MAY 1949 40c

RADIO MAINTENANCE

AM·FM·TV

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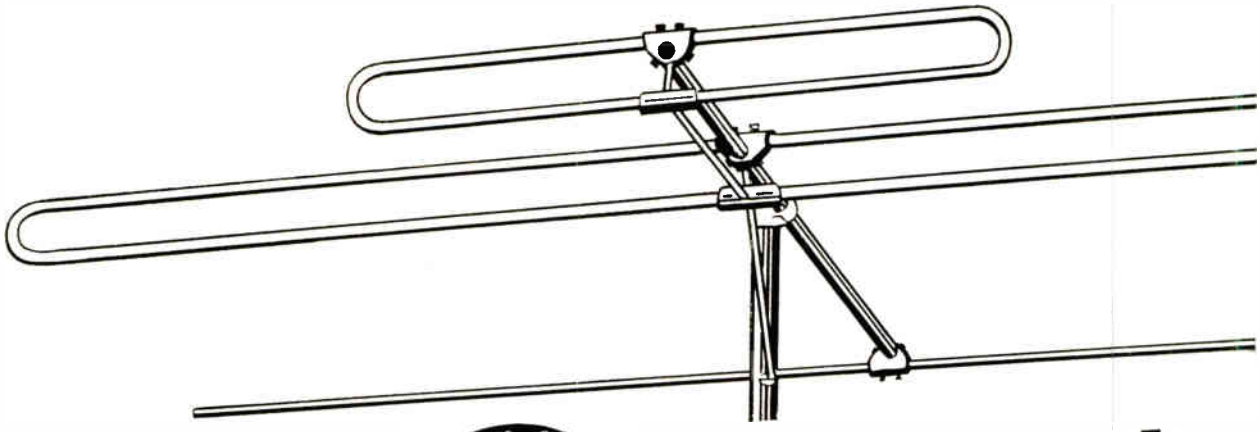
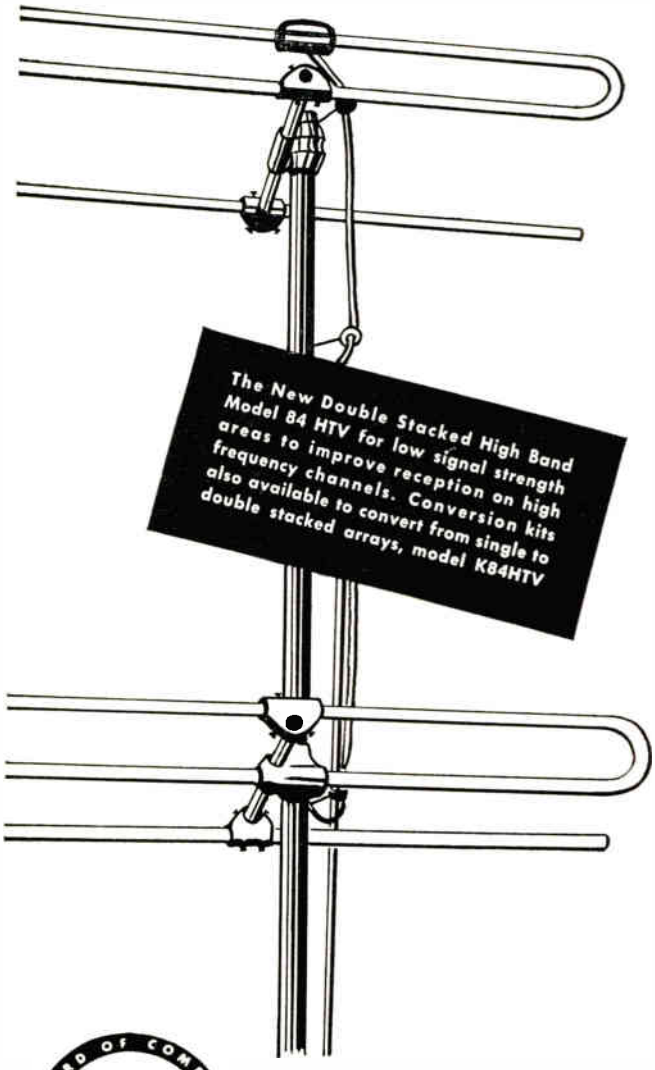


2 New Radiart TV-ANTENNAS



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Test Pointers

. . . ON TV HEAD ENDS

Head-end troubles in the rf stage, mixer, or oscillator of standard TV receivers which use separate picture- and sound-if amplifiers, are usually readily isolated because such defects are common to both the sound and the picture. When the raster is normal but the sound and picture are dead, weak, or intermittent, the trouble is probably in the head end.*

When this is the case, initial inspection at the customer's home can be confined to a check of the antenna and transmission line, tubes, and low-voltage power supply.

If sound and picture are both dead, the oscillator may be inoperative. The oscillator grid bias should be checked with a suitable electronic voltmeter against the value given in the manufacturer's service data.

A few volts change in oscillator grid voltage from channel to channel is to be expected. The oscillator frequency can be measured quickly with the aid of a heterodyne detector and a signal generator. The signal-generator frequency must, however, be very accurate; it should be either crystal controlled or crystal calibrated.

Some troubles in the head end show up only at the speaker and are not readily discerned in the picture, because the sound channel is more responsive to slight changes in frequency.

In a misaligned receiver, the rf oscillator may be detuned far enough in one direction to kill the sound with little effect on the picture. In any case, when the rf oscillator frequency is readjusted on sets which have a "fine tuning" control, center this control during the adjustment.

Head-end misalignment can also cause poor picture definition. The high video frequencies are usually affected first, in that the vertical wedges on the test pattern get "milky" and cannot be resolved very far "down," (in toward the center of the pattern).

To check the head-end alignment, connect the sweep generator to the antenna terminals, and the oscilloscope to the converter, as specified by the manufacturer of the receiver. An accurate marker oscillator is needed to determine the response curve. The head-end response should look about like Fig. 1A, which shows a good response curve for channel 13. The picture carrier frequency for this channel is 211.25 Mc; the marker pip at this frequency should appear at least 70% up the curve, and preferably on top, as shown. The sound carrier frequency for channel 13 is 215.75 Mc and should likewise appear above 70% on the curve.

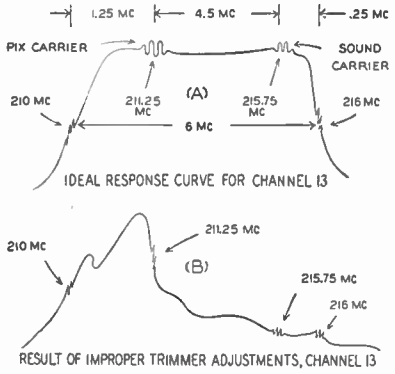

Fig. 1.

The rf response should be essentially flat over each channel. If the response is low at the sound carrier, the sound will be weak compared with the picture response, and vice-versa. Fig. 1B shows channel 13 misaligned. This response curve will produce a poor picture and very weak sound. Since a sharp peak exists on the low-frequency side of the picture carrier, the high frequencies will be attenuated and the picture will lack crisp, sharp definition. The vertical wedge of a typical test pattern would appear weak or "light gray" as compared with the horizontal wedges.

Intermittents and microphonics can be checked very readily by observing the response curves on the scope while the connections, switches, lead dress and slug adjustments are gently prodded and moved.

*Sets containing age circuits driven from the video amplifier and sets using the intercarrier system may also develop other faults which can cut off the picture without disturbing the raster.

RADIO MAINTENANCE

INCLUDING ELECTRONIC MAINTENANCE

Volume 5 | May 1949 | Number 5

CONTENTS

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Editorial

We are in Favor

FOR the past few months we have been reading and listening to complaints regarding several rather typical examples of competition at work. Since hardly anyone has taken the opportunity to do so, we think a few comments in favor of the situation in the recording industry and with regard to the FCC action on television allocation are in order.

First, we would like to state that in general most of the complaints now being made have a basis in fact. It is the tendency to constantly look at the dark side which we feel is wrong. It seems quite logical to us that record sales should fall during a period when recordings using two new standards are placed on the market in competition with ones made to the accepted standards. This condition has prompted many to condemn the record manufacturers for introducing two new records. A few of these people think that the manufacturers are conducting a private record war, intent only upon their own supremacy in the field, without regard to the interests of the public. They feel that we got along fine so far, that the sudden introduction of new systems of recordings is confusing to the public and detrimental to business, that it was unnecessary, and that it should not have been made.

But let us look below the surface of this matter. We are witnessing in this instance—and on a small scale—American business at work. The conventional 78-rpm record originally designed when the science of electronics was hardly born, was designed for mechanical playing. But while it continued to spin on millions of turntables, persistent progress was made in the field of electronics; and while this progress was taking place, no changes were made in the basic design of either records or players. Even after the introduction of the electric record players, records continued to be made by the old methods.

Now, during the last year, steps were finally taken to adapt records to the technological advances which had been made in the field. We are

still in the experimental stage, in the stage where different methods are being tried out. Competition will assure us that the records of tomorrow will be of the highest standard, and in keeping with the state of the electronic art.

Sales may be off for a while. But let us remember that progress is being made. After a period of readjustment record sales will again pick up and reach previous levels. As a matter of fact, the chances are pretty good that these previous levels will be exceeded.

The situation with regard to the action taken by the Federal Communications Commission concerning television frequency allocation is similar to that in the recording industry, in that many people have been complaining that this action has retarded sales and confused the public. We doubt that this complaint has much basis in fact. In a recent survey made by Sylvania, and in surveys previously made, fear of obsolescence was hardly ever given as a reason for non-purchase of television sets by buyer-prospects.

But even granting some validity to the claim that the action of the FCC has adversely affected receiver sales, the fact still remains that the action had become very necessary. Interference had become a common phenomenon in many localities and bands were becoming more and more crowded. Expansion of the industry would be effectively slowed down unless the allocation policy as originally fixed would have been left unaltered. It would, in fact, have been probable that sales would have been even more affected had the situation remained unchanged.

Two plans are currently suggested to improve crowded band conditions and unfreeze the FCC ban on new station permits. One involves the utilization of u-h-f channels for limited areas and the addition of v-h-f channels where possible, and the other is based on a program of synchronized stations. Neither one of these two suggestions has as yet been approved by the Commission. But while we may be complaining about lost sales, let us keep in mind the fact that once a new program has been approved and a new policy pronounced by the Commission, the progress of television will exceed even the fondest dreams which we had not too long ago. JJR

ELECTRONICALLY SPEAKING

Breaking the Bottleneck. RCA is opening a new factory to mass-produce 16-inch direct view metal tubes for television, another break in the picture tube bottleneck. At this rate, tele-set production may soon no longer be held up by a shortage of these tubes.

Television and the Movies. The recent Convention of the Society of Motion Picture Engineers (SMPE) devoted considerable time to a study of the relation between the motion picture and the television industries. They felt that some sort of union between these two industries was imminent, and were trying to coordinate this union. Right now, film is being used increasingly by television; at the same time, people who own tele-sets are going to the movies less and less often.

The Facts A number of studies have been made of the effect of television ownership on movie attendance. They all agree that tele-set owners go to the movies much less frequently than people who don't have television.

The Outlook. One source has predicted that this trend in television development will close down most small movie houses, but will leave the major first run places open.

Operation Classroom. Three months ago we mentioned in this department that the television receiver may soon become a companion piece to the traditional classroom blackboard. Seems it won't be long now. They have started a large-scale program of education by television in Philadelphia under the sponsorship of RCA, Philco, the Board of Education, Station WPTZ and Station WCAU-TV. Thirty-one schools are participating.

New Receiver. Seventeen tubes, three rectifiers, one 10-inch picture tube . . . together they make up the new G-E television receiver. Simplified circuit design makes this possible. Simplification makes for lower prices.

D-C Television. A ten-inch set, operating on d.c. only, and not to be confused with various a-c/d-c models now on the market—probably the first of its kind—has been introduced to the public. Eliminates use of a-c converters. At present distributed only in New York. Manufactured by Steward-Warner Corporation.

Round 'n Round. Have you noticed that more and more receivers are making their appearance with round viewing areas. A little while back, only rectangular screens were available. Wonder when they will start transmitting round pictures.

Crystal Ball. The Department of Commerce, Washington, D. C., has made available an article called "Trends and Prospects in Radio and Television Receivers." Costs a nickel, and is a worthwhile item for all who are trying to stay ahead of the game.

PCM. These initials stand for "pulse code modulation." It's a new system of transmitting electrical signals, developed by Bell Telephone Laboratories. It's characterized by freedom for distortion and interference. Not perfected yet, but may have great influence on television once it gets going.

Trend. For the first time in the history of IRE (Institute of Radio Engineers), part of an annual meeting was devoted to such topics as market research, sales planning, advertising, sales training, and sales promotion. Service technicians, please note.

Shades of Marconi. When Marconi started his transatlantic radio communication experiments, he used a flying antenna. The airborne antenna is now back, for television use. It's mounted on a combination kite-balloon and extends the range of reception of television signals. Other uses: find out height and location of antenna required to overcome effects of a mountenous area, promotional use (name can be lettered on balloon with black friction tape). Average operating altitude 100 to 200 feet, CAA limit, 500 feet.

Robot Chess Player. Dr. Shannon of Bell Telephone Laboratories tells about techniques whereby a computing machine might be made to play a first-rate game of chess. Said he: "A solution of the mechanical chess problem will force us either to admit the possibility of mechanized thinking, or to further restrict our concept of thinking."

The Big Freeze. Radio Manufacturers Association (RMA) has proposed that the FCC continue all 12 v-h-f channels now allocated for television where stations are either now operating or under construction. They want this allocation extended to other areas as soon as possible; and they suggest utilization of u-h-f channels for all cities not having v-h-f channels available, if no other alternative should present itself.

The Fly in the Ointment. The u-h-f channels do not seem to be as available as some believe. Philco, after a series of tests, predicts that these channels will not be useful for several years—power requirements are too high. Other findings of these tests: U-H-F reduces ghosts and man-made-noise problems. On the other hand, it requires four to five times as much transmitting power as do v-h-f channels and shadowing effect is much greater.

Obsolescence. Philco engineers found they could get good u-h-f reception by attaching a three-tube converter to standard set. When u-h-f channels do become available, most present receivers will not be obsolete, the ad-campaigns of some companies notwithstanding.

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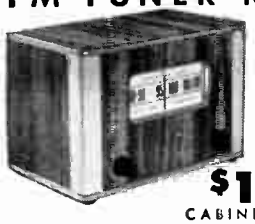
New HEATHKITS and ACCESSORIES

New Heathkit FM TUNER KIT



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CABINET EXTRA

A truly fine FM Tuner with the coils ready wound, all alignment completed — all that is necessary is wiring and it's ready to play — uses super regenerative circuit — 110 V. 60 cycle transformer operated — two gang tuning condenser — slide rule calibrated dial — two tubes — complete instructions including pictorial enable even beginners to build successfully. Shipping Wt. 4 pounds.

Beautiful mahogany cabinet for FM Tuner (shown above) extra **$3.75**

Heathkit TUBE CHECKER KIT

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Features

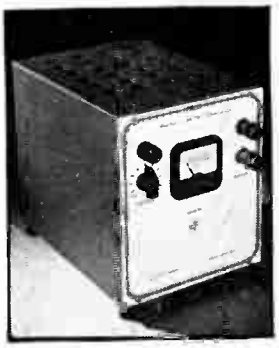
1. Measures each element individually.
2. Has gear driven roller chart.
3. Has lever switching for speed.
4. Complete range of filament voltages.
5. Checks every tube element.
6. Uses latest type lever switches.
7. Uses beautiful shatterproof full view meter.
8. Large size 11"x14"x4" complete.

Check the features and you will realize that this Heathkit has all the features you want. Speed — simplicity — beauty — protection against obsolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110 V. 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you 2/3 and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detail instructions — all parts — cabinet — roller chart — ready to wire up and operate.

SHIPPING WT. 15 LBS.

New Heathkit BATTERY ELIMINATOR KIT

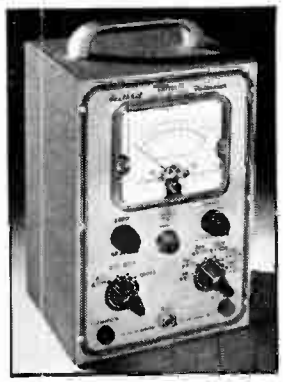


Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0-15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect.

$22.50
SHIPPING WT. 18 LBS.

Nothing ELSE TO BUY

New Heathkit BATTERY OPERATED VACUUM TUBE VOLTMETER KIT



The famous Heathkit VTVM now in battery operated type. Use it anywhere — carry it out for work on auto radios — aircraft — boats — any place where 110 V. house current is not available — instant warmup — turn the switch and it's ready to operate. Same quality features, six linear D.C. ranges 0-3V.-10V.-30V.-100V.-300V.-1000V. High voltage extended to 10,000 Volts with probe listed below. Large 200 microampere meter with shatterproof plastic face. Ohmmeter measures from 1/10 ohm to one billion ohms with internal battery. 11 megohm input resistance on DC. AC is copper oxide rectifier type with ranges as above except no 3 Volt range. Complete with all parts, cabiner, 2 color panel, tubes, batteries, test prods and detailed instruction manual.

$34.50
SHIPPING WT. 12 LBS.

Nothing ELSE TO BUY

New Heathkit TOOL KIT

Now a complete tool kit to assemble your Heathkit. Consists of Krauter diagonal cutters and pointed nose assembly pliers, Xcelite screwdriver, 60 Watt 110 V. soldering iron and supply of solder. Shipping Wt., 2 lbs. Complete kit. **$5.95**

RF Crystal Test Probe Kit

No. 309. Kit to assemble. RF probe extends VTVM range to 100 MC. Complete with IN34 crystal. Shipping weight, 1 lb. **$6.50**

10,000 V H.V. Test Probe Kit

No. 310. Extends range of any 11 megohm VTVM to 3,000 and 10,000 Volt ranges. A necessity for television. Ship. wt., 1 lb. **$4.50**

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Electronically Speaking

→ from page 6

In the Meantime. Thirteen new cities are going to get network service in 1949. American Telephone and Telegraph is expanding its facilities to provide this service. Both radio relay (450 route miles) and coaxial cable (300 route miles) will be used.

Tenant Troubles. In New York's Court of Special Sessions an all-tenant jury gave landlords the right to remove a tenant's unauthorized television antenna from the roof of the apartment house. Roof is not part of rented premises, they reasoned.

For Service Rendered. James M. Skinner, vice president, Service and Parts, Philco Corporation, was presented with a plaque by the Federation of Radio Servicemen's Associations of Pennsylvania, in appreciation of Philco's television training program for servicemen. Philco has been doing an excellent job in this respect.

Wonders Never Cease. The March IRE Show was something to behold: The ultrasonic fountain dissolving tumors without surgery, snow being manufactured right before your eyes (with a miniature train running around the scene, plowing snow off the tracks), a phono pickup playing 33⅓, 45, and 78 rpm records without changing needle pressure, a facsimile recorder receiving weather maps from Washington and Tokyo, printed circuits for television receivers, and many other marvels; whither mankind?

