seven stations in the New York-Newark area. Department, furniture and appliance stores in Los Angeles, Chicago, Baltimore, Detroit, Columbus, Ohio, and other cities are reporting sales gains ranging from 100 to 500 percent in a single month because they are now demonstrating television sets with good picture and sound quality on all available channels, even in locations normally considered to be noisy or ghosty.

It may sound too good to be true, but during the past nine months the Jerrold Mul-TV system has proved what can be done with a carefully engineered multiple antenna, amplifier and distribution system. This relatively new system is now installed and operating in more than 700 locations.

Used in TV Retailing

A majority of these installations are in the stores of television dealers who have recognized several advantages of using the system:

1. It permits a dealer to demonstrate . . . in showrooms, windows, special TV rooms or booths . . . as many television receivers as he wants. To this writing, Jerrold engineers have not been able to find an installation too big to handle.

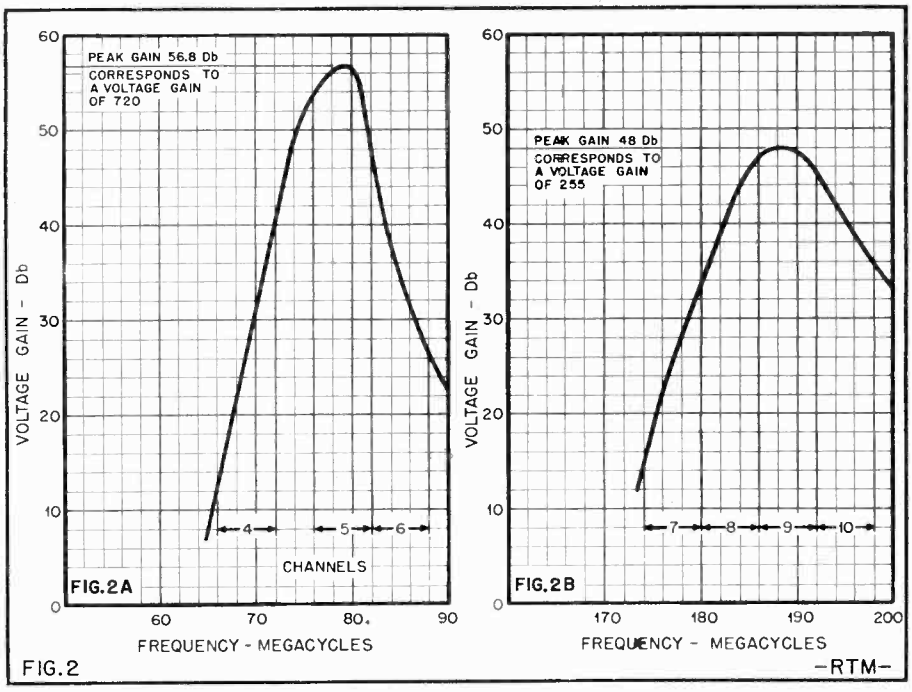
2. The full performance of every make and model of television receiver, direct-view or projection, small table model or console combination, can be demonstrated to the customer. Such side-by-side demonstrations afford retail salesmen an ideal opportunity to help the customer choose the receiver he really wants for his home.

3. By permitting the operation of a number of receivers simultaneously and with good picture quality in a store window, the system increases store traffic and leads customers in to see another good demonstration.

4. By providing additional outlets from the single master antenna and amplifier system, a dealer can readily deliver good video and audio from all channels to his service department. This is an advantage in efficient checking of each receiver before it is delivered to the customer—something that most dealers have learned to do as a matter of course—as well as repair of customers' ailing sets.

Design of System

For good reception, we must start with a good antenna installation. Our amplifiers and distribution boxes will not change the character of the signal received; they merely amplify this signal and distribute it to the TV receivers. Thus, if the signal received from the antenna is full of ghost images or noise, or if noise is picked up on the antenna



Typical response curves of amplifier strips. Each strip, including 5 6AK5's and a 6J6, is peaked for maximum gain in its channel, with sharp attenuation in neighboring channels.

lead-in, then we're starting with two strikes against us.

In most installations, we recommend Workshop Associates antennas, *with a separate antenna or array cut for each channel* and a separate lead-in of shielded cable (RG-11/U for long leads, RG-59/U for runs under 200 ft.) for each antenna. In fringe areas, where the signal level is very low, two of these antennas are stacked to make a six-element array; and in extreme cases, four antennas are stacked for a 12-element installation with maximum gain and directivity.

Amplifier Unit

The second major element in the system is the Mul-TV amplifier, Fig. 1. The amplifier is made in two parts:

a. A master control (MC-1) chassis containing the power supply, voltage regulators and separate 72-ohm antenna input terminals to accommodate any four channel amplifier strips. Where there are more than four channels received in an area, as in New York or Los Angeles, then two or three master control chassis can be inter-connected to accommodate up to 12 channel strips. For instance, using this system in Trenton, N. J., several dealers now receive New York-Newark stations as well as the three Philadelphia TV stations.

b. Individual channel amplifier strips, each with six tubes, which are plugged into the master control chassis and are engineered for each of the present 12 VHF television channels.

Individual gain controls are provided for each channel, so that the signal strength of "weak" and "strong" stations at any given location may easily be adjusted. In this way, all signals come into the TV receivers at the same level.

The contrast or gain controls on the receivers connected to a Mul-TV system need not be changed when tuning to different stations.

Because the plug-in channel amplifier strips used in this system employ six tubes per channel, it is possible to raise the signal level enormously without distortion before it is distributed to the TV receivers. A gain of from 48 to 60 db, an average voltage gain of about 500, is achieved, comparing the signal received at the antenna and the signal fed into television sets connected to the Mul-TV system.

Figs. 2A and 2B show the voltage gain characteristics of two channel amplifier strips. Note that the strips are peaked for maximum gain in their particular channels.

Circuit Analysis

Such performance is achieved as follows, looking at the schematic, Fig. 3. The input tube is a triode-connected 6AK5 that feeds a grounded-grid 6J6. This circuit is used to obtain a low input noise figure. The next four tubes are 6AK5's used in a cascade amplifier. The grid and plate circuits of these tubes are loaded to obtain 6 Mc bandwidth with a flat response curve for each channel. By operating these cascaded 6AK5 amplifier stages at low gain levels per stage, greater stability is achieved.

A bottom view of the MC-1 master control unit is shown in Fig. 4. Note input connections marked A, B, C and D for four antenna lead-ins, the channel amplifier strips, which plug in, and the output circuit which mixes the output of all the CA strips.

The output circuit consists of a matching network, built into the master control unit, so that the amplifier outputs are mixed for distribution (through distribution boxes) to the TV receivers. Two 72-ohm terminals are provided on the control unit chassis, marked "#1 OUTPUT" and "#2 OUTPUT" on the right of Fig. 4. Either terminal may be used to supply all the amplified signals to the distribution boxes and thence to the receivers by means of a single RG-59/U cable. The second terminal can then be used for a separate string of distribution units and receivers, or it can be terminated at the chassis with a 72-ohm resistor.

With signals mixed in the output cable, users of the television sets connected to the system simply turn on the receivers and select the station they desire.

Outlet Units

The third important part of the Mul-TV system consists of antenna distribution outlet units. The type used most has two separate outputs to feed two

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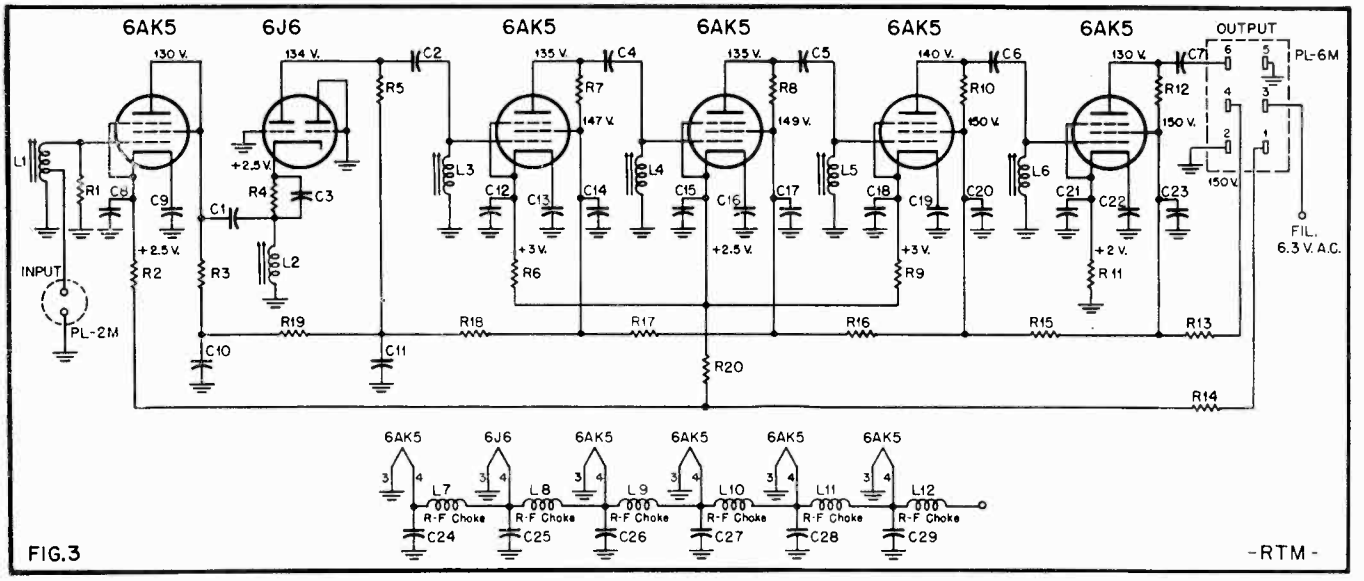


Schematic of one of the individual channel amplifier strips which plug into "master control chassis" of the Mul-TV system. Cascade 6AK5 stages operate at low gain levels for stability. Total gain is between 48 and 60 db through the strip. The strip is peaked for maximum gain in its particular channel and grid and plate circuits are loaded to obtain a 6 Mc bandwidth.

SERVICE SHOP ON WHEELS PROVIDES QUICKER INSTALLATION AND REPAIR, BOOSTS TV SALES

A COMBINED repair shop on wheels and delivery truck has been found highly satisfactory by Electro-Crafts Television, Kansas City, Mo.

Television and radio sets are repaired at their owners' doors with tools, parts, and test equipment in the truck. New television sets are delivered in the truck, and antennas are installed with the aid of an extension ladder mounted on the truck roof and a special antenna.

