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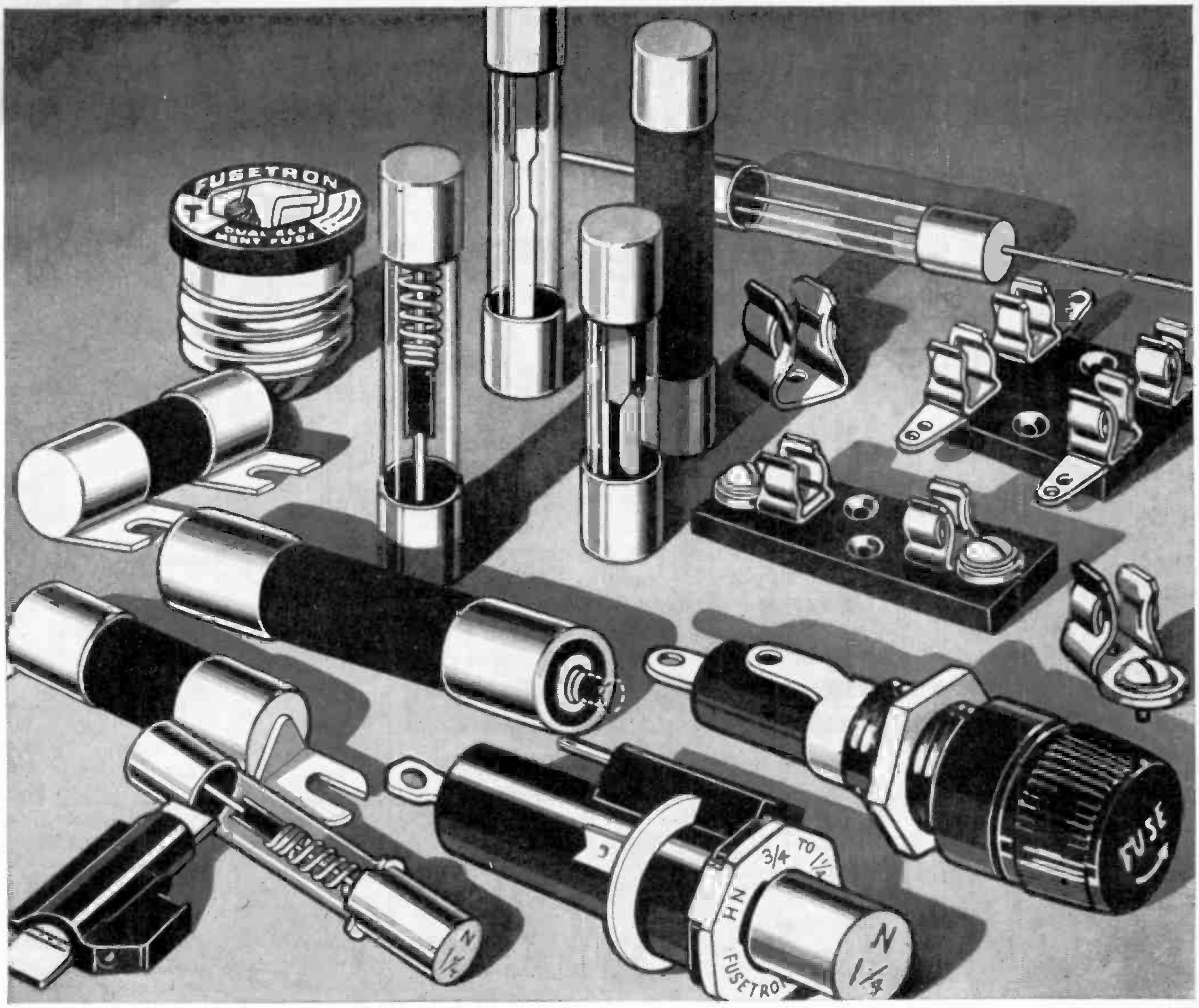

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Shop Hints and Short Cuts

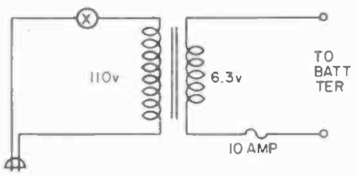
We would welcome hints and short cuts from our readers. ES will pay $5 for each hint used. Sorry, but we cannot be responsible for unaccepted material. In case of duplication, first received will be accepted.

When taking test equipment out on a call the linecord somehow or other always gets in the way, especially when in a hurry. I found that clothesline cleats available in any hardware store are excellent to wind the linecords up quickly and neatly. I fasten them with two sheetmetal screws near the hole where the linecord comes out and it's wound on and off in a jiffy. I think many of your readers will appreciate this little tip.

L. B.
Pittsburgh, Pa.

Auto radios using vibrator supplies may be tested without a battery eliminator by using 6 volts *ac* from a transformer. The set will work fine and without any hum provided that:

1. The set uses no transistors
2. The set uses a *pm* speaker.

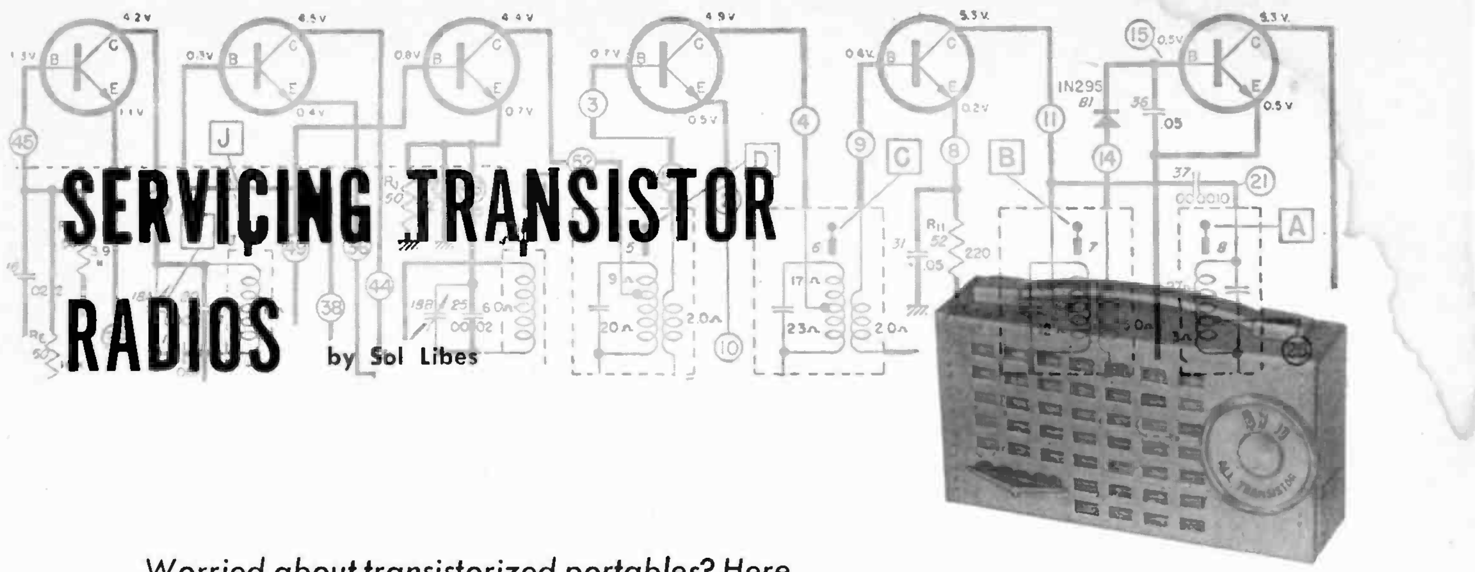


While vibrator troubles can not be determined with an *ac* supply, it does make possible the operation of car radios outside of the automobile without storage batteries or battery eliminators. It is best to use a fuse so that any short in the set will not ruin the transformer.

C. B.
Miami, Fla.

When troubleshooting "dead" radios it is sometimes difficult or inconvenient to determine whether the local oscillator is working. This is particularly

[*Continued on page* 34]



SERVICING TRANSISTOR RADIOS

by Sol Libes

Worried about transistorized portables? Here is a practical approach to troubleshooting and repair presented in simplified chart form.

TRANSISTORS are fast becoming the mainstay of our electronic era. These highly efficient devices are found in many present day electronic instruments and in the next few years will probably supplant the vacuum tube in most functions. Production and sales figures show that transistorized products are only beginning to come of age.

Many manufacturers have during the past two years produced several different types of transistor radios. These radios illustrate the higher efficiency and greater dependability of transistors as compared to vacuum tubes.

Transistor radios are not something completely new. Rather they are still the same old "superhets" using 455*kc* *if* amplifiers, local oscillator-converter, detector, audio amplifier and speaker. The chief difference is that these stages have been transistorized. Instead of using tubes to perform these operations we are now using transistors.

The transistor, like its predecessor the vacuum tube, should not be a dark mystery to service technicians. Both are performing the same function, namely controlling the flow of current and amplifying. In the vacuum tube triode the small *voltage* that exists between grid and cathode, controls the current flow between cathode and plate. In the transistor the small *current* that flows between the base and the emitter controls the larger current flow between emitter and collector. The tube is thus *voltage* controlled and the transistor *current* controlled.

The transistor is biased, in much the same way as a tube, to operate on a particular portion of its curve. Hence the bias on the transistor determines whether it conducts, is cutoff, how much gain it provides, etc.

This discussion of transistor radios will concentrate on *servicing* rather than *theory*. In the first section the servicing precautions to be followed when trouble-shooting transistor radios will be discussed. Section two is a chart of troubles, their probable causes and servicing procedures to be used. The third section ties up the loose ends with a discussion of servicing other types of circuits not found in the example used in the chart (push-pull audio output stage, reflexed amplifier, etc.).

Most Frequent Troubles

Two years experience in servicing transistor radios has shown that the following troubles occur most often (listed in order of occurrence).

1. Weak or dead battery (in some cases wrong polarity)
2. Poor solder joints
3. *IF* amplifier regeneration or oscillation
4. Antenna loop defective
5. *IF* transformers defective
6. Oscillator coil defective
7. Earphone jack open
8. Electrolytic capacitors defective
9. Transistor fused
10. Unbalance in push-pull audio output stages.

PART I. SERVICING PRECAUTIONS

Transistors are very stable devices and have an exceptionally long life. However, they can be damaged by the application of too much heat, excessive or improper voltages or mechanical abuse. Therefore, certain precautions must be observed when servicing transistor radios. Test equipment, tools and procedures must be used which will not damage the transistors.

Test Instruments

All test equipment should contain isolated power supplies. Transformerless test equipment should be used only when an isolation transformer is placed between the equipment and the *ac* line. The ground leads should always be connected between the equipment and the receiver being serviced before the "hot" leads are connected.

Be careful when probing around in a transistor radio. Indiscriminate tugging, pushing and touching of miniature components can mean momentary current surges. These currents may be relatively large and can do great damage in low impedance circuits. Likewise touching the transistor terminals together will disrupt the existing bias and momentary current surges may cause the transistor to become fused.

A vacuum tube voltmeter is recommended for all voltage measurements. If a multimeter is used it must have a 5000 ohm-per-volt sensitivity or better on all ranges, otherwise excessive current will be drawn from the circuits under test. Generally, circuit checks made with an accurate voltmeter are more useful than resistance checks. All voltage measurements are made with the tuning capacitor set at maximum capacity and the volume control at minimum.

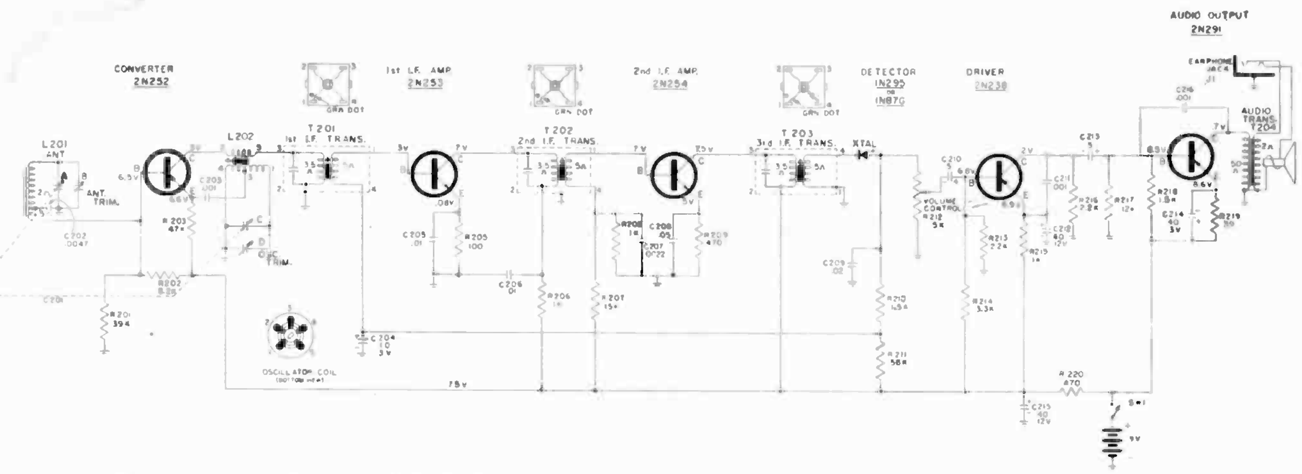


Fig. 1—Schematic of Airline model GTM 1108. This is a typical transistorized portable radio.

Ohmmeters must be of the low current type, not passing more than 1 *ma.* of current on any range. This current should be checked by connecting a milliammeter in series with the ohmmeter leads. The current drawn should be checked on all ranges. The milliammeter must have a low resistance. Generally, it is safe to use an ohmmeter with a battery of 3 volts or less if used on the *R x 1,000* scale or higher. Before making resistance checks either remove the transistor from the circuit or the component being checked. *Know the polarity of the ohmmeter leads* since the low voltage electrolytic capacitors can easily be damaged by reversed polarity voltages.

Always use a fresh battery to power the receiver under test. Check the battery voltage under load to see that it is at its rated value. Also check to be sure that the battery polarity is correct, (wrong polarity voltages will damage the transistors and electrolytic capacitors). A battery eliminator is not recommended as a source of power for transistor radios (due to poor regulation and possible high *ac* ripple content).

Tools

It will be found advantageous, when servicing compact transistor radios, to use smaller than normal servicing tools, such as a small soldering iron (35 watts or less), tweezers and a small wire brush to clean away the excess solder.

The soldering iron should be of the low wattage type to prevent excessive heating of the transistor and printed circuit. When soldering or unsoldering transistors from a circuit a needle-nose plier or similar device should be used as a heat sink at the element being unsoldered. Always solder as quickly as possible. Use a low melting point rosin core solder and be sure that the soldering iron is hot enough to melt the solder quickly before beginning. No battery voltage should be applied to the receiver at this time.