45-rpm Prices. Prices for RCA 45-rpm records and players run as follows: single classical disc: 95 cents; single popular, children, and other type platter: 65 cents. Record playing attachment (9JY) sells for $24.95, and a complete table model phonograph (9EY3) comes to $39.95.

Advance Patrol. Oklahoma City and Indianapolis will soon be invaded by television. RCA has been holding briefing sessions in both cities with dealers, to map plans for its introduction. Everything seems to be in readiness. Happy viewing.

Schooldays. 300 servicemen and dealers attended the DuMont television receiver seminar in New York. Takes time to attend these and other sessions, but it pays off later on. At least the servicemen who attended felt that way.

Trouble, Trouble. The Radio Manufacturers Association (RMA) went to the New York State Supreme Court to contest New York City's local Law No. 64, prohibiting, in effect, radio and sound equipment in public places. Violates New York State law, they say; also the Federal Constitution. Decision still pending.

Something New Has Been Added. G-E has come up with an 8½-inch picture tube costing no more than 7-inchers but giving a picture fifty percent larger than that produced by the 7-inch tube. It's of the metal type and will make for larger pictures on the lower priced sets.

All this and Tape too. The different-speed records soon may no longer confine their competition among themselves. Minnesota Mining and Manufacturing Co. now has a machine for mass-producing recorded music on reels of tape, and we may expect it to compete with records sometime in the future. Up to now you could only get blank tape, had to make your own recordings.

Here's How. Have you ever wondered who makes the rules and sets the standards governing the manufacture of electronic equipment? It's 1,500 radio engineers who make standards studies for the RMA, and the standards which they recommend are then offered to the industry, and generally accepted by it.

Can Do. In Los Angeles, about two years ago, a worker using a high-frequency welding machine, interfered with a police car receiving a radio message. FCC ordered production of this equipment stopped by April of this year, unless a remedy for the interference could be found. It was. National Cylinder Gas Company did it by shielding the arc with inert gas. No more interference to either radio or video.

For all Contingencies. Westinghouse has a new television antenna consisting of interchangeable components adaptable to all types of receiving arrays. Instead of coming in kits, the components come in bulk, making for greater efficiency. They're called Stratovision Television Antennas.

One Arm. G-E's new f-m/a-m radio phonograph console models will have single tone arm with interchangeable pickup heads for use with both standard and microgroove records.

TV Tubes. Sylvania has come out with a new line of receiving tubes for replacement service in television receivers. Sylvania hopes it will reduce the number of service calls now required.

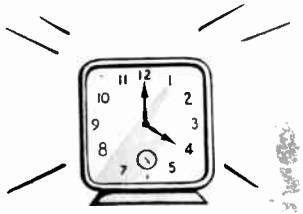
Very True. Max F. Balcom, President of the Radio Manufacturers Association, had this to say in March about the Town Meetings of Radio Technicians: "One of the most beneficial results of these Town Meetings . . . is that they have brought the manufacturers, the distributors, and the servicemen more closely together . . . Town Meetings will lead to greater cooperation within the industry in the future to the mutual benefit of all concerned . . . Perhaps we have learned a lesson from a quarter of a century of radio." Better late than never.

No Rest for the Weary. Addition of RCA's 45-rpm records to the markets keeps manufacturers hopping. Alliance now has a combination 33⅓-45-rmp single play phono-motor assembly for record players. Probably the first unit with this arrangement.

$1,000,000,000. Television should account for business activity totalling over a billion dollars this year. That's the prediction made by John K. West, Vice-President in charge of RCA Victor Public Relations.

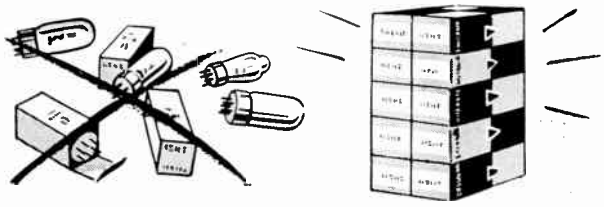
Thumbs Down. Last month we reported in this department the progress made by Westinghouse in stratovision-television experiments. We are sorry to report today that the FCC has not granted permission for stratovision telecasts. No channels available. ✓ ✓ ✓

SAVE TIME!



SAVE MONEY!

SAVE SPACE!



with Sylvania's New 10-Lot Cartons of *fastest-moving radio tubes!*

HERE'S the new, handy 10-lot package, developed by Sylvania to make your job easier! You save time, you save money by keeping plenty of fast-moving tube types *on hand.* No need to make numerous trips to your distributor to buy a few tubes at a time—especially when you're just one type short on a service job!

This new package is easy to handle, easy to stock—no more loose tubes and cartons to take up unnecessary space! Now your shelves will be neatly arranged, making it possible to store more tubes in the same space. Buying Sylvania tubes the 10-Lot Carton way simplifies your inventory and re-ordering job since you can inventory on the basis of 10 and re-order the same way! See your Sylvania Distributor today for any further details! *Sylvania Electric Products Inc., Radio Division, Emporium, Pa.*

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS

CIRCUITS WHICH ENLARGE A PORTION OF THE NORMAL RECTANGULAR TELEVISION PICTURE HAVE BEEN INCORPORATED IN A NUMBER OF RECENT RECEIVER MODELS. A TYPICAL EXAMPLE OF THIS FEATURE IS DISCUSSED BY THE AUTHOR

Fig. 1 A Garod television model, incorporating the Tele-Zoom

TELEVISION PICTURE EXPANSION CIRCUITS

by Martin Clifford

TELE-ZOOM is the trade mark for a new television development produced by the Garod Radio Corporation. Any such new development—whether by Garod or any other manufacturer—represents an additional source of income for the serviceman. Modifications of existing television circuits are ordinarily very simple (Tele-Zoom is no exception) but even simple circuits require servicing and maintenance.

In this Garod electronic device (on which patents are pending), a remote-control button, called the "Pres-

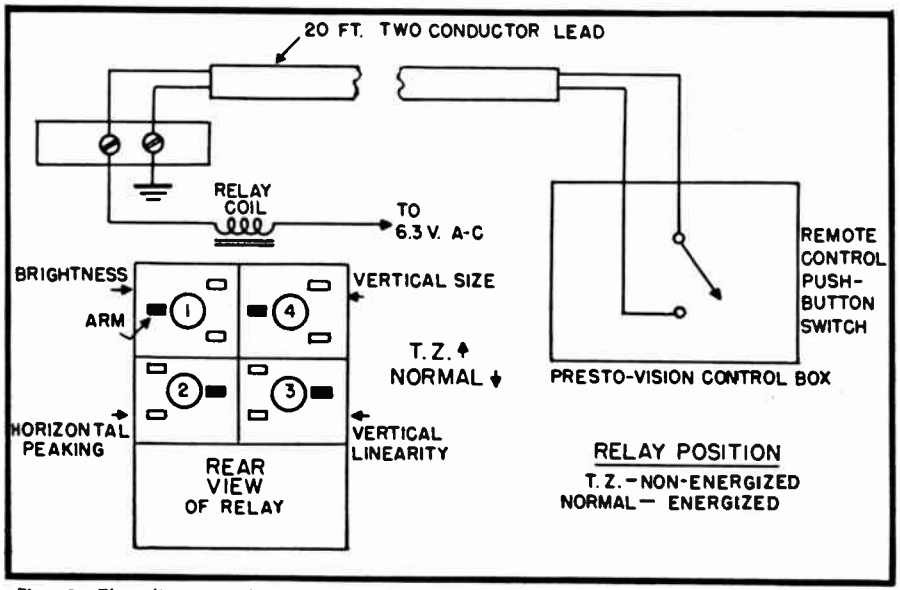


Fig. 2 The diagram above shows the operation of the remote control push button switch. Pressing the button slightly more than doubles the picture area on the screen

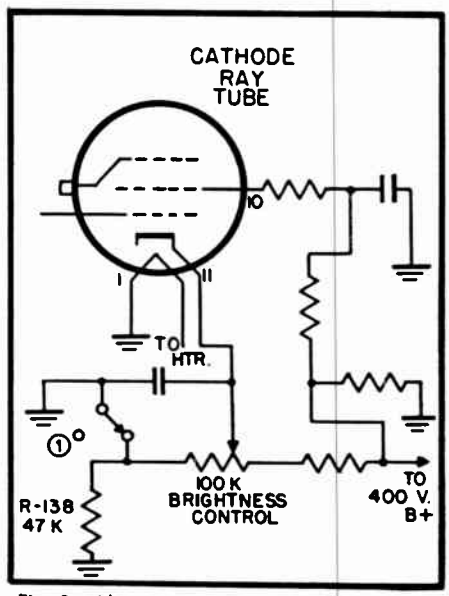


Fig. 3 Above is circuit for automatic brightness control, shown in the expanded position

to-Vision" button, is used to expand the picture from the normal rectangle to an enlarged picture which makes use of the entire circular screen area. This is highly desirable when that portion of the picture which is of primary interest is centered on the screen. The picture size viewed in the expanded position is increased one and one-half times both in height and width over the normal rectangular picture and therefore the viewed image appears twice as large. As a matter of fact, pressing the "Presto-Vision" button does exactly that—it slightly more than doubles the picture area.

A television picture, however, cannot be arbitrarily enlarged . . . not without running into serious distortion trouble. In the case of Tele-Zoom, Garod engineers maintained a constant aspect ratio—that is, the ratio of image width to image height remains the same, whether or not the picture is in the expanded or unexpanded position.

By pressing the "Presto-Vision" button the picture can be changed from the expanded Tele-Zoom position back again to the normal rectangular size picture. The cord on the control unit is supplied in a standard length of 20 feet for ease in using the control romotely. In Fig. 1 we see the expanded picture (produced by the Tele-Zoom feature) on the screen. Note that the entire circular area of the screen is used, thus producing the effect of a close-up.

Ordinarily, expansion of a picture would mean a loss in brightness. You can easily test this for yourself by shining a flashlight on the wall. As you move forward, the light spot gets bigger, but is no longer as bright. The same thing holds true when mak ing a television picture bigger. Hence, in order to avoid a re-setting of the brightness control, Tele-Zoom automatically advances the brightness by just the right amount. An adjustment is also made at the same time in vertical size, linearity, and horizontal peaking. Now let's see what makes Tele-Zoom work.

Remote Control

First, let's take a look at the device which remotely controls Tele-Zoom. This is shown in Fig. 2. Here we have a little square box marked "remote control push button switch." This is the "Presto-Vision" button

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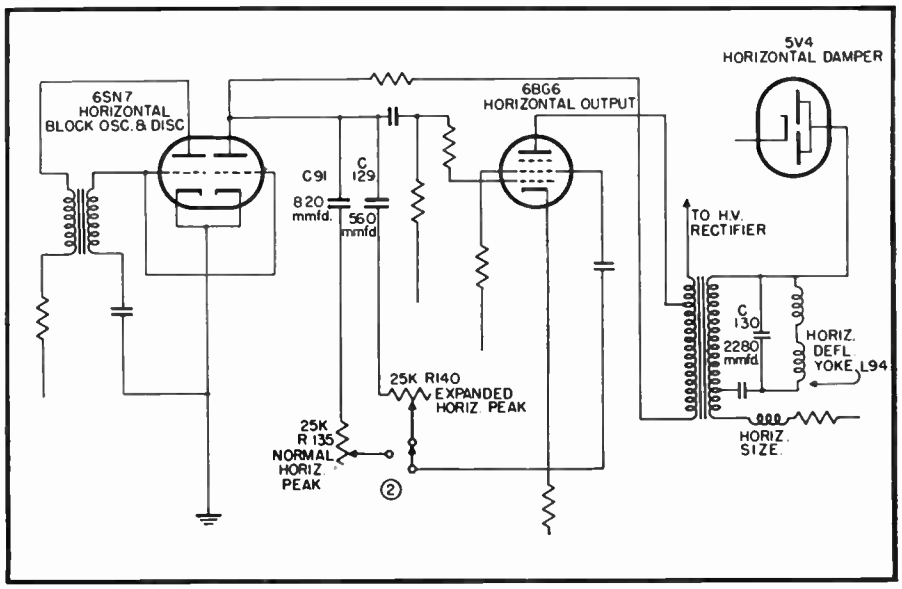


Fig. 4 Above is schematic diagram of the circuit for normal horizontal peaking and expanded horizontal peaking. The circuit shown above is in the expanded position

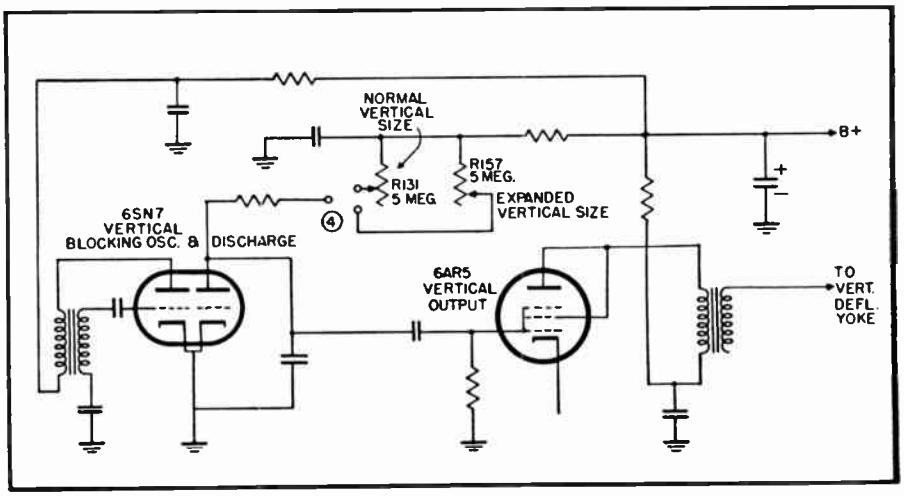


Fig. 5 Circuit diagram for normal vertical linearity and for vertical linearity when the picture is expanded. The diagram above is for a circuit in expanded position

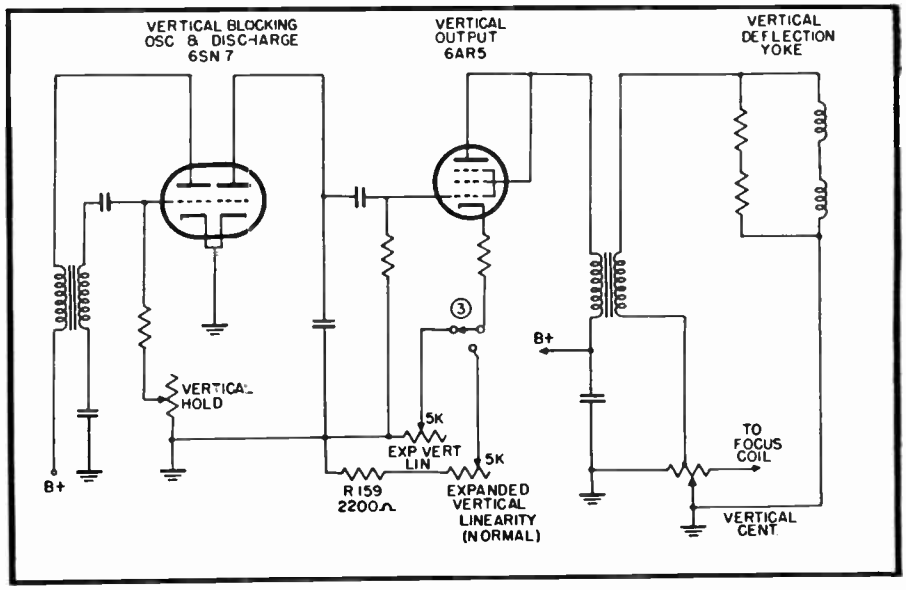
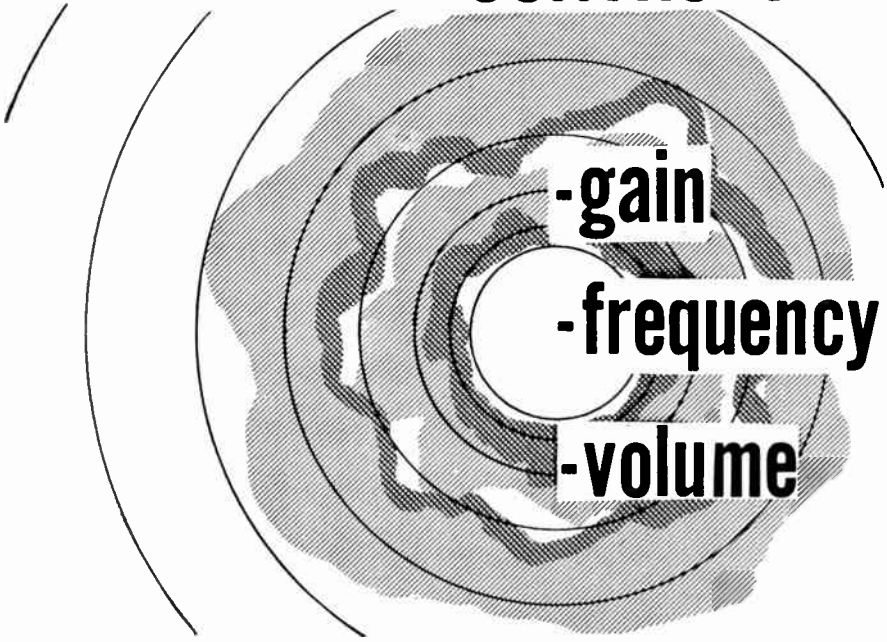


Fig. 6 Shown above is the circuit for normal vertical size and for expanded vertical size. As illustrated in the above diagram, the circuit is shown here in the expanded position

TV AUTOMATIC CONTROLS



by Matt Mandl

AUTOMATIC CONTROLS ARE INCORPORATED IN MORE AND MORE TELEVISION RECEIVERS. THE TECHNICIAN MUST KNOW HOW THEY OPERATE AND HOW THEY ARE SERVICED AND ADJUSTED

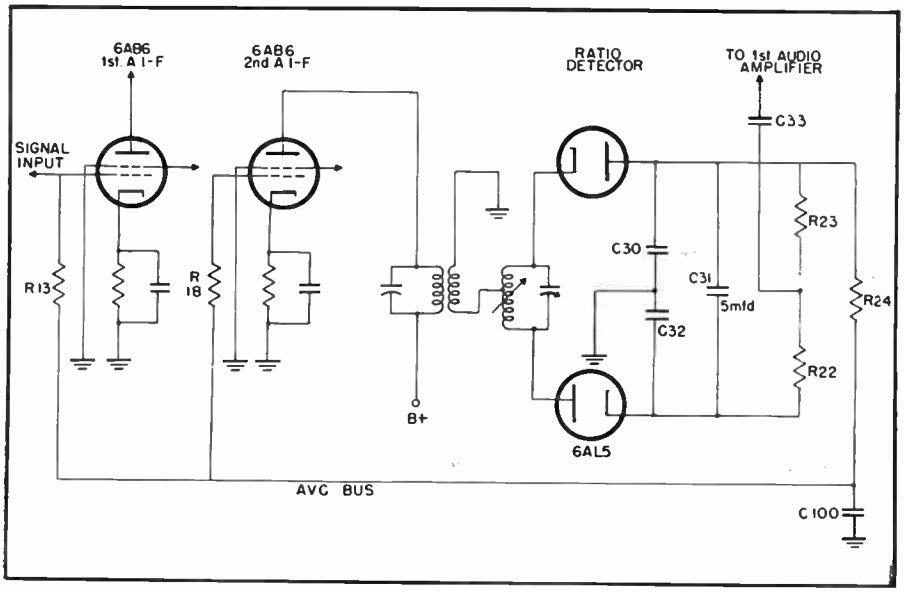


Fig. 1 Indicating how a.v.c. potential is secured from ratio f-m detector. This is the type circuit used with Belmont TV Receiver Model 22A21-22AX21 and Console 22AX22

AN increasing number of television manufacturers are incorporating automatic control circuits in their receivers, because they simplify tuning, reduce the number of front panel controls, and maintain average picture background and volume at prescribed levels. At the same time such circuits are of material benefit to the technician because the various d-c voltages they establish for different signal levels are extremely helpful in trouble shooting, signal tracing, and aligning.