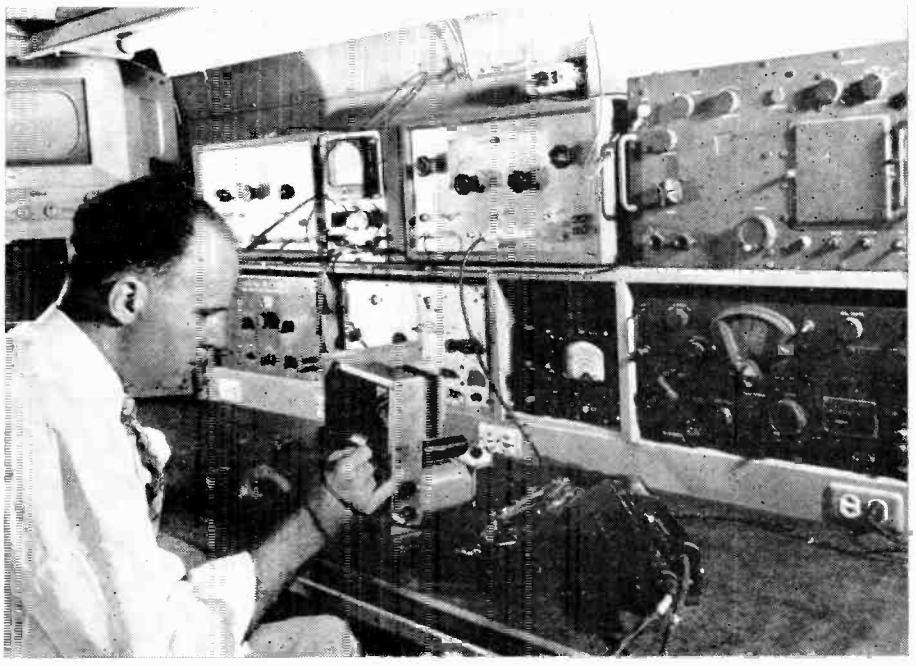
The company's sales and service facilities are advertised through a public address system while the truck is on the road. Microphone and controls for the public address system are in front of the driver's seat.

Charles T. Owsley, president of the service-sales outfit, constructed the rolling service shop in a Dodge Route-Van delivery truck. He built parts drawers and tool cabinets on the right wall of the body. On the left wall he installed a work bench with electrical outlets, a 110-volt AC generator, a television monitor set, and test equipment.

Uses Telescopic TV Antenna

The telescopic television antenna, one of the company's most potent sales aids, is mounted on the truck floor and extends through the roof. The antenna can be turned in any direction and raised to any height up to 40 feet to find the best position for reception in any area.

Exterior of the converted truck.



Interior of the rolling service shop. Note TV screen at upper left, 110 v. AC outlets. Power is provided by an auxiliary generator in the truck.

Television sets are loaded and unloaded through the 38-inch rear doors. The low floor at the back—18 inches from the ground—permits cabinets to be handled easily.

When a set is delivered to a home, plugged in, and turned on, the owner is invited to step inside the truck and see whether an antenna would improve his reception.

Reception Compared

The truck is parked close to the house. Servicemen turn on the generator which powers the test equipment and the TV monitor screen. They show the customer the picture on the screen without any antenna—the same picture which is being received on his own set. Then they attach the telescopic antenna.

Raising the aerial slowly and turning it in different directions, the technicians find the perfect direction and height for that area when the most efficient wave pattern appears on the oscilloscope. The customer compares the reception with no antenna to the reception obtained with the antenna that is properly oriented.

If he decides to buy an antenna it is installed immediately with the tools and ladder carried on the truck.

This demonstration not only increases sales of service and equipment, but provides the customer with the best possible reception, makes him more satisfied with his new set, and sells him on the value of the company's service facilities.

The truck itself is a powerful sales and service builder. The public address system reaches hundred of persons daily, calling their artention to the name and telephone number on the body.

Customers Inspect Truck

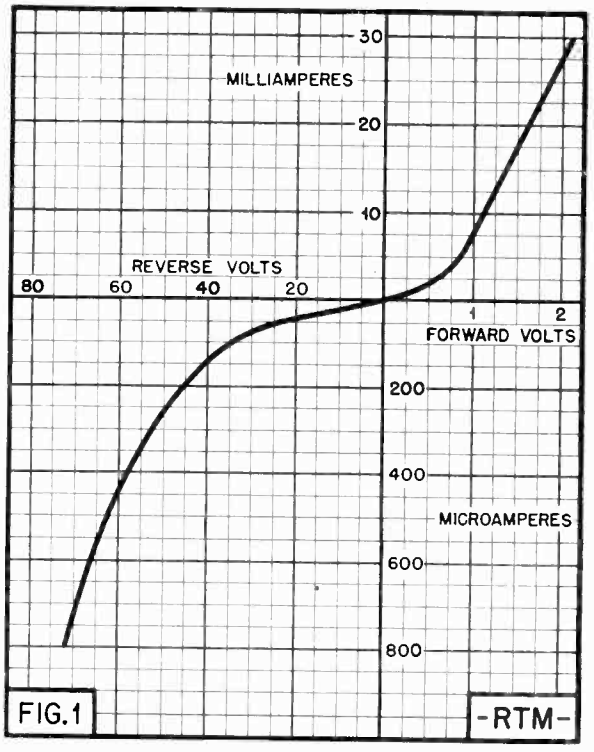
Owners are invited inside the truck while their radios or television sets are repaired. Servicemen then have an opportunity to get acquainted with customers and to show them the service equipment.

Characteristics, design and use of a relatively new type of component part

The Full Story on

GERMANIUM DIODES

by ROBERT C. MOSES
Sylvania Electric Products, Inc.



Current-Voltage characteristic of 1N34 diode.

ALTHOUGH the germanium diode has been available commercially for only a few years, it has already found a great many uses in radio and television receiver design. Featuring compact, rugged construction, high forward conductance, freedom from contact potential effects, and low inter-electrode capacitance, it provides excellent circuit performance in many applications.

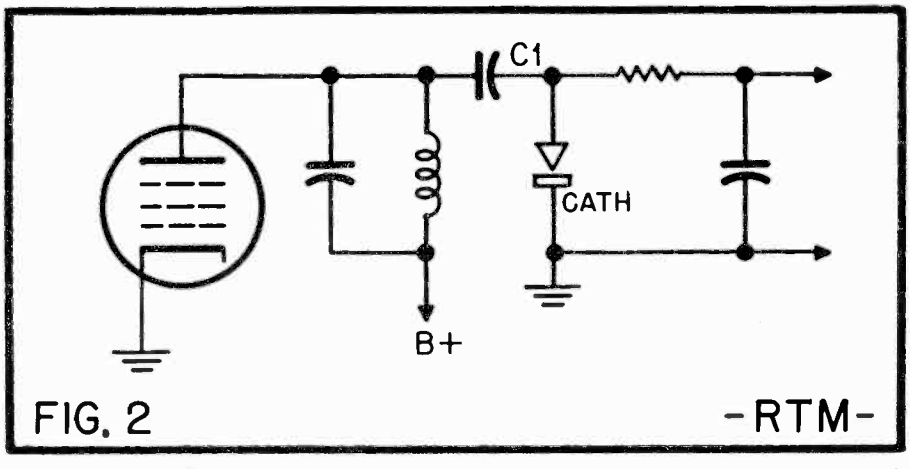
Following the introduction of the general purpose type 1N34, Sylvania has made available 13 additional germanium diode types. Among these are diodes for operation up to 200 volts, diodes featuring exceptionally high forward conductivity, and other types all with extremely low reverse leakage.

Characteristics

In any discussion of the germanium diode, it is desirable at the outset to describe briefly the electrical qualities of the unit itself, and to point out the differences between its characteristics and those of the vacuum tube diode.

Fig. 1 shows a typical current-voltage characteristic of the type 1N34. Unlike the vacuum tube, the germanium diode presents a finite although high resistance in the reverse direction, that is, with its anode negative with respect to cathode. The reverse resistance at a given voltage is normally several hundred times greater than the forward resistance at the same voltage. Reverse conductivity is a fundamental characteristic of the germanium diode which must be taken into account when designing circuits for use with it.

In the forward direction, the current-voltage curve resembles that of a vacuum tube diode with two important exceptions. Above about 0.2 volts, the curve becomes considerably steeper, indicating that the dynamic impedance of the germanium diode becomes substantially lower over the major portion of its operating range. Secondly, the curve passes through the zero voltage point at zero current, meaning that the diode exhibits no contact potential or initial velocity effects.



Shunt detector circuit, illustrating possible surge-current overload of germanium diode. In initial application of power, charging of C may be large enough to damage the germanium unit.

Ratings and Installation

Like any electronic component of its type, the germanium diode must be operated in accordance with its maximum ratings. Germanium diodes carry similar ratings to those of thermionic diodes. Among the more important are maximum reverse voltage (or "peak inverse voltage"), maximum average anode current, and maximum peak anode current. In addition, because of the nature of the germanium diode, a restriction upon ambient temperature range must be imposed.

Failure of a germanium diode in service is almost invariably due to operation of the unit beyond its ratings, as the life of the unit, if properly used, is practically indefinite. One of the principal

limitations which must be acknowledged is that of maximum reverse voltage. This, fortunately, is easily measured in a practical circuit. The effect of excessive reverse voltage is to cause a high current to pass through the diode in the reverse direction. This generates heat at the point of contact of the whisker with the semi-conductor, and results in deterioration of the barrier layer. The reverse resistance of the diode decreases, which in turn allows a higher reverse current to flow. The action is cumulative, and ultimately carries the diode to destruction.

Another factor which unfortunately is not so easy to evaluate is that of peak anode current through the diode in the forward direction. Anode current peaks may be either of a recurrent or transient nature. Recurrent peaks occur in normal operation in certain types of circuits, and are usually well within the peak current ratings of the diode. Transient peaks may come about through a surge when turning the equipment on or off, or through failure of some component. These surges will sometimes be sufficiently large to damage the diode. As an example of how this can occur, consider the simple shunt detector circuit of Fig. 2.

Surge-Current Overload

With the equipment off, capacitor C_1 is, of course, discharged. If power is applied suddenly, the charging current for C_1 will flow in the forward direction through the diode, to the capacitor, thence through the low-resistance plate circuit of the preceding stage to B+. If the impedance of the plate supply is low and the capacitance of C_1 large, the charging current of the latter may momentarily exceed the surge current rating of the diode and cause damage.

Failures of this sort may be minimized by restricting the charging current with a relatively small capacitor or by including sufficient impendance in the plate supply to limit the peak current to a safe value. It is sometimes possible to arrange the circuit so that the charging current must flow through the diode in the reverse or high-resistance direction. For purposes of design, Sylvania germanium diodes are conservatively rated to pass 500 ma maximum transient current for a period of one second.

Ambient Temperatures

A further consideration in the application and installation of germanium diodes is the ambient temperature conditions to which they are to be subjected. All germanium diode types are rated for continuous duty over a temperature range of —40°F to +167°F. It is not likely that low temperature extremes will be encountered in any ordinary application, but units may be subjected to high temperatures in certain locations within a poorly ventilated receiver chassis or while being soldered into a circuit. While Sylvania germanium diodes will withstand the heating incurred in ordinary soldering procedures, it is advisable as a precautionary measure not to solder within ¼ inch of the end caps and to apply heat no longer than necessary to insure a good joint.