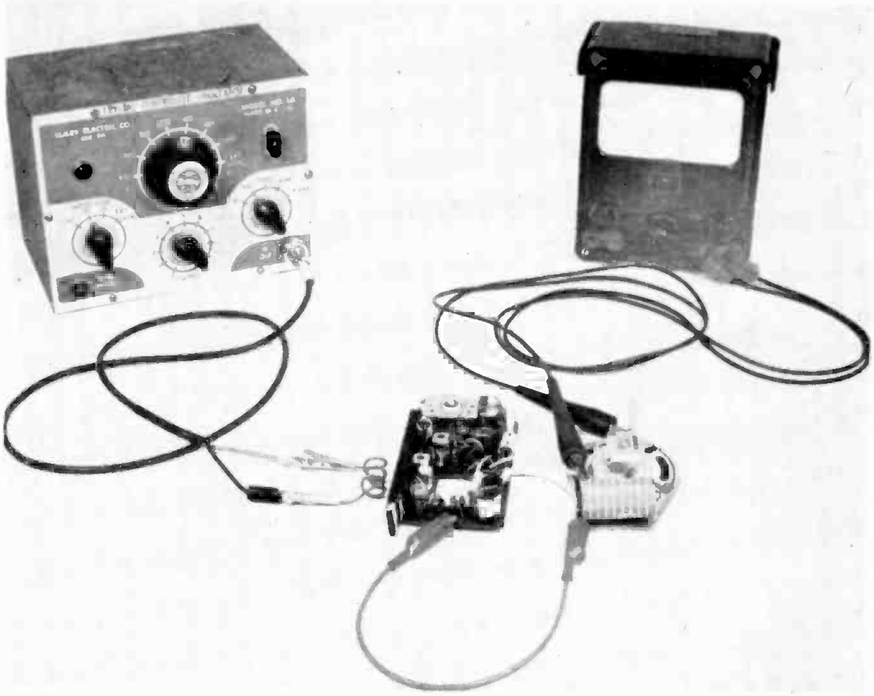


Fig. 2—Instrument arrangement for checking converter stage operation. Generator is coupled to receiver by the four turn loop.

PART II. TRANSISTOR RADIO TROUBLE-SHOOTING CHART (Refer to *Fig. 1*)

TROUBLE	POSSIBLE CAUSE	SERVICING PROCEDURE
I. Dead receiver	a. Dead battery	1. Replace battery. Check current drain; if excessive proceed as in 1b below.
	b. *DC* supply circuit defective	1. Check by measuring current drain of receiver. Place a milliammeter in series with battery. If current drain is approximately 17 *ma. dc* supply circuit is not at fault. On chassis using push-pull amplifier, (see *Fig. 3*) the current drain should be approximately 6 *ma. with no signal.*

[*Continued on page* 32]

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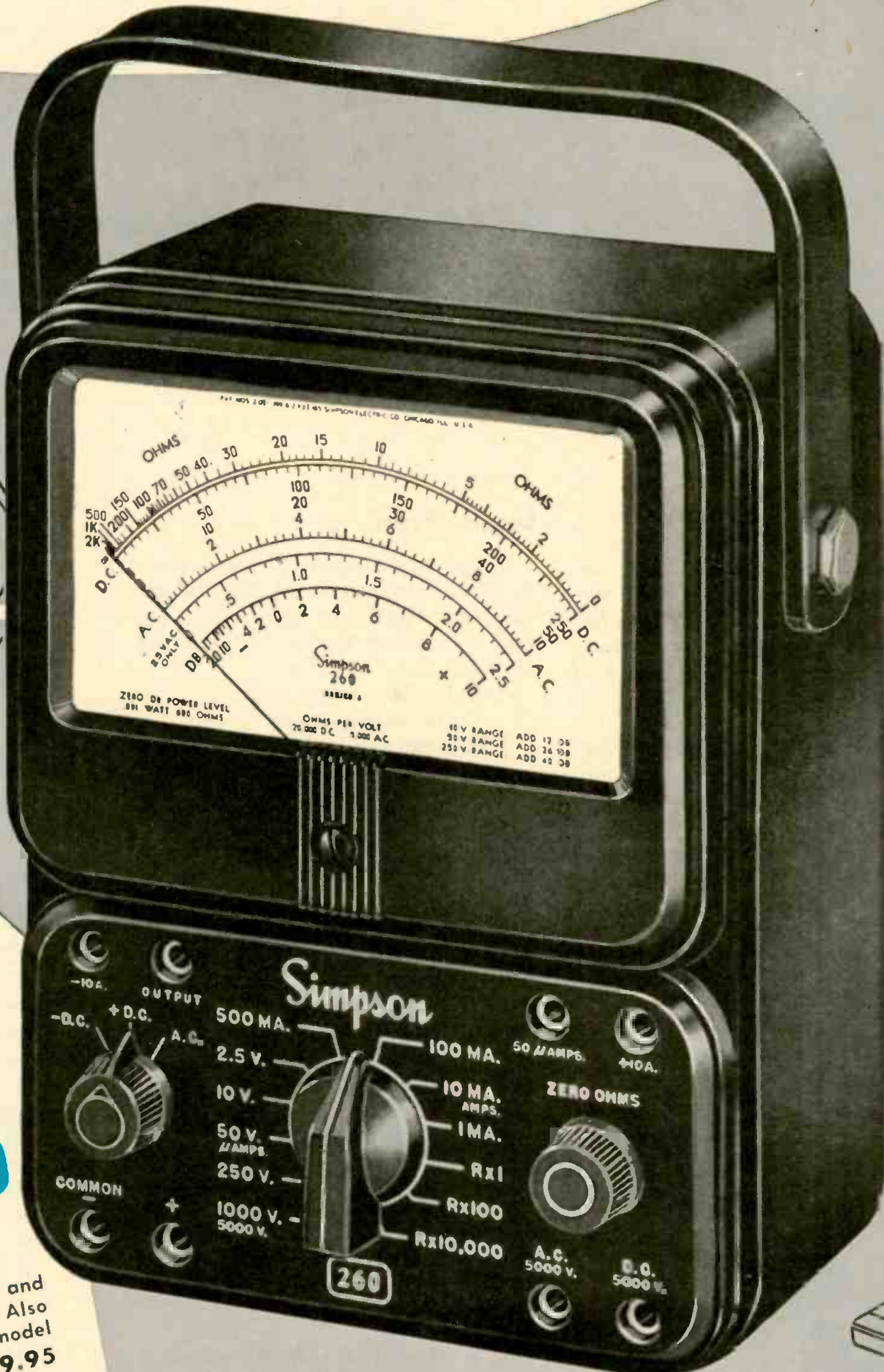

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Multi-Set Antenna Couplers

by Rudolf F. Graf

A description of multi-set couplers available to the trade and a detailed analysis of coupler requirements.

OVER 4 million homes now have two or more TV receivers and it is expected that as more color sets are installed, their number will increase greatly in the future. With *hi-fi* reception taking on greater importance, there are also many *fm* tuners in use which will greatly benefit by a signal from a good antenna. So, the two set coupler, a device for coupling receivers to one antenna, is a much more important accessory than it used to be. We can, with little additional expense, obtain enough signal from one antenna to supply two or more *TV or fm* receivers or any combination of both. This is a fact that many lay *TV* set owners do not know. Hence they may be reluctant to buy a second set, because they believe the expense and bother of a second antenna installation will be required.

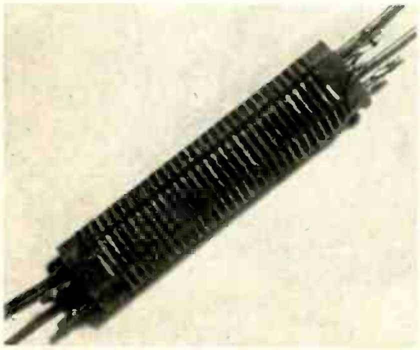


Fig. 1—Typical bifilar coil used for multi-set couplers.

Coupler Types

Couplers, or signal dividers, presently fall into three categories and are classified by the means which are used to achieve the desired splitting of the signal:

1. Bi-filar wound coils
2. Resistive network
3. Inductive or transformer network

In multiple installations the signal must be divided. The strength of the signal delivered by the antenna determines just how simple or elaborate the divider installation will have to be.

Obviously, since there is no additional amplification, each receiver will, at best, receive half of the signal delivered from the antenna. Losses in the coupler, desired or otherwise, reduce the signal at the receiver to an even smaller fraction.

Coupler Requirements

A coupler should have as many of the following characteristics as possible. This listing is not necessarily in the order of importance. The relative need for one or the other will be discussed later.

1. Insertion loss should be low so as to make as much of the received signal as possible available for the receiver. Ideally it would be *3db* if each receiver receives 50% of the power available to the coupler from the antenna transmission line.
   Insertion loss represents the ratio of the power delivered to the receiver without the coupler, to the power delivered with the coupler connected. To put it another way, it is the ratio of the input to the output power of the coupler to one of the receivers. This ratio is, as all power ratios usually are, expressed in *db*. For example if the power ratio is 2 to 1 the insertion loss is *3db*. If the power ratio is 3 to 1 the insertion loss is *4.8db* and so forth.

2. Sufficient isolation to prevent interaction and interference between sets should be provided. This interference would be caused by the local oscillator of set A beating against the carrier of the station received on set B and takes the form of horizontal bars (herring bones) on set B. (This problem exists in older receivers having an *if* around 21

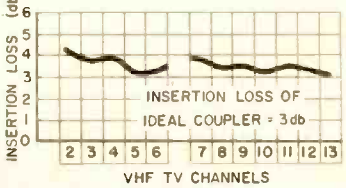
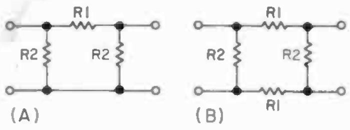


Fig. 2—Insertion loss of the Taco 820 two set coupler.

For 75 ohms — For 300 ohms



	75 ohms	
Attenuation	*R1*	*R2*
6 db	56	220
9 db	91	160
12 db	130	120
15 db	200	110
	300 Ohms	
Attenuation	*R1*	*R2*
6 db	110	910
9 db	180	620
12 db	270	510
15 db	390	430

Fig. 3—Circuits and values for various attenuating pads.

mc.) Furthermore, neither receiver should be appreciably affected when the other is turned off.

Isolation, in the case of this three terminal network (one input and two output terminals) refers to the ratio of the power applied to one output terminal to the power that would, as a result, appear at the second output terminal if everything is properly terminated. As before, this ratio is also expressed in *db*.

3. The isolation to insertion loss ratio should be as high as possible for greatest efficiency. Hence, the isolation should be high and the losses low.

4. Proper match should exist to the impedance of the line as well as to the receivers, otherwise high insertion loss and ghosts, due to multiple reflections, will result.

5. The available signal should be equally divided between both receivers, and the coupler should be effective for all signals in the *vhf* and *fm* bands. If possible *uhf* should also be included.

6. Couplers should also provide high pass filter action to eliminate any interfering signals below *54 mc.*

7. Units should be reasonably small, not too expensive and easily installed. No maintenance should be required.

Bi-Filar Couplers

Bi-filar units employ two transmission lines, each having a characteristic impedance of 150 ohms. Since actual transmission lines would be quite large and not too easy to handle, the lines are wound on a coil form as illustrated in *Fig. 1*. They are generally referred to as bi-filar coiled transmission lines or, more simply, bi-filar coils. The size of the wires as well as their spacing determine the characteristic impedance of the line and for the sake of convenience they are wound on a coil form. Some bi-filar coils are made with actual transmission line rolled in the form of a coil and then glued together thus obviating the need for the extra coil form. These lengths of artificial transmission line have been adjusted so that if the outputs of the coupler are terminated in 300 ohm resistors and a signal is applied to the antenna terminals from a 300 ohm generator, the Standing Wave Ratio will be close to 1 for all frequencies from channel 2 through 13. We thus achieve the best possible match between receivers and antenna. There is also another advantage to this particular construction. Because of its very nature, there is distributed capacitance and inductance and these have been so designed as to act as a reasonably effective high pass filter with such characteristics as to reject signals below *54 mc.*

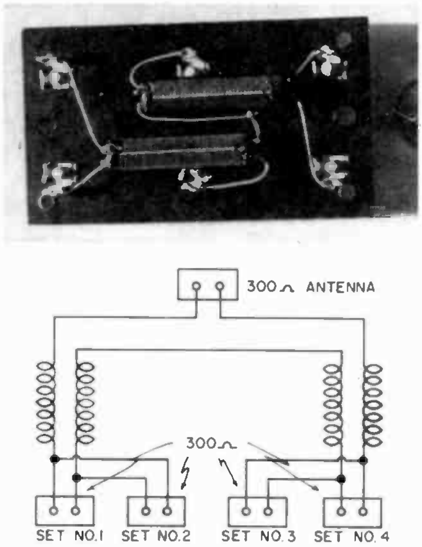


Fig. 4—Photo and circuit illustrating typical bi-filar set up.

The efficiency of a coupler is measured by its interset isolation and the insertion (signal) loss due to the use of the coupler. The insertion loss of an ideal coupler is *3 db*. The insertion loss of a Taco series 820 two set coupler is shown in *Fig. 2*. We can see from the curve that the insertion loss for this type of coupler is very low.

The isolation of this coupler averages about *10.2 db* on the low band and *9.2 db* on the high band. Isolation becomes important in areas that receive channels whose difference frequency falls in the *if* band of the receivers. These would be channels 2 and 5; 3 and 6; 7 and 11; 8 and 12; 9 and 13.

Although in most cases couplers have enough isolation to prevent oscillator radiation between sets, a herring-bone type of interference may sometimes be found when sets are tuned, simultaneously, to any of the pair of channels listed above. In such instances a simple attenuating pad at one or both sets will tend to eliminate the trouble. Resistor values for such pads giving 6, 9, 12 and 15 *db* of attenuation are given in *Fig. 3*. Start with *6 db* and, if necessary, go higher until the interference is eliminated.

The circuit diagram and photograph of a typical bi-filar two set coupler are shown in *Fig. 4*.

Some manufacturers produce couplers such as these shown in *Fig. 5*. These units are designed specifically for outdoor use and their containers are usually tapered to shed water and prevent moisture condensation. They should also have a cover which overhangs *below* the terminal board so that the terminals are properly protected. Furthermore, they are so designed that any downward pull by the hanging transmission line will not cause damage.

On some couplers "ground" lugs are used. They tend to reduce noise

[*Continued on page* 33]

Fig. 5—Two typical couplers designed for outdoor use.

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SOUTH BEND
Radio Clinic..........729 So. Michigan

IOWA

CEDAR RAPIDS
Ace Electronics....1024 First St., S.W.
DAVENPORT
Supreme TV Service....1618 W. 3rd St.
DES MOINES
TraViss Television and Radio 1606 Locust
SIOUX CITY
Bob's Radio & TV Sv....703 W. 8th St.

KANSAS

DODGE CITY
Interstate Electronic Supply Corp. 402 Military
HAYES
Interstate Electronic Supply Corp. 122 West Ninth
HUTCHINSON
Interstate Electronic Supply Corp. 325 West 4th
KANSAS CITY
Thomason Radio and Electronic Service 2810 West 53rd Street
WICHITA
Booker's Television......5403 E. Kellogg

KENTUCKY

LEXINGTON
Webb Radio Service.712 No. Limestone
LOUISVILLE
Magnetic Tape Recorder Co. 637½ South Preston Street

LOUISIANA

NEW ORLEANS
Southern Radio Supply...1900 Tulane

MAINE

BREWER
Sullivan Royal Radio TV Sales and Service..............2 Somerset
PORTLAND
H. D. Burrage & Company.92 Exchange

MARYLAND

BALTIMORE
Jos. M. Zamoiski......110 S. Paca St.
CUMBERLAND
Humbertson's Strand TV Service 29 South Centre Street
FREDERICK
Hankey's Radio Service.......404 Elm
HAGERSTOWN
Stouffer Radio Service.201 So. Potomac

MASSACHUSETTS

BOSTON
DeMambro Radio Supply Co. 1095 Commonwealth Avenue
SPRINGFIELD
Springfield Audio & Electronics, Inc. 664 Worthington Street
WORCESTER
DeMambro Radio Supply Co. 220 Summer Street

MICHIGAN

DETROIT
Allied Music Sales Company 7600 Intervale
FLINT
Flint Radio & Television. 106 First Ave.
GRAND RAPIDS
Reid Television Service 444 Michigan N.E.
KALAMAZOO
Kuiper & Warfield Electronic Service Co. 2242 Portage Street
LANSING
Wolverine Service Company 4000 South Cedar Street
MUSKEGON
Reid Television Service..1638 Terrace
PONTIAC
Blake Radio-Television.3149 W. Huron

MINNESOTA

DULUTH
Hawley-Collins Co...2814 W. Third Ct.
Lew Bonn Company...228 E. Superior
MANKATO
Hurry's Appliance 208 South Front Street
ST. PAUL
Dealer's TV Service....137 W. 7th St.