Automatic gain control, automatic frequency control, and automatic volume control circuits all work on the principle of rectifying the radio frequency signal and using the average value of this d.c. to control other circuits. Essentially, all are derived through the detecting process. Thus, with a.g.c. and a.v.c., if the signal strength from the station increases, a greater d-c voltage will be developed, and a greater control exerted on the other circuits. This voltage is utilized to maintain the controlled circuits at a gain previously established by the user of the set; a.f.c., in similar fashion, employs the rectified d.c. produced at the f-m detector when the local oscillator drifts, to bring the oscillator back on frequency.

Automatic Volume Control

The ratio detector in the f-m section of television receivers lends itself nicely to a.v.c. uses, because the direct current established across its output is directly proportional to the signal strength of the station received. Fig. 1 shows two f-m intermediate frequency stages controlled by the a.v.c. voltage secured from across the output of the 6AL5 ratio detector. This is the type of a.v.c. circuit used in the Belmont television receivers models 22A21, 22AX21 and Console 22AX22. The ratio of voltages across R22 and R23 constantly varies with the frequency variation of the f-m signal, and the audio is taken from across one of these. The over-all voltage across the two resistors, however, will remain constant as long as the incoming station signal remains at the same level. Static pulses, and other type of amplitude modulation of short duration, are absorbed by the comparatively large 5 mf capacitor, C31. Thus, C31 also tends to keep the voltage across the two resistors at a constant value. If, however, a nearby station is tuned in,

the increased signal strength charges C31 to a higher value, and this greater voltage appears across the two resistors.

The a.v.c. voltage is taken from the top of R23 and fed back to the grids of the two i-f stages. This minus voltage adds to the bias on these tubes and thus controls the gain of these stages. A stronger signal will produce more bias, which in turn will decrease plate current flow and reduce the gain, thus bringing the volume back to the previous level. Pure d.c. for the automatic volume control voltage is assured by use of the filter section, R24 and C100.

Failure of the a.v.c. circuit to function properly may be due to several causes. The circuit from the top of R23 to the grids of the i-f tubes should be checked for continuity, to make sure the a.v.c. voltage has a closed circuit to the grids. C100 should also be checked, especially for a short, because this would ground the a.v.c. potential. A faulty C31 capacitor will not only affect a.v.c performance, but will allow static pulses to ride through the audio amplifiers, since the a-m suppression is dependent on this large value of C.

Television Tuning Indicators

DuMont RA-103 models and Stromberg-Carlson Series 10-11 television receivers, utilize the rectified voltage derived from the sound detector to actuate the tuning indicator tube. Fig. 2 is typical of the circuit as employed by DuMont and others for the 6U5 "magic eye" tube, or the 6AL7 tuning indicator. In this case a discriminator, instead of a ratio detector, is used for f-m, and this means that the voltage across R242 and R243 is zero when no station is on the air. It is also zero if the station is on the air with an unmodulated carrier; that is, no audio-causing frequency modulation.

If the station were on, and no sound transmitted, the magic eye tube would remain open if we had it connected across the two resistors. If the station is on the air, however, a voltage does exist across each resistor, though the voltages would be equal and opposite to each other. The most logical place to take the voltage for the tuning indicator is, therefore, across one of these resistors, so that we can still get the eye to close when tuning in a station that is not at the moment sending sound. This is done

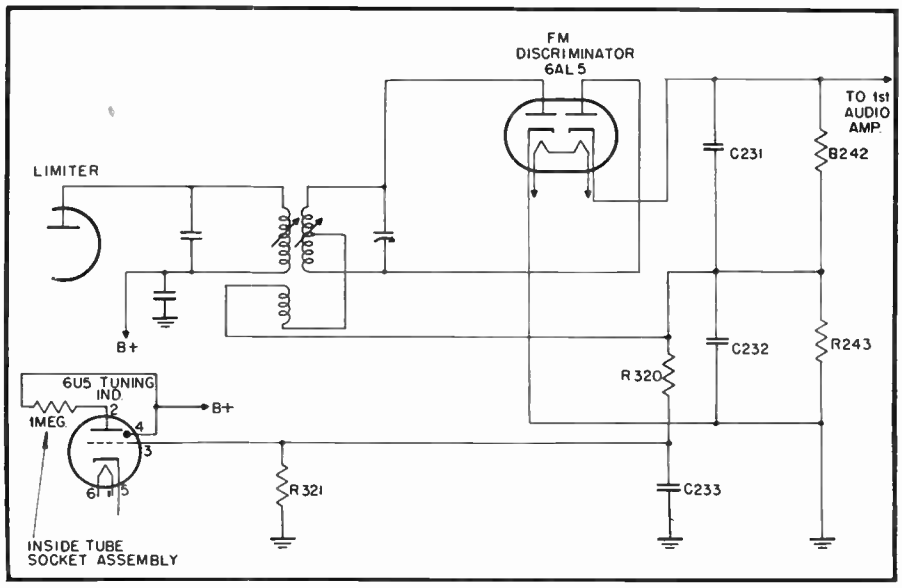


Fig. 2 Voltage obtained from f-m discriminator used for controlling magic eye tube. This is the type circuit used in Du Mont Television Receiver Model RA-103

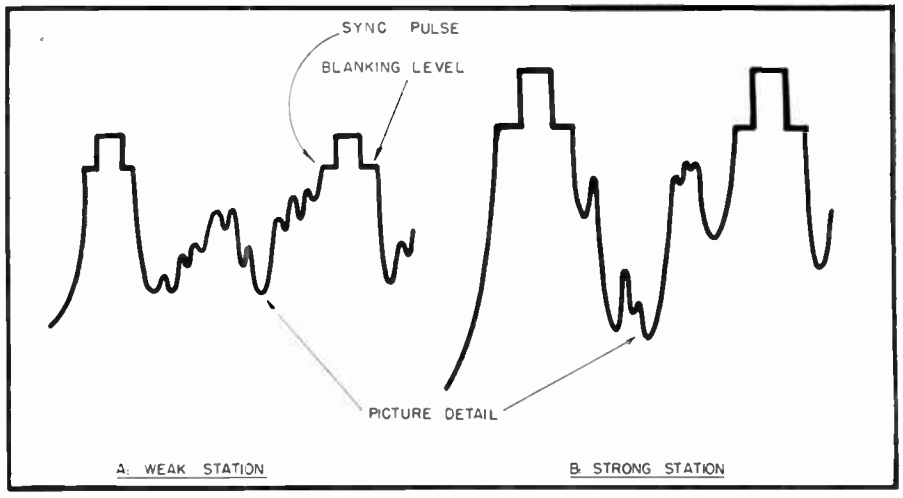


Fig. 3 Showing how average values of picture detail vary, but sync pulses and blanking level reach same amplitude for given station. (A) weak station, (B) strong station

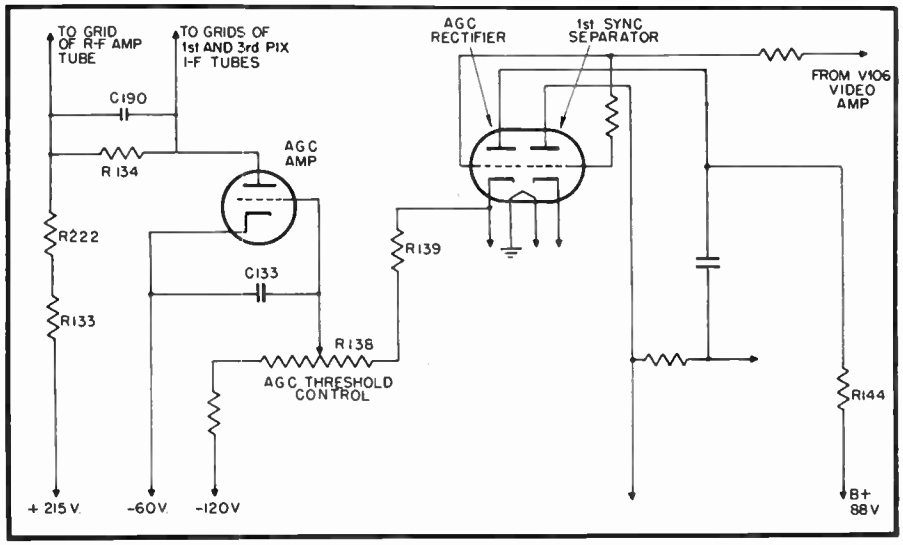


Fig. 4 Sectional detail of the automatic gain control circuit of the RCA television receiver models 8T241, 8T234, and 8T244. Threshold control is used to control contrast

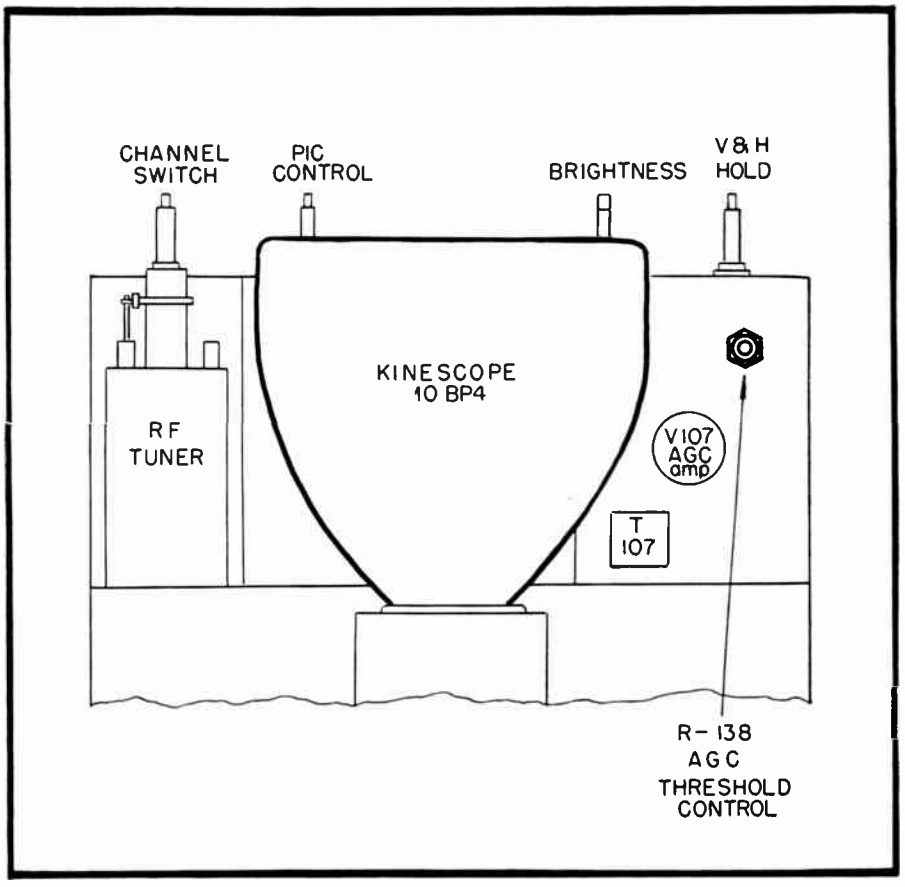


Fig. 5 Diagram of the front section of the RCA Television Receiver Model 8T241—4 chassis top, showing the location of a.g.c. threshold control (R-138), at upper right

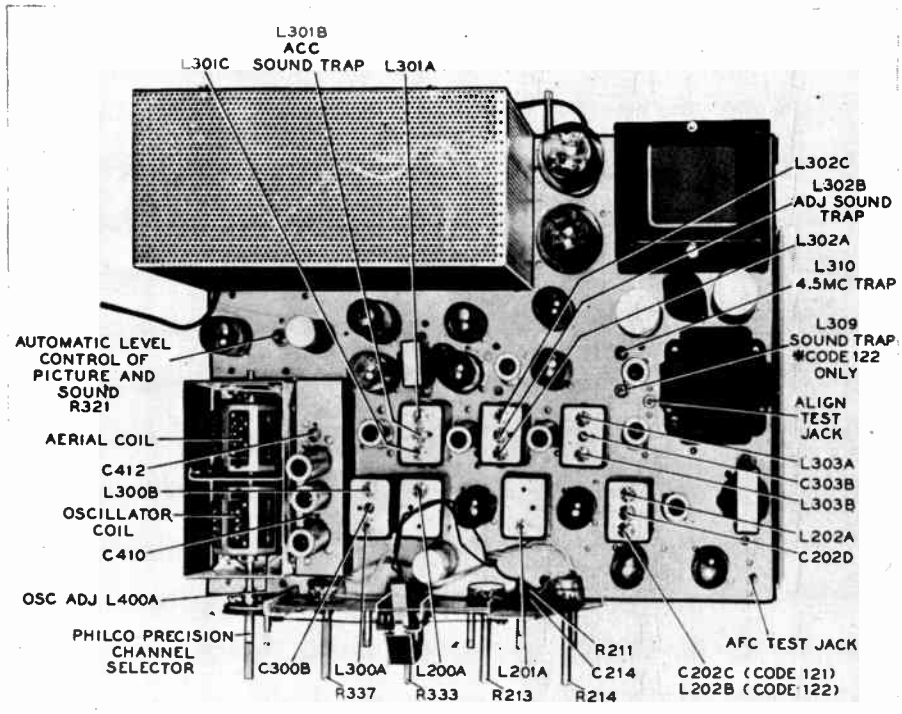


Fig. 6 Top view of Philco Television Receiver Model 48-1000 chassis, showing location of "automatic level control of picture and sound"—R321, and a.f.c. test jack

in the case of the discriminator shown in Fig. 2. Any audio variations which might be picked up by this line are again filtered out by the combination of resistor-capacitor network, R320 and C233. R321 is the rigid leak resistor of the 6U5 magic eye tube.

As with all devices using vacuum tubes, the latter should be checked at the first signs of any faulty operation. If the tuning indicator does not function and the tube checks good, the resistor inside the tube socket assembly should be tested. This resistor, about 1 megohm in value, may have opened or come loose from the soldered joints. As with radio receiver magic eye assemblies, the socket at the end of the magic eye cable must be opened in order to replace the resistor. The value of this resistor is rather critical and close tolerance rating should be maintained. Failure of the eye to close completely, or the closure overlapping, means an incorrect value for this resistor. Checks should also be made on the other resistors and capacitors of the circuit, particularly R320 and C233.

Automatic Gain Control

Automatic gain control in television receivers is similar to a.v.c. in a-m radios, inasmuch as both control the gain of the i-f stages. In television we have come to associate a.g.c. with automatic *picture* control while we think of a.v.c. as having to do with volume control only. Actually, a.v.c. is also an automatic gain control device—the only difference being that one controls the gain of the *sound* i-f stages, and the other the gain of the *picture* i-f stages. It is for this reason that some manufacturers refer to the picture (a.g.c.) control as "automatic picture control" to differentiate it from automatic volume control.

By controlling the gain of the picture i-f stages, the average background (contrast) of the picture can be maintained at a level set by the operator. Once the contrast control is set for a certain channel, subsequent switching to another channel will have little effect on contrast difference. This, of course, holds true only within reasonable limits, since the low level signal of a distance station cannot always be brought up to the level secured from a nearby high powered station, despite full gain from all i-f stages.

Because the a-m modulation percentage of the picture signal is not a constant value, the average voltage of this signal is ignored and the sync tips are used for a.g.c. purposes, as indicated in Fig. 3A. These tips are always brought to the same level by a particular station, regardless of picture detail change. The average value of the rectified sync tips is used for the controlling bias on the picture i-f stages. Tuning in another station with a stronger carrier, such as shown in Fig. 3B, gives an increase in the amplitude of the average a.g.c. voltage. Fig. 4 shows the a.g.c. section of the new RCA Models 8T241, 8T243, and 8T244 series of receivers. The sync pulses are rectified; then amplified so that they will have the proper potential for controlling the bias of the picture i-f stages. The a.g.c. threshold control is used to adjust the contrast so that the picture will not bend or tear when the user advances the contrast control too far (This is as though an extra volume control were placed inside a radio, so that the customer could never turn the radio up to where it would blast and distort.).

In a number of television receivers both the sound and picture i-f ride through one or more common stages of amplification before the sound i-f is separated and channeled to its individual stages. In such cases the a.g.c. will have the dual function of controlling both picture and sound gain. This condition is aided by the fact that both sound and picture carriers are present in the r-f stage, which also is controlled by a.g.c. It is for this reason that Philco Corporation calls their a.g.c. adjustment "Automatic Level Control of Picture and Sound."

Fig. 5 shows a drawing of a section of the chassis top of the RCA 8T241 series of receivers, and indicates location of the a.g.c. threshold control. Fig. 6 is a photograph of the Philco 48-1000 series of TV receivers (Code 122) showing the location of the Automatic level control on the left and the aligning test jack and a.f.c. test jack on the right.

A.G.C. control adjustments should be made with the selector switch of the receiver set to the channel on which the strongest signal is received. The control adjustment should be set so that picture bending is moved, or reduced to a minimum, with the contrast control advanced to maximum position.

Control adjustments should not be made on a weak station because, if the control adjustment is set too far for a weak signal, the receiver may over-load when a strong signal is received. In fringe areas, where it may be impossible to get the picture to bend even with contrast control turned to maximum, the control adjustment should be turned until the snow (salt-and-pepper) effect in the picture becomes more noticeable, and then readjusted until the best signal to noise ratio secured.