In installing or replacing germanium diodes, it is advisable to locate them in such a position that they are not subjected to heat radiated from other components in the equipment, such as power transformers, voltage divider or bleeder resistors, and large rectifier tubes. Well ventilated locations as much in the clear as possible are recommended.

Testing

It is frequently necessary to evaluate, in terms of one easily made test, the condition of a germanium diode either

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TYPE	1N34	1N35*	1N38	1N39	1N40**	1N41**	1N42**	1N54	1N55	1N56	1N57	1N58	1N60†	V403††
Description	General Purpose Diode	Matched Duo-Diode	100-Volt Diode	200-Volt Diode	Plug-In Varistor	Lug-Type Varistor	Plug-In 100-Volt Varistor	High Back Resistance Diode	150Volt Diode	High Conduction Diode	80-Volt Diode	100-Volt Diode	Video Detector Diode	Low Impedance Varistor
Continuous Reverse Working Voltage (volts max.)	60	50	100	200	25	25	50	35	150	40	80	100	50	40
Peak Back Voltage for Zero Dynamic Resistance (volts min.)	75	75	120	225	75	75	120	75	170	50	90	115	70	50
Forward Current at +1 Volt (ma min.)	5.0	7.5	3.0	3.0	12.75 (@ 1.5 volts)	12.75 (@ 1.5 volts)	12.75 (@ 1.5 volts)	5.0	3.0	15.0	4.0	4.0	†	15.0
Average Anode Current (ma max.)	40.	22.5	40.	40.	22.5	22.5	22.5	40.	40.	50.	40.	40.	40	50
Recurrent Peak Anode Current (ma max.)	150	60	150	150	60	60	60	150	150	200	150	150	150	200
Instantaneous Surge Current (ma max., 1 sec.)	500	100	500	500	100	100	100	500	500	1000	500	500	500	1000
Reverse Current (μa max.)	50 @ −10 v 800 @ −50 v	10 @ −3 v	6 @ −3 v 625 @ −100 v	200 @ −100 v 800 @ −200 v	50 @ −10 v	50 @ −10 v	6 @ −3 v 625 @ −100 v	10 @ −10 v	300 @ −100 v 800 @ −150 v	300 @ −30 v	500 @ −75 v	800 @ −100 v	†	300 @ −30 v
Shunt Capacity ($\mu\mu$f.)	1 $\mu\mu$f. nominal for all types													
Ambient Temperature Range (°C)	−50°C to +75°C for all types													
Average Life (hours)	More than 10,000 hours for all types													

* Units are matched in the forward direction at +1 volt so that the current flowing through the higher resistance unit is within 10% of that in the lower resistance unit. Ratings shown are for each diode.

** Consists of 4 specially selected and matched germanium diodes whose resistances are balanced within ±2.5% in the forward direction at 1.5 volts. For additional balance, the forward resistances of each pair of varistor crystals are matched within 3 ohms. Ratings shown above are for each diode.

† Units are tested in a circuit employing an input of 1.8 volts rms at 40 mc, 70% modulated at 400 cycles. Demodulated output across a 4700 ohm resistor shunted by a 5$\mu\mu$fd capacitor is a minimum of 1.1 volts peak to peak.

†† Consists of four matched low impedance germanium diodes each of which, with a voltage of one volt impressed in the forward direction, will pass a current within one ma of the average current of the four. Ratings shown above are for each diode.

Specifications for 14 types of Sylvania germanium diodes. A comparatively recent development in the non-vacuum-tube diode field, the germanium units have the advantage that they can be soldered directly into the circuit. Although the diodes are extremely resistive in the reverse direction, a certain reverse conductivity must be taken into account in designing circuits utilizing the units.

Causes and cures in one of the toughest service jobs

ELIMINATING TV INTERFERENCE

by HERBERT S. BRIER

MANY television technicians would rather do almost anything than attempt to eliminate interference. This is understandable, because there are a great many things capable of causing television interference, and it is usually necessary to find the source before a cure can be effected.

Demonstrating to a complainant that his own refrigerator, shaver, vacuum cleaner, or some other device is causing his interference is, of course, the easiest way to solve the problem. He then has the option of buying a line filter for the offending device and having it cleaned and put into first-class operating condition or not using it while his television receiver is in operation. Next easiest is to track the TVI to a neighbor's appliances. It is then up to the customer to persuade him to eliminate the interference. This is often not difficult if the neighbor has a television set of his own. If he does not, or if the complainant lives in an apartment building with literally hundreds of devices capable of causing interference, a more efficient antenna may be the only solution.

RF Interference

The second major source of television interference is from equipment generating radio-frequency power. In this category are amateur, police, FM, TV, mobile transmitters, diathermy machines, RF heating units, and other television receivers. They cause interference by spurious radiations, or receiver blanketing, or a combination of both.

Spurious radiations may be defined as radio-frequency energy radiated by a device which is not intended to emit these waves. In general, the television technician is directly concerned only with such radiations from other television receivers.

Eliminating oscillator radiation is not usually difficult, if the set owner is willing to have it done, but often it is a major diplomatic victory to convince a set owner that his apparently perfectly-functioning television receiver is creating interference in the neighborhood. If the interference disappears when the antenna is disconnected from the suspected receiver, a booster in the antenna feed line is effective in almost every case. Shielding the lead between the antenna terminals at the back of the chassis and the tuner to eliminate direct pickup from the oscillator is also frequently helpful.

Shielding the oscillator tube or the oscillator section of the tuner will reduce direct radiation, as will bypassing, filtering, and shielding plate and filament supply leads to the oscillator. A particularly effective filter for this purpose is an RF choke of forty turns of number 20 to 30 wire wound on a one- or two-watt, one-megohm resistor. The choke should be placed in series with the supply lead, close to the oscillator, with each end bypassed to the chassis with 500-mmfd mica or ceramic condensers. An Ohmite Z-50 or equivalent commercial RF choke may also be used.

Oscillation in RF

An oscillating RF stage can also be the cause of receiver radiation. When this occurs, the resulting interference is usually on the channel that the receiver is tuned to, while when the interference is caused by oscillator radiation, the interference is usually four channels higher or lower, depending upon whether the oscillator is tuned to the high-frequency side or the low-frequency side of the signal. Symptoms of an oscillating RF stage are abnormal sharpness or "crankiness" in tuning as compared with other receivers of the same type, and possibly great variations in the sensitivity of the receiver on different channels. With oscillation present in the RF stage, the receiver is extremely sensitive to all forms of interference and is easily overloaded.

To stabilize an oscillating stage, first inspect the "dress" of the RF leads to be sure that they were not disturbed in a previous servicing. Next measure voltages at the tube socket. If they differ from recommended values, see if the value of an associated resistor has changed. Also check resistances across tuned circuits to be sure that they have not increased in value, and align the stage according to the manufacturer's directions. If after all this is done and all the bypass condensers are good, oscillation is still present, decrease the screen-grid voltage slightly or increase the cathode bias voltage slightly.

Amateur Interference

Amateur stations, as well as every other class of station, cause some interference to television reception, but the Federal Communications Commission has discovered that the great majority of such interference is the result of "design compromises inherent in many television receivers." These compromises sharply limit the ability of receivers to reject strong off-channel signals, which cross-modulate the early stages or ride through them into the audio and video stages. This is usually called "blanketing."

Blanketing can only be eliminated at the receiver, and is usually easily indentified. If the interference is approximately

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PRODUCTS FOR THE TRADE

Some of the interesting new items being made available currently in the Radio and TV service field are presented in this column. For further information, write to: Products Editor, RADIO AND TELEVISION MAINTENANCE, P. O. Box 867, Atlantic City, N. J.

TESTER KIT

A new tube tester kit, the Model 625K, has been put on the market by EICO. With sockets for 4, 5, 6, large and small 7-pin, octal loctal, noval, hytron, VR and magic eye tube bases, as well as for pilot lamps, the new unit is available factory-wired and in kit form.

A blank spare socket and an adapter for future base designs are also provided.

An illuminated, gear-driven roll chart gives setting-up data for all tubes. Two grid caps are provided, and an overload bulb acts as a fuse and shows any possible transformer overload.

—RTM—

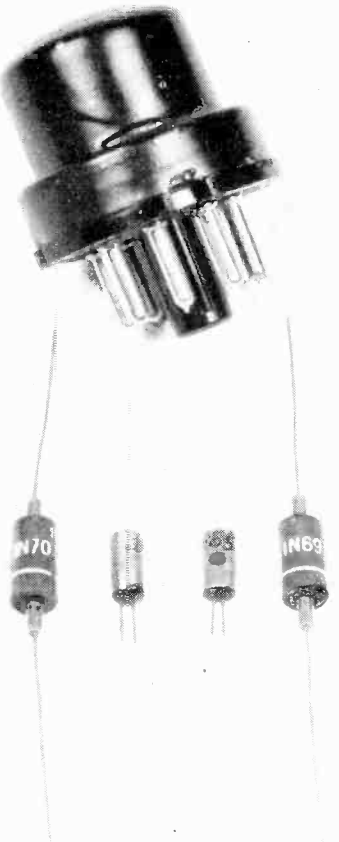
NEW DIODE UNITS

The addition of two transistors, two germanium diodes built to JAN specifications and a germanium quad to the G-E line was announced recently.

The transistors, types SX-4A and Z-2, use a metal case with two silver-plated phosphor bronze connecting pins. Each SX-4A is checked for power gain of between 13 and 20 db with 0.1 volt input at 5 KC. Maximum ratings are: emitter DC current of 1 milliampere; collector DC current of 2 milliamperes and emitter RMS signal of 0.3 volts. The Z-2 units are checked for characteristics suitable for trigger circuits.

The diodes built to JAN specifications are types 1N69 and 1N70. Both can be used with either solder or clip-in mounting.

The 1N69 has a continuous reverse working voltage of 60 volts, peak current of 126 milliamperes, average current of 40 milliamperes, surge current of 400 milliamperes and maximum operating temperature of 70 degrees C.



The 1N70 has a working voltage rating of 100 volts, peak current of 90 milliamperes, average current of 30 milliamperes, surge current of 350 milliamperes and maximum operating temperature of 70 degrees centigrade.

The quad, type G-9, is a combination of diodes with matched characteristics. The diodes are hermetically sealed in a metal tube shell with octal base.

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NEWSLETTER

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SEES SHORTAGE OF SERVICEMEN

The television industry is facing a critical shortage of technicians, according to a recent statement from RCA Victor Service Department's C. M. Odorizzi. "Between five and six million sets will be sold this year," he said. "That means that the nation's television technicians must be prepared to install and service in the next five months about as many TV receivers as were installed and serviced during the first four years of post-war television."