MISSISSIPPI

JACKSON
May & Jackson......125 South Lamar

MISSOURI

ST. LOUIS
Fridley Brothers, Inc..6510 Page Blvd.
SPRINGFIELD
Jack's Radio & TV Service 618 Kimbrough

NEBRASKA

LINCOLN
Harlan-Weist Sv. Inc. 1025 N. 35th St.
OMAHA
Tele-Radio Technicians....4605 Dodge

NEVADA

RENO
Emporium Electronics..214 No. Sierra

NEW HAMPSHIRE

MANCHESTER
DeMambro Radio Supply Co. 1308 Elm Street
New Hampshire Radio & Sound Service, Inc....96 Merrimack Street

NEW JERSEY

ATLANTIC CITY
Radio Electric Service Co. 452 North Albany Avenue
CAMDEN
Radio Electric Service Co...513 Cooper
HACKENSACK
Greater New Jersey TV Service 210 Essex Street
LINDEN
A.C.S. Television....1111 E. Elizabeth
MANASQUAN
Brad Radio............77 Main Street
NEWARK
All State Distributors...457 Chancellor
Michael's Radio Service...60 Williams
NIXON
A.C.A. Television.......156 Plainfield
PATERSON
R. H. Sonnenberg TV Experts 178 East 33rd Street
TRENTON
Trenton Television Parts & Service Co., Inc.......1849 Brunswick Avenue

NEW YORK

ALBANY
Lake Electronic Co...1650 Central Ave.
BINGHAMTON
Ross' Radio Service.....34 Chenango
BRONX
Universal Sound & Phono Serv. 1916 Cross Bronx Expressway
BROOKLYN
Audio Visual Equipment Co. 2516 Avenue "U"
Schwartz & Son Service, Inc. 170 Scholes Street
BUFFALO
Erie Audio Serv Co...151 Genessee St.
Johnson Radio & Television 1530 Main Street at Ferry St.
Radio Equipment Corporation 147 Genesee Street
ELMIRA
Chemung Service Company 403 E. Third St.
Elmira TV Center 3021 Grand Central Ave.
FOREST HILLS
Circuit Laboratories 110-68 Queens Blvd.
MIDDLETOWN
S & L Electronics....17-21 Cottage St.
NEW YORK
Sigma Electric Co....11 E. 16th Street
NIAGARA FALLS
Val's Radio & T.V. 2728 Woodlawn Ave.
ROCHESTER
Rochester Radio Supply Co. 600 E. Main St.
SYRACUSE
United Radio.....711 So. State Street
UTICA
Jewell's Radio Service...1137 Linwood
WEST HEMPSTEAD
Audotronic, Inc...493 Hempstead Ave.

NORTH CAROLINA

ASHVILLE
Freck Radio Supply Co. 38-40 Biltmore Avenue

NORTH CAROLINA (Cont.)

CHARLOTTE
Radio T.V. & Appliance Co. 1300 East 4th Street
DURHAM
United Radio Service...121 Orange St.
FAYETTEVILLE
Jones Radio & T.V. Service 116 Old St.
GOLDSBORO
Hughes Radio Laboratory 1009 North William Street
RALEIGH
Nelson's, Inc.......517 Hillsboro Road
WILMINGTON
R & E Radio T.V. Service 1415 S. 5th Avenue
WINSTON-SALEM
Andrew's Appliance Service 803 North Liberty Street

NORTH DAKOTA

BISMARCK
Bristol Distributing Company
Palmer TV & Radio....423 Third Street
FARGO
Bristol Distributing Company 1345 Main Avenue
GRAND FORKS
Bristol Distributing Company
MINOT
Radio Clinic....201 First Avenue, S.E.

OHIO

AKRON
Midtown Radio & Television Service, Inc. 11 North Summit Street
CANTON
Television Maintenance Co. 3017 Cleveland Avenue, N.W.
CINCINNATI
Factory T.V. Service...25 E. Court St.
CLEVELAND
Associated TV & Radio Service 3101 Berea Road
COLUMBUS
Ace Radio & T.V. Service 214 East Gay Street
Thompson & Hamilton, Inc. 211 North 4th Street
DAYTON
Guarantee Radio and TV 12 South Williams Street
TOLEDO
Allied Music Sales Company 2940 Monroe Street
YOUNGSTOWN
South Side Radio & TV Co. 1742 Market Street

OKLAHOMA

OKLAHOMA CITY
W. S. Cox Radio and Sound 111 N.W. Ninth Street
TULSA
Audio Electronics, Inc.. 216 E. 10th St.

OREGON

MEDFORD
Medford.................19 Fir Street
PORTLAND
Bressie Electric. 909 S.W. 5th Avenue

PENNSYLVANIA

ALIQUIPPA
Lou's Fonograt Sv. Co. 345 Franklin St.
ALLENTOWN
Ray Electronics Co...141 North 6th St.
ALTOONA
General Electronics.508 Crescent Road
CHESTER
La Gamba Bros..........406 E. 9th St.
EASTON
Howard's TV Service...809 Wilbur St.
ERIE
Warren Radio Company....1313 Peach
FARRELL
Frank's Radio Electrical Co. 1012 Beachwood Avenue
HARRISBURG
K. & D. Service Company 126 South Second Street
LANCASTER
K & D Service Company 332 North Queen Street
LEBANON
George D. Barbey Company 821 Quentin Road
NEW CASTLE
McGrath Radio & TV....207 Mills Way
PHILADELPHIA
Audio Service Co....131 North 10th St.
Lee Service, Inc. N.E. Corner 40th & Walnut Street
Merit TV Sv..........6640 Ogontz Ave.
Radio Electric Service.112 N. 7th Street
Seattle TV & Radio..4672 Griscom St.
PITTSBURGH
Dealer's Radio Service...508 Chestnut
E. & M. TV Service........3625 Butler
Eastern Factory Authorized Service Co. 2805 Penn Avenue
READING
George D. Barbey Co.... 157 Penn St.
SCRANTON
Greene Radio Service......405 Gibson
STRAFFORD
Boyd Radio Service 710 Lancaster Pike
WILKES-BARRE
Rad-Art Radio Service..13 Carey Ave.
WILLOW GROVE
Louis J. Smith Service Center 359 North York Rd.
YORK
Robert N. Tate......802 So. Duke St.

SOUTH CAROLINA

CHARLESTON
Holst Radio Service Co. 428 Meeting Street
COLUMBIA
Colonial Radio & TV Shop 3207 Colonial Drive
FLORENCE
Tommy Ayers Radio Service 116 South Coit Street
GREENVILLE
Carolina Camera Repair 500 Rutherford St.

SOUTH DAKOTA

WATERTOWN
Jensin's Radio & TV Service 11 South Broadway

TENNESSEE

CHATTANOOGA
Northside Radio & Appliance Service 313 North Market Street
KNOXVILLE
Chemcity Radio & Electric Co. 2211 Dutch Valley Rd.
MEMPHIS
Denton Radio & T.V. Service 3515 Southern Avenue
NASHVILLE
Eddie's Radio & TV Co. 265 Hermitage Ave.

TEXAS

ABILENE
Howard Television Service..1511 Pine
AMARILLO
R & R Electronics Co....707 S. Adams
AUSTIN
Friendly Radio & Television 119 Congress
BROWNSVILLE
Blackburn's..747 East Elizabeth Street
CORPUS CHRISTI
Harken Company..3001 Leopard Street
DALLAS
Bradley Radio-TV Service 912-914 North Peak Street
EL PASO
The Telectronix Co. 108 W. Paisano Dr.
FORT WORTH
The Cearley Co......517 Pennsylvania
HOUSTON
Miller Audio Co. 4811 Gulf Freeway
LA FERIA
La Feria Radio and TV Service Co. Box 868
LUBBOCK
Radio Lab............1501 Avenue Q
NAVASTA
A-Z Television Service 1209 South La Salle Street
PORT ARTHUR
Carl's TV Co.........1816 Seventh St.
SAN ANTONIO
Spangler Radio & TV 322 Marquette Dr.
VICTORIA
Sam Niel TV Service...204 So. Moody
WACO
Radio Center Television..1813 Speight
WICHITA FALLS
Perry & Bob.............1104 Grace

UTAH

SALT LAKE CITY
Electronic Service & Supply 115 E. Broadway

VERMONT

BURLINGTON
C. P. Smith Supply Co., Inc. 129 S. Winooski Avenue
RUTLAND
Vermont Television Service Co. 28 Allen Street

VIRGINIA

HARRISONBURG
Chew Brothers..242 East Water Street
NORFOLK
Bradshaw's T.V.-Radio Service 810 W. 25th Street
RICHMOND
Lakeside Radio Service 5101 Lakeside Avenue
ROANOKE
Wagner Electric Company 2902 Williamson Road, N.W.
STAUNTON
Southern Electric Corp. 818 Greenville Avenue

WASHINGTON

CLARKTON
Orin's Radio Service.....724 Sixth St.
SEATTLE
Seattle Radio Supply, Inc. 2117 Second Avenue
SPOKANE
Mu-Sonic Services . 208 Symons Bldg.
TACOMA
Ajax Electric Co. 747 Faucett Avenue

WASHINGTON, D. C.

Emerson Radio of Washington 1522 - 14th Street, N.W.
National Radio & T.V. Co. 6902 Fourth Street, N.W.

WEST VIRGINIA

BECKLEY
Haddad's TV & Furniture Co...112 Main
CHARLESTON
Pierce and Sodaro 325 W. Washington St.
HUNTINGTON
Cunningham Television Co. 3437 Piedmont Road
LOGAN
Central Gulf Service Co. Box 643 Radio & TV Dept.
PARKERSBURG
General Electronics Distributors 512 Seventh Street
WHEELING
General Electronics Dist......735 Main

WISCONSIN

APPLETON
Tri-City T.V. Service, Inc. 605 North Superior Street
EAU CLAIRE
Luarken's Inc. 315 North Barstow Ave.
GREEN BAY
Video-Electronics..1514 No. Irwin Ave.
KENOSHA
Clear Vue T.V. Specialists 6821 - 14th Avenue
LACROSSE
Numsen TV & Appliance Service 1804 Jackson Street
MADISON
Chic Young TV Engineering Service 2503 University Avenue
MILWAUKEE
Mr. TV........5407 West Center Street
OSHKOSH
Ra-Tel Service, Inc...394 Ceape Street
SHEBOYGAN
Van's Radio & T.V., Inc.,1511 S. 12th St.
WAUSAW
Day's Hardware & TV Service 1910 - 6th Street

features of the
110° picture tube

by R. C. Janzow

Training Dept.
RCA Service Co.

New styling concepts and production economies are being achieved in the design of monochrome television receivers through the use of recently developed 110° kinescopes. The new picture tube is another advance toward the ultimate in picture tube depth, namely the kinescope that can be hung on a wall like a picture.

Size and Weight

The difference in cabinet size required for table and console designs using 110° kinescopes compared to 90° kinescopes is significant. Cabinet styles utilizing the 110° kinescope harmonize with contemporary and traditional decor by minimizing cabinet bulk.

The new 110° kinescopes have several other features of interest to service people in addition to the weight and length reductions. They are: 1) a short, thin neck, 2) a new integral glass button base having straight through leads fitted with an indexing plug, and 3) a new electron gun that delivers sharp all-over screen focus and eliminates the ion trap.

Fig. 1—Typical 110° deflection yoke. The arrow points to a thermistor, R133. Note magnets used to minimize pincushioning.

The neck of a 21CEP4 is 5 7/16 inches long and 1⅛ inches in diameter. (Similar dimensions hold for the 17 and 14 inch 110° kinescopes.) The reduced diameter allows the design of a yoke of high deflection sensitivity.

Deflection Problems

High deflection sensitivity is also a function of the long segment cores used in construction of the yoke core. By using a yoke of greater deflection sensitivity, the horizontal output stage need deliver only moderately increased power to the yoke, compared to a 90° circuit.

The physical design of the 110° yoke is more radical than its 90° counterpart. Referring to *Fig. 1*, note the extreme flaring of the winding compared to that of a 90° yoke. This flaring serves the purpose of removing the stray fields of the yoke end turns from the deflection area. Furthermore, the flared construction allows a close fit between the yoke and kinescope bell, eliminating the need for a separate yoke support mechanism.

A problem encountered in the design of the high sensitivity yokes was the temperature rise of the windings. It was observed that the temperature rise of the vertical windings caused the resistance of the copper wire to rise to a value that in turn resulted in a decrease in raster size from top to bottom. This effect was overcome in the 110° yoke design by the addition of a thermistor, *R133*, between the two vertical deflection coils. The location of the thermistor in the vertical deflection circuit may be seen in *Fig. 2*.

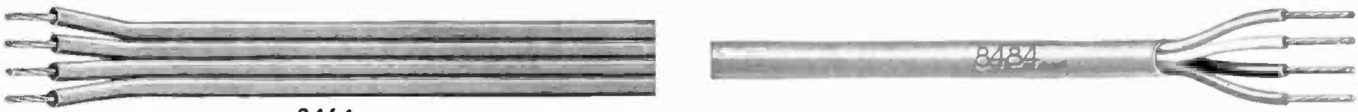
The thermistor is a temperature dependent resistor. Its resistance decreases with a temperature increase. The thermistor holds the resistance of the vertical deflection circuit virtually constant, thus maintaining full raster height throughout normal operating temperatures.

Referring to *Fig. 1* again, note the small bar magnets fastened to the yoke frame to minimize pin-cushioning. Two additional bar magnets are fixed to the rear side of the yoke frame 90° from the magnets showing in *Fig. 1* and are barely visible.

To compensate for static beam deflection due to the earth's magnetic field, the yoke core is magnetized sufficiently to deflect the beam ½" in the opposite direction. This permanent magnetization is necessary because no d.c. flows through the yoke. Conventional centering is obtained by a permanent magnet centering assembly attached to the rear protective cover of the yoke.

[*Continued on page* 35]

If it's worth the cost of installation...



8464

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Superior Cables engineered for the job—In a complete line for every requirement. Packaged for easy handling.

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9¹-8

Magnet Wire • Lead Wire • Power Supply Cords, Cord Sets and Portable Cord • Aircraft Wires
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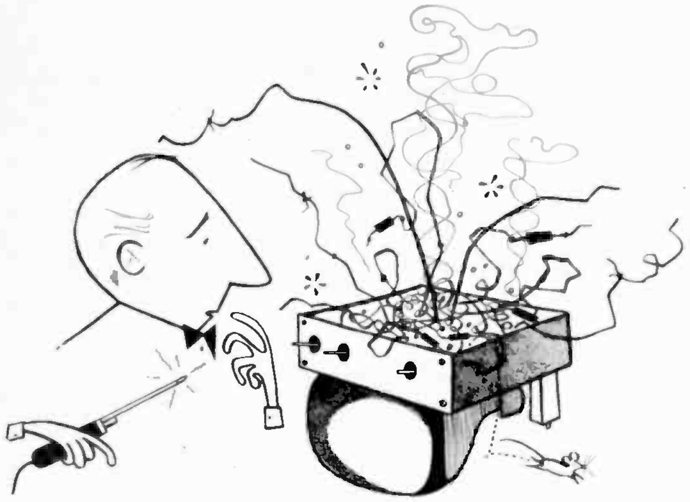


Looking for Trouble?

by Cyrus Glickstein*

A new series presenting useful and practical service information in an entertaining manner. Can you solve the problem?

THIS simple TV servicing quiz is the first of a new series. You can try your hand at trouble shooting the defective receiver by checking the correct answer to each question in the quiz.