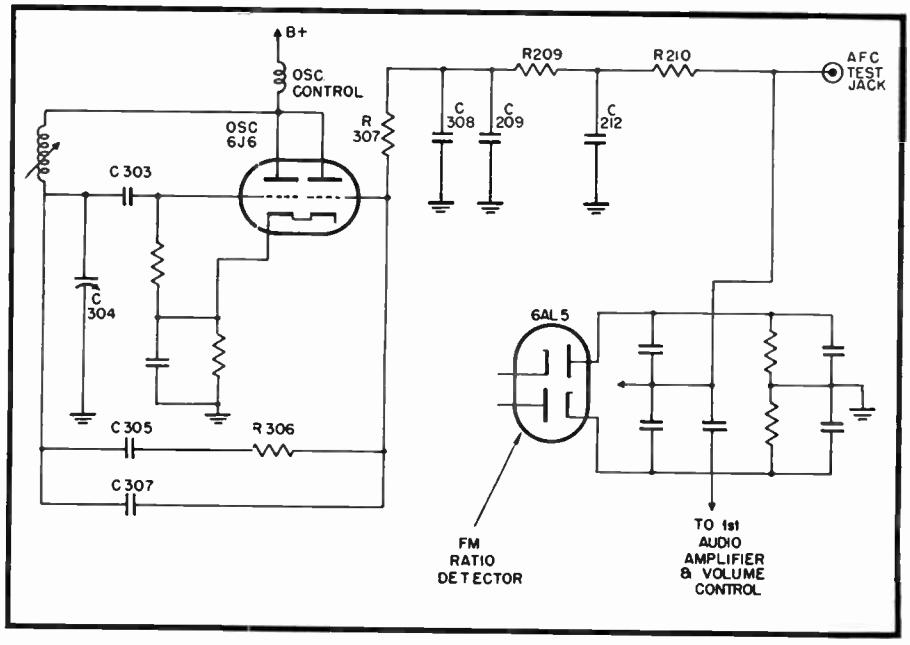


Fig. 7 Automatic frequency control used by Philco. Circuit automatically compensates for frequency drift of local oscillator, eliminating need for fine tuning control

Automatic Frequency Control

A.F.C. is not new, having been used in earlier radio receivers to pull the station in when the mechanical push-button arrangements did not provide the accuracy desired. When a.f.c. is used in television receivers, however, it serves the very useful purpose of eliminating the "fine tuning control" on the front of the set. The fine tuning control is used to retune the station manually when the local oscillator drifts; and the a.f.c. circuit functions in a similar manner, except that it does this automatically with electronic control.

Fig. 7 shows the type circuit used by the Philco Corporation in its receivers. Briefly, the theory of operation is as follows: A 6J6 twin triode tube is used, one section comprising a modified Colpitts oscillator, and the other section a reactance modulator. The latter electronically controls the oscillator frequency, compensating automatically (and instantly) for any drift of the oscillator frequency or incoming-signal frequency.

The oscillator drift is controlled by a direct current signal derived from the frequency modulation ratio detector, where any deviation of the audio i-f center frequency develops a positive or negative voltage. This voltage, applied to the grid of the reactance modulator, swings the oscillator frequency either lower or higher, so that it comes back to the correct intermediate frequency. The place where the a.f.c. voltage is obtained from the f-m detector is zero volts when the i-f center frequency is correct.

It must be noted that some manufacturers refer to their sound detectors as "discriminators" while others differentiate between the two most commonly used f-m detectors, by referring to one type as a discriminator, and to the other "ratio detector." The two are somewhat different in circuit arrangement and servicing is simplified if these differences are kept in mind. The discriminator type of detector requires a limiter stage before it in order to clip off amplitude modulation in the form of static or other types of electrical interference. The ratio detector does not require a limiter, because a large capacity across the output effectively absorbs any

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TELEVISION Booster Amplifier DESIGN

by Engineering Department, Aerovox Corporation

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WHILE IT HAS NOT BEEN THE NORMAL POLICY OF *RADIO MAINTENANCE* TO REPRINT ARTICLES, THE EDITORS FEEL THAT THIS DISCUSSION OF PRE-AMPLIFIERS WARRANTS AN EXCEPTION

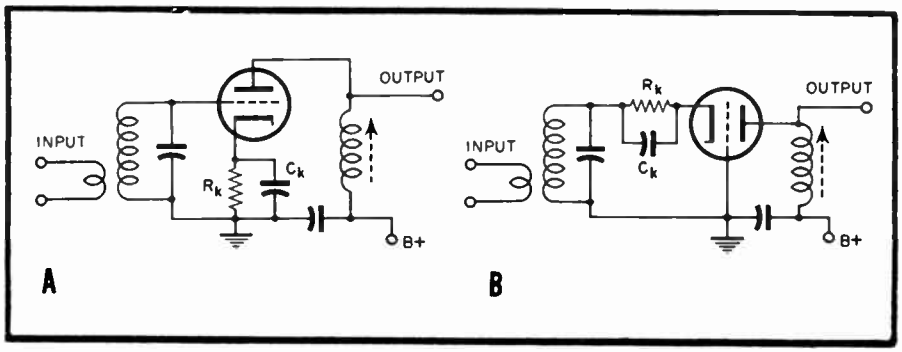

Fig. 1 *A* shows diagram of typical grounded-cathode triode circuit. When used at high gain, feedback causes oscillation. *B* shows grounded-grid triode, which is stable

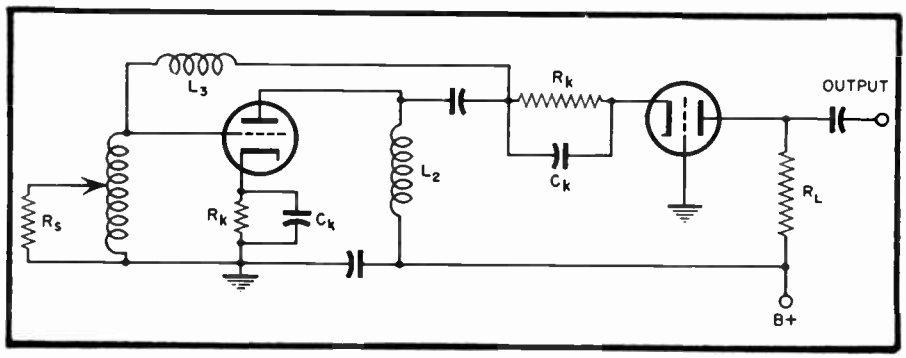

Fig. 2 The basic circuit of the cascode amplifier. A grounded-cathode triode is followed by a grounded-grid triode. Noise figure is improved over that of single pentode

THE performance of a television receiver can usually be improved by the addition of a properly designed "booster" or pre-amplifier. This is especially true of one operating on the "fringe" of the transmitter service area where the signal is weak. The "rural coverage area" is defined by the F.C.C. as being the region in which the transmitter signal strength is 5000 microvolts per meter or more. In areas where the atmospheric and man-made noise level is low, good reception may be had with much lower signal strengths. Since few of the commercial medium- and low-priced television sets have more than one stage of r-f amplification preceding the mixer, owing to the complexity of gang-tuning additional circuits, the advantages to be gained by adding a high-performance "outboard" r-f amplifier may include.

1. Improved signal to noise ratio.
2. Added gain.
3. Better image rejection.
4. More isolation against local oscillator radiation.

As is quite well known, the sensitivity performance of any radio receiver is largely determined by the characteristics of the first stage. This input circuit establishes the signal-to-noise ratio of the receiver and thus ultimately determines the limit of detectability of weak signals. If the first stage (and more particularly the input circuit) contributes noise voltages due to thermal agitation and tube shot-noise effects which are comparable in magnitude to the received signal voltage, both signal and noise voltages will be amplified equally by subsequent stages. Therefore, a more important consideration than extremely high gain in the first circuit is its noise characteristic. Of course, the input circuit must provide as much gain as is consistent with low noise contribution. If it does not appreciably raise the level of weak signals, then the noise figure of the second stage assumes importance.

The design of the receiver input

stage thus becomes a problem of finding a suitable compromise between low noise performance and amplification. Since the booster amplifier is to become the all-important input stage of the television receiver, a satisfactory solution to this problem must be found in its design.

Comparison of Tube Types

In selecting a tube compliment for an r-f pre-amplifier, the designer is invariably attracted by the low noise characteristic of the triodes. Pentode tubes contribute noise currents which are several times greater than those of triodes or triode-connected pentodes. This is because the random division of cathode current between the screen and plate elements of a pentode is a source of noice (called "partition noise") just as the random fluctuations in cathode current in any tube is a source of noise. The "noise figure of merit" of a vacuum tube is expressed as its *equivalent noise resistance*, i. e. the value of the actual resistor which would generate an equal noise level. Tubes with low equivalent resistance values generate the least noise. The values range from 210 ohms for the 6J4 triode to over 1800 ohms for the 6AK5 pentode. A 6AK5 connected as a triode has an equivalent noise resistance of only 385 ohms.

When used in broad band circuits, where the loading resistances are of necessity quite low, the triode is also capable of gains comparable to those achieved by pentodes. This is because the much higher internal resistance of the pentode dissipates much of its available power within the tube when it is used with heavily loaded (low resistance) output circuits.

Circuit Types

For these reasons, the triode would seem a very logical choice for use in a television pre-amplifier. When used in the conventional grounded-cathode circuit as shown in Fig. 1A, the triode has one serious disadvantage, however. The higher plate-to-cathode capacitance provides feed-back which causes instability in the form of oscillation when an attempt is made to use the triode at high gain. Neutralization or special circuit configurations may be used to reduce this tendency. A triode connected as a grounded-grid amplifier, as shown in Fig. 1B is very stable since the grid is at r-f ground potential and acts as an electrostatic shield between the input and output circuits. The available gain is much less than that that obtainable from the grounded-cathode circuit, however, since a degenrative effect takes place in the cathode circuit. A signal voltage which tends to make the cathode more negative with respect to the grounded-grid, and thus increase the plate current, is opposed since the increased plate current flows through the cathode resistor in such a direction as to make the cathode *less* negative. This effect reduces the gain and the sensitivity to weak signals.

The input resistance of the grounded-grid amplifier is also very low compared with the grid input circuit. In a grounded-grid stage where the plate circuit is heavily loaded to achieve greater bandwidth, as would be the case in a television booster, the input resistance is approximately equal to the reciprocal of the tube transconductance expressed in ohms. Thus, a tube with a transconductance of 3300 microhms (.0033 ohms) would have an input resistance of roughly 1/.0033, or 300 ohms. This low value of resistance shunted across a tuned input circuit would cause it to be quite broad—about 50 megacycles—and hence would make tuning unnecessary. This low input resistance feature of the grounded-grid amplifier is used in several commercial television sets to directly match the 300-ohm twin lead transmission line from the antenna. In a booster amplifier, such "wide open" input circuit tuning is considered to be detrimental since it provides no discrimination against off-channel, spurious signals and external noise.

Therefore, if restricted to a single triode, the designer has a choice between the high gain grounded-cathode circuit with its inherent tendency toward oscillation, and the highly stable grounded-grid circuit with its lower gain and much less selective input circuit. As far as noise figure is concerned, there is little difference between the two circuits, although the lower gain of the grounded-grid arrangement may make the noise contribution of the following stage assume some importance.

The Coscode Circuit

The ideal solution would, of course, be a circuit combining the desirable features of both types discussed above, with the disadvantages of each eliminated. Such a high-gain, low-noise stable circuit arrangement does indeed exist in the special "cascode" amplifier which was developed by Wallman, Macnee, and Gadsden at the M.I.T. Radiation Laboratory in 1944, and widely used as an intermediate amplifier input circuit for radar receivers. The design described here is an adaptation of this circuit for use as a high-performance television pre-selector.

The basic circuit of the cascode amplifier is shown in Fig. 2. Two tubes are used; a grounded-cathode triode followed by a grounded-grid triode. The two triodes (or triode-connected pentodes) used in this combination give a gain only slightly better than that obtainable from a single typical pentode. However, a considerable improvement in the noise

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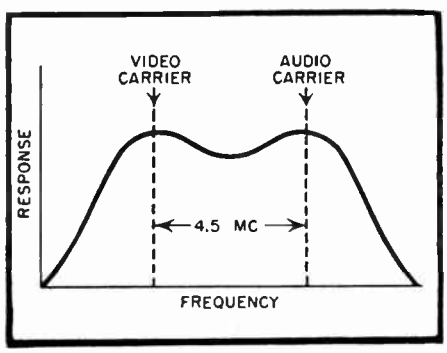


Fig. 3 Shown above is a typical standard response curve for television r-f front ends

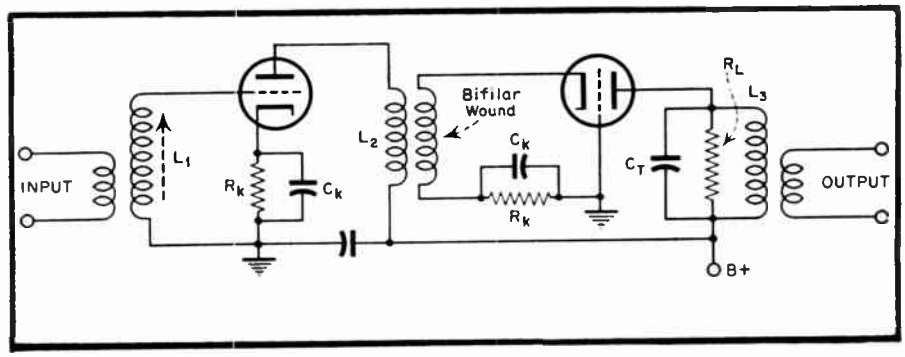


Fig. 4 Cascode circuit modified for use as a television booster. L3 has been eliminated and L2 is bifilar wound to provide a d-c path for cathode current of grounded grid-stage

LOUDSPEAKERS IN FM RECEIVERS

by J. Richard Johnson

Continuing our series on f-m receiver circuits, we go into a discussion of the loudspeaker, how it operates and how it is serviced

IN the previous article in this series we have traced the signal through the f-m receiver from the antenna to the output circuit of the a-f amplifier. We now consider the one remaining component, the loudspeaker, and our analysis of the receiver is complete.

Loudspeakers in f-m receivers have the same purpose as loudspeakers in a-m receivers and are generally similar. This purpose is the conversion of a-f electric currents from the a-f amplifier into sound waves whose instantaneous pressure amplitude varies in the same way as the electric current amplitude in the amplifier output circuit.

If all the intervening circuits have been properly adjusted, the sound waves emanating from the loudspeakers should be quite similar to those which enter the microphone at the broadcasting studio of the received station. However, in many cases it has been found desirable to make modification in the modulation signal to suit the average personal taste as to frequency response. This is especially true in a-m broadcast receivers, in which the average listener leans toward over-accentuation of the low frequency portion of the a-f range and a "bassy" signal. This tendency has probably developed from distortion effects in the higher frequency range which cause the listener unconsciously to want to eliminate this range and thus simultaneously eliminate much of the distortion.

In f-m receivers, however, more attention has been given to development of proper response and a low percentage of distortion throughout the a-f range from 50 to 15,000 cycles per second. It may now be said that, with modern components and equipment available, exact reproduction of the originally transmitted sound waves is a reasonable ideal.

Loudspeaker Requirements

The requirements of loudspeakers in f-m receivers are in general somewhat more exacting than those for a-m broadcast receivers. But small table and midget model f-m receivers have the same types of loudspeakers as similar a-m models. For these, then, there is no need for special consideration here. Rather, we are concerned with the larger, more elaborate f-m receiver in which reproduction is expected to meet nearly all the higher standards possible with the f-m system.

For such a receiver the loudspeaker system must be capable of doing full justice to the low distortion and extended frequency response preserved in the receiving circuits themselves.

Problems in f-m receiver loudspeakers are concerned mainly with the increased frequency response range and minimizing of harmonic and intermodulation distortion. The latter two factors are related to the first, since a wider frequency response allows the high frequency distortion components to pass as well as the *desired* original higher frequency components of the signal.

For instance, a loudspeaker which does not reproduce signal components above 5,000 cps automatically filters out any harmonics of signal component fundamentals between 2,500 and 5,000 cps, as shown in Fig. 1. A wider pass band allows more distortion to be reproduced, providing, of course, it is present in the signal or introduced somewhere along the line.

The loudspeakers used in the elaborate types of f-m receivers are ordinarily specially designed for low distortion, good frequency response and considerable power handling capability, even though their appearance is very similar to that of other, less rigidly designed types.

The common "garden" variety of loudspeaker reproduces a range from about 200 cps to 4,000 cps with a reasonably low distortion percentage, but with wide variation in different types. Moreover, most of the less expensive speakers are subject to numerous resonance frequencies which cause the response curve to have sudden jumps or peaks and thus add to frequency distortion.

Single loudspeakers used in some of the better f-m receivers are capable of reproducing signal components from 60 to 10,000 cps with distortion in the order of no more than five percent.

Differences in Physical Appearance

Single loudspeaker units of high fidelity characteristics generally have large field coils and magnetic cores, or, in the permanent-magnet type, large magnets. Better general workmanship in the constructional details than in cheaper types is also often discernible.

Otherwise, single high fidelity loudspeakers are very similar in appearance to the less rigidly designed types.

Diameter Over-emphasis

There is a tendency among radio men to overemphasize the importance of large cone diameters for high quality reproduction. Actually the size of the cone has an influence on only one factor, that is the "cutoff" frequency, which is the lowest frequency reproducible with the speaker. It also has an indirect bearing on the efficiency. However, cones as small as eight inches in diameter are giving superb performance, competing in many installations with 12- and 15-inch models. The smaller diameter models have the advantage that baffling and mounting are much simplified.

Dual Loudspeakers

The use of more than one loudspeaker unit in one receiver is not frequently encountered. One arrangement includes two speakers mounted alongside each other, as in the General Electric "Musaphonic" models (RADIO MAINTENANCE, *February 1949*). This gives better distribution of sound than a single speaker and allows each speaker to operate well below its maximum power capabilities for improved quality of reproduction. The voice coils of these speakers are connected in parallel and no dividing network is necessary.

Only one or two commercial receiver models have dual loudspeakers, that is, loudspeaker systems in which separate assemblies are used for reproduction of the high and low frequency components respectively. However, these loudspeakers find ready use in *custom* installations. These installations offer good business possibilities to the serviceman, so a brief review of types of dual loudspeakers is given here.

Woofers and Tweeters

The original dual system employs completely separate loudspeakers for the high and low frequency ranges. With this arrangement, the speakers are designed for maximum efficiency and minimum distortion within the relatively narrow frequency range each has to cover.

The low frequency speaker is referred to as a "woofer" and the high frequency speaker as a "tweeter." The woofer is usually a rather large diameter cone speaker designed to reproduce the lower frequency range with a minimum of distortion. The tweeter, which handles only high frequency signal components, is physically relatively small, since the cutoff frequency, or low frequency limit, can be quite high and more efficiency can be obtained on the higher frequencies with a smaller assembly.