NEW TV CHASSIS WILL BE SIMPLER

Both Sylvania Electric and RCA have announced simplified television chassis which are said to be better in operation than previous models. Consolidation of component part functions into pre-wired assemblies, use of fewer tubes and associated circuits, use of germanium diodes, all will combine to make the serviceman's job easier. According to RCA Service spokesmen, a new design will permit "normal servicing operations" without removal of the chassis from the cabinet.

TUBE SIZES ARE STILL CONFUSED

Picture tubes for television, some only in the development stage, are varying between 17-inch rectangular, 19- and 20-inch rectangular, 22, 24, and 30-inch round. Some standardization is expected by the end of the year, although set manufacturers must still guess as to what will be most popular. Many tube makers at the recent RMA convention said rectangular tubes would come into their own within a few months.

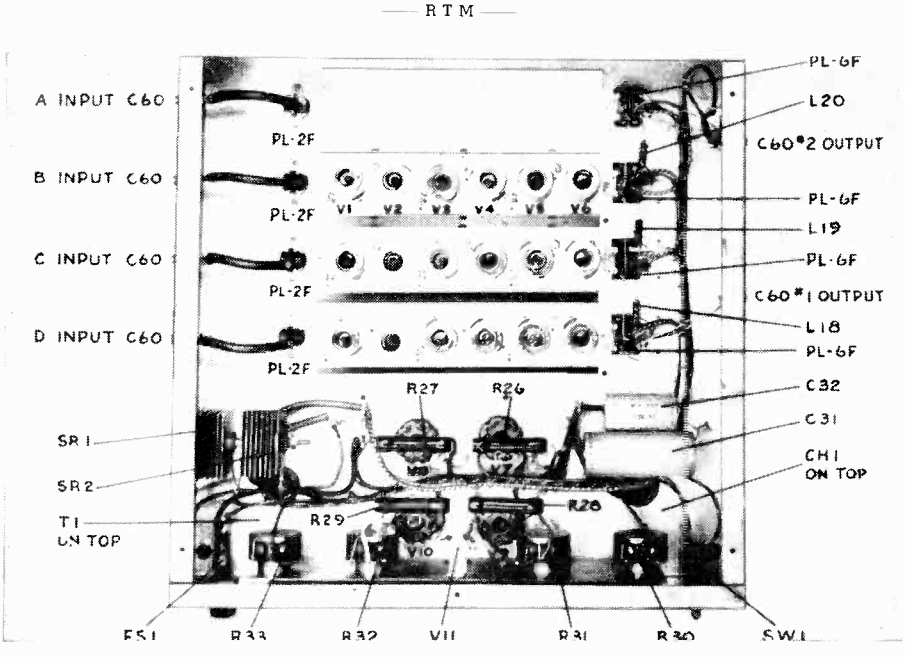


Fig. 4. Under-chassis view of the Mul-TV master control section, with channel amplifier strips plugged in. Gain controls, transformers, rectifiers are at bottom.

Multiple Antenna System

→ from page 12

television receivers. Both receivers fed by this box may have an input impedance of 72 ohms or both of 300 ohms or the unit will supply one 72-ohm and one 300-ohm receiver.

These distribution boxes utilize a cathode follower circuit, which has two advantages:

1. Signals from the desired station reach the television receiver with very low loss and with the amplification supplied by the CA strip in the master unit.

2. Interfering signals caused by the local oscillators of the TV receivers are greatly attenuated while trying to "work backward" through the cathode follower circuit of the ADO unit. Thus, interaction between any pair of receivers fed by a distribution box is effectively eliminated.

Each unit is self-powered with its own 115 volt, 50-60 cycle AC operated selenium rectifier power supply. As many of these ADO units as desired may be connected in series along an antenna line; and adding additional distribution boxes to the line has no appreciable effect on receivers already connected to the system. The limiting factor is signal loss in the cable itself.

Typical Setup

A typical installation of the system is the case of Mort Farr, suburban Philadelphia dealer-serviceman. Several difficulties prevented good reception with ordinary antenna setups in Farr's store. His building is shadowed on one side by the modernistic slab-wall of a big chain grocery. Across the street is a water tower which used to cause some bad ghosts on the TV sets. In addition, many of the big airliners flying in and out of Philadelphia International Airport, which is only a few miles from the Farr store, pass right over the roof.

Thus, for a dealer in a suburban area, Farr has a rather poor location for television reception.

In solving the problem, the first thing was to get adequate height for the antennas so that he could get good pick-up of relatively clean signals. By placing the antennas on a tower, well above the "apparent ground" of the two-story store's roof, good reception from all

three Philadelphia stations (Channels 3, 6 and 10) was achieved. Using antennas cut to the correct length and oriented for each channel, with separate 72-ohm shielded lead-ins of RG-59/U, signals of good quality were delivered to the amplifier-master control unit.

Amplifier Located Centrally

The master amplifier unit was located in a storage room midway between the front of the store, where it can be utilized by both the street-level store and the mezzanine level, and the back of the store, where Farr has his service, storage and shipping facilities.

From the amplifier, which contains channel amplifier strips for Channels 3, 6 and 10 and a fourth strip for FM radio, there are two distribution lines of RG-59/U cable running from the two outlets. One line is connected to a string of 30 distribution boxes feeding 60 television receivers of various makes, models and sizes on the shop's first floor and in the show window.

The other line is connected to a group of about 15 demonstration TV receivers on the mezzanine, and extends to part of Farr's service department, supplying signals for adjusting, aligning and repairing receivers.

"We are now able to show clean pictures in the store's show windows on any channel, without snow, streaks or noise," says Farr. "Now that baseball games are televised practically every afternoon, this good window demonstration brings customers into the store daily. It's the first time we have been able to show good picture quality in the windows."

New Fields

The Atlantic City hotel which is providing good pictures to its guests with receivers connected to a Jerrold Mul-TV installation is "The President," a 400-room building of steel, concrete and brick construction, more than 60 miles from the nearest TV stations, in Philadelphia.

Reception in Atlantic City has been notoriously poor; pictures are generally snowy, with streaks of noise caused by interference from electrical power lines, local FM transmitters, and other sources.

The first Mul-TV installation in Atlantic City was in the M. E. Blatt department store, early this year. This dealer has reported over 100% increase in TV receiver sales because he can now

→ to following page

→ from preceding page

give good demonstrations.

In the President, installation was made in March, and the hotel purchased a quantity of Philco television receivers for rental to guests in their rooms.

Jack Morris, resident manager of the President, states that many guests commented that the picture quality in the hotel rooms in Atlantic City was actually better than pictures they have watched in Philadelphia.

In an installation of this type, the use of a slightly different type of antenna distribution outlet from those described above makes greater flexibility possible. In hotels and apartment houses, instead of using the standard ADO-2 unit which handles two TV receivers, the use of a similar unit, the ADO-8, to which eight television sets may be connected, is recommended. These latter distribution outlets may be placed at one or more convenient points on each floor of a hotel or apartment house, and cables extended through conduit to the individual receivers. The installation of the antennas and the master control unit follows the same general pattern as in store installations.

—RTM—

Sweep-Frequency Generators

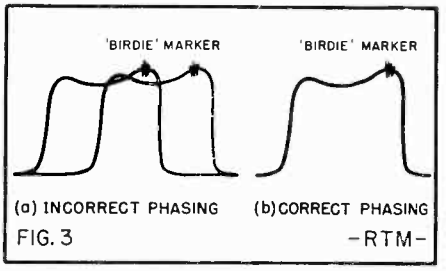
→ from page 10

overlap because the 60-cycle sine wave that is fed to the oscillator is not in phase with the 60-cycle sine wave that is used as the horizontal sweep of the oscillograph. This condition is corrected in most wobbulators by feeding the sine-wave signal for the oscillograph through a phasing network (Fig. 4) to adjust the phase of the sweep voltage so that it reaches its maximum at the same time that the wobbulator reaches its maximum deviation. When the phasing control on the wobbulator is correctly adjusted, the response curve that is generated during the positive half cycle of the sine-wave sweep is superimposed upon the response curve that is produced during the negative half cycle of the oscillograph sweep. Correct phasing of the response curves is shown in Fig. 3(b).

When a sawtooth signal is used to modulate the oscillator and provide the sweep on the oscillograph, the same results are obtained as with sine-wave signals.

Frequency Markers

In order to identify particular points on the response curve when sweep generators are used, it is necessary to insert a marker of known frequency. The marker appears superimposed as a "birdie" on the response curve (Fig 3). The marker signal can be furnished from a separate signal generator and mixed with the sweep frequency signal in the amplifier stage, or as is often done, it is built into the wobbulator itself. The



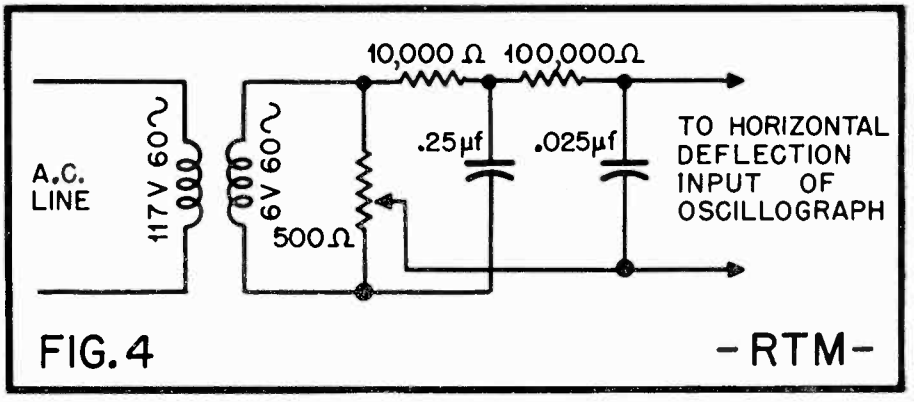
marker oscillator is a separate oscillator such as a Hartley, whose frequency is adjustable over the full range of center and deviation frequencies. The output of the marker oscillator is impressed upon the final amplifier tube of the sweep frequency circuit. When the wobbulator output is rectified and examined on an oscillograph, a "birdie" is visible at the point where the instantaneous frequency of the wobbulator and the operating frequency of the marker oscillator are equal. By varying the frequency of the marker oscillator, any frequency in the range of the sweep generator can be identified on the oscillograph pattern. Since the marker frequency must be read to an accuracy of 0.1 Mc, many wobbulators with built-in markers use crystal-controlled oscillators.