The faulty TV set is being serviced on the bench. The questions below are based on typical servicing procedures. The rules of the game are simple. Answer each question before going on to the next, since the answer may be indicated in the following question. Usually, there is only one one correct answer but if the question has more than one correct answer, pick all of the possible choices.

The answers and discussion follow the questions. At the end of the discussion, troubleshooting hints for quickly localizing this type of trouble are included.

Receiver: Westinghouse, Chassis V-2328, transformer low-voltage power supply.

Symptoms: Complete loss of horizontal sync, sound normal.

Questions:

1—Complete loss of horizontal sync may indicate a fault in the following:

☐ a. Sync section;
☐ b. Horizontal *afc* circuit;
☐ c. Horizontal sweep circuit (horizontal multivibrator, horizontal output, damper);
☐ d. Video section;
☐ e. Low-voltage power supply.

*Author of "Repairing Television Receivers," John F. Rider Inc.

Control Action

Following the usual procedure, the picture is examined closely for all available symptoms. Video information (black and white content of the jumbled picture) seems to have the correct amount of contrast.

Pertinent controls are rotated to determine the effect on the picture. Rotating the horizontal hold control has only a small effect in changing the number of diagonal lines (horizontal blanking bars) in the picture. It is not possible to sync the picture horizontally at any position of the horizontal hold control. Varying the vertical hold control through its range makes the picture roll vertically in either direction as well as horizontally. The vertical hold seems to have the normal lock-in range.

Action of the contrast control in varying the shading appears normal. The sound is undistorted and varies normally as the volume control is rotated through its range.

Varying the brightness control shows normal operation—blacking the screen at one extreme and showing excessive brightness at the other extreme of rotation. The channel selector and fine tuning settings have no effect in improving operation. The same symptoms are present on all active channels. The raster appears normal on inactive channels.

The horizontal *afc* and horizontal sweep section tubes are changed and have no effect on the symptoms.

2.—The next step in trouble shooting is:

☐ a. Change the video section (video *if*, video amplifier) tubes;
☐ b. Change the h-v rectifier;
☐ c. Vary the *agc* control;
☐ d. Vary the horizontal range trimmer;
☐ e. Vary the sync control.

Stage Isolation

The horizontal hold control is left in the center of rotation and the rear-apron horizontal range trimmer *(C423)* is rotated in each direction. A point is reached where the picture comes into sync momentarily. However, the picture doesn't hold but keeps drifting out of sync. Varying the trimmer setting slightly in either direction makes the picture lose horizontal sync, with the horizontal blanking bars slanting either to the right or to the left, depending on the direction of trimmer rotation. By leaving the trimmer at the optimum point and continually varying the horizontal hold control slightly in either direction as necessary, the picture can be kept in horizontal sync. More than a slight variation of the hold control, however, causes the picture to lose horizontal sync. Vertical hold operation continues normal. While in sync, the picture appears normal.

3.—On the basis of the above, the trouble may be caused by the following:

☐ a. Loss of signal input to the sync amplifier stage;
☐ b. Loss of horizontal sync pulse input to the horizontal *afc* circuit;
☐ c. Defective horizontal *afc* stage;
☐ d. Defective horizontal oscillator (horizontal multivibrator);
☐ e. Defective horizontal output stage.

Voltage Analysis

DC voltage measurements were taken around the horizontal *afc* and horizontal multivibrator stages (see Fig. 1). To further help in localizing the trouble, the voltage measurements were repeated with the horizontal *afc* tube out of the socket. The readings were as follows:

Hor. *afc* (6AL5)

Pin	*afc* Tube In	*afc* Tube Out
1	74 v	36 v
5	74 v	36 v
7	68 v	71 v

Hor. MV (12AU7)

Pin	*afc* Tube In	*afc* Tube Out
1	35 v	Same
2	3.3 v	
3	3.6 v	
6	142 v	
7	–20 v	
8	3.6 v	

4.—On the basis of the above readings, the most likely trouble is:

☐ a. *C404* leaky;
☐ b. *R425* changed value;
☐ c. *C413* shorted;
☐ d. *C418* shorted;
☐ e. *C415* leaky.

Answers and Discussion:

1. a, b, c, d, e

A complete loss of horizontal sync may be caused by a defect in almost any section of the receiver. It is therefore essential to note what other symptoms may be present to help localize the trouble quickly. With vertical sync, video information and sound normal, the fault is usually in the horizontal *afc* or horizontal sweep circuit. A defect in the horizontal oscillator can cause a large change of horizontal frequency which cannot be compensated for by the horizontal controls. Trouble in the horizontal *afc* system can result in inability to control the horizontal oscillator or even in throwing the oscillator completely off frequency.

Partial Sync Loss

A partial loss of horizontal sync (horizontal bending, intermittent tearing, etc.) may originate in almost any section of the receiver. The horizontal sync pulses pass through the video section as part of the composite video signal, then are clipped off in the sync section and are applied to the horizontal *afc* circuit. Here the horizontal sync pulses are compared to a sawtooth signal coming from the horizontal sweep circuit. Any difference in phase or frequency causes a correction voltage to be generated and applied to the grid of the horizontal oscillator. The correction voltage brings the oscillator phase or frequency back in step with the incoming horizontal sync pulses from the video signal. A partial loss of horizontal sync can therefore be caused by defects in the video section, sync section, horizontal *afc* circuit, horizontal sweep circuit or low-voltage power supply.

As with most other types of trouble, the first step in localizing the trouble causing the loss of horizontal sync is to check the visible and audible symptoms carefully and to note the effect of rotating various controls.

Even with the complete loss of horizontal sync, a close examination of the screen can provide additional clues to the general trouble area. If the jumbled picture is over-contrasty, this may indicate trouble in the video section, especially the *agc* circuit. If the video content is light and brightness can't be controlled by the brightness knob, there may be a *crt* grid-cathode short or fault in the crt input circuit. Weak video content with the loss of both horizontal and vertical sync points to trouble in the antenna, front end or video section, and so on.

Stage Isolation

2. d

Noting the effect on symptoms as pertinent controls are varied can be very helpful in localizing the trouble. Rotating the contrast control through its range should have the normal effect in changing picture shading even though the picture is jumbled. At the normal contrast control setting, the black and white areas should be clear and crisp. Greyish or overcontrasty picture information points to video section trouble.

Sync Limiting

Although the video information seems normal, some sync pulse clipping (limiting) may be occurring in the video section or sync (sync amplifier, sync clipper) section. To check this possibility, the vertical hold control is rotated through its range to determine if the vertical sync action is normal. Loss of vertical sync superimposed on the loss of horizontal sync shows up as vertical blanking bars (broad horizontal black bars) moving up or down on the screen. If the vertical hold control seems to have the normal lock-in range (about ¼ to ½ of rotation) before causing a loss of vertical sync, this usually indicates that the vertical sync is normal and the loss of horizontal sync is probably caused in either the horizontal *afc* or horizontal sweep circuit.

Changing the channel selector set-

[*Continued on page* 27]

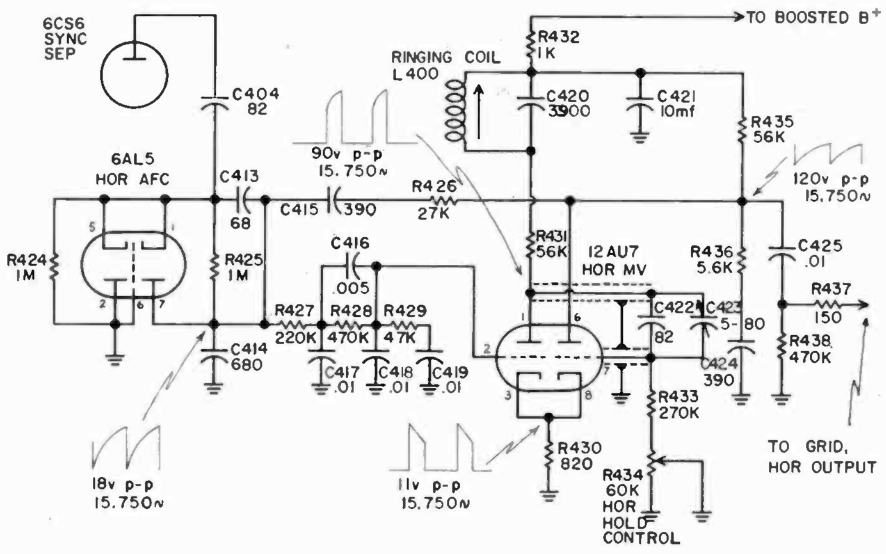


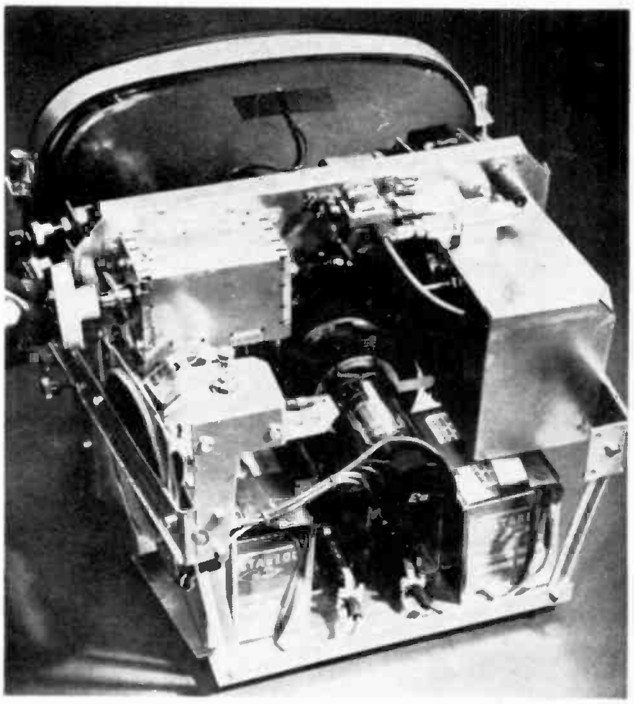
Fig. 1—Horizontal circuit of Westinghouse V2328 TV receiver.

TRADE

The first truly portable TV set, fully transistorized and battery operated, has been unveiled by Motorola. Introduced today by Edward R. Taylor, Executive Vice President, the set, a full 14-inch over-all diagonal model is entirely cordless and is capable of playing anywhere a television signal is present.

The set employs 31 Motorola-developed transistors driven by two nickel-cadmium batteries to deliver a picture and sound comparable in quality to the finest of present-day portable models. It consumes only 12 watts power per hour, however, in contrast to the minimum of 105 watts consumed by present-day sets.

A full six hours of playing performance can be had from one charging of the batteries which measure only 5 x 5 x 5 inches. To re-charge the battery requires only two hours and they are capable of a minimum of 2,000 cycles. This means the operating cost of the transistor set averages about four cents an hour.



Motorola's transistorized portable TV chassis.

Developing the new set required 8,000 hours in engineering manpower, Taylor pointed out, and was an extremely valuable research project in that a great deal was learned about transistorization and other matters during the year's work required.

"Release of the set to the general market is related most directly to the availability of the component transistors," Taylor said: "Estimates at this time indicate that such a set could be marketed at a practical price around 1960."

FLASHES

The first public demonstration of stereo discs was held in the auditorium of Radio Station WQXR, New York's high fidelity station, late last month to an audience of interested audiophiles.

The Fairchild Model 603 Stereo Arm and Cartridge, and the Fairchild 412-1 Turntable were used to playback stereo discs to the audience of approximately 150 enthusiasts.

It was pointed out by Fairchild company spokesman that the Stereo Cartridge employed the moving coil principle similar to that used in the standard Model 225A. Switching the two coils in series permitted the cartridge to play back regular monaural discs thus making the cartridge completely compatible with regular LP records.

● ● ●

The day of televised telephone calls is almost here. This was disclosed today by a top General Electric Company electronics expert. The Technical Products Department announced that a system for transmitting pictures over conventional telephone lines by slow-scan television has been successfully demonstrated to the military. Department engineers will be making the first installation for the military early next year.

Slow-scan TV was described as a method for reproducing televised pictures at the rate of one image about every five to ten seconds instead of the customary 30 frames per second in commercial television. This principle reduces the bandwidth necessary for such transmission over regular telephone wires. The G-E department general manager said the military installation "will be the first practical step towards . . . seeing the person you are phoning."

● ● ●

Robert W. Galvin, president of Motorola, has received a citation in recognition of his service to physically handicapped workers. This award, was presented by Dwight D. Guilfoil Jr., president of Paraplegics Manufacturing Company, Inc., on behalf of his fellow employees . . . who have received more than one hundred thousand hours of employment, as a result of Mr. Galvin's interest in their "self-help" enterprise. In accepting the award, Mr. Galvin told these workers assembled, in Paraplegics' plant at Franklin Park, that their workmanship has well exceeded industry standards, proving that the physically handicapped worker can with properly designed set-ups . . . be fully productive.

● ● ●

The Electronic Industries Association said in defending the nation's radio and television serviceman against charges of unethical practices which appeared in articles written for two nationally-circulated magaziens, that the "vast majority of these people are sound, ethical businessmen and are technicaly competent." EIA said it deplores the type of pubicity which places emphasis on the "comparatively rare but more sensational examples of unethical practice," instead of "praising the less newsworthy but vast majority of competent, honest service." ■ ■

The Work Bench

by Paul Goldberg

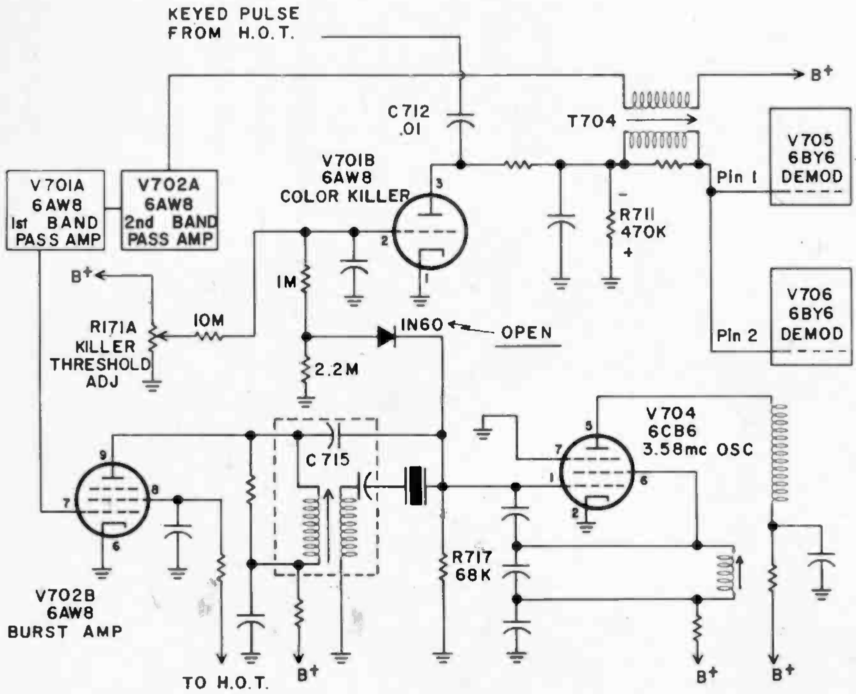


Fig. 1—Partial schematic of the RCA CTC5N color receiver.

This is the first in a series of Workbench articles on color receivers. A thorough knowledge of color circuitry is necessary to solve these problems.

RCA Color Receiver CTC5N (Fig. 1.)