With the simple cone radiator construction, such as is used for the woofer, the high frequency signal components have a marked directional characteristic. These signal components are radiated in a relatively narrow beam around the axis of the cone, as shown in Fig. 2. On the other hand, the low frequency signal components are much more uniformly distributed. The result is, that unless special measures are taken to distribute the high frequency radiation, a listener located to the side of the cone hears very

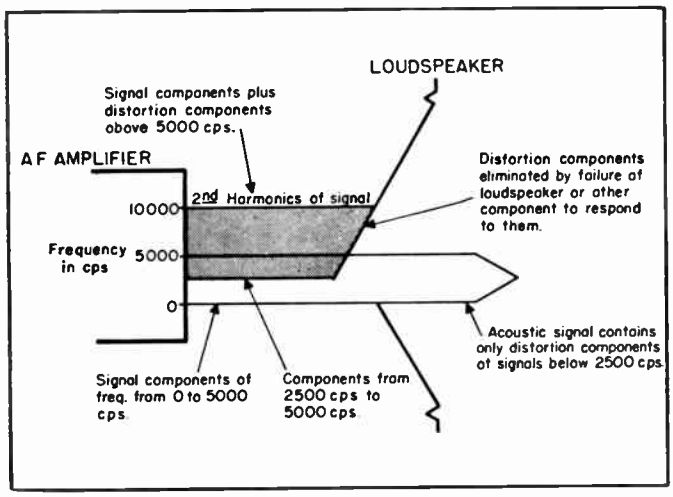


Fig. 1 The above diagram illustrates how a loudspeaker system which does not reproduce high frequencies may improve reception

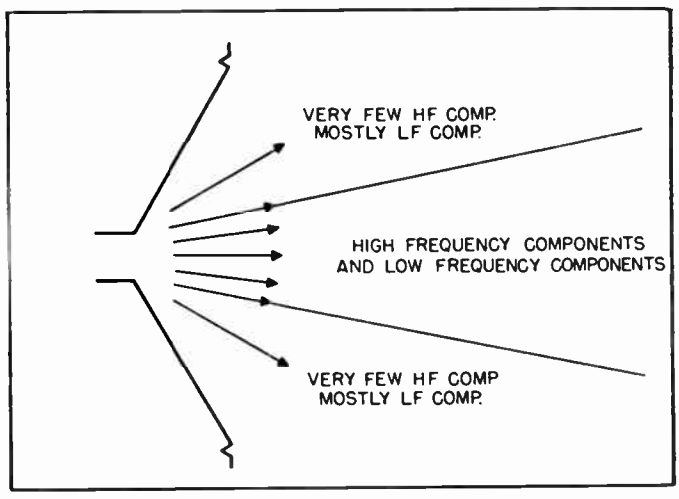


Fig. 2 A typical woofer-tweeter combination loudspeaker. High frequency components are radiated in narrow beam around cone

Fig. 3 Shown above is an Altec Lansing speaker. Such horns are used for better distribution of high frequency components

Fig. 4 This Jensen coaxial speaker shows how woofer and tweeter units are physically combined, though functioning separately

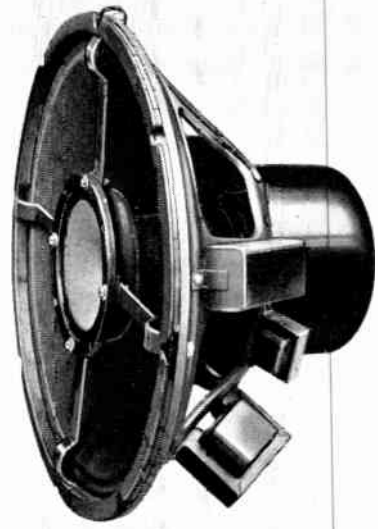


Fig. 5 The dual combination speaker illustrated above has its complete separate tweeter unit mounted in front of woofer cone

few high frequency components, while only the listener located directly in front hears the proper proportion between the high and low frequency ranges.

To overcome this tendency, the radiating devices on tweeters are usually specially designed to increase the angle of distribution of the high frequency sound. One such an arrangement is the cellular horn illustrated in Fig. 3. The horn is divided into small separate sections; the output of each section is directed at a slightly different angle, the side sections directing the acoustic energy at the greatest angle from the cone axis. Sometimes a pair of small horns, each directed at an angle are used.

Tweeters are available as part of a particular loudspeaker system, or, if a good woofer is available, the custom builder may buy a tweeter to add to the woofer. Types are available which can be mounted inside a receiver or speaker cabinet or others which can be placed on the top of the radio cabinet.

Combination Dual Speaker Types

Loudspeakers in high fidelity installations often employ dual types in which the woofer and tweeter units are physically combined although separate in function. One of the most common of these is the *coaxial* type illustrated in Fig. 4. The small tweeter unit is built into the center portion of the woofer pole piece. Separate voice coils and driver units are employed. Such an arrangement is available in either the tweeter single horn or the cellular tweeter horn styles.

Another type of dual combination is the one which uses a completely separate tweeter mounted *in front* of the woofer cone, as illustrated in Fig. 5.

The above type of dual speakers all have a separate *electrical* system (separate voice coils) as well as separate mechanical systems (separate cones or horns). Another popular type, in which only a single voice coil is required for two mechanical assemblies is the "diacone" arrangement. The principle is illustrated in Fig. 6. The woofer portion is quite conventional. The tweeter is a small diaphragm assembly mounted in the center of the woofer cone and coupled to the woofer cone by means of a piece of material which has the property of transmitting high frequency signal components from the woofer cone to the diaphragm. This mechanical connection between the two radiators discriminates against low frequency signal components and thus acts as a high pass filter, conserving most of the low frequency energy to operate the large woofer cone.

Dividing Networks

In order that the full advantages of the dual type of loudspeaker system be obtained, a dividing network must be used. This is true with all types except the diacone type last mentioned, in which the mechanical connection between the high and low frequency radiators acts as its own dividing network.

For loudspeakers in which two separate voice coils are used, however, it is necessary for proper efficiency that the a-f signal output of the receiver or amplifier be divided into two parts, according to frequency range. A certain frequency, which is to be the dividing line between the high and low frequency ranges, is chosen by the designer of the speaker system, and is called the *cross-over frequency*. This may be defined as the frequency at which the dividing network has the same response for the high frequency output circuit as for the low frequency output circuit. At frequencies above this cross-over value, the tweeter receives more signal than the woofer, at frequencies below it, the woofer receives more signal.

Fig. 7 illustrates the general principle involved and how the a-f signal is divided into two separate ranges. There are two input ter-

minals on the divider network, to which the signal from the amplifier is applied. There are usually four terminals at the output of the divider network; two of these terminals connect to the tweeter voice coil while the other two connect to the woofer voice coil. The ideal of a well-designed dividing network is to feed *all* the signal components with frequencies higher than the cross-over value to the tweeter and all those having lower frequencies to the woofer. Actually, nothing is ideal and practical networks are a compromise arrangement in which the response is something like that illustrated in the graph of Fig. 8.

The design of the dividing network filters in commercial installations is quite technical and special components of odd values are often used. The average serviceman will ordinarily not be called upon to make any changes or adjustments inside the networks he encounters. Since failures of components and other breakdowns in dividing networks are extremely rare, the serviceman is concerned mainly with checking external connections and understanding overall operation.

Generally the same servicing approach is applicable as would be used for any dynamic loudspeaker. However, in the dual types, special design features introduce delicate adjustments beyond the scope of the general technician. The serviceman will probably find that custom installations and checking of high fidelity installations will be his main contacts with this type of equipment. In such cases, it is almost certainly more profitable not to attempt to repair defects in the more elaborate speaker assemblies himself, but to replace the units when such defects occur, unless some simple obvious defect is repairable in a short time.

We have now completed our circuit description of the f-m receiver from the antenna to the loudspeaker, considering those details of technical information which are useful to the service technician in making his everyday repairs. We now turn to the proper technique of alignment of these receivers, and our next article in this series will concern itself with this subject.

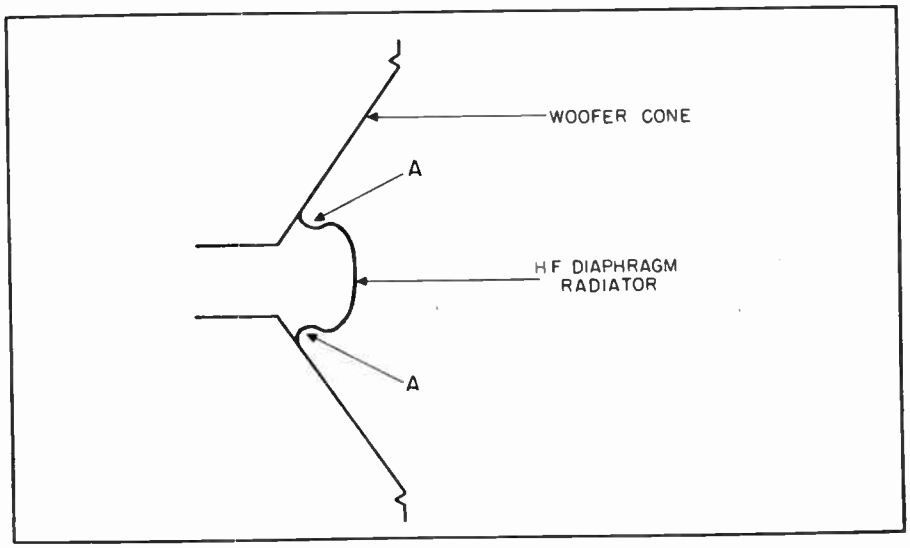


Fig. 6 In this "diacone" arrangement, the tweeter is a small diaphragm mounted in the center of the woofer cone. Only a single voice coil is required for this type speaker

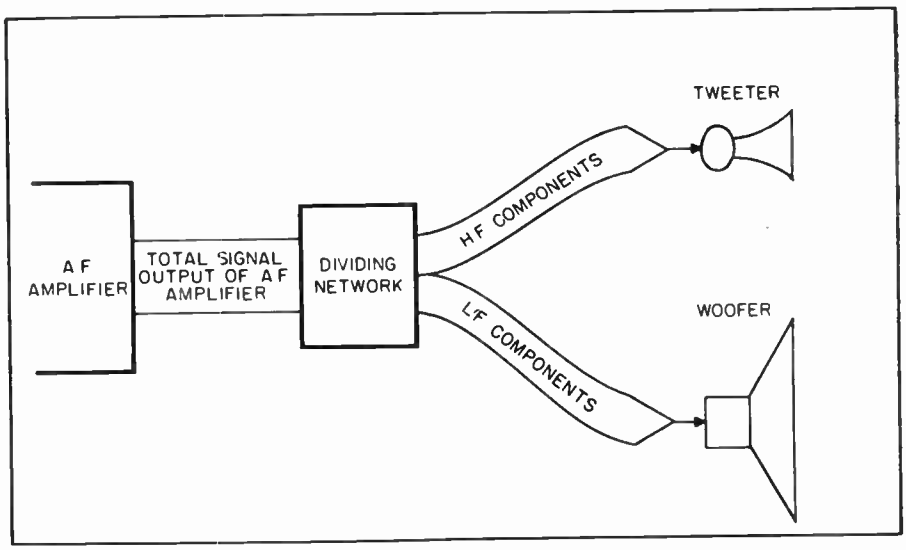


Fig. 7 Above diagram shows how dividing network separates the high frequency and low frequency components of the a-f signal for application to tweeter and woofer respectively

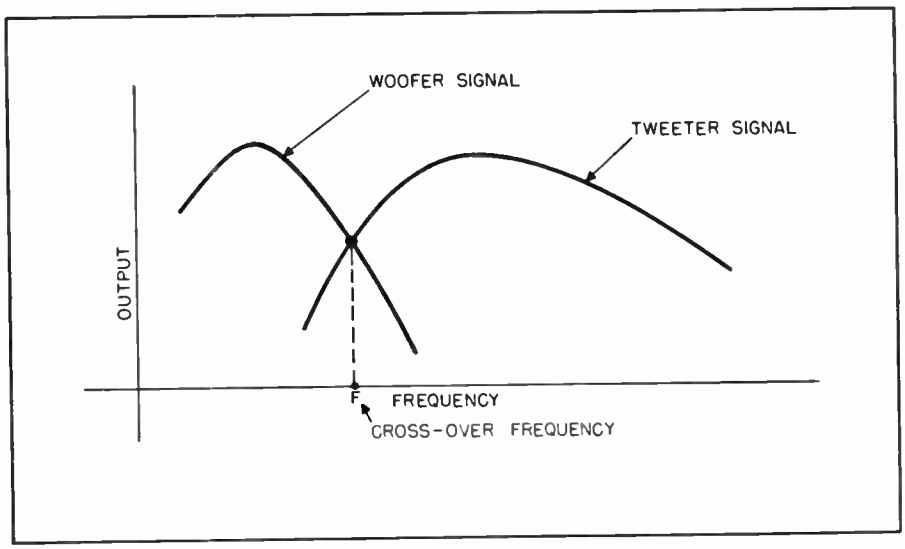
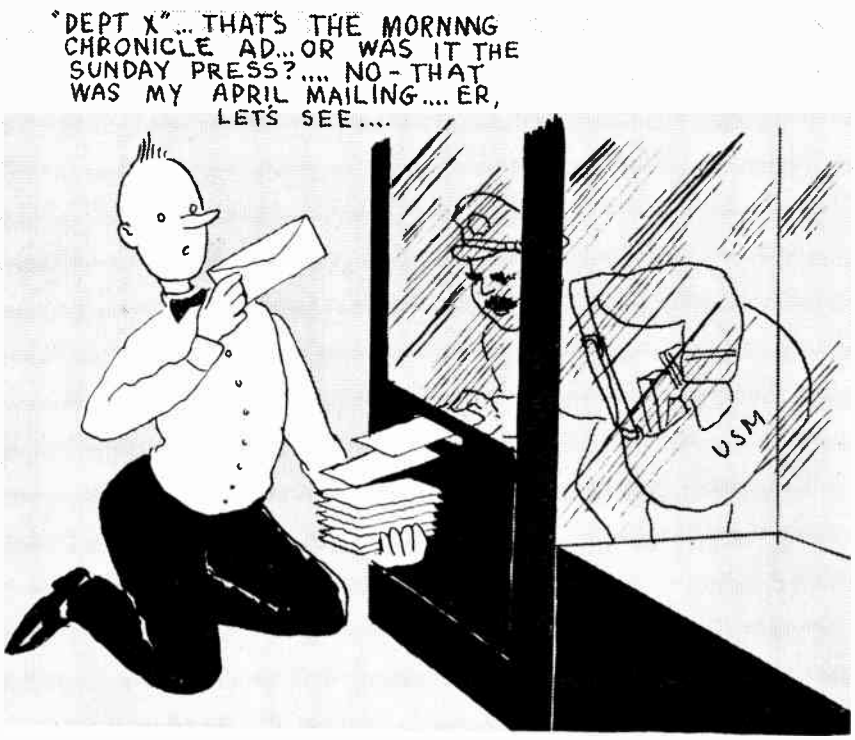


Fig. 8 Typical response curve for a divider network. In the ideal network all signal components with frequencies higher than the cross-over value are fed to the tweeter

CHECKING AD RETURNS and some tips on direct-mail

by Victor M. Turner Advertising Manager, Radio Maintenance

CHECK ON EVERY AD YOU RUN AND DON'T PLACE AN AD OR MAIL A PROMOTION LETTER WITHOUT HAVING A MEANS OF KNOWING WHAT ITS EFFECT WILL BE



AS we said before in this series, and as you no doubt already know if you've done any advertising, checking the "return" of advertisements is not an easy matter.

Making certain of the results of your ads is very important to you, because it influences your future advertising campaigns. Never place an ad blindly and without some means of ascertaining its effectiveness. Because, unless you know what your promotion is doing for your business, you cannot hope to prepare an efficient campaign; and you certainly cannot afford to continue paying for advertising that is not pulling for you.

There are several ways in which you can tally the returns of advertising.

One of the most obvious, of course, is to ask the new customer how he came to select your shop for his trade. Many business firms do this while taking down the name of the customer. This is, however, by no means a necessarily accurate check, although it does give generally a fair indication of the influence of your advertising. It is not altogether accurate because, as all research organizations can testify, direct questioning does not always meet with a reliable answer. Incorrect answers are not always due to the fact that people naturally and deliberately give wrong or evasive replies, but because they do not remember in many cases what made them choose this particular shop. Sometimes they come into the shop weeks after they have seen the ad, and naturally don't recall much about it.

The Key

The most common and most widely used means of checking the return of advertisements is by "keying." This is the system whereby ads, placed in several different media, are each equipped with a different "key." This key is usually inserted in the address of the firm or in a coupon where the reader is given some inducement to write.

For example, if you have an item as a free giveaway, you might say near the bottom of the ad: "This is yours, free, simply by writing Dept. A, Jenkins Radio Shop." If this ad is placed in two different newspapers at one time, the ad in one newspaper would have "Dept. A" in the address and the ad in the other would have

"Dept. B". Then, as the letters come in, you can see which newspaper gives you the most response.

If you supply a coupon in the ad, for the reader to fill out when asking for the free souvenir, then you may have a number set in one corner of the coupon, and this will serve as a key.

The practice of keying ads is used not only to test the influence of the newspapers or periodicals, but also to test the effectiveness of your own advertising technique. If you are not sure as to the right copy or headline approach to use in a campaign you can test the results of each by putting both ads into circulations and key them differently. Your direct-mail advertising should also be keyed. Do not put the same reply card in two successive mailings without changing the key.

Problems of Checking Returns

The returns you get from these keyed ads must be checked *carefully*, taking several factors into consideration. If you are testing the pulling power of one newspaper against another, the test ads should be inserted simultaneously for maximum accuracy in the tally. If one ad appears one day and the other on the following day, a timing factor will enter the picture, and will throw off the result seriously. The different days of the week, the different weeks and months in a year, all affect advertising returns. An ad appearing on a Monday of the first week in a month will have different effects from an ad inserted on the Monday of the second week of that month.

Another factor to consider is the proper percentage of return which should be considered too. This percentage of return is that number of replies you get to the total circulation of the paper or periodical in which the ad appeared, or to the total number of pieces which were sent out in a mailing.

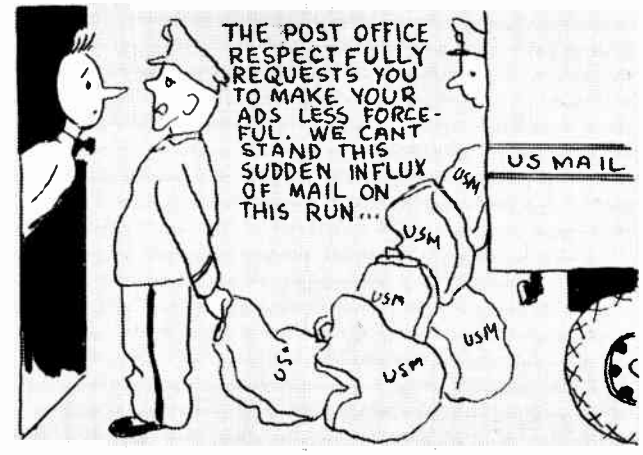
Usually, a good percentage of return can vary from one half of one percent to five or ten percent, depending on the nature of the product or service sold in the ad. Since you are not selling a product which can be ordered by mail (such as a book, or a correspondence course), the number of replies you get to an offer of a free giveaway does not represent the total number of persons who have read your ad and selected you as the man to whom to entrust their radio for repair when the need arises. Since a giveaway will not only prompt action on the part of some of your prospective customers, this must be kept in mind in anticipating the percentage of replies received. On the other hand, not every person who sends in for the free item will prove to be a cash customer later on; but this can be due to negligence on your part in not priming him enough with direct-mail follow-ups. (Every name that comes into your hands should be considered a fortunate and valuable treasure, to be added to your mailing list.)