Coax Line Used

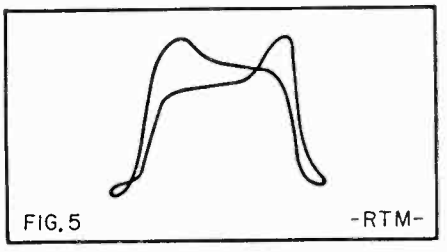
At such high frequencies the only practical method of carrying the RF voltage from the wobbulator to the receiver is by means of a terminated coaxial cable. A length of coaxial cable, terminated in its characteristic impedance, has a response which is flat over these frequencies. Most sweep generators are provided with properly terminated cables. At least 0.1 volt of wobbulated RF signal should be at the end of the cable. For aligning IF amplifiers, and those RF heads which are normally connected to the antenna by a coaxial line, the wobbulator should have single-ended output. For aligning RF heads with balanced input, the wobbulator should have a balanced-to-ground, push-pull output. An attenuator should be provided to permit varying the output of the wobbulator.

Since few oscillographs have a sweep voltage which can be adjusted to the proper phase, the wobbulator should supply its own sweep voltage. If varying the bandwidth varies the phasing, as is usually true of the electro-mechanical types of wobbulators, a phasing control should be provided.

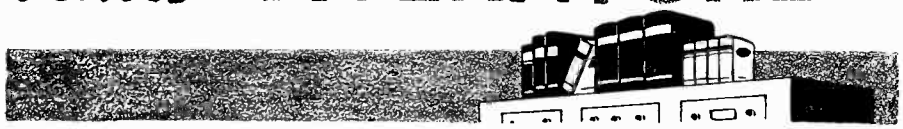
If the Y-axis amplifier of the oscillograph and the detector used to detect the sweep frequency do not have good 60 cycle square-wave response, curves will be obtained which are not true representations of the actual circuit response. Figure 5 shows how this will appear with a horizontal, sinusoidal-sweep voltage. The slope on the response curve is due to the poor frequency response of the detector or oscillograph. It may be corrected by using a detector



Network used to bring sweep voltage into phase with wobbulator deviation. Correct adjustment results in in-phase trace shown above in Fig. 3(b).



trade LITERATURE



NEW KIVER EDITION

"Television and FM Receiver Servicing," by Milton S. Kiver (D. Van Nostrand Co., Inc.), is in its second edition. A complete, 250-page, magazine-size volume, the book covers both TV and FM in a very comprehensive manner, from the elements to the detailed analysis of commercial and general circuits. With a view to attacking the cause of most television reception difficulties first, Mr. Kiver devotes the first section to antennas, in theory and in practice. He also describes receiver installation, test equipment and its use, and operation and servicing in a clear, down-to-earth style. The book, which costs $3.25, is well worth the price even to those who will skip the sections on fundamentals.

—RTM—

ENGINEERS' HANDBOOK

The twelfth edition of Kent's "Mechanical Engineers' Handbook" has been published in two volumes. Consisting of 3,000 pages of material by 168 contributors, the handbook stresses practice rather than theory.

Volume 1 covers design and production, while Volume 2 deals with power. The book has been completely rewritten, and much of the material from the previous edition has been condensed. The publisher is John Wiley and Sons. Cost: $8.50 per volume.

—RTM—

TVI BOOKLET

"Filter-Facts," which describes several methods of reducing television interference, is a 20-page booklet chiefly devoted to installation instructions, with diagrams, for two devices manufactured by Barker and Williamson, Inc., for interference suppression. Copies can be ordered for $.15 from Barker and Williamson, Inc., Upper Darby, Pa.

—RTM—

RIDER TV MANUAL

A new Rider manual on "TV Installation Techniques," by Samuel L. Marshall, will be released this month. Placing emphasis on the mechanical details of antenna installation, the book includes data on guying, ice loading, and wind resistance. The 330-page, cloth-bound volume has about 250 illustrations. The cost is $3.60.

—RTM—

BOOKLET ON DIODES

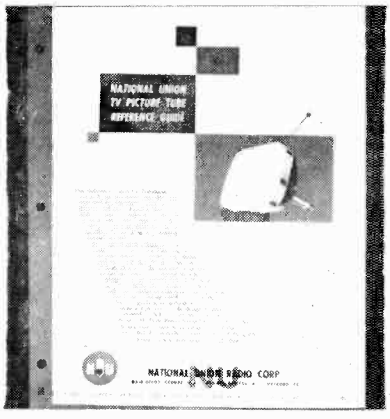
"Forty Uses for Germanium Diodes," a 50-page booklet put out by Sylvania, describes, with diagrams, various circuits utilizing the tiny but efficient units, from simple crystal receiving sets to a tubeless tone generator.

The booklet is divided into three sections, dealing with crystal diode applications in radio and television receivers, in radio transmitters and amplifiers, and in instruments and supervisory circuit devices. It also gives ratings and characteristics of available Sylvania types. The booklet may be gotten from Sylvania tube distributors, or from the advertising department of Sylvania Electric Products, Inc., Emporium, Pa. Cost is $1.00.

—RTM—

PICTURE TUBE GUIDE

Keeping pace with the rapid development of new TV picture tubes may be made easier by the publication of the "TV Picture Tube Reference Guide" by National Union Radio Corporation. The booklet, which is comprehensive on all television cathode-ray tubes to date, lists 13 electrostatic-deflection and 73 electromagnetic-deflection tube types.



Included in the data on the tubes are base diagrams, bulb outline drawings with dimensions, anode terminal types and their locations, dimensions of outer conductive coatings, ion trap field specifications, focus coil placement, and length of neck on electromagnetic types. The guide is available free from NU tube distributors.

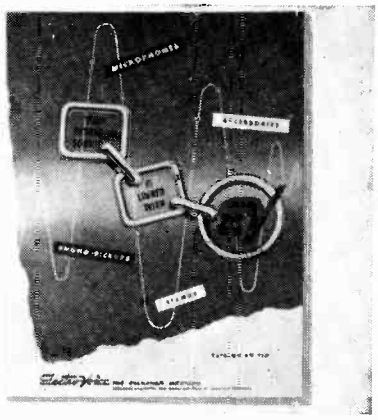
—RTM—

MICROPHONE CATALOG

A new Microphone Catalog (No. 110) has been issued by Electro-Voice.

Titled "Your Future in Sound is Linked with E-V," this catalog presents up-to-date information and specifications on the line of Electro-Voice dynamic, crystal, velocity and carbon microphones —omnidirectional, unidirectional, bidirectional and differential types for every purpose—also floor, desk and banquet stands.

It includes high fidelity, ultra-wide-range TV, FM and AM dynamic broadcast microphones, cardyne and cardax cardioids, general-purpose types, mobilmikes, close-talking noise-cancelling models, and others.



A helpful microphone selection guide indicating microphones recommended for varied applications in broadcasting, recording, public address, communications, and sound level measurements and technical information on the operation of various types of microphones are included. Available by writing to Electro-Voice, Inc., Buchanan, Mich.

—RTM—

Sweep-Frequency Generators

→ from opposite page

circuit such as described in the December issue of *Radio and Television Maintenance*. The oscillograph that is employed should have a Y-axis amplifier response that is uniform from DC or 2 cycles to more than 1,000 cycles, with negligible phase shift over this frequency range.

Products for the Trade

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7-INCH SCOPE

A new high-gain, wide-band cathode ray oscilloscope has been announced by Sylvania.

The new type 400 scope, which is supplied with a 7JP1 green screen tube, provides a vertical sensitivity of ten millivolts per inch and a vertical response up to four megacycles.

It has four-position frequency-compensated attenuator for uniform frequency response at any gain setting, vernier gain control, internal 60 cycle sine wave sweep, wide-range phasing control, internal hard tube sweep circuit, control for synchronizing to either positive or negative signal, good vertical bounce and return characteristics and rapid return trace.

—RTM—

SELENIUM RECTIFIERS

A new line of high voltage selenium rectifier cartridges has been developed. The rectifier illustrated is rated at 440 volts DC and 10 milliamperes DC with a peak current rating of 120 milliamperes and a peak inverse rating of 1500 volts. The 440 volt rectifier (half wave), is 9/16" OD with an overall lenth of 1⅝". Its voltage drop at rated load is about 25 volts, and its weight is ½ ounce.

The cartridges are available in either phenolic, glass or hermetically sealed assemblies from ¼" to 1¼" OD or they can be built to individual specifications utilizing either half wave or voltage doubler circuit.

—RTM—

TV "RULER"

A television "ruler" which will actually measure pictures in microseconds has been developed by RCA's tube department. The device, called the "Microstick," is a transparent plastic ruler which is held flat against the safety glass of the receiver. Scaled to all picture sizes, the gadget can be used to measure the receiver's bandwidth, calibrate

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GERMANIUM DIODES

→ from page 15

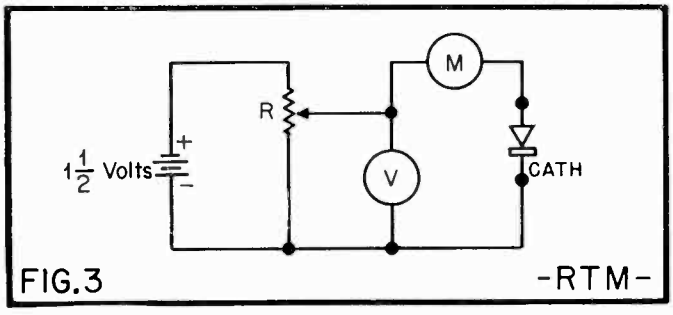
in or out of a circuit. Although rather complicated equipment is required in order to determine the exact diode characteristics, this is not ordinarily required in maintenance work. For a quick and very rough indication, an ordinary ohmmeter, preferably one applying from 4 to 9 volts on the high resistance scales will serve. Readings obtained with the diode polarized in the forward direction will lie in the vicinity of 200 to 500 ohms, while with the polarity reversed, the readings may be anywhere from 50,000 ohms to more than 1 megohm, depending upon the particular type being tested. These figures should not be interpreted too literally, however, because considerable variation exists between ohmmeters of different types, and the actual voltage applied across the diode is not the same in every case.

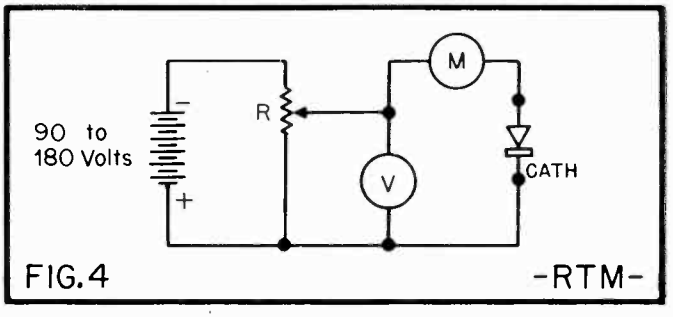
A more accurate method of testing is shown in Figs. 3 and 4. These are essentially resistance measurements in which both voltage and current are indicated. The forward current for all types is measured at 1 volt, while the reverse current is measured at voltages ranging from 3 to 200 volts, depending upon the diode type under test.