The receiver was turned on and it was noted that there was no color on the color channel, but that black and white reception was normal. In other words this receiver showed the color transmissions in black and white. First those tubes effecting the total color signal were replaced individually. V701A & B, the 1st bandpass amplifier and color killer was replaced, but had no effect. V702A & B, the 2nd bandpass amplifier and burst amplifier was next replaced, but had no effect. From a study of the schematic it was seen that the negative voltage from the grid of V704, the 3.58 *mc* oscillator, is fed back through the 1N60 crystal diode rectifier to the grid of the color killer tube. The output of the burst amplifier is fed to grid of V704, through capacitor *C715*. The negative voltage developed across *R717* by grid leak action is enough to cutoff the color killer tube, V701B. With no plate current flow, there is no negative voltage drop across the color killer tube's plate resistor *R711*. The voltage developed across *R711* is fed through T704 to the grids, of the demodulators, V705 and V706. During the color transmission the demodulators conduct while during black and white transmission V705 and V706 are biased to cutoff by the negative voltage developed across *R711*. With these facts in mind V704, the 6CB6 3.58 *mc* oscillator, was replaced but had no effect. *R171-A*, the killer threshold adjustment, was varied but had no effect. This control adjusts the point at which the demodulators will be cutoff. A voltage check was next made at the plate of the color killer tube, V701B. The meter indicated about 23 volts negative. The color killer tube was therefore conducting. The voltage was next checked at the grid of the color killer tube. Here the voltage measured was around zero. Following through, the voltage was next measured at the control grid the 6CB6, 3.58 mc oscillator. The voltage measured at this point was about 10 volts negative. Obviously this—10 volts was not reaching the killer tubes control grid. The 1N60 is utilized to allow only dc voltage to trigger the killer tube. The 1N60 was naturally a most probable suspect. It was resistance checked and found to be open. A new 1N60 was installed. The killer threshold was adjusted by selecting a channel that was blank and setting *R171A* at a point where no colored streaks or snow appeared in the raster. A color channel was next selected and the color came through fine. Turning the channel selecter to the blank channel and then the color channel we determined that R171A was set correctly. The receiver was then checked both on color, and black and white channels and was found to be functioning properly.

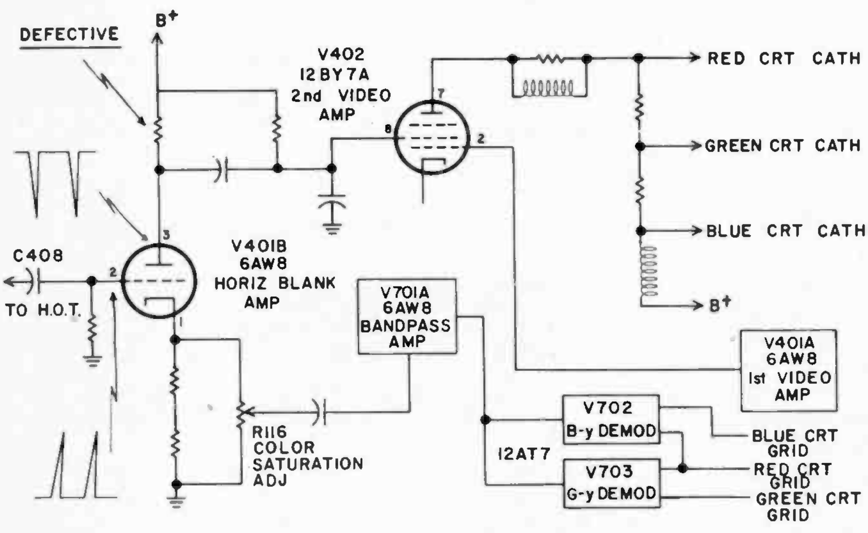


Fig. 2—Partial schematic of the RCA CTC5 color receiver.

RCA Color Receiver CTC5 (Fig. 2.)

This receiver was turned on and the black and white pictures were satisfactory, but on color channels there was a wide green vertical area on the left hand side of the raster. Now in all color receivers the beams of the three guns are blanked out dur-

[*Continued on page* 31]

ANSWER MAN

Mr. Answerman:

I had a receiver in which the horizontal output tube failed. I replaced the tube in the customer's home and went on my way. Several days later I received a call that the picture shrunk slowly in width. I replaced the tube again. The picture came in full size so I left. The next day I received another call from the same customer. The same trouble still existed. To make a long story short, I pulled the chassis and have been working on it for quite a while. The damper and horizontal oscillator tubes, the boost condenser and all other important resistors and condensers have been checked and most even replaced but to no avail.

Have you any suggestions?

J. C.
Chicago, Ill.

Frankly, the most logical culprit to cause this type of trouble is the horizontal output tube. Bad tubes are certainly not impossible. Just because they come in a shiny new box gives no guaranty that the tube will work properly. There have been runs of tubes that were not up to specifications.

It may be that several in the latest quantity of these tube that you purchased are not so good. It is suggested that you try several of this same type of tube made by a different manufacturer in this receiver, and see if they work the same way. Many technicians operate on the premise that if one new tube does not correct the problem the trouble is under the chassis and they immediately dig into its guts. In troubles that are so typical of tubes certainly more than one should be tried first.

Dear Answerman:

I have a customer with one of the new 110 degree deflection picture tubes. The horizontal deflection is narrow and the picture does not fill the tube fully. I realize that the line voltage is on the low side in this customer's home and that this is most probably the cause.

What do you suggest as the best way to expand the width under the low line voltage conditions? The receiver is an Emerson chassis 120380-h.

H. T.
Riverhead, Long Island

This condition frequently is encountered in small towns in rural areas. Fortunately, the receiver contains a means of correcting for this possibility, low line voltage. A resistor, *R85* in the screen circuit of the 12DQ6A horizontal output tube (*see Fig. 1*) can be shorted out, thus increasing the screen voltage and thereby, the width. The resistor is positioned on a terminal strip near the 6CG7 vertical oscillator tube and is accessible without removing the chassis from the cabinet.

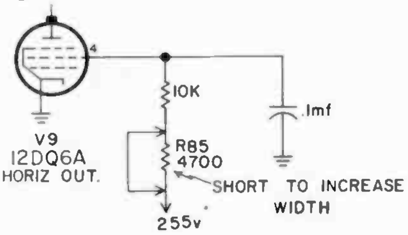


Fig. 1—Horizontal output tube screen circuit width jumper

Answerman:

I have a Magnavox chassis 73 which exhibits hum in the audio. The hum does not sound quite like 60 cycles but a little higher in frequency as though it was 120 cycles. The receiver has been checked over quite thoroughly but the cause hasn't been found. Have you any case histories on this complaint in this receiver.

L. D.
Brooklyn, N. Y.

The hum encountered is most probably due to *R502*, a 680 ohm resistor having decreased in value or shorted. This component and the associated audio circuit is shown in *Fig. 2*. The result of the resistor decreasing in value is that a 120 cycle-per-second pulse is fed from the power supply into the audio circuit and thus heard at the output.

Mr. Answerman:

I have a TV receiver that has critical tuning with interference beat patterns in the picture. I replaced the tuner but the trouble still exists. Have you any ideas as to the cause? I know it is in the receiver because it performs in the same manner on my shop bench using an antenna that works fine on all the other sets.

A. F.
Cleveland, Ohio

A seldom considered cause of this type of problem is the tube and other shields such as the *if* strip covers, etc. Many TV servicemen regard these items quite lightly. A shield that makes poor contact with the chassis ground or the fact the shield is missing can be the reason for many types of picture beat patterns and audio troubles. Interference patterns, the result of oscillation in the *if* circuitry can be caused by a missing, loose or rusty shield that does perform its function. It is always a wise policy to check that grounding springs make good contact to the shield in all cases of beats in TV picture that do not originate outside the receiver. If the receiver employed a shield over the video detector crystal it should be in place, otherwise this can easily be the source of interference radiation, although in this particular case

[*Continued on page* 29]

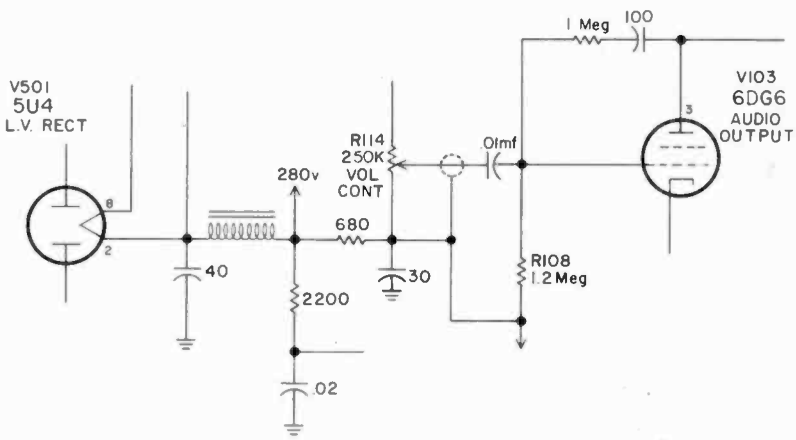
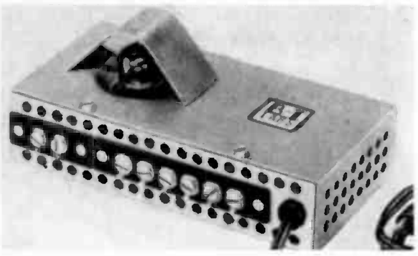


Fig. 2—Partial circuit of Magnavox 73 supply and audio stage.

NEW PRODUCTS

The Triplet Instrument Company has made available two new volt-ohm-milliammeters, models 630 PL and 630 APL. Both meters feature a single selector switch for function and range with an off position for shorting out the meter. They also provide a polarity reversal switch. The *dc* voltages range from 2.5 volt scale to 5000 volts at 20,000 ohms per volt. The *ac* scales range from 3 to 5000 volts at 5,000 ohms per volt. The ohmmeter reads from .1 of an ohm to 100 megohms in four scales. The current range is from 10 *ma* to 10 amperes. Model APL features a mirror backed scale for elimination of parallax error and also ½% precision resistors.



Blonder-Tongue Laboratories, Inc. of Newark, New Jersey, announces the production of Model B-23 Two-Set Booster. This all channel broadband amplifier permits operation of two or three TV receivers from one antenna. The unit amplifies signals on one, two, or three sets, even when all sets are in operation at the same time. Model B-23 outperforms non-powered couplers by more than two to one. It is a one-tube amplifier that will bring in sharper, clearer pictures on the VHF channels. There is no interaction between operating receivers. Installation is simple; only a screwdriver is needed to make the connection between the antenna and the TV sets. The unit can be mounted out of sight or at the rear of one of the receivers, and is designed for continuous operation.

The new "Music Minder" Switch, featuring automatic shut-off of the entire high fidelity system after the last record is played, is now being marketed by CBC Electronics Co., 2601 N. Howard Street, Philadelphia, Pa. This new unit makes it possible for the listener to place a stack of records on the record changer and leave the system completely unattended. At the conclusion of the last record, a relay is actuated and the entire system is shut off. Music lovers, who enjoy listening to music after retiring at night, can now do so without fear of falling asleep or having to get out of bed to turn off the high fidelity system. Should the user not wish to use the automatic feature, the switch can be set on the "manual" position. In this position the automatic feature is inoperative.

A new battery eliminator in kit form has been announced by the Paco Electronics Company, Inc., a newly formed division of the Precision Apparatus Company, now celebrating its 25th anniversary. The unit features a self-contained, special low-ripple L-C filter output (0.3% maximum ripple) designed to power modern transistor circuits. The Paco Model B-10 battery eliminator kit features both 6 and 12 volt outputs, automatic overload protection, continuously variable voltage output, a heavy-duty, louvred steel cabinet and a two color panel. It doubles as an ideal battery charger. Detailed information on the entire Paco line may be obtained from Paco Electronics Co., Inc., a division of Precision Apparatus Co., Inc., 70-31 84th Street, Glendale 27, L.I., N.Y.

Service Instruments Corp. (Sencore) of 171 Official Rd., Addison, Illinois has announced a new tester called a "Fuse-Safe Circuit Tester." The unit is designed to check either *ac* currents, *dc* currents or a combination of both. This is neces-

[*Continued on page* 30]

Mfr: Emerson **Chassis No.** 120322 120329 120323 120330

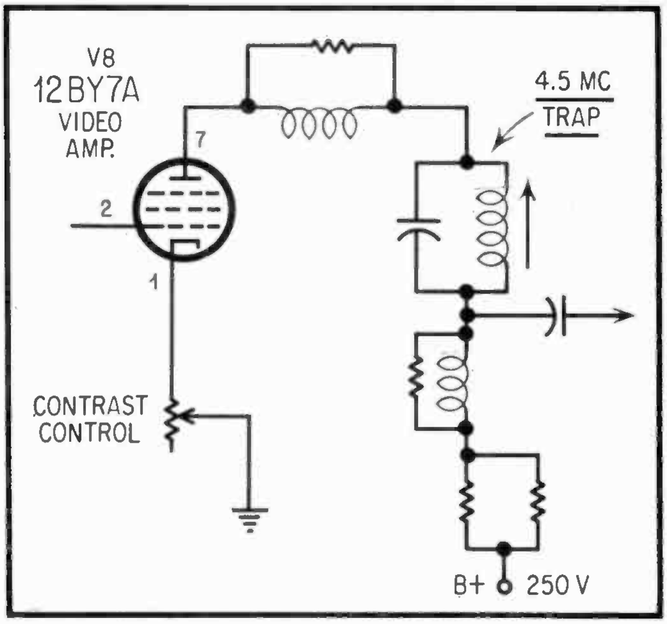
Card No: EM-120322-1

Section Affected: Video.

Symptoms: No picture.

Cause: Open 4.5 *mc* trap winding eliminating plate voltage from V8.

What To Do: Repair break in coil or replace 4.5 *mc* trap.



Mfr: Emerson **Chassis No.** 120322 120329 120323 120330

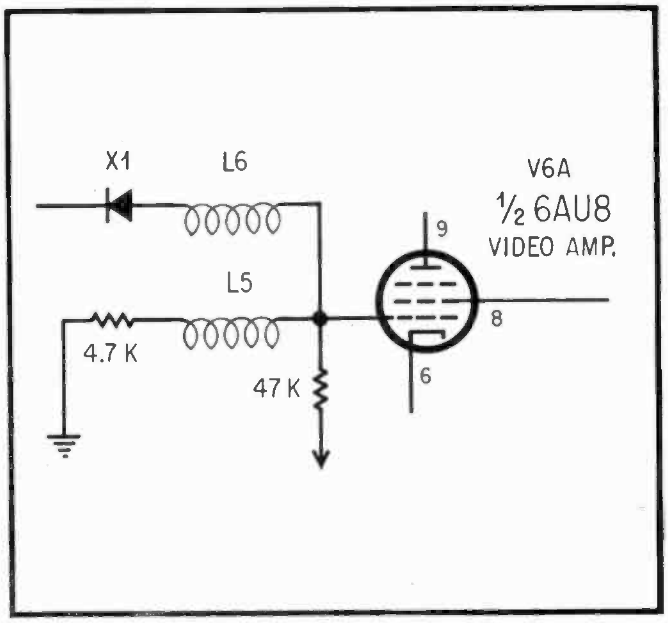
Card No: EM-120322-2

Section Affected: Picture and sound.

Symptoms: No picture, no sound, raster normal.

Cause: Open video detector shunt peaking coil *L5* (500 *μh*).

What To Do: Replace *L5*.