If you are giving away a free item, it is primarily a device to arouse interest and to provide you with a means of checking your advertising Your main purpose is of course to impress the reader with your radio servicing ability. For this reason, the announcement of any giveaway should not be the most dominant thing in the advertisement. If it is mentioned toward the bottom of the ad in small type, you may be more certain that the person sending for it has read the main text of your ad.

Combining all these facts—the possible average fraction of a media's readers that will see your ad—the percentage of this group that will act upon it immediately—and the group that will not respond immediately but intends to use your services—we may assume that with a small giveaway of moderate interest value, you should expect a return of from one to three percent if you are placing your ads intelligently and are using good copy and layout.

If this percentage is not reached, then you must improve your advertising technique or find other media in which to place your ads.

But before forming any conclusions on the effectiveness of your campaign, make very sure that you are tabulating your ad returns accurately and carefully.



Direct-Mail Advertising

There are some techniques that are in successful use in direct-mail advertising today. You should keep them in mind when preparing your mailing pieces.

Basically, a mailing piece should be made to resemble an individually addressed letter or postcard as closely as possible. This resemblance should cover both the text which is used and the reproduction which is made.

One of the most effective combinations (using an envelope) is a typewritten letter and a printed sheet or folder.

The letter should be produced to appear individually typed with a signature printed in blue for maximum effect. It should be written in a personal style to the reader. The style

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WHAT'S IN A NAME? P-R-O-F-I-T

by Jack Bedford

READ HOW THIS SERVICE TECHNICIAN IMPROVED HIS BUSINESS BY A VERY SIMPLE METHOD YOU TOO CAN USE

WHEN I arrived at the South Berkeley Repair Shop, Bill was busy helping customers. My turn came and I briefly told him that I wanted an interview on the secret of his successful shop operation. Since there were others waiting in the shop, I suggested that I delay the interview until he had more time.

While I was waiting for the interview, I discovered the reason for Bill's success.

Bill didn't do business on cut rate prices. His shop was not out of the ordinary. The location was just average, but customers were actually going out of their way to bring in repair work for Bill.

Why?

Because there is a friendly atmosphere in Bill's shop.

Yes, this is the secret of Bill's successful operation. He creates a friendly atmosphere in the shop and people enjoy doing business with him. He makes all of his customers feel welcome and that they are his friends. Waiting doesn't seem too long in a friendly service store.

How does Bill create this friendly atmosphere? He greets his customers by their name.

While I was waiting for the interview, he took care of eight customers. Seven of these he called by name in a friendly greeting when they entered. The eighth was a new customer, but before this man left he was called by his name, Mr. Bennett, no less than six times.

Does calling customers by their name pay off in increased business?

It certainly does for Bill. In the last year his service income has more than doubled. He actually has more business than he can handle. The friendly atmosphere in his shop which he creates by calling his customers by name has paid off in handsome dividends.

All service shop operators can increase their service income by creating a friendly atmosphere in their shops. Calling customers by their names does a great deal to improve the customer relations of a service shop. A little earnest effort in learning and remembering customers' names will encourage customers to do business with you.

Many servicemen say that they can't remember their customers' names. But they can. It is not a difficult task if the following suggestions are used. The application of these principles will make remembering names a pleasant pastime rather than a business hazard.

Want to remember customers' names

This step in the memory process shouldn't prove too difficult. If a vivid impression is made of the sound of the cash register ringing to the tune of customers' names, a natural desire is created to remember names. Anyone can remember things if he sees some reason for the memory work. The reason in this case is that it will create a friendly atmosphere in the service shop. This in turn will produce profits.

Ask new customers their names

This is just a natural conversational opener, and it can erase the thought of trying to sell the customer some extra service. People naturally don't mind talking about their own names. A little practice on this rule and you will become an expert at asking people their names and getting them to talk about themselves. It is easier to sell extra service and parts to a talking customer than to one that is silent.

Understand the customer's name

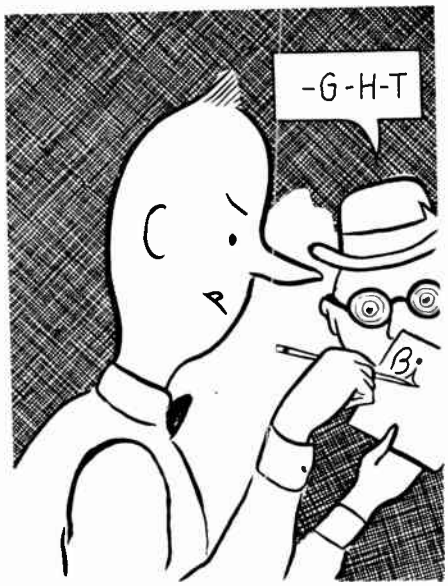
If the name isn't clear when you first ask the customer his name, ask him to repeat it. It is much better to get a clear impression of the customer's name at first than to run the risk of mispronouncing it later. Ask the customer how he spells his name if it is not clear. If it is unusual, make some comment about it.

For example, Mr. Bennett has a double 'n' and a double 't' in his name. Some appropriate comment on the name will clear up any hazy impression that results from not hearing the name distinctly at first.

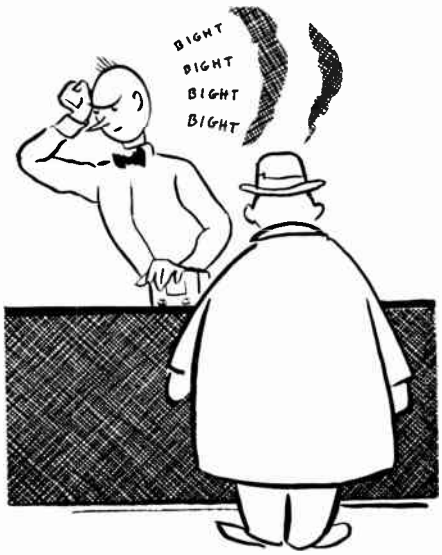
Concentrate on the name

After getting the name on the service work order, make an effort to eliminate all other thoughts from the mind for a brief instant. Think only of the name and the customer. Focus attention on the name and it

First, find out the name of your new customer



Be sure to get the spelling of that name right



Then concentrate on it so you won't forget it

will be indelibly impressed on your memory. This is the most difficult of steps in the memory process, but with practice it can be developed.

Repeat the name several times

Repetition is one of the oldest methods used in memory work. Many things that we remember have been accomplished by the process of repeating. To remember the customer's name, repeat it several times during his first visit to the shop. Bill repeated the new customer's name, Mr. Bennett, six times while making out his service order.

Associate the name with the customer

This can be accomplished by learning something about the customer and his interests. Always look for the good points in this association because it is easier to remember pleasant associations than those which are unpleasant. With a little practice on this rule, it will soon become an easy matter to associate the customer's name with something favorable about him.

Review the name periodically

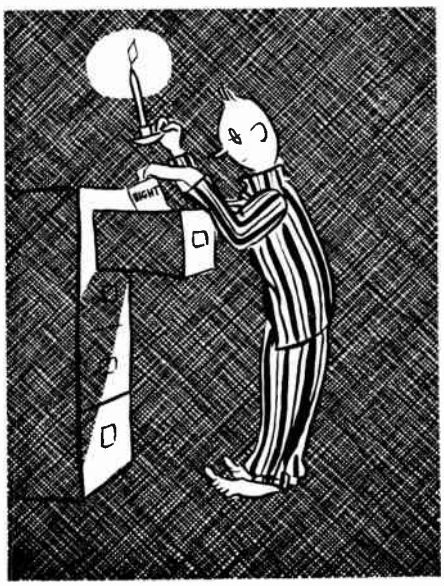
If the customer is greeted by his name after a long absence from the service shop, his visits will probably become more and more frequent. To remember a name over a period of time it is best to write the name on a card and review the cards occasionally. Most service shops have a permanent record card that will serve the purpose for recording the customer's name and other helpful information.

When reviewing the cards, it often proves helpful to picture the customer. Bill keeps a card file of the names and service work done of all his customers. He makes it a practice to review these at least once a month. In this way he has developed his memory for the names of his new customers.

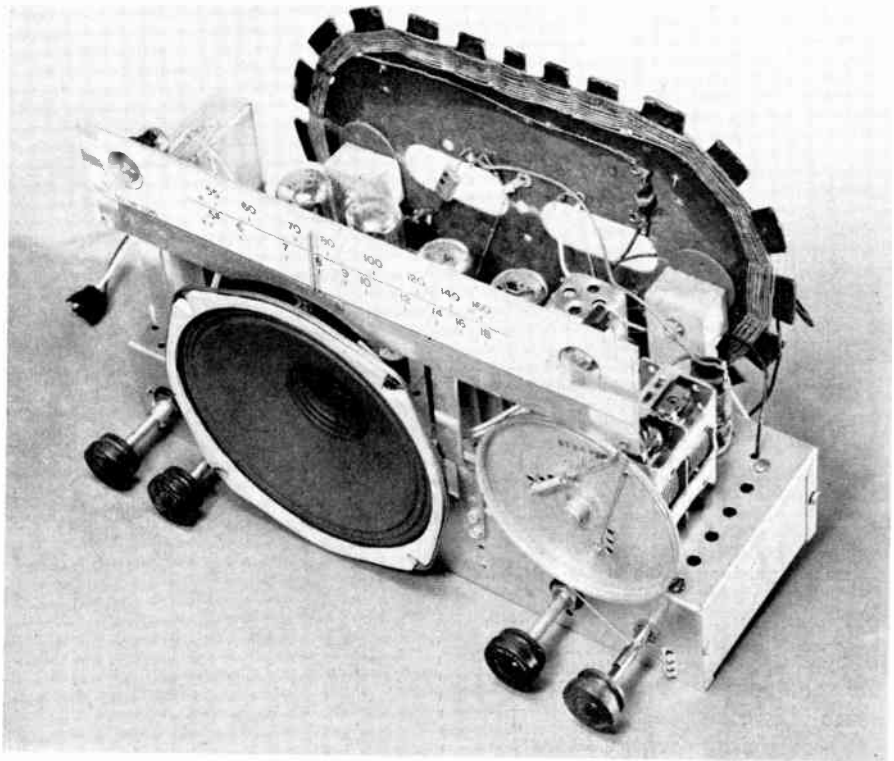
Yes, a friendly atmosphere can be created in a service shop by remembering customers' names. The friendly shop is the shop that enjoys increased service orders and profits.

And now repeat it to the customer a few times

After he leaves, associate him and his name



And review it often, so you will remember it



AC-DC models, as this Federal receiver, will constitute the new technician's first jobs

AC-DC Hints for the New Service Technician

by Richard Laurence

THE ANSWERS TO SOME OF THE PROBLEMS YOU WILL MEET WHEN STARTING YOUR RADIO SERVICE CAREER

THE beginner-serviceman in the average community will find that a very large percentage of his work will be on inexpensive table model radios. This is natural, because the people with large, costly receivers will tend to shy away from him until he has established a reputation of being honest and competent. Most table models were transformer operated a decade ago; but the series type a-c/d-c power supply is practically standard in the $15-$20 class radios of today. Since he will have to deal with so many a-c/d-c receivers, the new serviceman should learn to recognize and correct typical faults without going through time consuming troubleshooting procedures. It will enable him to turn out a much larger (and more profitable) volume of work.

Burnt out tubes are much more common in these radios than is the case with a straight a-c power supply. If the receiver will not light up when turned on, you can be almost certain that one of the heaters has opened up. The fastest way to discover the bad one is to take the tubes out one at a time and test the filament for continuity with an ohmmeter. After looking up the pin connections of typical tube lineups a few times, you will know them by heart, and can service the average job of this kind in three to five minutes. If the radio is fairly new, you will probably not need to do any further work; if it is five or six years old, it may pay you to test the rest of the tubes in a tube tester in the hope of selling the owner on the idea of replacing the weak ones. Most modern series rectifier tubes have a filament tap that runs the dial light; in the 35Z5 this is connected between pins three and two. Always test this tap for continuity, as well as the main filament (pins two and seven). Other types have different pin connections, but the idea is the same.

Open Filter Condenser

Opening up of the filter condenser is another common trouble. You can spot these at once; there will be a loud hum, even with volume turned all the way down, and reception will be weak and distorted, as if someone were talking with his mouth full of water. You will need a good supply of 20-50 mf 150-volt electrolytics for these replacements. Most of the original filters will be in a single block. You should replace all sections of the block, either with single condensers or a similar block, and it is considerably cheaper to buy replacement blocks. Sometimes the filters become leaky instead of open. In this case, hum will be more normal, and distortion not noticeable; but reception will be weak. You can spot these by measuring plate supply voltage. It will be fifty to sixty volts d-c, instead of the usual 80-100. If new filters do not bring your supply voltage up to normal, try a new rectifier tube, even though the old one tests o. k. I have found that it pays to buy only the best in filter condensers. The cheap ones cause you much more grief and ill will than the few pennies you save are worth.

Modulation Hum

Another common trouble is mo'ulation hum. You will hear this only when a station is tuned in, and turning down the volume decreases it. An .05 mf, 600-volt paper condenser from the rectifier plate to B minus will cure nearly every case of this type. Sometimes the chassis is B minus, and sometimes it is a common bus wire, isolated from the chassis. For this reason I always connect the low end of the condenser to the re-

ceiver side of the on-off switch, since it is invariably a B minus point (this is true only of a-c/d-c receivers, not of those that have an a-c transformer or a voltage doubler). The condenser can also be connected between the rectifier plate and cathode. Usually the trouble will be caused by the original condenser having opened up, or it may have been left out altogether for reasons of economy. About once in two hundred radios, you will find this condenser shorted. This burns out the rectifier tube, and is worth checking for if you find a radio with this tube open. I ruined two new 35Z5s the other day when I was tired and in a hurry and failed to check this condenser.

Shorted bypass paper condensers are very rare in a-c/d-c receivers because of the low working voltage and the absence of surges. When you do find one, it will generally be the condenser discussed above, the coupler between the first audio tube and the output tube, or the bypass between the output plate and B minus. The filter condensers in an a-c/d-c receiver short out with about the same regularity as in any other type of radio.

Intermittent Reception

You will run across many cases of intermittent reception. These fall into two classes.

1. The radio stops working completely for varying periods of time, the light goes out of the tubes, and it acts just as if it had been turned off.
2. The radio stays on and hums normally, but there is no reception or extremely weak reception.

The first type intermittent is relatively easy to diagnose. Just turn the chassis upside down and connect an a-c voltmeter (if you are using a-c current) to the two ends of the line cord inside the radio. If the reading remains normal when the radio quits, you can clear the cord and plug, and start looking for a tube whose filament is opening up from time to time. Connect the a-c voltmeter across the filament prongs of each tube in turn. If there is no reading (with the set dead) the tube is o. k. When you find a tube with full line voltage reading across the filament, you have found the open one. The same procedure applies to series dropping resistors if there are any in the re-

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Service with the Ammeter

Some techniques developed by a practicing technician which can save you time, labor, and effort

by O. J. McDaniel
Mack's Radio Service

IN MY servicing work on home and car radios I have found the use of an ammeter very efficient. This testing procedure, employing an a-c ammeter for home radios and a d-c ammeter for automobile sets, has resulted in a saving of time and labor. And although the ammeter is not an instrument which will solve all servicing problems, it has, in nine out of ten cases, indicated the faulty part in a receiver.

The idea underlying the use of the ammeter for testing purposes is very simple. The normal power consumption of a receiver is either given on the name plate on the chassis, or on the schematic diagram for that receiver. If the actual power consumption, as determined with the meter, does not correspond to the specifications, faulty operation is indicated. By converting power consumption, as specified for the receiver, into amperes by using the formula,

$$I = \frac{W}{E}$$

where I = amperes, W = watts, and E = volts, a direct comparison between actual and specified power consumption can be made.

If a receiver has become inoperative, some component has broken down. The trouble may be shorted filters, bypass condensers, shorted power transformers, burned-out output transformers, burned-out field coils, open filaments, etc.

With a little study and practice of this test procedure, the ammeter will indicate in many instances the fault of the receiver. However, you must keep in mind that it will not tell everything.

Home Rodios

For servicing home radios, it is best to use a 0—1 ampere a-c meter. It is more sensitive than the larger ones, and therefore more efficient. The range of this meter is about 115 watts, which is sufficient for most radios without the phono section. A one-ampere fuse in series with the meter has to be used. The meter is mounted on a panel, into which the radio can be plugged. A schematic diagram of the panel is shown in Fig. 1.

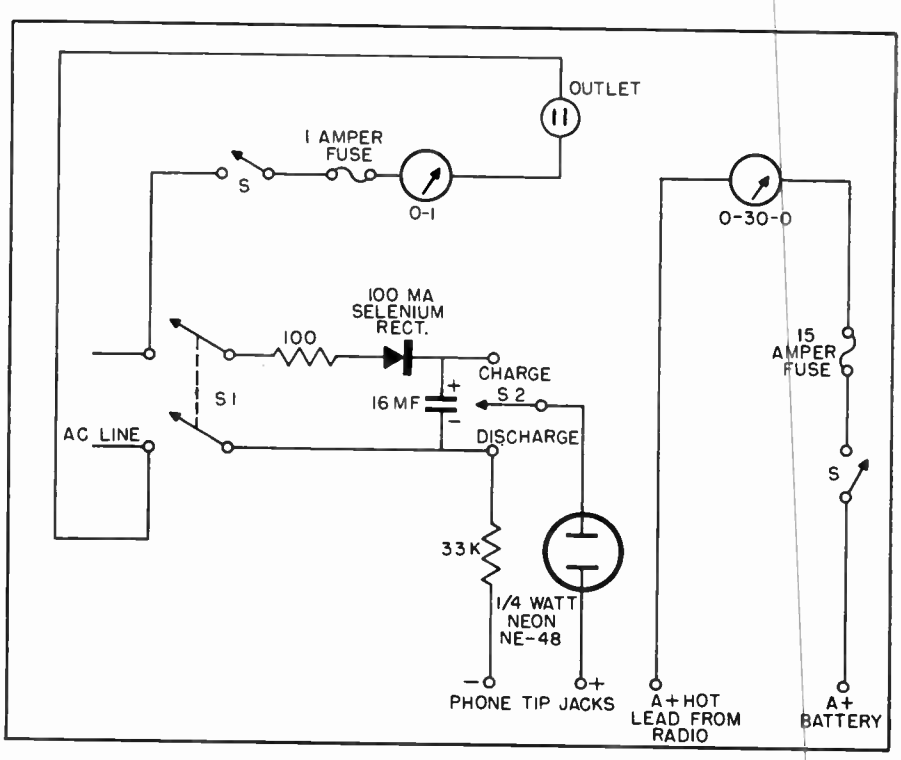

Fig. 1 Shown at left is schematic of a-c ammeter as mounted in the panel. The neon tester is used for the examination of capacitors. The d-c ammeter is shown at right

In servicing a-c/d-c receivers, the meter shows the continuity of the filament string and the current drawn while the set is heating up.