Applications

Germanium units are useful in many radio and television receiver applications. Typical of these are video and audio detectors, limiters, AVC and AGC diodes, DC restorers, and noise clippers. Because the germanium diode is a high conductance-low capacitance circuit element, it is particularly useful as a wide band video detector at frequencies of 20 Mc and higher. Germanium diodes function exceptionally well in pulse circuits such as sync separators, limiters, noise clippers, and DC restorers. Here, the low diode capacitance provides increased gain by virtue of reduced capacitive loading on the video source. In balanced discriminators, absence of contact potential and elimination of heater requirements improves circuit balance and minimizes AC hum troubles. In test equipment, the diodes are useful as instrument rectifiers, balanced modulators, mixers, and heterodyne detectors. Because of their compactness and small interelectrode capacitances, they have found wide application as diode peak rectifiers in voltmeter probes for r-f measurement work.

Used within their ratings of voltage, current, and temperature, germanium diodes have a life expectancy of well over 10,000 hours.



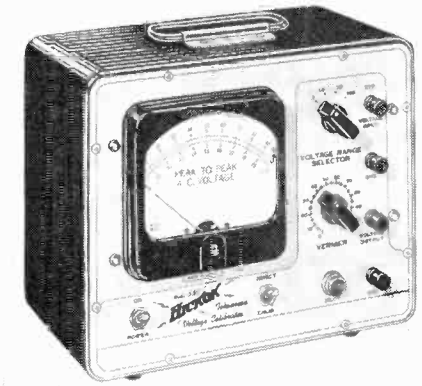


Test method for germanium units. In Fig. 3, forward current is measured at one volt. In Fig. 4, reserve current is measured at voltages of from three to 200, depending on the type under test. Method, essentially a resistance measurement, is more accurate than ohmmeter tests.

Television Voltage Calibrator

Instrument Gives True Peak-to-Peak Readings

By WALTER A. WEISS
Vice President and Chief Engineer
Hickok Electrical Instrument Co.



The Hickok Model 630 TV Voltage Calibrator.

UP to the video detector of a television receiver, the circuits involved are practically identical to the circuit of any conventional superhet, except that they are broader tuned and operate at different frequencies. From the video detector on, however, the serviceman is confronted with problems entirely foreign to radio receivers. Most servicemen agree that 80 to 90 percent of the really tough TV service problems are found between the video detector and the picture tube grid, or between the detector and the deflection coils, or in AGC circuits. The Hickok Model 630 Television Voltage Calibrator was developed specifically for shooting trouble in these parts of television receivers.

Accurate Measurement Needed

Most manufacturers give pictorial views and voltage information for the various waveforms which should occur from the video detector through the sync amplifying, separating, clipping circuits, and on through the horizonal and vertical deflection circuits, to the picture tube. While an oscillograph can be used to display these curves to determine whether or not they have the correct shape, an oscillograph without some other means of determining voltages will not give the magnitude of the various positive and negative peaks of the voltages being observed. Consequently, even though the picture on the scope screen might look like the illustration given, the voltages might still be incorrect.

Conventional voltmeters, either the vacuum tube or copper oxide type, cannot be used for accurately measuring irregular waveforms by merely taking the reading which is supposedly RMS value and multiplying it by 2.8 to give the peak-to-peak value. This method is only useful for sine waves. The Model 630, however gives immediate, accurate peak-to-peak readings on less regular wave forms.

Circuit Analysis

The block diagram illustrates the operation of the instrument. A self-contained, regulated power supply supplies the necessary voltages to a multivibrator type of square wave generator, which operates at a frequency of approximately 420 cycles. The output of the multivibrator is fed through an attenuator control directly to a meter. The meter is calibrated in terms of peak-to-peak voltages and has a range of zero to 100 volts. The square wave is then fed to the high end of a decade voltage dividing network. With the range switch on the 100 volt position, the voltage from the attenuator is equal to that indicated on the meter. With the range switch moved to the 10 volt position, the amount of voltage fed from it will be one-tenth of the meter reading with a maximum of 10 volts. In the same manner, on the 1 volt position the maximum output is one volt, and on the .1 position, one-tenth of one volt. This voltage is taken to a two-position selector switch on the front panel of the device. In the position labeled "Calibrate," the square wave output is taken from the voltage dividing network and applied to the vertical input of the scope. In the other position, marked "Direct," the output is fed directly through to the vertical input of the scope.

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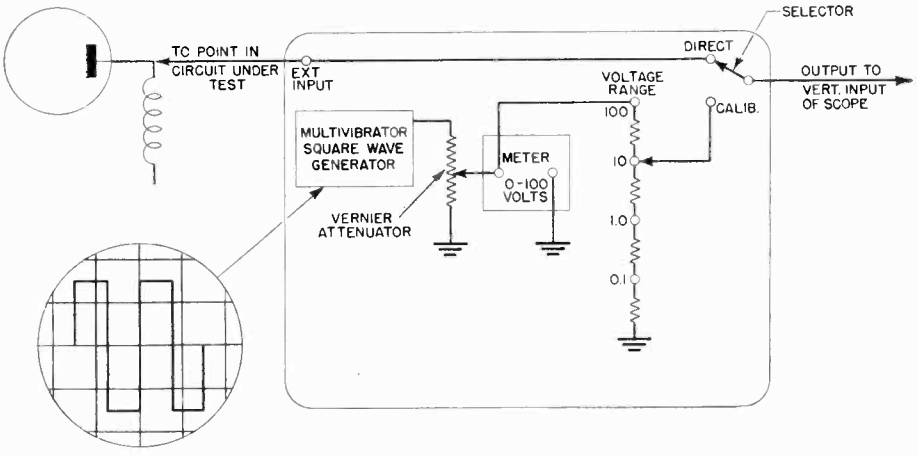

Block diagram of the Model 630.

Operation of Instrument

There are two ways of determining peak-to-peak value of the unknown voltage. The first technique is to turn the output selector switch to "direct" and connect the external input lead to the source of voltage to be measured. With this connection made, adjust the vertical gain controls of the scope until some specific value of vertical deflection is obtained. Then move the output selector switch to the "calibrate" position and adjust the voltage range and vernier controls until a vertical deflection is obtained. The indication on the meter, *taking into account the voltage range,* will be the value of the peak-to-peak voltage being measured.

The second method can be used if the approximate value of the voltage to be measured is known. In this case, the output selector switch of the calibrator is turned to the "calibrate" position and the scope calibrated by it in terms of voltage deflection per inch. For example, if the scope vertical gain controls are set so that with one volt being delivered, one inch deflection is obtained, then the scope is calibrated for one volt per inch deflection. The output selector can then be switched to the "direct" position, and if 3 inches of deflection are obtained from the voltage being measured, the peak-to-peak voltage is 3 volts. For values of more than 100 volts, the scope should be calibrated on the basis of 100 volts per inch.

Stage Gain Measurements

Since the Model 630 will permit voltage measurements at any frequency within the limits of the scope being used, it provides a means for making stage gain measurements throughout all circuits, from the video detector through video amplifier stages to the cathode ray tube grid, and also from this point through all sync. amplifiers, sync. separators and deflection amplifiers, on to the deflecting circuits of the cathode ray tube.

The use of the device in such gain measurements follows: with a signal being received from a station or from a linearity pattern generator, the calibrator is connected to a plate lead, and the voltage is determined. The input is then transferred to the plate lead of the following stage and the second measurement made. The ratio of the two voltages is in direct proportion to the gain of the latter stage.

Products for the Trade

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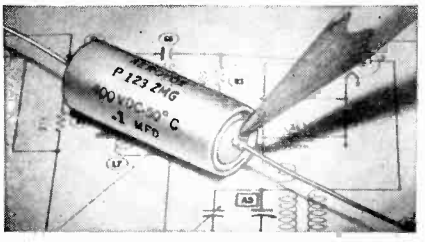
wedges in test patterns, determine the beat frequency of interference, and measure the airpath distance of ghosts. It will also be useful for measuring the duration of sync pulses, horizontal blanking, and other video signals.

—RTM—

SUBMINIATURE CAPACITORS

Extra-severe-service requirements in subminiature volume are met by the new type P123ZG Aerolite capacitors. The marked size reduction is attained primarily by the metallized-paper section which is Hyvol K or M impregnated and placed in a non-magnetic hermetically-sealed metal case with vitrified ceramic terminal seals. Operating temperatures range from —550° C. to +50° C. without derating, and again at ambient temperatures up to 95° C. with voltage derating. Power factor is less



than 1% when measured at or referred to at a frequency of 1000 cps and an ambient temperature of 25° C.

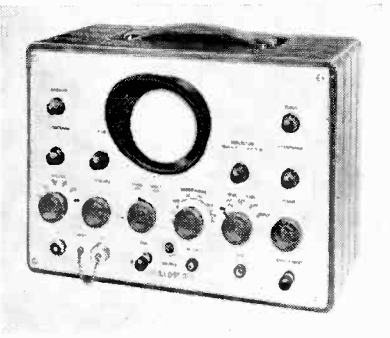
Type P123ZG Aerolites, called the world's smallest possible standard capacitors by the maker, are available in 200, 400 and 600 VDC, and capacitance values of .0005 to 2.0 mfd. Dimensions range from .175" dia. by 7/16" long, up to .670" dia. by 2-7/32" long. These bare metal-can units may also be had with plastic insulating sleeves, adding .062"to the diameter and 1/16" to length.

—RTM—

PORTABLE SCOPE

A new portable service-type oscilloscope, which incorporates engineering features formerly found only in more costly laboratory oscilloscopes, has been announced by RCA.

Deflection sensitivity of the instrument is better than 30 millivolts per inch. The frequency response of the



vertical amplifier is flat within 2.3 decibels from zero to 500 kc, down only 6.8 db at 1 megacycle, and useful beyond 2 megacycles.

A design feature of the new oscilloscope is the direct-coupled vertical amplifier which is used to provide flat low-frequency response. Good low-frequency square-wave reproduction, essential for correct sweep alignment, is thus assured. High-frequency square-wave response up to 100 kc enables the scope to reproduce blanking and sync-pulse wave shapes with fidelity heretofore unobtainable in moderately priced service oscilloscopes.

"Tilt," caused by low-frequency phase distortion, and "overshoot," caused by high-frequency amplitude and phase distortion, are minimized in the new oscilloscope. Less than 2 per cent tilt and overshoot assure more accurate viewing of square waves, pulses, TV deflection-circuit waveshapes, and transient waves.

—RTM—

BUILT-IN ARRESTER

The JFD Manufacturing Co. has come out with a lightning arrester molded into the dipole bakelite insulator of the company's "D-Xer" conical antennas TA160, TA161 and TA162.

In installation, grounding of the mast is all that is necessary to make the arrester effective. The device accommodates all types of transmission lines, and is waterproof. It does not affect impedance or unbalance the line. The insulator bearing the arrester has been increased in thickness for added strength.