Mfr: Emerson **Chassis No.** 120322 120329 120323 120330

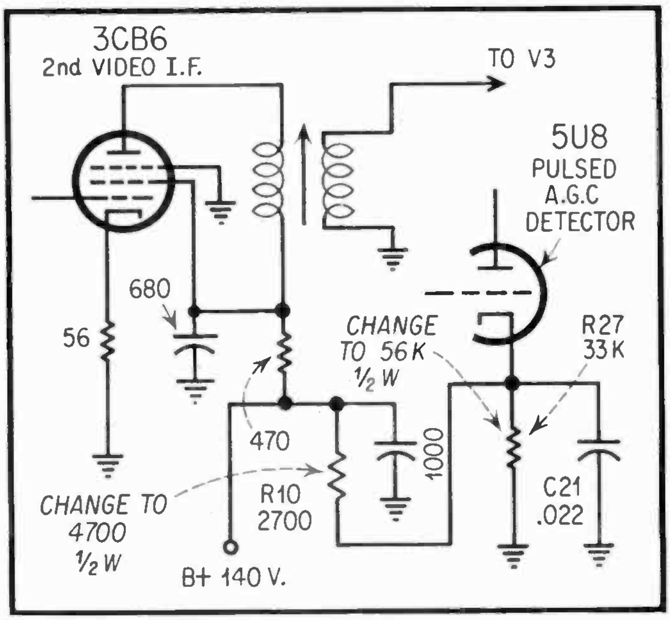
Card No: EM-120322-3

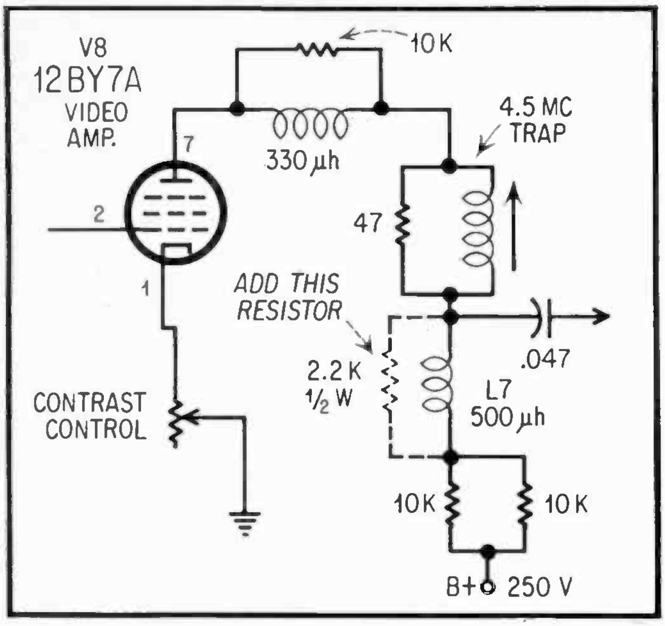
Section Affected: Pulsed *AGC* detector.

Symptoms: *R27* 33K cathode resistor overheats.

Cause: Component value tolerances. Note: Chassis incorporating this change have been coded (A).

What To Do: Change the value of *R27* from 33K ½W to 56K ½ watt. Also change the value of *R10* from 2700 ohms ½W to 4700 ohms ½ watt. *R27* is located on the audio video board and *R10* under the *if* plate.





Mfr: Emerson

Chassis No. 120322, 120329, 120323, 120330

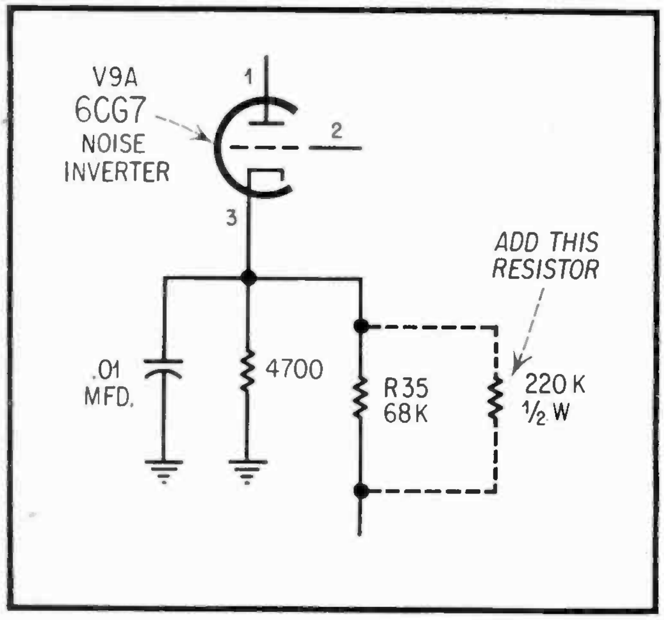
Card No: EM-120322-4

Section Affected: Video.

Symptoms: Video ringing (close spaced double images).

Cause: Video peaking in set could cause video ringing.

What To Do: Shunt the video amplifiers (12BY7A) shunt plate peaking coil (L7 500 *µh*) with a 2.2K ohm ½W resistor.



Mfr: Emerson

Chassis No. 120322, 120329, 120323, 120330

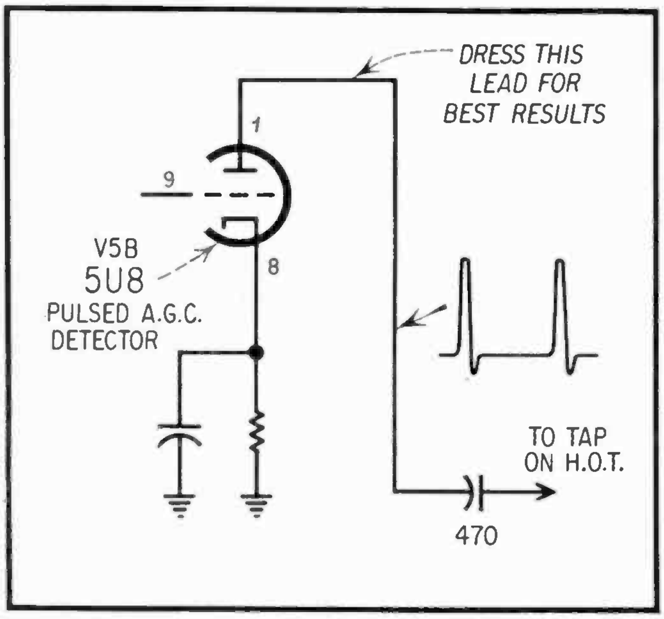
Card No: EM-120322-5

Section Affected: Horizontal.

Symptoms: Poor pull-in range of horizontal oscillator especially noticeable when switching channels.

Cause: Lowered amplitude of the *agc* pulse from the horizontal output transformer.

What To Do: Shunt R35 68K cathode resistor of the noise inverter with a 220K ½ watt resistor to compensate for lowered pulse.



Mfr: Emerson

Chassis No. 120322, 120329, 120323, 120330

Card No: EM-120322-6

Section Affected: Horizontal.

Symptoms: Horizontal pulling and/or bending.

Cause: Radiation of *agc* pulse from the horizontal output transformer to other sections of sound and video board.

What To Do: Dress lead to pin #1 of V5, 5U8 pulsed *agc* detector away from board and leave in position which eliminates trouble. If further improvement is desirable try several 5U8 tubes.

Mfr: Zenith **Chassis No.** 17Z22Q

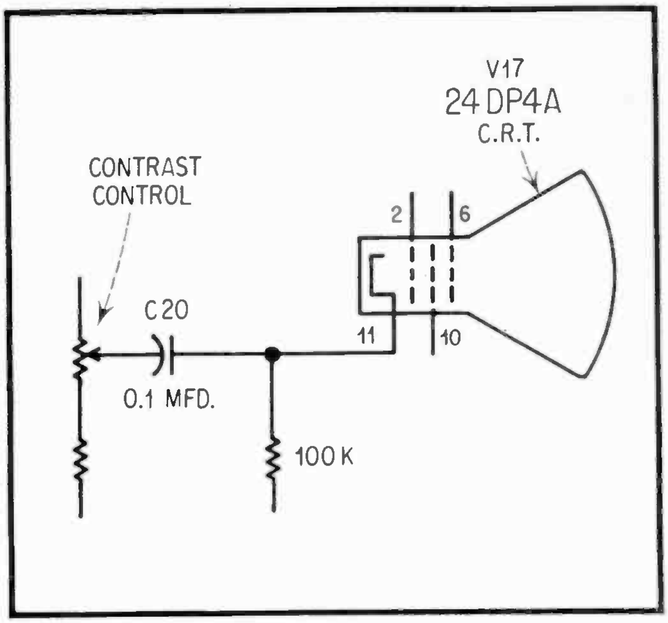
Card No: ZE-17Z22Q-1

Section Affected: Raster.

Symptoms: No raster.

Cause: Shorted *C20*—placing large positive voltage on cathode, cutting *crt* off.

What To Do: Replace *C20, .1 mf,* 600V.



Mfr: Zenith **Chassis No.** 17Z22Q

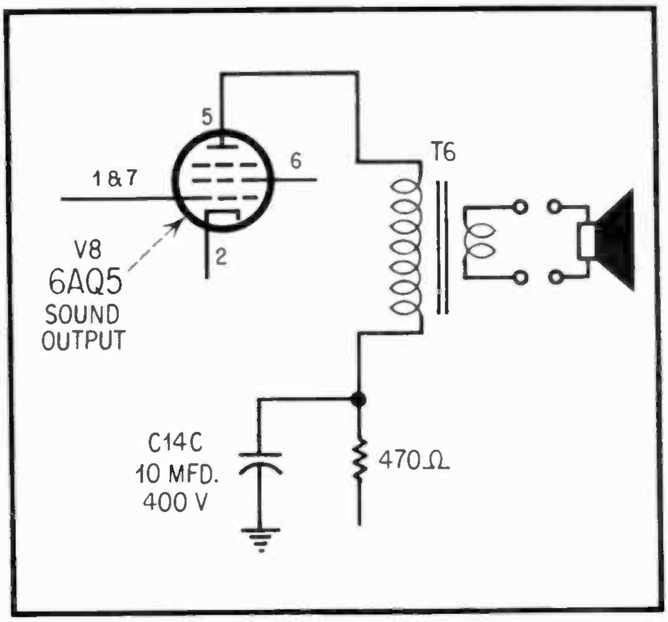
Card No: ZE-17Z22Q-2

Section Affected: Sound and picture.

Symptoms: Sound bars in picture and growling sound.

Cause: Leaky or reduced capacity of *C14C*.

What To Do: Replace *C14C, 10 mfd,* 400V.



Mfr: Zenith **Chassis No.** 17Z22Q

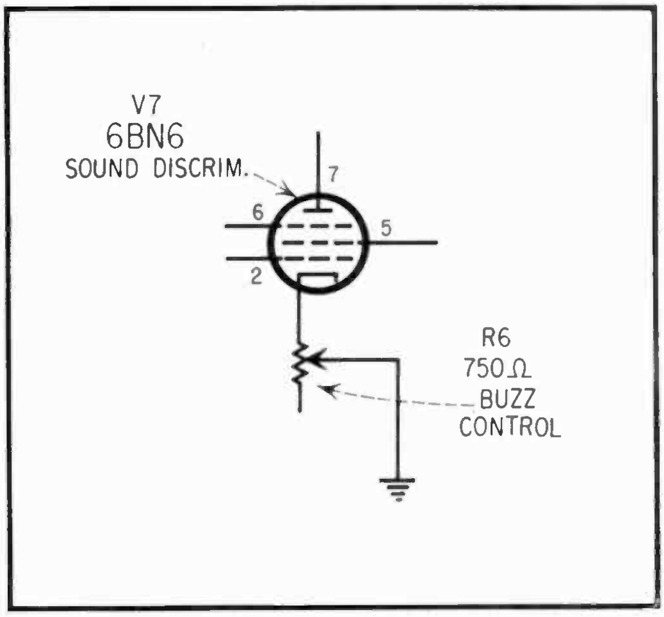
Card No: ZE-17Z22Q-3

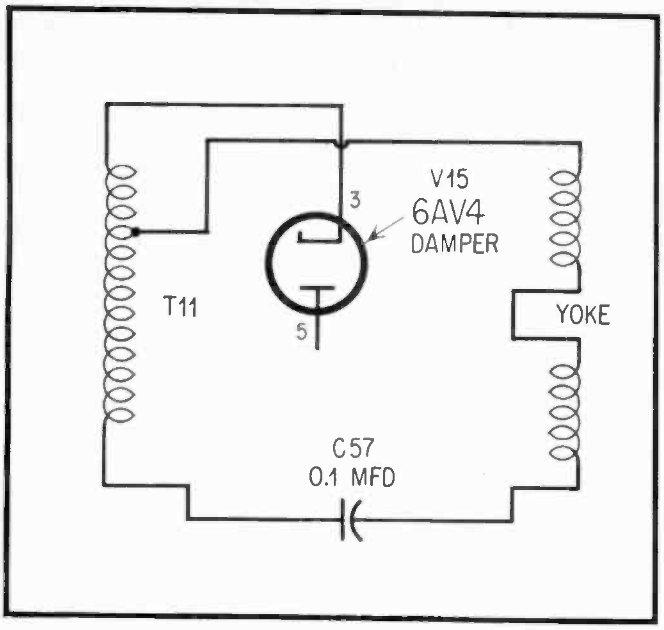
Section Affected: Sound.

Symptoms: Intermittent buzz.

Cause: Leakage from *R6* to ground.

What To Do: Replace *R6,* 750 ohm buzz control.





Mfr: Zenith **Chassis No.** 17Z22Q

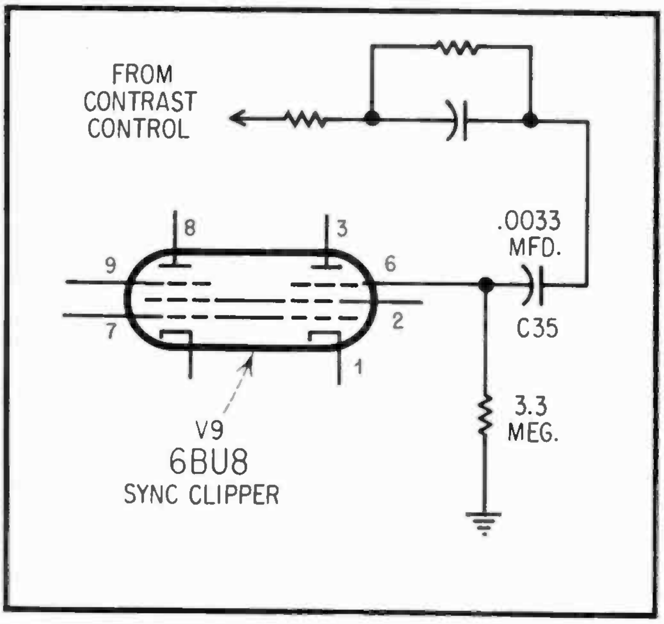
Card No: ZE-17Z22Q-4

Section Affected: Raster.

Symptoms: White vertical line down center of screen.

Cause: Shorted *C57*.

What To Do: Replace *C57, .1 mf* 600V.



Mfr: Zenith **Chassis No.** 17Z22Q

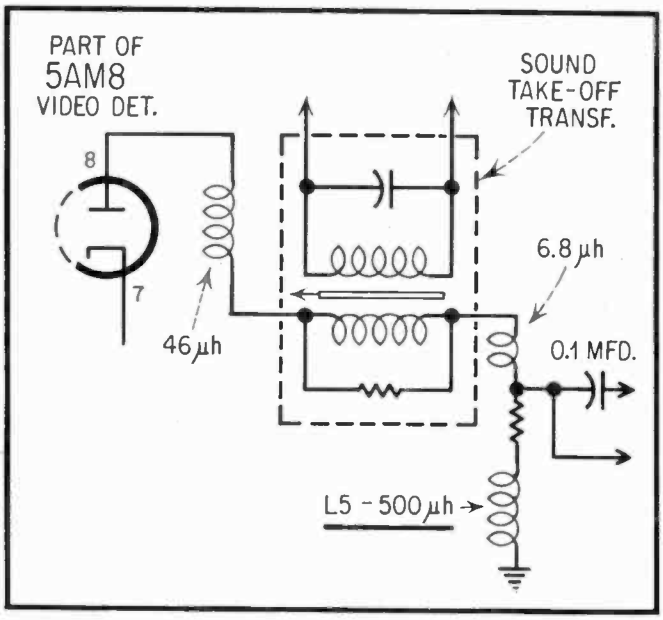
Card No: ZE-17Z22Q-5

Section Affected: Sync.