A 35-watt a-c/d-c receiver draws about 18 watts when it is first turned on. As the tubes heat up, the current begins to rise, and if nothing is shorted the needle will stop on the 35-watt mark.

It will take the needle about 15 seconds to come to rest. A longer period than this may be caused by high resistance in the filament string or a poor rectifier tube. If the needle does not move off the starting point, a bad rectifier tube is indicated.

The meter will show immediately if a filter is shorted. Shorted plates and bypass condensers will not be detached until the filters are charged.

A 60-watt a-c receiver, working properly, draws about 39 watts (.34 amperes) when first tuned on, and begins to increase its power con-

sumption as the tubes warm up. Should the meter go beyond the 60-watt mark, a short is indicated.

With the rectifier tube removed the meter reading will drop to 25 watts (.22 amperes). On the other hand, if the current consumption is high and if, after removing the rectifier tube, current consumption remains high, the fault is likely to be a shorted power transformer. With the power amplifier tube removed, the meter reading will drop to 48 watts (.42 amperes). A burned-out field coil or burned-out output transformer will drop the consumption to about 40 watts. An open filament will cause a drop of about 5 watts.

Here is an example to illustrate the use of this testing procedure in actual practice.

A Ward Model 84WG-2714A was brought into my shop with the complaint that it would cut out on a-m after a short time of operation and, after playing on f-m until warm, would not play when switched to a-m.

With the receiver set to f-m and plugged into the panel, the meter indicated 60 watts (.52 amperes) consumption. This was the correct power consumption for this model. With the radio switched to a-m, the meter read 70 watts, indicating a partial short. An ohmmeter check showed that the 8200-ohm resistor from B+ to ground had decreased to 300 ohms. Replacing this resistor restored the set to normal operation (60-watt power consumption).

One note of caution. You have to be ready to turn off the meter if the reading should go high, as radios which have a serious short will draw 2 amperes or more, and may damage the rectifier tube or blow the 1-ampere panel fuse.

Automobile Radios

For servicing work on car radios I use a 0-30-0 d-c ammeter. This meter is in series with the "A hot" lead. It is possible to use a 0-20 meter, but if such an instrument is used, be sure that the polarity of the meter is not reversed. The schematic for a particular set will give the normal rated input current for a certain input voltage (usually 6.3 volts).

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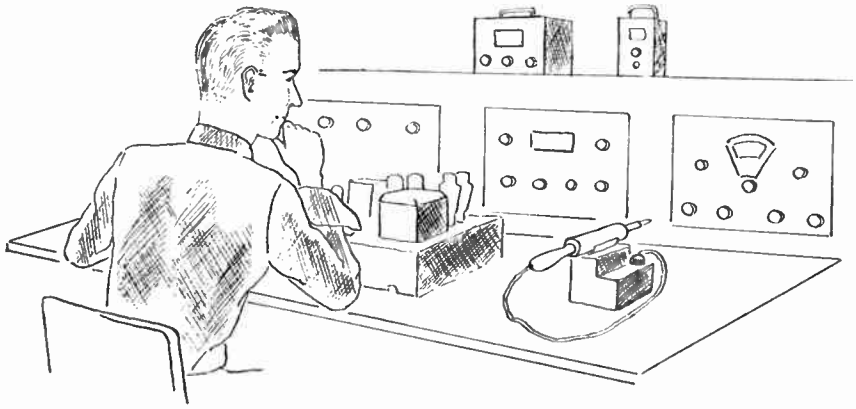
Over the BENCH



by John T. Frye

DAMON and Pythias, Jonathan and David, Tennessee and his Partner—yes, history and fiction have recorded many great friendships, but the feeling between the radio manufacturer and the radio serviceman would hardly belong on this list.

There is many a manufacturer who secretly believes that the average serviceman is a dull-witted, half-educated electronic butcher who takes a fiendish delight in messing up the receiver built with such great pains and then tries to cover up his lack of technical knowledge by saying that the set was poorly constructed.

At the same time, no small number of servicemen are half-convinced that most of the radios that come into their shop have been designed, built, and inspected by a bunch of slip-stick-happy college kids who could not fix one of their own brain-children in a month of Sundays and whose main object in life is to make the receivers just as hard to service as they can.

As is usually the case when two people dislike each other without knowing each other, both of these opinions are grossly inaccurate. They are the result of looking at the radio receiver from purely personal points of view without any attempt to grasp and understand the problems of the opposite party.

It is hard for us servicemen to keep in mind that the manufacturer is forced by competition to give the most attractive receiver for the least possible money. Notice that I say "most attractive" instead of "best," for it is the customer's ideal of a good receiver that must be approached rather than the manufacturer's. If the customer prefers a flashy push-button tuning system to an extra t-r-f stage, that is the set he will buy, and the manufacturer must be guided accordingly or go broke.

Another thing that we should try to realize is that many times there is a sharp conflict between ease-of-assembly and ease-of-servicing. Can the manufacturer, who is forced to watch every penny to be able to meet the prices of his competitors, be blamed if he adopts the system that permits him to assemble the receiver with the fewest number of operations, even though that process does make some of the components hard for the serviceman to reach? I doubt it.

At the same time, the manufacturer who still thinks of the serviceman as an ignorant dub whose goodwill is not worth the seeking is about as up-to-date as a cat's whisker detector. The way in which the service fraternity is taking television in its stride is an unshakeable testimonial to the technical soundness, mental alertness, and progressive versatility of the servicemen.

Just remember that this television thing was more or less dumped without warning into the laps of the radio maintenance men. While the war was going on, most of the manufacturers were working with television circuits in radar and other high-frequency equipment and so were becoming familiar with the operation and problems of this new medium; but during this same time the serviceman was working his head off just trying to keep half-way even with the flood of a-m sets that poured in through his doors. He had practically no time to do any reading or studying against what then appeared to be the far-distant advent of television.

When the war was over, though, television sprang up like a mushroom after a warm spring rain. One minute it was a laboratory toy; the next it was an immediate, insistent, and rapidly-expanding service problem. The fact that the serviceman took right hold of this "bolt from the blue" is a complete answer to any charges that he does not know his business.

What the smart manufacturer is beginning to realize is that the radio serviceman makes a much better friend than he does an enemy. It is a rare day when one of the radio man's customers does not ask him to recommend what new set to buy. Time and again he hears this parting question, "By the way, is this radio of mine any good or not"? If he wishes, he can take time to explain to a disgruntled purchaser of the manufacturer's receiver that he has no right to expect a radio to run forever without need of service.

But do you think that he puts in a good word for the product of the manufacturer whose radio is put together with no consideration for ease of servicing? You know, the type of set that has the wires soldered to the speaker terminals instead of to a convenient plug, that employs Rube Goldberg dial cable arrangements, that cannot be removed from the cabinet unless it is lying face-down on the floor—but I need not go on. You know, all too well, the kind of set I mean.

And how about the manufacturer who prices special parts—special in some minor but hard-to-duplicate detail—at about twice what equivalent standard parts cost? or who takes three weeks or a month to send repair parts? or who refuses to give out service data to anyone exept an exclusive dealer?

I imagine that you do exactly what I do: suggest that the customer buy any other set *except* the one made by the non-cooperating manufacturer. In doing this we are not just being revengeful. We know that servicing such a set requires much more time and effort than it should, and we know that our customer is going to have to pay extra for this; so we have his interest as well as our own in mind when we try to steer him away from the set that is built simply to sell and for which the maker apparently feels no responsibility once it is sold.

We do not expect ease of servicing to be the *first* consideration of the manufacturer, but we do insist that it be given some thought; and we strongly feel that the manufacturer should cooperate fully with us in the matter of providing service information. Working together, we can both have a satisfied customer; bucking each other, we are likely to cause the customer to become thoroughly disgusted with the two of us.

Fortunately, there are many signs pointing to the fact that the manufacturer and the serviceman are moving closer together. The arrival of television on the scene has brought sharply home to both that they need each other. By far the greater majority of the manufacturers are doing everything in their power to help the serviceman, even going so far as to conduct schools, distribute educational literature, and hold demonstrations to aid in installing and maintaining their products. The servicemen are taking full advantage of all this help and are deeply appreciative of the manufacturer's giving it.

If every serviceman could sit in the manufacturer's chair for six months and every manufacturer could work at the serviceman's bench for the same length of time, this slowly-growing friendship would blossom overnight. ✓ ✓ ✓

Better Soldering for Better Service

Some notes on one important part of successful servicing

THERE is virtually no component in the original radio or television assembly that doesn't have solder in its make-up. Consequently, soldering must play a vital part in service activities. Since that is the situation, it is advisable every now and then to review the fundamentals that enter into the efficient and profitable application of solder.

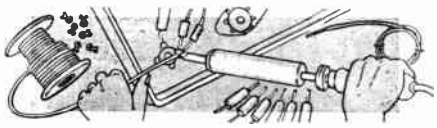
SPEAKING of profitable soldering, it has often been said "that the radio technician's income can be judged on the basis of the number of hours spent with his soldering iron." In soldering, the cost of the solder consumed is exceedingly small, the time involved is proportionately greater, of course; but actually the "returns" for this type of service work are virtually all profit.

"THE RIGHT SOLDERING IRON for the job"! This remark is heard so often that many fail to heed the advice. It is generally realized that the function of the soldering iron is to convey heat through its tip to the parts to be soldered, sufficient heat to melt the solder. Its efficiency for transferring this heat depends upon its ability to transmit or conduct heat through its own body and the ability to discharge this transmitted heat to a second metal. A good many connections are made in tight places but this does not mean that "a small soldering iron" must be used.

THE SOLDERING IRON should be at least 100 watts with an interchangeable small tip for those "fine" jobs. Adequate wattage means adequate heat capacity to bring the parts to be soldered up to solder-melting temperatures. This is elementary but for that very reason its importance is often overlooked. Another "must" . . . keep that iron tip clean and well tinned (solder coated) at all times.

SINCE THE DAY the first commercial radio receiver came off the production line, it has been established that an alloy ranging from 40% tin—60% lead to 50% tin—50% lead is most efficient, providing the finest and fastest soldering results. Some fanciful claims have been made such as "this solder has an improved flux, so you can use less tin in the alloy and save money, etc." However, it is a definite fact that solders of lower tin content are inferior and will not do the soldering job with the proper speed and efficiency, secured only with solder of the proper tin content, regardless of the claims of anyone.

DON'T "CHEAT" on the solder, because the difference between success and failure depends upon the use of "good holder." The cost of the small amount of solder used is so insignificant in relation to the labor-cost involved, that it does not warrant the risk of faulty soldering results, always encountered in using inferior



solder. To do the best work in the fastest manner, use flux-core solder containing within the core nothing but rosin or rosin-base flux. This flux must be absolutely non-corrosive and non-conductive. From time to time, activated rosin fluxes have appeared on the market. In selecting one of these, it is necessary to use extreme caution to make sure that the activating agent is not a corrosive substance . . . is not of a corrosive nature.

FOR THOSE difficult-to-solder parts encountered in television receivers and some radio assemblies, parts that are fashioned of such metals as zinc, nickel-plate, brass, etc., conventional rosin-core solder will not always do the job. Consequently, another type of rosin-core solder must be selected. Make sure it comes from a reputable manufacturer who has been identified with the radio industry since its inception . . . that's important.

TO SECURE the best soldering results, remove unusual surface oxides, if present, at the point of solder-contact wherever the parts or connections are readily accessible. Flux-core solder must be applied at the exact junction between the metal and soldering iron so the solder and flux will be liberated simultaneously just where it is needed. Observation of this technique will allow the flux to exert its greatest activity when and where it is required. Never attempt to carry molten flux-core solder on the face of the iron tip or float it down to the job; if this is done the flux will decompose and leave just a charred residue. Rosin is an organic substance which disintegrates under the influence of excessive heat.

IF THE SOLDER tends to act "stringy or lumpy," as the soldering iron is being removed, it is an indication of the absence of flux or what is termed . . . a change in "surface tension." This is because there is no flux to act upon the oxides that are now forming on the surface of the molten solder. A sparing reapplication of flux-core solder will correct the condition.

BEFORE APPLYING the solder, if at all possible, make a mechanical connection first. In other words, support the joint preparatory to soldering . . . give the solder a helping hand in doing its work. This will provide a solder-bond that will really be lasting.

THE SUCCESSFUL and profitable application of solder is based on a few relatively simple fundamental principles, just as intimated in the opening remarks. Their observance, plus the selection of a *good* solder and soldering iron made by a reputable manufacturer, will give consistently good and profitable soldering results. ⌐ ⌐ ⌐

Checking Ad Returns

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should be casual and friendly, but should cover your story in detail just as any other ad would do.

The printed sheet or folder would cover everything you mentioned in the letter, only in more detail, and impersonally. It should have some good illustrations of your shop and personnel.

If you have a giveaway offer, this should be mentioned in the letter and also on a reply card enclosed with the letter. This card could also be intended for the reader to fill out and invite a visit to examine his radio. In any case, this card must be postage-free for the customer.

This is an expensive mailing piece to make up, but if your budget can stand it, it will prove to be one of the most effective advertisements you can employ.

Some Other Direct-Mail Techniques

The other possibilities for a mailing piece are a combination letter-flier which is a simulated typewritten page with illustrations spotted here and there, or a regular printed ad which may be a reprint of one you are running in a newspaper, thus saving a make-up charge. It is best to include a reply card of some kind to induce action and promote attention.

An effective personalized effect can be achieved by reproducing a handwritten letter by offset printing. When doing this, however, make sure the handwriting is legible and attractive.

Postcards are effective low-cost mailers and have a great advantage in that they can be sent several times for the cost of a single more expensive mailing. The double postcard, one section of which is used as a reply card, can be used very appropriately for a return request.

Postcards can be handled in many ways. They can be printed, using small illustrations, in either letterpress or offset; they can be, as the letters above, typewritten and signed, or they can be hand-written. For the small business with a limited budget, and not too big a mailing list, these postcards can actually be typed and written by hand, thus saving reproduction costs.

the INDUSTRY *Presents*

INTERFERENCE FILTER SELECTOR

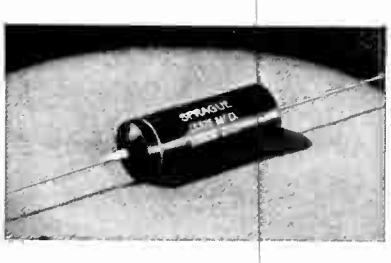
The selector is made of metal and contains hinged-over compartment holding assortment of connecting cords, plugs, clips, and the like. On the job it is readily connected in various ways to the noise-producing equipment. The knob is then turned through a series of different settings, each bringing into circuit the same circuit elements as found in Aerovox interference filters of corresponding type number. What type filter to use and the best connections to make are thus shown on the instrument.

Manufacturer: Aerovox Corporation, New Bedford, Mass.

MISMATCH CORRECTOR

Tradenamed Telematch, this instrument is said to eliminate the electrical mismatch existing between antenna and receiver in so many television receiver installations. The unit is installed by attaching two cable lugs to the receiver antenna input terminals. No tubes or electricity are used.

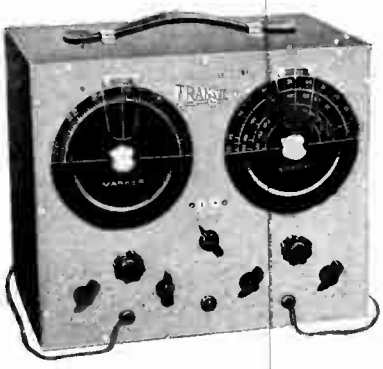
Manufacturer: Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill.



HIGH-VOLTAGE CAPACITORS

Designed for use in television receivers, this new series of high-voltage paper dielectric capacitors is now available. These capacitors are oil-impregnated and encased in molded phenolic housings, rated at 6,000 and 10,000 volts d-c working. As many other capacitors produced by this firm, these are also relatively small in size.

Manufacturer: Sprague Products Co., North Adams, Mass.



FM AND TV SWEEP SIGNAL GENERATOR

This instrument has complete frequency coverage from 0-227 Mc with no band switching, has a sweep width from 0-12 Mc completely variable, and has built-in marker generator. Power consumption 35 watts at 115 volts. Further information may be obtained by writing directly to the manufacturer.

Manufacturer: Transvision, Inc., New Rochelle, N. Y.

TUBE AND SET TESTER

If you're thinking of buying a new tube and set tester, the Supreme Model 600 may be worth while looking into. It has sockets for all tubes, including nine-pin, and a spare for a new one that might be developed, an important anti-obsolescent feature. You can get complete information on this instrument by writing direct to the company.

Manufacturer: Supreme, Inc., Greenwood, Miss.

PORTABLE MIRROR

The "Picture-Vu" comprises a portable mirror placed on a metal stand, and facilitates television receiver adjustments. In operation it is placed in front of the set, giving the technician working behind the set a good view of the screen. The mirror itself is made of unbreakable metal and measures 10 x 14 inches.

Manufacturer: Federal Engineering Co., 37 Murray St., New York 7, N. Y.

INDOOR ANTENNA

For f-m and television use, this indoor antenna is designed with a view toward harmonizing with the home of the set owner. It is portable and can be moved to any location in a room. It is preassembled for installation and supplied with a 10-foot length of 300-ohm twin lead. The manufacturer also states that the "Tele-Vee" is effective in eliminating ghosts and improving performance on desired television channels when used in conjunction with an outside antenna. Illustrated bulletin No. TV130, describing this antenna, free upon request from the company.

Manufacturer: JFD Manufacturing Co., 4117 Ft. Hamilton Pkway, Brooklyn 19, N. Y.

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Industry Presents

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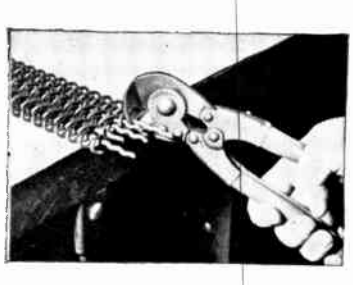


WIRE CUTTER

Because the cutting edges of the Porter Handclip No. 6A Angle Cutter are offset at a 45° angle from the tool axis, cutting can be done in close quarter. Another advantage of this angular feature is the fact that work will be in plain sight in most cases. 8" long and weighing 13 ounces, the tool has a capacity for cutting wire and soft rods up to 3/16" and annealed bolts in thread up to ¼".

Manufacturer: H. K. Porter, Inc., Somerville 43, Mass.

DIODE PROBE

In an effort to extend the usefulness of the RCA Master VoltOhmyst Meter (WV-95A), the company has announced that the RCA Twin-Diode Probe (WG-275), used with RCA VoltOhmyst meters for high-frequency measurements and adjustments, is now available as a separate item. The company states that the probe has a substantially flat response from 30 cycles to 250 megacycles and reads sine-wave voltages directly in RMS values. Peak-to-peak voltages of both sine and complex waveforms are obtained by simple multiplication. The probe also permits direct measurements of voltages in coaxial lines. It is supplied complete with cable, one twin-diode 6AL5, a probe clip attachment, a ground conductor with clip, and a 4-pin connector for attachment to the Master VoltOhymst Electronic Meter. Available through RCA test equipment dealers.