—RTM—

NEW PILOT LIGHT

A new neon-type pilot light has been announced.

Completely enclosed in a plastic case, the "Omni-Glow" mounts through a ½"

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Eliminating TV Interference

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uniform on all channels, it is probably blanketing, but if only some channels, especially those in harmonic relation to the transmitter frequency are affected, spurious transmitter radiations, which can only be eliminated at the transmitter, may be the cause. A further, almost infallible, indication of blanketing is that all television receivers within approximately the same distance from the transmitter will suffer from interference.

Once the interference has been identified as blanketing, steps to eliminate it can be taken. The value of a well-installed, high-gain antenna in decreasing all forms of interference is well known. Less well known is that the length of the feed line may also be very important. This is especially true with 300-ohm ribbon. In one installation, two hundred feet from a twenty-eight Mc transmitter, a technician received a slight RF burn from the antenna terminals of the receiver, and the received picture was completely snowed under when the transmitter was turned on. Adding three feet to the antenna feed line brought the picture out of the storm. Apparently, the entire antenna system had been resonant to the transmitter frequency.

Boosters and Traps

Work on the antenna system alone will seldom eliminate interference completely. Besides, one must frequently work under conditions where the antenna is far from ideal, such as with built-in or indoor antennas. There are other methods of attack.

Boosters or preselectors work by adding selectivity and amplification at the television frequencies. Although almost any of them will amplify the television signals, some are poor in discriminating against off-channel signals; therefore only a trial will reveal whether a given model will reduce interference.

Much cheaper than preselectors (and usually more effective, judged solely on their interference-reducing ability) are interference traps. Best installed right in the receiver cabinet as close to antenna input terminals of the tuner as possible, there are two general types:

"The salesmen sure are pushing this fringe-area business."

non-resonant high-pass filters, and resonant traps. Non-resonant filters discriminate against all signals outside of their pass band, while resonant traps attenuate only the frequency to which they are tuned.

Use of Filters

High-pass filters, giving protection from all signals below forty megacycles, are available from Drake, Eldico and others. In rare instances a high-pass filter may increase rather than decrease interference. If it does, changing the length of the feed line a few feet will usually remedy the trouble.

Unfortunately, high-pass filters do not always have the high attenuation of parallel-resonant traps at the latter's resonant frequency. Series-resonant traps are on the average, slightly less effective than either a good high-pass filter or parallel traps. Quarter-wave, linear traps are fairly effective and very cheap. They have the disadvantage of being messy to install, one for twenty-eight megacycles being approximately seven feet long. Meissner and Millen, among others, manufacture resonant traps for frequencies up to 108 megacycles.

Combined Operation

Where necessary, any combination of interference-reducing methods may be used together. For example, interference may come from a transmitter operating on different frequencies at different times. A high-pass filter would probably eliminate most of the interference, but for complete elimination, it might require the help of a pair of resonant traps tuned to the frequency causing the greatest interference. Alternately, separate traps tuned to the several frequencies could be used. Or a booster might require the help of a filter or trap at its input or output terminals.

The band width of a resonant trap is important, especially when the interfering station is operated by an amateur. Amateurs seldom operate on exactly the same frequency within an amateur band all the time; consequently too sharp a trap might defeat its own purpose. On the other hand, a sharp trap gives more attenuation than a broad one. Within limits, the higher the capacity used, the sharper the trap and the greater its attenuation. Experience has shown that

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hole in the panel. Maximum diameter is less than ⅝", making mountings as close as 13/16" on centers, when using a standard speed nut. Maximum extension behind panel is 1½". For high temperature applications, a special nylon housing is available. Standard coloring is red, with other colors suitable for neon illumination available.

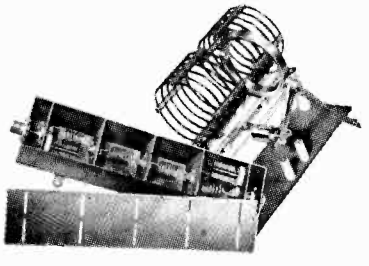
The lamp is equipped with 4" tinned leads and may be connected into any 75-150 volts AC or DC source.

—RTM—

FARADAY LINK, FILTER

Another attack on the television interference problem has resulted in the development of a combination of a Faraday shielded link and a low pass filter to knock out unwanted signals.

Completely shielded, the Faraday link reduces harmonic or spurious signal radiations normally transferred by capacitative coupling. The filter, consisting essentially of two "m" derived end sections and three midsections of constant K type in separate, sealed copper



compartments, prevents inductive transfer of unwanted frequencies from section to section. RF bypass condensers in the K sections have resonant frequencies higher than 500 Mc, thus eliminating resonances within the TV bands.

This combination, when installed in accordance with recommendations, provides suppression of harmonics above 50 Mc, approximately 75 Db or more throughout the entire television band. Insertion loss is less than .25 Db.

—RTM—

NEW SOLDERING IRON

A new type of electrical soldering iron is now being offered to the trade. The "Vari Hot" soldering iron heats in 30 seconds and will idle at 500 degrees F. when plugged in. A conveniently located booster button on the handle offers extra heat, which can be varied as required.

The iron has dual wire-wound heating elements which are located within the tip to reduce heat loss and thermal lag. It requires only 25 watts to maintain a tip temperature comparable to conventional irons using 100 watts. When the booster button is pressed, 100 watts is provided within the tip.

The "Vari Hot" has a pistol type plastic handle.

—RTM—

VT VOLT-OHMMETER

Feiler Engineering Co. recently released for sale a new VT volt-ohm-milliammeter, Model TS-9, said to include every feature of the all-purpose VTVM plus many new improvements over old types.

The device, in connection with Feiler "stethoscope" units, can be used as an RF VTVM, and in other cases requiring a 0-1 Ma meter. Input impedance is 26 megohms DC; 3 megohms AC. The meter is 4½ inches wide. Two separate tubes are used in a balanced and compensated bridge circuit with cathode feedback, permitting careful matching of tubes and individual replacement.

—RTM—

SWEEP GENERATOR

A new TV-FM sweep generator and marker combined in one instrument has been added to the Tee Vee line. The sweep generator uses an electro-magnet type of sweep and two oscillator circuits. An internal blanking circuit permits retraces to be blanked out regardless of the type of oscilloscope used.

Other features of the instrument include a continuously variable frequency range of five to 240 Mc. and a sweep width variable from 400 Kc. to 10 Mc. Linearity is adequate for band pass checking with an oscilloscope. The marker is of the high "Q" absorption type, and ranges from 17 to 48 Kc.

—RTM—

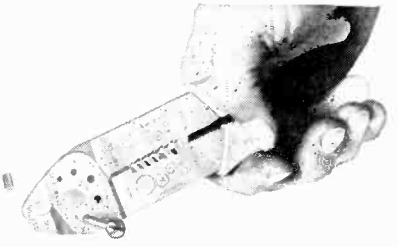
SNAP-ON FUSE HOLDER

Littelfuse has perfected a fuse holder which snaps onto the blown pigtail within the set. This is said to eliminate the time wasting and costly servicing problem which is the usual difficulty when replacing soldered-in pigtail fuses.

Called the "Snap-On TV Fuse Holder," the fibre unit becomes a permanent attachment within the set. Each time a new fuse is needed, it can be slipped into the holder. With this improvement for servicing, soldering, cutting and the blowing of fuses with a hot iron are eliminated.

HAND TOOL

A new low cost hand tool incorporates jaws for crimping solderless terminals with a versatile cutting, stripping and bolt-shearing device. The tool is designed to attach a special line of inexpensive general use terminals and connectors known as "Wire-ends" to wire in ranges #22 to #10.

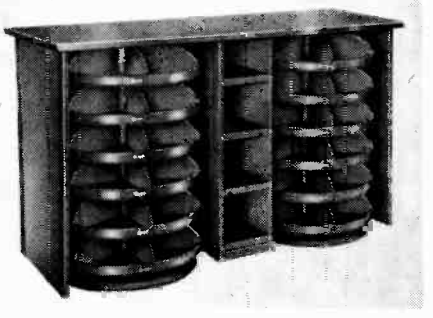


The tool, called "Champ," is also capable of preparing the wire beforehand by use of its wire cutting and wire stripping features. Bolts, too, in five most used sizes will shear off clean, requiring no additional filing before use. Wire size and stud size gauges are engraved on the side of the tool.

—RTM—

NEW COUNTER

Designed to increase the availability of storage space under counters, a new "Rotabin" counter provides aisle access to 72 large compartments in twelve 28" diameter independently rotating trays. In addition, four stationary spaces are available for large items.



Built entirely of steel, the counter will stand up under hard usage. The counter top is formed from a single sheet. Center shelf section is bolted in place.

Overall dimensions are 6' 3-1/4" long x 27" deep x 41-5/8" high. Finish is olive green enamel.

—RTM—

SCREWDRIVER-HOLDER

Called the "Klipxon," a new screwdriver equipped with a sturdy screw-holder has been announced. The screw holder is a spring clip which may be

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THE LOUDSPEAKER

The installation and repair of television receivers are not jobs for the layman. They are jobs which should be left entirely to qualified, special trained technicians . . . and the public should be told!

A man and his wife were killed recently, trying to install a TV antenna. The man mounted his aerial on a pole, and was raising the assembly to put it into brackets on his house when it struck a high voltage power line. The shock killed him and when his wife ran towards him, she stumbled against a fence that the pole was touching and was herself electrocuted.

The worst feature of this tragedy is that it was completely unnecessary. A qualified television mechanic could have been called in to install the antenna, and he would have had no trouble in doing it. Yet the man, thinking that there could be nothing simpler than to put up a TV aerial, didn't bother to hire a trained serviceman. He thought it would save him money to do the job himself. It cost him his life!

Television is not dangerous in the hands of a capable technician. He knows what to watch out for. He knows what hazards to avoid in antenna installation, he knows what damage a bursting picture tube can do, and he knows what fatal voltages are to be found in the operating set.

But when a layman tries to do the work of the serviceman the results can be disastrous. At best, the work will not be done properly.

It is not simply the responsibility of the buyer to keep away from the inside of his set, and to leave the antenna installation to the serviceman. It is also the duty of those in the radio and television industry to keep the public informed on the safety factors to be considered in television. The duty of television manufacturers, servicemen, and salespeople is to make sure that buyers know that no matter how carefully a television set is designed, certain hazards exist when an unknowing consumer does not let a professional handle the work. On the other hand, potential purchasers must not be given the impression that a TV receiver is a dangerous thing in the home.

The only feasible action, where the serviceman is concerned, is to spread the idea as much as possible that television should be and is safe, but that it would not be at all safe without the qualified technicians to install and repair the sets. With the total number of receivers in this country heading for 10 million, and sales and service volume increasing at a terrific rate, we must spread the idea to new set buyers and present set owners that "qualified servicing keeps TV safe and entertaining."