Symptoms: Vertical roll and horizontal tear.

Cause: Leakage through *C35* upsetting bias voltage.

What To Do: Replace *C35, .0033 mfd* 400V.



Mfr: Zenith **Chassis No.** 17Z22Q

Card No: ZE-17Z22Q-6

Section Affected: Sound and picture.

Symptoms: No sound, no picture.

Cause: Open *L5* peaking coil.

What To Do: Resolder pig tails on coil. If this does not help replace *L5* (*325 mh.*)

TROUBLE

[*from page* 17]

ting determines if the fault is present on one channel or common to all channels. Examining the raster on an inactive channel is helpful in determining if there is a raster deformity which may point to a defect in the horizontal sweep circuit.

Horizontal Range

Varying the rear-panel horizontal range trimmer is important for two reasons. In the first place, the loss of horizontal sync may simply be due to aging of circuit components to a point where the hold control cannot compensate for the frequency change. The aging process is usually gradual over a period of time, with the hold control requiring more frequent resetting. When the complaint is a sudden loss of horizontal sync, it is not likely to be caused by aging circuit components.

Secondly, even if the fault cannot be corrected by adjustment of the horizontal range trimmer, the effect on the horizontal sync as the control is rotated very often provides valuable clues to the source of trouble.

Where there is some indication of both vertical and horizontal sync instability, the sync control should be varied to check the effect on the sync condition. Overcontrasty or weak video points to a possibility of an *agc* fault and the *agc* control should be varied to check the operation of this circuit.

3. b, c

Loss of signal input to the sync amplifier stage usually affects both horizontal and vertical sync. A defective horizontal oscillator would probably not permit even momentary horizontal sync by rotating the coarse horizontal frequency controls. A defective horizontal output stage generally does not affect the frequency and in addition usually affects the raster and/or high voltage. The action of the horizontal range trimmer points to either a loss of horizontal sync pulse input to the horizontal *afc* circuit or to a defective *afc* stage.

In checking the operation of the horizontal range trimmer, the horizontal hold should be left in the center of rotation and the initial position of the trimmer should be marked before making any adjustment. This will permit returning to the original position if desired.

The control is turned in the direction to reduce the number of slanting blanking bars. Horizontal blanking

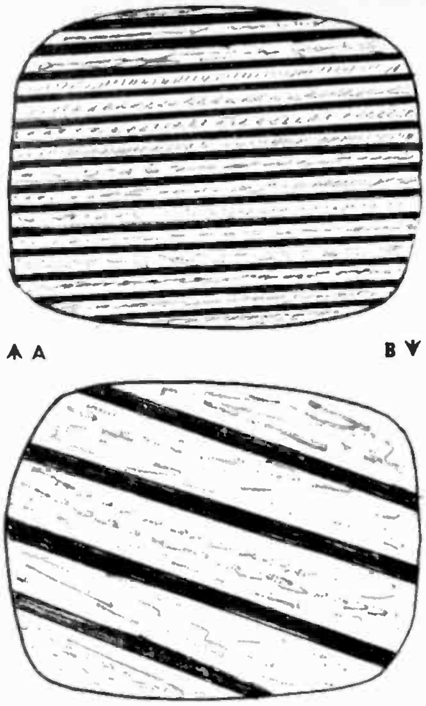


Fig. 2A—Blanking bar angle when frequency is low. 2B represents a higher frequency.

bars slanting down to the right indicate the horizontal sweep frequency is too high; to the left, the frequency is too low (Fig. 2). If the number of blanking bars is reduced by rotating the trimmer but the picture cannot be brought completely into sync, the coarse horizontal frequency control (ringing coil adjustment) should then be varied. If the picture is brought into sync by these two controls and remains fairly well in sync on all active channels with the horizontal hold having normal or almost normal range of control, this indicates a horizontal circuit realignment is all that is necessary for normal operation. The alignment should be performed in accordance with the manufacturer's specifications.

AFC Defects

In many cases, the picture can be momentarily brought into sync by

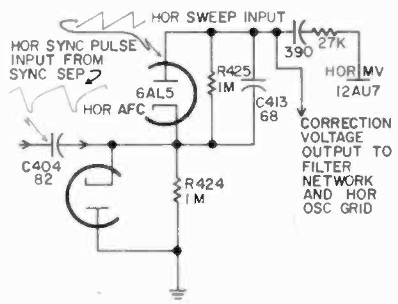


Fig. 3—AFC circuit waveforms.

rotation of the horizontal range trimmer. This indicates the horizontal oscillator is capable of reaching the correct frequency If the picture keeps drifting out of sync after this adjustment, this usually points to a fault in the horizontal *afc* circuit which prevents this circuit from performing its function of keeping the horizontal oscillator synchronized at the correct frequency. The horizontal oscillator normally can hold the correct frequency only momentarily if the horizontal *afc* circuit is not functioning properly.

If the horizontal range and ringing coil controls have little effect in changing or stabilizing the horizontal frequency, this usually points to a defect in the horizontal sweep circuit.

4. e

On the basis of the *dc* voltage readings, the trouble is a leaky *C415*. The *dc* voltage readings with the horizontal *afc* tube in the socket were rather misleading. With the tube in, the higher reading on the cathodes (pins 1-5) compared to the plate (pin 7) was caused by a pulsating *dc* signal component at the cathodes (see Fig. 3) which was added to the *dc* voltage present. Without the pulsating *dc* component and with only a positive *dc* voltage applied to the diode plate (pin 7), the diode cathode (pin 1) would have practically the same potential as the plate because the tube would conduct steadily and the drop across the tube would be negligible.

Circuit Analysis

Analysis of the circuit action clarifies the reason for the higher cathode voltage. Diode 2 (pins 2-5) acts as a clamping diode. Incoming horizontal sync pulses through *C404* are developed across *R424* as pulsating *dc* signals instead of *ac* signals. On negative alternations, the cathode is negative with respect to the plate and the diode conducts, acting as a short across *R424*. On positive alternations, the cathode is positive compared to the plate, the diode doesn't conduct and these signals appear across *R424*. The positive pulsating *dc* voltage developed by the incoming signals is added to the steady *dc* voltage at the cathode. With the *afc* tube in, therefore, and *C415* leaky, the cathode voltage (pins 1 and 5) is higher than the plate voltage at pin 7.

Pulling out the tube eliminated the pulsating *dc* component, giving a clearer picture of the *dc* voltage distribution in the circuit and pinpoint-

[*Continued on page* 28]

MORE TROUBLE

[*from page* 27]

ing the trouble (see Fig. 4). The lower positive voltage now measured at pins 1-5 (junction of *R424* and *R425*) compared to the voltage at pin 7 (junction of *R425* and *C415*) showed the direct current path was from ground through *R424*, *R425*, a leaky *C415* and *R426* to the plate of the horizontal oscillator. The voltage divider also includes a parallel path as shown in Fig. 4.

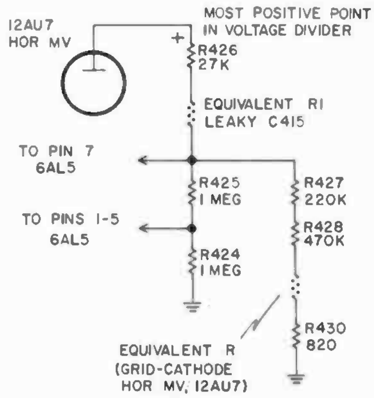


Fig. 4—Equivalent plate circuit when C415 is leaky.

A leaky *C404* would cause a *lower* positive *dc* voltage on pin 7 as compared to pins 1-5 with the tube out. The horizontal oscillator grid (pin 2) would draw current and there would be a current path from ground through the cathode-grid circuit of the tube, *R428*, *R427*, *R425* and the leaky *C404*. The voltage at pin 7 (junction of *R427* and *R425*) would be closer to ground (less positive) than the voltage at pins 1-5 (junction of *R425* and *C404*) as shown in Fig. 5. The

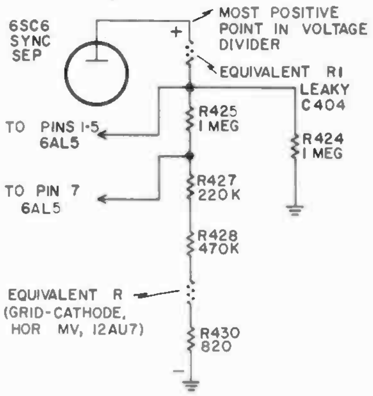


Fig. 5—Equivalent plate circuit when C404 is leaky.

voltage divider also includes a parallel path (*R424*) as indicated in Fig. 5.

A change of value of *R425*, shorted *C413* or shorted *C418* could not account for the abnormal voltage.

ANSWERMAN

[*from page* 21]

it probably isn't the cause of the interference. A more probable cause can be the omission of the *rf* amplifier shield or a poor ground connection. In some instances the tube socket grounding spring has been soldered to the tuner so as to be certain of a good connection. ■ ■

Dear Sir:

An RCA receiver of the 8-PT-7030 series that I am servicing has a vertical bounce to the picture. I have checked everything that I believe could possibly cause this, except one component and that is the vertical output transformer. I suspect it has shorted turns and therefore I intend to substitute another for it if you agree that the transformer is at fault. Can the vertical output transformer cause this trouble?

N. S.
Washington, D. C.

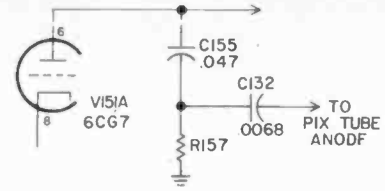


Fig. 3—Circuit modification to reduce vertical jitters.

Vertical output transformer can be the cause of vertical bounce or jumping as well as intermittent vertical collapse, poor linearity, insufficient height and other vertical troubles. However, before you replace the transformer it is suggested that resistor R157 as shown in *Fig.* 3 be changed from 15,000 ohms to 8200 ohms. This change has been made in later models to eliminate some of the aforementioned troubles. ■ ■

Servicing Hints

Some quick checks can often help to localize the cause of complete loss of horizontal sync.

First, to determine if the trouble is in the horizontal oscillator, the horizontal *afc* or a preceding stage, short the horizontal oscillator grid (pin 2) to ground with a screwdriver. This shorts out the correction voltage input to the horizontal oscillator but at the same time shorts out any incorrect voltages or spurious signals caused by trouble in a preceding stage. Then note if the horizontal hold control can bring the picture into horizontal sync momentarily or close to horizontal sync. If so, the horizontal oscillator is probably good and the trouble is most likely in the horizontal *afc* or a previous stage.

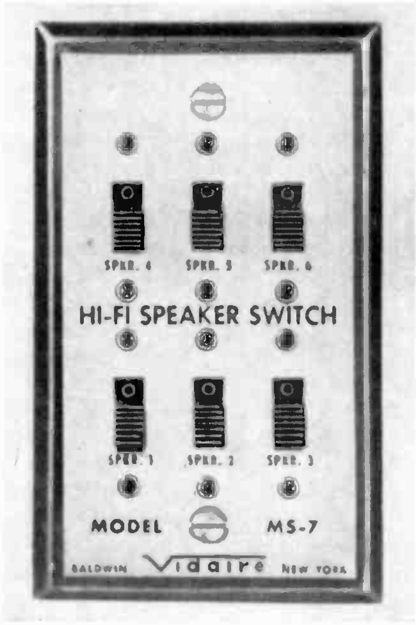
If the picture can't be synchronized or almost synchronized with the grid shorted, and the horizontal hold seems to have little effect in bringing the picture closer to horizontal sync, the trouble is probably in the horizontal oscillator stage.

Second, if the horizontal oscillator seems good on the basis of the first step, short the input to the horizontal *afc* circuit (pins 1-5, horizontal *afc* stage). If the horizontal circuit can again be synchronized momentarily or brought close to sync by rotating the horizontal hold control, this indicates defective horizontal sync pulses are being applied to the horizontal *afc* stage and the trouble is before this stage. If the picture can't be synchronized momentarily or brought close to sync, this indicates trouble in the horizontal *afc* circuit. Circuit variations in some models may make this second step inconclusive and additional steps such as oscilloscope checks may be required to further localize the fault. After the approximate trouble area is localized, voltage and resistance readings usually expose the defective part. ■ ■

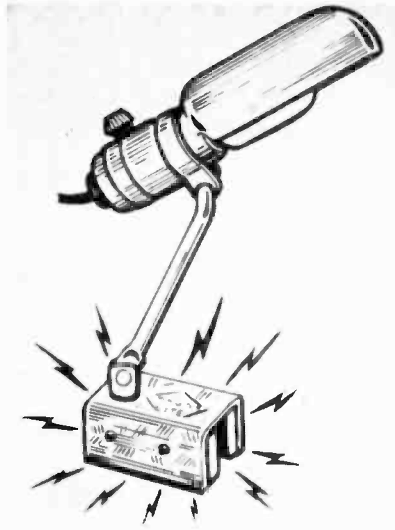
NEW PRODUCTS

[*from page* 30]

sary for fuse resistor circuit checks. According to the company, this is the first tester designed for this purpose and they point out that most service type meters do not have *ac* current measurements and none will read a combination of both *ac* and *dc* current. The FS3 is connected in place of a fuse, fuse resistor or circuit breaker to test leads and automatically indicates whether or not it is safe to make a replacement. Separate scales are provided for each value fuse resistor. Each scale is green up to the maximum current used by TV manufacturers and red beyond that point. The unit also provides line current and power readings by plugging the receiver into the tester and the tester into the powerful receptacle. A zero to 10 ampere range is provided for these checks. The tester reads up to 1100 watts at 115 volts. A 5 ohm, 10 watt resistor is wired in series with the meter on fuse resistor checks to prevent circuit damage and to stimulate operating conditions.



Vidaire Electronics Mfg. Corp., of Baldwin, L.I., announces the addition of a six position speaker selector to their line of audio accessories, Model MS-7. Six slide switches are mounted on a polished brass embossed wall plate for installation on a standard wall box or panel. Any combination of six speakers may be selected with a constant impedance maintained at the amplifier. Any size or impedance of speakers may be used with the MS-7. It is ideally suited for PA or intercom installations.



A help to the TV and Radio Serviceman is the new Magna-Lite, recently developed by R-Columbia Products Co., Inc., Highwood, Ill. This firm known for its Serviceman-Designed Products has long felt that a new and different type of service light was needed by the trade. They feel that their new Magna-Lite answers this need. The magnetic base allows this light to be placed on any metal surface without danger of falling and the specially designed flexible-joint arm gets the light where you want it, even under its own base. Available in two models, Model 300 with Standard Shade and Plug and Bulb, and Model 350 with Flood Shade and Standard Plug (less Bulb), this new product can be had for $3.95 Dealer Net. Write manufacturer for further information.