The importance of leaving TV service and installation work to the serviceman cannot be stressed too much to consumers. They must know television is for their enjoyment, not a gadget to play with.

M. de A.

Eliminating TV Interference

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15 to 100 mmfds of capacity with the appropriate inductance to tune to the desired frequency is usually satisfactory.

AF and IF Interference

It is often questionable whether blanketing from signals in the 20 to 30 Mc. region is caused by overload of the RF stages or by the signal getting into the 21-27 megacycles IF channel, either directly or through the input circuits. Shielding of the IF channels, changing the IF frequency slightly, or putting a trap in the IF channel, may help.

When the interfering station's frequency is near, but not in the IF channel, a high-Q trap, tuned to the interfering frequency and coupled to the mixer plate lead through about five mmfd of capacity, will often attenuate such interference greatly. An IF sound trap, usually tuned to approximately 27.25 megacycles, may sometimes be retuned to act as an interference trap. Discretion must be exercised in doing either to be sure the picture quality is not reduced by the trap itself.

Moving the IF channel to a different frequency requires shifting every tuned circuit in the IF channel, and shifting the oscillator the same number of kilocycles, to retain the correct band width and frequency relationships. The obvious difficulties involved make this operation rather unattractive.

Even the audio system of a television receiver can pick up interference. The cause is usually direct pickup by the control grid of the first audio tube. Bypassing the pickup point to ground through a 100 to 250 mmfd condenser is an almost sure cure of this difficulty.

Less common is interference entering the receiver through the power line. Any trap effective at the interfering frequency and capable of carrying the primary current will attenuate it. The recently announced Sprague High-pass condensers are also good for bypassing most forms of interference out of the power lines.

There is, of course, a tremendous difference in the ability of different receivers to reject off-channel signals. Some models almost make one wonder

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Stuck?

Got a repair job you can't beat? Send it in and get the best technical brains in the country to advise you! A new department in RADIO and TELEVISION MAINTENANCE, "What's Your Problem?" will contain the posers of the most general interest, and answers submitted by readers.

If two or more answers sent in to a particular toughie are good enough, they'll all be published. If only one solution is printed, the sender will receive $5. If more than one answer appears, the second best will bring home $3, and the third best $2. The editors of R & TM are the sole judges.

Watch for "What's Your Problem" in an early issue of RADIO and TELEVISION MAINTENANCE!

Send your problems to: Problems Editor, P. O. Box 867, Atlantic City, N. J.

Products for the Trade

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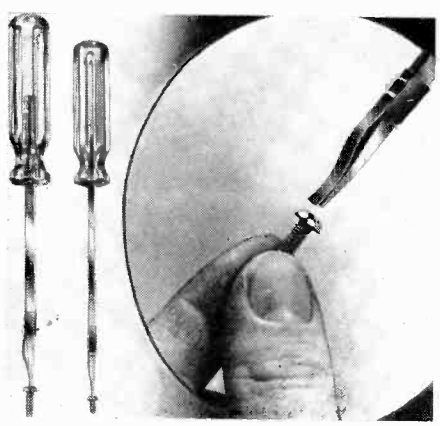
slid back up the shaft and out of the way when not needed.

With this tool, it is possible to secure a screw to the screw driver bit for starting a screw in a recessed hole, and to



extract the screw. The device can be made to grip the screw through sense of "feel" and light pressure. Even the smallest screws may thus be gripped.

Mobile TV studio leaves Camden, N. J., for Mexico City. Mayor George Brunner of Camden (second from right) hands letter to David Cervantes, Station XHTV representative, for delivery to Mayor Fernando Aleman of Mexico City.

EQUIPMENT SENT FOR FIRST MEXICAN TV STATION

XHTV, Mexico City, Gets Mobile Studio to Complete Facilities

CAMDEN, N. J.—A television "studio on wheels" for Mexico's first TV station started a 3100-mile trek by highway from here to Mexico City recently with a send-off by Camden's mayor, the Mexican consul, and RCA executives. Station XHTV, for which the mobile unit is the final item of equipment, will be North America's first over-the-border link for an eventual international exchange of TV programs with U. S. networks.

Participating in the ceremony in the mayor's office in Camden City Hall were Mayor George E. Brunner and other city officials; Ernesto Zorrilla, Mexican Consul in Philadelphia for the tri-State area of Pennsylvania, New Jersey, and Delaware; W. W. Watts, Vice President of the Radio Corporation of America; Herbert C. Edgar and George De Arellano, of the RCA International Division; and David Cervantes, official representative of Romulo O'Farrill, owner of the Mexico City station and publisher of the newspaper *Novedades*.

Other items in the all-RCA equipment for Station XHTV, including a five-kilowatt transmitter, antenna, cameras and other studio equipment, were shipped to Mexico City in March. The station is expected to go on the air with test patterns this month. The "studio on wheels" will provide all necessary facilities for remote pickup of fiestas, celebrations, bullfights and other spectacles, as well as news and public events.

Senor Cervantes took with him on the long trip a letter from Mayor Brunner to the Hon. Fernando Casas Aleman, Mayor of Mexico City, congratulating him on the entrance of his country into the "television family of nations." The ceremony was transcribed for later radio broadcast in Mexico City, and also filmed for reproduction in Mexico City theatres and over Station XHTV.

Eliminating TV Interference

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whether they were designed for television or for interference reception. Some however, have built-in high-pass filters or tunable interference traps. Although these traps seldom have sufficient range to eliminate an interfering signal below 30 megacycles, they should be adjusted to minimize interference before trying other methods. They are particularly effective against images and interfering signals near a locally-assigned television channel. If the signal is actually in the channel, the trap may remove the picture as well as the interference.

— RTM —

Projection TV Adapter

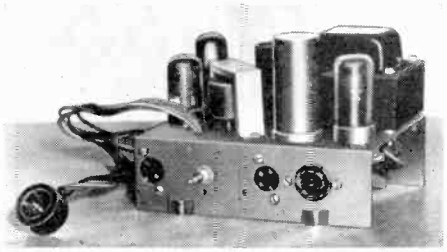
→ from page 8

the system. More than adequate sweep is obtained from any 10", 12½" or 16" picture tube set. The height control is a simple resistive shunt across the vertical deflection coils. The width control consists of a permeability tuned coil in series with the horizontal deflection coils. The inductance is dumped by a resistor to prevent ringing.

Sockets are provided on the Duo-Vue chassis for connection of the focus coil and high voltage unit.

Applications of System

The intended use of the unit in its cabinet, is to serve as a table for table model type direct-view sets. When large picture performance is desired, the unit



Projection picture tube (above), and auxiliary chassis, containing 7C5 video amplifier, 7Z4 rectifier, 7B6 for automatic biasing, and compensation for additional wiring and switch capacity used in the Duo-Vue system.

is positioned properly and switched to projection on a normal movie-type reflective screen. It can be used in living rooms, dens, playrooms and clubs.

Although this is essentially a system for "on screen" projection, many servicemen install the unit so as to project from the rear "through" a screen.

Provided the ambient light is excluded, and light entering the system through the screen is killed by painting all reflective surfaces flat-black, a very acceptable rear-projected 3 by 4-foot picture can be obtained for use in clubs, hospital recreation rooms, restaurants, airport waiting rooms, places of entertainment, theater lobbies, custom home installations, sponsor rooms in TV studios (and other program monitor uses), where a controlled lighting is feasible.

—RTM—

PRSMA Show is Scheduled

PHILADELPHIA — Service technicians and members of radio organizations are invited to the 2nd annual Radio, Television and Electronics Exhibit, planned for Sept. 25-27 at the Broadwood Hotel here.

More than 8,000 radiomen are expected to attend the meeting, which will include discussions on the future of television, UHF problems, large-picture conversion for TV, record changer repair, and other subjects of general interest. Material related to post-graduation problems will be a special feature for radio and TV school students.

The programs, under the sponsorship of the Philadelphia Radio Service Men's Association, will be centered on particular themes each evening of the conference. Color television and Phonovision are among the subjects to be considered.

Demonstrations of color television, exhibits of the products of leading manufacturers, and speakers prominent in the industry will be featured at the show. The U. S. Army Signal Corps and the Bell Telephone Co. will display several educational exhibits.

Sessions will begin at 7 p.m. Sept. 25, and will run from 10 a.m. to 10 p.m. the second and third days. Trade displays will be in the hotel's main ballroom.

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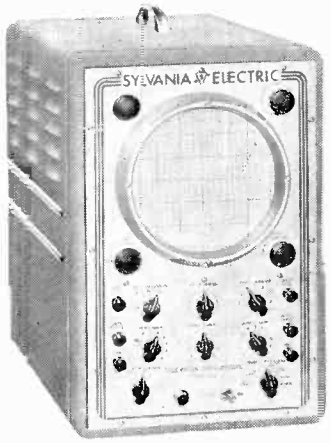
"That's great news for TV Service men!"

TV Test Instruments!

Sylvania's early pioneering in radio testing devices naturally places this company in a position to step ahead in the field of television testing equipment.

So again Sylvania comes through! This time for service dealers everywhere, with a splendid new line of TV Test Equipment. Here are the first two instruments in this line. A new TV Marker Generator will be announced soon. Mail coupon for prices and latest specification sheets.



Sylvania TV Oscilloscope

Here's an entirely new high gain, wide band oscilloscope especially designed for television. Accurately displays any TV pulse, wave-shape or signal on a large 7-inch screen. Has excellent tilt, rise-time, and overshoot characteristics. Features include: 3-position frequency-compensated attenuator; vernier gain control; low internal hum level. Mail coupon for full details.

Type 400

Sylvania TV Sweep Signal Generator

This compact instrument is equipped with electronically controlled sweep circuits to eliminate the complexities inherent in mechanical type sweeps.

The smooth attenuator gives continuous control of the output from 300 microvolts to the maximum of .1 volt. Voltage-regulated power supply insures good frequency stability. Double shielded to prevent unwanted signal leakage.

Type 500

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

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THE QUALITY OF RCA TUBES IS UNQUESTIONED

RCA for *Deflection Tubes*

. . . with dependability

Each standard by which you judge a tube in service is considered in establishing the design requirements of RCA tubes. Dependable performance of deflection circuits starts with *dependable* tubes. For example.

RCA-designed driver tubes, such as the 6SN7-GT and 12AU7—as well as the RCA-6K6-GT and RCA-6AQ5 vertical-deflection tubes—are exceptionally low in microphonics. They are built for *dependable* performance.

RCA-designed horizontal deflection tubes, such as the 6BG6-G, easily withstand peak plate voltages of 5000 volts, and as readily meet peak emission demands on the cathode. They, too, are built for *dependable* performance.

For these reasons, RCA tubes offer *dependability* beyond the average. With fewer service failures and fewer costly call-backs, there is, then, an additional hidden profit in every RCA tube and kinescope you sell.

Always keep in touch with your RCA Tube Distributor

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