WORKBENCH

[*from page* 20]

ing horizontal retrace periods. This is accomplished in this receiver by applying negative going horizontal blanking pulses to the screen grid of the 2nd video amplifier V402, a 12BY7A. These pulses produce positive going pulses in V402's plate circuit, which is direct—coupled to the cathodes of the picture tube. This all takes place during the horizontal retrace period. If the horizontal blanking pulses are missing at the screen of V402, then during the reception of color signals, the demodulated burst signals, which are present at the grids of the picture tube in this model will appear in the picture as a wide green vertical area near the left hand side of the screen. This area is green because when the hue control is adjusted to obtain correct hues in the picture, the demodulated

[*Continued on page* 33]

[Transistor Radio-Servicing from page 7]

TROUBLE	POSSIBLE CAUSE	
I. Dead receiver	b. DC Supply circuit defective	2. Check voltages at base, collector and emitter of each transistor. Abnormal voltage at any of these points indicates a defect in that particular circuit which causes excessive current drain. For example if C206, C210, C211, C22, C213, C214 or 215 shorted, voltages, as above, will be abnormal. An abnormally high positive voltage at the collector (PNP type transistors) indicates that the transistor itself is fused (provided forward bias between base and emitter is normal). Abnormally low positive voltage at collector of NPN type transistor indicates a fused condition if forward bias between emitter and base is normal.
		3. If current drain is zero check on-off switch for open.
	c. Audio Output stage defective	1. Inject an audio signal at base of 2N291 transistor. If signal is passed, stage is functioning.
		2. If not functioning check for possible open jack, open speaker or open output transformer.
		3. Check voltages at base, emitter, and collector of transistor for correct bias voltages. If biasing is incorrect, check circuit resistances (should be within 10% of rating). If transistor is fused the current through the transistor will be excessive and an abnormally large positive voltage will appear on the collector. (See b2 above.)
		4. Check C213 for open condition by paralleling with known good capacitor, also check for possible short by removing one side from circuit and measuring resistance. Check C216 in a similar manner.
	d. Driver stage defective	1. Inject an audio signal at base of the 2N238 transistor. If signal is passed, stage is functioning.
		2. If not functioning check voltages of driver transistor as in c3 above.
		3. Check C211, C212 and C210 in a manner similar to step c3 above.
	e. Detector defective	1. Check the resistance of the diode with one side removed from the circuit. The forward resistance should be approximately 40 ohms and the backward resistance approximately 600K ohms.
		2. Check voltage at junction of R212 and R210; should be .15 volts. If not present check C209 for short. If output voltage of crystal is excessively positive the *if* amplifiers are probably oscillating. In this case see section IV below.
	f. IF amplifier stage defective	1. Check *if* stages by signal injection. Set signal generator to 455*kc*. Inject signal at base of 2nd *if* transistor through a .005mfd capacitor. Keep generator output as low as possible. If signal is passed, stage is operating. Repeat this procedure for the 1st *if* amplifier stage.
		2. Check the voltages at elements of transistors as in step c3 above.
		3. Check the *if* transformers for opens, shorts or shifting of frequency.
	g. Converter stage defective	1. Check by signal injection. Set generator to a frequency near 550*kc* and inject signal by forming a 4 or 5 turn loop of wire and placing it near the antenna loop (see *Fig. 2*). Rotate the variable tuning capacitor near the fully closed position. Keep generator output as low as possible. If signal is passed, stage is operating.
		2. Check the voltages at elements of transistor as in step c3 above.
		3. Check local oscillator operation as in II-b below.
II. Noise with no signal	a. Weak battery	1. Replace battery. Check current drain; if excessive proceed as in I-b above.
	b. Local oscillator defective	1. To check oscillator measure the voltage across R203; it should read—1.4 volts. Short out oscillator coil (from ground to terminal #1 of osc. coil) and if the voltage increases the oscillator is working. If there is no change the oscillator is not operating.
		2. To check the oscillator frequency place the radio near a known good receiver. Turn good receiver on and set it to the highest station receivable. Now rock the dial of the defective radio about a frequency 455*kc* below the station frequency. If oscillator is operating a whistle will be heard from the known good receiver every time the signals beat together. The calibration of the entire low end of the band may be checked in this manner.
		3. If the oscillator is dead check voltages as in I-c-3 above.

[Continued on page 34]

WORKBENCH

[from page 31]

burst signals are negative going on the red and blue grids and positive going on the green grid. The green beam current increases due to a positive green grid while the negative blue and red grids decrease their respective beam currents. Keeping these facts in mind, V401A & B, 6AW8, blanking amplifier and 1st video amplifier was replaced but had no effect. The color saturation control was next adjusted in order to see the green left side better. A waveform check was made at the control grid of the horizontal blanking amplifier, V401B. The waveform was correct. This is the pulse that is tapped off a winding on the horizontal output transformer and fed to pin #2 through *C408*. A waveform check was next made at the plate of V401B. This waveform was not correct. It was much too small. A voltage check was made at this plate and the meter read about 295 volts instead of about 270 volts. The circuitry was next examined. It was noted that the plate load resistor, *R421*, was burned badly. A resistance check of this resistor showed its value to be 300 ohms instead of 3.9K. *R421* was next replaced, and the receiver now functioned properly. As no leaky condensers could be found, the 6AW8, V401A & B was replaced as a precautionary measure against further trouble of this kind. ■

MULTI-SET COUPLERS

[from page 11]

pickup and help dissipate static charges.

There are several bifilar coil couplers available utilizing printed circuit techniques. Two such couplers together with their printed circuits are shown in *Fig. 6*. The printed circuits consist of two bifilar coils of copper ribbon uniformly wound on a Fiberglass support. Each coil has a characteristic impedance of 150 ohms and they are so adjusted as to compare to a transmission line cut to one-fourth wavelength at channel 5.

One manufacturer (Snyder) uses a special three wire cable as a resonant transmission line section. In order to reduce its physical length and still maintain the required electrical length for channel 2, the cable is wound into

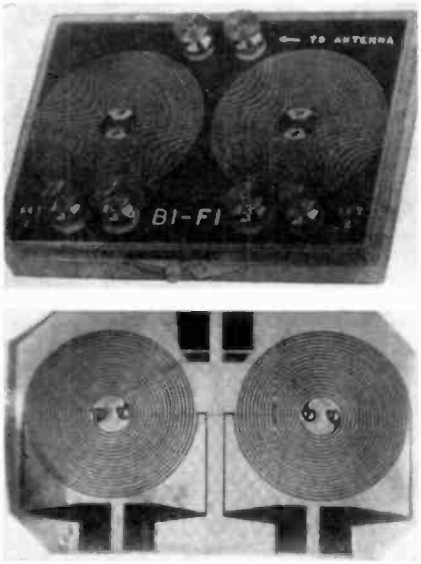


Fig. 6—Printed circuit bifilar two set coupler.

two coils which are housed within the plastic coupler case. This coil arrangement utilizes capacitive and inductive effects between the individual wires to achieve the desired broad band coverage of all *tv* and *fm* channels.

Coupler Construction

If you wish to construct your own bi-filar two set coupler, it can be put into a plastic box measuring about 4 x 5 x 1 inches with a hinged or preferably a removable cover.

The coils are rather difficult to wind, and it will be best to buy them. (J. W. Miller Co. part No. 6202 or RCA part 73591.)

Terminal strips will also be required. It is best to use three of them, each having two terminals. If desired, a ground lug may be added between the two SET terminal strips. Use the layout shown in the photographs of the couplers in this article. Cut slots and mounting holes in the box cover for the terminal strips, mount the strips and wire the coils as shown in *Fig. 4*.

An ohmmeter should be used to ascertain the correct coil connections. Since both windings on each coil have an identical number of turns, it is not necessary to select a "primary" or "secondary" winding.

It is the author's belief, that even though the instructions given in this article are sufficiently detailed to construct your own coupler, it will behoove the serviceman to purchase his ready made. Professional appearing relatively inexpensive couplers are manufactured by many reputable TV accessory manufacturers.

[Concluded next month]

TROUBLE	POSSIBLE CAUSE	
		4. Check the loop, oscillator coil and 1st *if* transformer for opens or shorts. Check for possible shorts in loop and in tuning capacitor stator to ground.
III. Signal weak, distortion	a. Weak battery	1. Replace battery. Check current drain. If excessive proceed as in I-b above.
	b. Loop defective	1. Examine loop for possible cracks by flexing.
	c. *C207, C204, C210, C213, C212, C214* Defective	1. Check these capacitors for opens by paralleling with known good capacitors.° Check for shorts by removing one side of capacitor from circuit and substituting known good capacitor.
	d. Alignment incorrect	1. Check alignment as described in service manual.
	e. *AGC* voltage incorrect	1. Check the *agc* voltage at the junction of *R210* and *R211*. It should be .3 volts at no signal. If not correct check detector and *if* amplifiers as above.
	f. *IF* amplifier defective	1. Check the *if* stages as described in I-f above.
	g. *AF* output driver defective	1. Check these stages as in I-c above.
IV. Oscillation or regeneration	a. Weak battery	1. Replace battery. Check current drain. If excessive proceed as in I-b above.
	b. Defective oscillator	1. Check as in II-b above.
	c. *C204, C209, C215*, defective	1. Check by paralleling with known good capacitors.° If oscillations occur only on strong signals check *C204* for possible open.
	d. Poor ground connections	1. Check connections between tuning capacitor frame, speaker mounting bracket, *if* transformer cans, etc. to the printed circuit board grounds. Check all ground circuits printed on board for micro-cracks.

°Observe correct polarity

[*Concluded next month*]

SHOP HINTS

[*from page* 5]

true with the new transistor portables. Here's a simple way to find out.

The local oscillator works at the incoming frequency plus *455 kc*. Thus at the low end of the dial, the local oscillator operates at *540* plus *455* or *995 kc*. The oscillator frequency increases as higher stations are tuned in. For example, if the receiver is tuned to *770 kc* the oscillator frequency would be *1225 kc*.

In order to check if the local oscillator is working bring the receiver near another set tuned to any station from about 1000 to 1600 *kc*. Tuning the receiver under test should produce "birdies" when the local oscillator is near the frequency of the station being listened to.

This simple test will determine local oscillator action only for the low end of the broadcast band, since the local oscillator frequencies for stations above *1150 kc* are over *1600 kc* and can not be "zero beat" against another broadcasting station. If a short wave receiver is available which tunes up to about *2 mc* the rest of broadcast band can also be checked easily.

A. N.
Bangor, Me.

[from page 14]

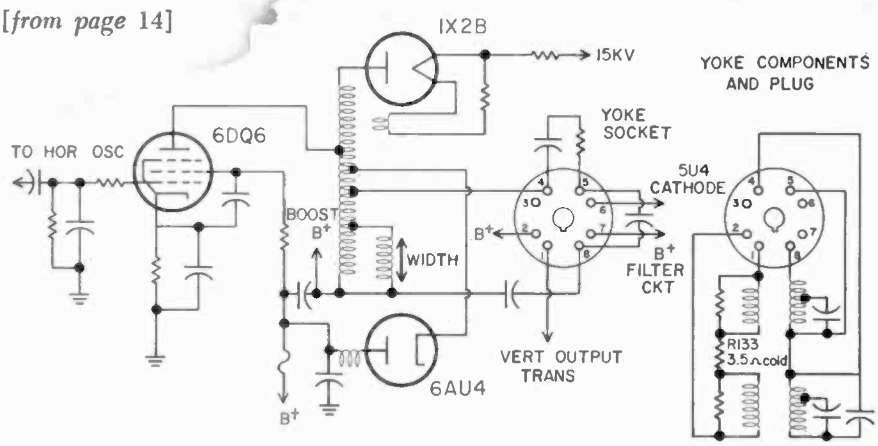


Fig. 2—Horizontal output and high voltage circuit of a typical 110° set. Note R133, a thermistor, in the vertical yoke circuit.

110° Tube Base

The base construction of the 110° kinescope is novel for picture tubes. See *Fig. 3*. This construction eliminates the base plug with its solder connections between the base pins and electron gun element leads. The overall design is rugged and durable, representing a worthwhile improvement. Care must be observed, however, as with any glass button base tube, to prevent breaking the base when removing the kinescope socket.

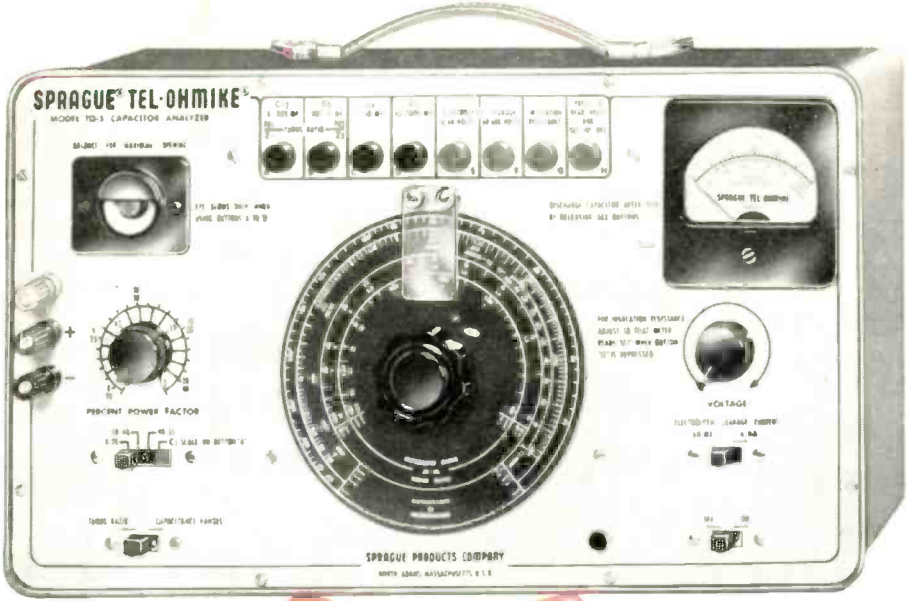
The electron gun in this new line of kinescopes has been considerably shortened by incorporating a straight gun design. Novel design features of the gun insure that the beam spot will remain sharp over the entire screen area. With the new gun design, ions are allowed to impinge on the screen. By holding the aluminum faceplate backing to close tolerances, no ion burn results. Hence no ion trap is necessary.

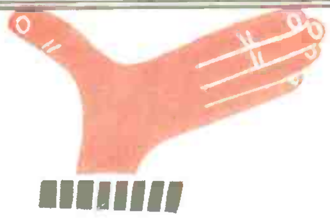
The features of the 110° kinescopes discussed above contribute to the design of receivers that have great appeal to the present day TV buyer. Decreased weight in the picture tube

Fig. 3—Base of 110° kinescope showing straight thru pins and indexing plug.

contributes in a large degree to light weight portables. The shortened picture tube gives the cabinet stylist ample opportunity to use his creativity in designing compact enclosures. Servicemen will find the new tubes easier to adjust since no ion trap is used. Yoke mounting is simplified too, making this phase of servicing a routine one. ■ ■

Advertisers' Index





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2. Your entry must be made on an official entry blank and must be submitted in your own name describing your own opinions in connection with "National Television Servicemen's Week"—March 24th to 29th, 1958. You may prepare your own entry blank, or you can ask your RCA Tube Distributor Salesman to help you prepare your entry blank. If your distributor salesman does help you, be sure to have him countersign your entry blank—he is also eligible for a prize if you win. Official entry blanks are available from your Authorized RCA Tube Distributor and from RCA Electron Tube Division advertisements. Only one entry per person is permitted.

3. Mail your entry, using adequate postage to: RCA Electron Tube Division, P.O. Box 551, New York 46, N. Y. *All entries must be postmarked on or before midnight, March* 15, 1958. No general correspondence should be sent to this address.

4. The entries will be judged by Advertising Distributors of America, Inc., an impartial, independent contest judging organization, on the basis of originality, sincerity, and aptness of thought. Decision of the judges is final. All entries become the property of Radio Corporation of America, and none will be returned. Entry in the contest constitutes permission to RCA to use your name and entry in any way it sees fit.

5. The contestants will be ranked in each region, in the order of the merit of their entries, as determined by the judges as provided above. They will be visited in person or phoned, in succession, sometime between the period of April 1, 1958 and April 30, 1958, by a "Mystery Shopper". The "Mystery Shopper" will ask a question about the product features of RCA Silverama Picture Tubes or RCA Receiving Tubes. The first service dealer or service technician in each region who answers the question correctly will be presented with the grand award. The next 3 dealers or their service employees in each region who answer the question correctly will be awarded one of the beautiful, new RCA Victor color TV sets. An additional 10 contestants in each region who answer the "Mystery Shopper" question correctly will receive one of the exquisite RCA Victor High Fidelity Sets. And 10 additional contestants in each region who answer the question correctly will receive an RCA Victor Transistor Radio. All contestants will receive a token of recognition.

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