Manufacturer: Radio Corporation of America.

TUBE TESTER

Word has reached us from Hickok that their new Model 600 Tube Tester is now available. Portable, it is equipped with the Hickok Dynamic Mutual Conductance circuit, and has scales reading directly in micromohs. The company states that the last two features are exclusive with Hickok. Applicable to a-m, f-m, and television tubes.

Manufacturer: Hickok Electrical Instrument Co., 10514 Dupont Ave. Cleveland 8, Ohio.

SWEEP GENERATOR

The Ferret Model 720 F-M Television Sweep Generator is designed for the alignment of f-m and television receivers. The instrument is equipped with a built in variable absorption type marker from 19 to 40 Mc on fundamentals. An internal crystal allows for any desired frequency up to 20

Mc on fundamentals by plugging in the crystal on the front panel. This generator also has a combination of push buttons which operate the B+ circuits only. Entirely electronic, the instrument does not use any mechanical devices, such as vibrators or speakers. Other characteristics include: 400 cycle audio oscillator with 50 volt output, 9" calibrated dial with 5 to 1 vernier drive; all bands have an accuracy of ½%. Size: 10¼" x 10¼" x 5½", weight: 14½ pounds.

Manufacturer: Coastwise Electronics Co., Inc., 130 North Beaudry Ave., Los Angeles 12, Calif.

ISOLATION TRANSFORMERS

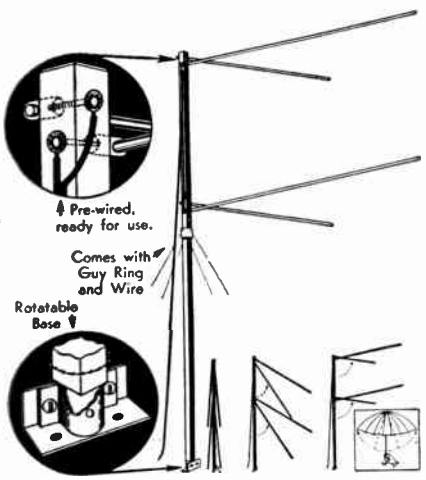
Chicago Transformer has announced the addition of three isolation transformers to its line, with respective capacities of 50, 150, and 250 VA. These are suitable for adjusting line voltages to operate equipment on 115 volts, and for isolating chassis ground from line ground, lessening shock hazard on ac-dc television sets. Secondaries of these transformers will provide 115, 105 and 125 volts.

Manufacturer: Chicago Transformer, 3501 W. Addison St., Chicago 18, Ill.

SIGNAL GENERATOR

Specifications of the Jackson Model TVG-1 Television Generator are as follows: Sweep frequencies: from 2 Mc to 216 Mc in three ranges, all on fundamentals. Sweep width: adjustable from 100 kc to 12 Mc. Marker oscillator: three ranges from 4 Mc to 42 Mc. R-F output: provides impedances of 10 and 30 ohms. Additional features are calibrating crystal jack, 400-cycle modulation, and shielding.

Manufacturer: Jackson Electrical Instrument Co., 18 S. Patterson Blvd., Dayton 1, Ohio.



ALL BAND TV ANTENNA

The trade name of this antenna is "Flip-Up" and the manufacturer states that it will receive all television channels. This antenna is pre-assembled. It is also pre-wired. It can be oriented for the weakest station in an area and will, according to the manufacturer, bring in all other channels equally well. Because of these features, it is stated that the antenna is particularly suitable for fringe area installations.

Manufacturer: Transvision, Inc., New Rochelle, N. Y.

TRANSFORMERS

Ready for immediate delivery is a new line of Utah replacement transformers. They are so designed that they may be used in conjunction with Utah speakers and match tubes in common use. Three types are being produced: universal output, universal line, and single output. These three types come in eight sizes.

Manufacturer: Utah Radio Products, Huntington, Ind.

CAPACITORS

Recommended by the manufacturer for ultra-high temperature d-c applications and for r-f bypassing and coupling duty, a new line of Plasticon TS Capacitors has been put on the market. The dielectric in these new capacitors consists of texlon film and silicone fluid, both materials with temperature stability and low dielectric loss.

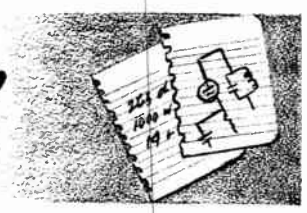
Manufacturer: Condenser Products Co., 1375 North Branch, Chicago, Ill.

ALL-TRIODE AMPLIFIER

A 10-watt version of the Brook 30-watt amplifier has now made its appearance and, according to the manufacturer, equals the performance of the latter in every respect—within the range of its power rating. This amplifier is said to have a virtually flat frequency response from 20 to 20,000 cycles and to show only negligible intermodulation and harmonic distortion. Output impedances range from 2 to 500 ohms.

Manufacturer: Brook Electronics, Inc., 34 DeHart Place, Elizabeth, N. J.

THE Notebook



Two dollars will be paid for each item published

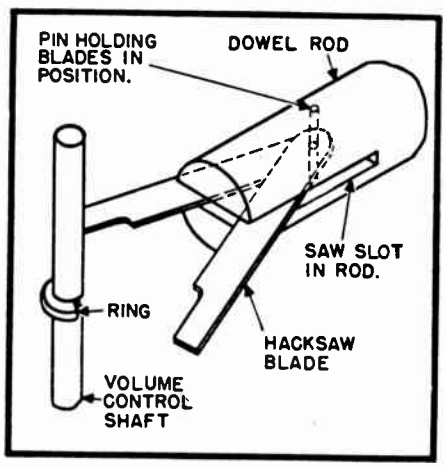
RCA MODEL 65BR9

This RCA storage battery portable has a 1,200 mf, 5-volt condenser across the filaments of a 1T4 and the 1S5 tubes. This condenser develops an intermittent partially shorting condition that results in erratic and puzzling changes in volume because of its effect on the filament voltages of these tubes. Cutting the condenser out of circuit will restore the volume, but will also introduce a noticeable hum, especially on a-c operation. The defective unit should be replaced.

John T. Frye
Logansport, Ind.

C-RING EXTRACTOR

A handy tool for removing C-rings from volume-control shafts can quickly be made from a hack saw blade and a small piece of dowel rod. Break the hack saw blade into two ends, three or four inches long. Place one atop the other, hole to hole, saw edge to saw edge. Grind the broken

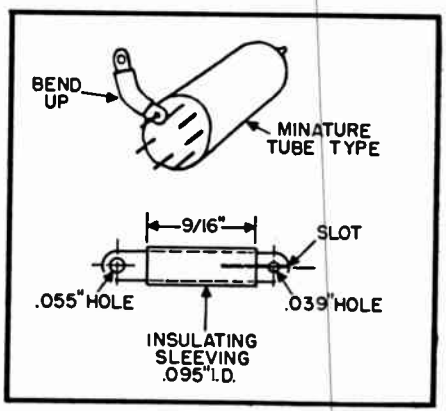


edges square, and cut a piece, one quarter of an inch deep and one inch long, out of the corner of the back edge. Take the teeth off. Separate, and fasten in the slot in the length of the dowel rod with a nail or a nut and bolt. Permit about two inches to project beyond the edge of the rod. The blades may have to be thinned a bit near the working edge in order to facilitate their entrance into the slot in the volume control shaft.

Max Alth
Yonkers, N. Y.

LEAD CONNECTIONS

The device shown here will help minimize the technician's difficulties with lead connections when he is dealing with high frequency receivers, such as television or f-m.



The tube is removed, the device slid over the tube pin required, and the tube replaced. The test lead connections can be made above chassis.

The device is best made of hard copper or bronze sheet, and its size will depend on the tube on which it is used. A few of them at hand in the shop will prove very helpful.

Clay Seidel
Pennsauken, N. J.

MAGNETIZED SCREWDRIVER

Sets which have screws hidden way down out of reach, can still have them taken out and put back with ease. I salvaged a magnet from a damaged P.M. speaker and mounted it on one side of my service bench. Magnetizing the screw driver and placing it in the screw head slot keeps it firm and ready for insertion at almost any angle.

John Mancini
Winthrop, Mass.

AUTO RADIO

Microphonism is about the worst trouble found in radios that use a variable tuning condenser and are subject to very much jarring. The best way to put a stop to these vibrations is to tighten the nut on the side of the variable which holds the plates. This will give a somewhat higher button pressure, which does not, however, interfere with the tuning. After the nut is tightened, all joints in the variable are soldered. The oscillator section of the variable is also covered with solder. A check is then made to be sure that the plates in all sections are centered. Finally, the r-f trimmers are aligned.

Egido Munerol
Kokomo, Ind.

BRIGHTENER

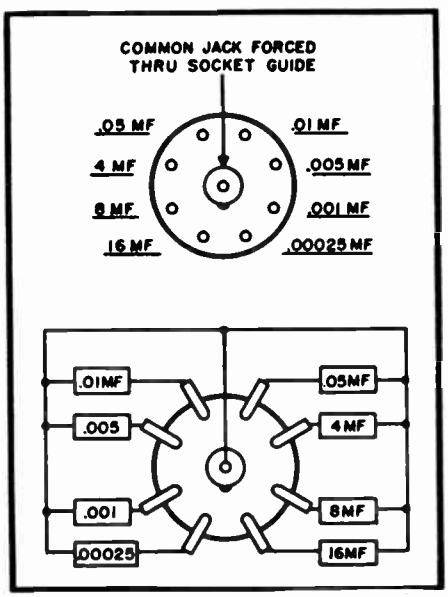
A pair of bamboo or wooden tweezers with fine sandpaper glued to the insides of the points will make a handy tool to brighten wire or parts to be soldered. The tool will reach broken wires inside coils that can not be reached with the fingers.

O. J. McDaniel
Sumatra, Fla.

TEST CONDENSERS

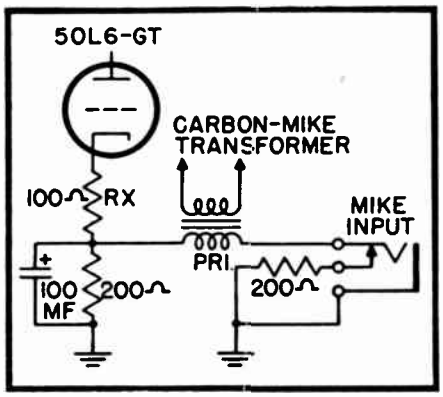
This method of mounting test condensers on a panel will keep overcrowded benches somewhat clearer, will keep the most used values handy, and will be very convenient to use. The values may be changed to suit each individual case. Ordinary test leads are used in conjunction with this setup. Be sure to connect all negative leads to the center and common socket. Some sockets and jacks are of different sizes and may have to be enlarged or drilled. All condensers are connected between common and a prong on the octal socket. Values may be printed on a piece of paper and put around it.

Saul Altzman



NEW MIKE SUPPLY

The circuit outlined below does away with batteries when using a carbon mike. The primary end of the mike transformer is connected to the cathode circuit of the output stage across the biasing resistor. The circuit and values shown are for a 50L6 tube, but the circuit can also be adapted to output tubes of different types. All you have to do is to change the value of RX to suit the tube used.



Albert Loisch
Darby, Pa.

PHILCO 46-420

Mixing of stations and whistling in localities with several transmitters. This trouble is caused by excessive r-f input. This set uses a tuned r-f stage, but untuned first detector. To remedy this trouble, remove several turns of the loop antenna, sometimes as many as ten. This will decrease the r-f input and in most cases completely cure the trouble. Should at a later date more r-f input be desired, simply connect several feet of wire to the "External Antenna Lug."

K. H. Elbers
New Orleans, La.

SLIPPING WIRE CABLES

For dial drives which have a tendency to slip, a good solution is to use a mixture of ⅓ Fuller's Earth and ⅔ shellac, and a very small amount of resin. Brushing this lightly on the drive cable only, and letting it dry for an hour or so, will make the cable taut and ready to drive the condenser. The solution should be well shaken before use, and should be employed only sparingly.

Marion L. Rhodes
Knightstown, Ind.

BRIGHTENING SOLDERING IRON TIP

To save wear and tear on your soldering iron, pick up one of these bronze brushes for suede shoes. Fasten it to the bench and run the tip of your iron through it and it will brighten up without the need for filing.

Leo E. Collins
Monroeville, N. J.

SPARKS ELIMINATED

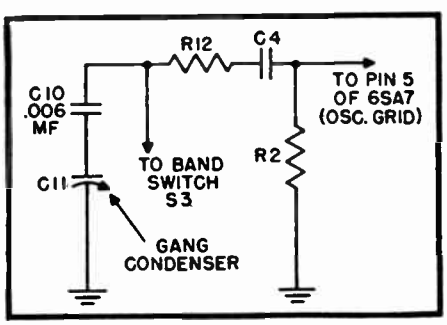
A little scotch tape around the point of your screwdriver will eliminate sparks during the i-f alignment.

Christy Dennison
Pasadena, Calif.

RCA 5Q55

I have experienced the following trouble in two consecutive RCA 5Q55 (1940) radios: the reception was good over all the broadcast band for about five minutes. The set would cut out on the lower end of the band, but would start playing again when the dial was tuned to the high end of the band. When tuned to the low band, it would play for a few minutes, then cut out again. A test showed that the oscillator stage was the culprit. I replaced C10 in each set, permanently curing the trouble.

H. A. Blake
Cloverport, Ky.



trade LITERATURE

Practical Television Servicing, *by J. R. Johnson and J. H. Newitt, (Murray-Hill Books, Inc.), 331 pages, $5.00*

Mr. Johnson, former managing editor of Radio Maintenance and now a regular contributor to its pages, has collaborated with Mr. Newitt, former project engineer of the Federal Telecommunications Laboratory, to produce a book of interest to the television technician. The theory of television is discussed in chapters 1 through 8. Chapters 9 through 15 deal with practical problems of television installation and service. As stated in the preface of the book, the practical chapters are based on the authors' first-hand experience, and should prove suggestive to practicing technicians. They cover such things as trouble shooting, wiring techniques, installation, test equipment, alignment procedures, and so forth.

At the end of each chapter a list of questions is provided, intended for use in class-room or home-study work. Answers are provided only for odd-numbered questions, even-numbered questions being meant for class-room study assignments.

The book is amply illustrated. Some of the pictures, particularly in the antenna section, however, could have been clearer.

1948 Record Changer Manual, volume II *(Howard W. Sams & Co., Inc.) 400 pages, $6.75*

This manual continues the record changer series started by Howard W. Sams & Co., Inc. in 1947, and follows the style and format of the first volume. The book does not duplicate the information in, but is rather a continuation of that volume. It contains exploded view diagrams for forty-six changers, operational and adjustment instructions, trouble shooting check-charts, and many illustrations. Long-playing mechanisms are included in this book, their associated pickup, stylus, and cartridge requirements. The book also has a complete index and cross reference section, covering all post-war changers and combinations.

Catalogs and Pamphlets

Pre-Aligned Kit. Philmore Manufacturing Company, 113 University Place, New York 3, N. Y. has a four-page flyer describing its kit with tuner, video and sound channels wired and pre-aligned.

Sound Equipment Catalog. This very up-to-date catalog, called "For True Sound Reproduction" has been published by the Terminal Radio Corporation, 85 Cortland Street, New York 7, N. Y. Contains three-speed record changers, microgroove phonograph equipment, magnetic recorders, tuners, amplifiers, and other accessories. Free for the asking.

Tube Tester. A four-page folder describes and illustrates the latest line of Dynamic Mutual Conductance Tube Tester manufactured by Hickok Electrical Instrument Co., 10634 Dupont Ave., Cleveland 8, Ill.

Hole-Saw Catalog. A 6-page catalog-price list covering hole-saws, replacement blades, and parts, is available free of charge from Misener Manufacturing Company, Syracuse 2, N. Y. They list some interesting items.

Chart. A chart, showing auto speaker replacement data for practically all auto radio receivers now in existence is available free of charge from Permoflux Corporation, 4900 W. Grand Street, Chicago, Ill. Write for Chart #J-28.

Bulletin. Cannon Electric Development Company, 3209 Humbold Street, Los Angeles 31, Calif., has available the RTC-1 Bulletin, describing its recently developed series of connectors designated as the "RTC." Free upon request to Catalog Department.

Television Transformer Guide. Chicago Transformer Division, 3501 Addison Street, Chicago 18, Ill., has sent us its catalog, replacement guide, and list prices for its line of television transformers. The firm claims that it has one of the most complete lines of television transformers in the country; so it may be worthwhile to take a look at this catalog.

FM & Television Antennas with Flexibility is the title of a new, looseleaf binder catalog, published by L. S. Brach Manufacturing Corp., 200 Central Ave., Newark, N. J. Besides giving the firm's line of antennas and accessories, each item listed carries with it a notation as to where it is best applicable.

Catalog No. 49-1, put out by Roger Television, Inc., 86 Walker St., New York 13, N. Y., lists 18 new products to aid in television installation problems, including antennas, masts, power supplies, test equipment, and interference eliminators.

Socket and Mounting Notes for Raytheon Flat Press Subminiature Tubes gives information on subminiature tube sockets, and explains methods of connecting to the tube and shielding it. It is a summary on the mechanical applications of Raytheon subminiature tubes. It will be of particular interest to engineers concerned with the design of electronic equipment.

3-Star Performers is a small circular that you may want to keep in your data file. It lists several American Condenser Co. condensers, their catalog number, capacity, size, list and net price.

Television Component Folder No. P-1 is a four-page folder published by Transvision, Inc., 460 North Ave., New Rochelle, N. Y., giving complete details on its line of 19 television components. These components are analyzed according to function, general use considerations, ratings, and connections. Copies of the folder may be obtained from the company.

Another folder put out by Transvision is *D-1*, describing a 3-point dealer setup designed to improve your business by a tie-in with Transvision.

Catalog No. 89. 178 pages filled with parts and equipment ranging from terminal lugs to complete television receivers make up this latest catalog published by Lafayette-Concord Radio, 100 Sixth Ave., New York 13, N. Y. An index in the back of the book makes using the catalog easy. It's fully illustrated.

1949 Catalog. Cameradio, 963 Liberty Ave., Pittsburgh 22, Pa., has published its 1949 catalog, 248 pages filled with listings of practically all radio and electronic parts used in radio service. Comes complete with index and is fully illustrated.

"Currently." This is the name of a new house organ published by Sorensen & Co., Inc., 375 Fairfield Ave., Stamford, Conn. It appears every two months and is devoted to new development in the voltage regulation field. If you are interested in precise voltage control through electronic instruments, write to Ed McCarthy, Editor, to be placed on the free mailing list.

Association NEWS

AS WAS to be expected, television technicians are forming their own specialized associations. The **Television Installation and Service Association of Chicago** is one of the more active of these groups. At a meeting recently held in the windy city, they developed a program for the improvement of the technicians' working conditions and methods. Specifically, the goals of this program are the establishment of adequate technical standards, the determination of a uniform installation and service rate schedule, provisions for the advanced training of member personnel, and the cementing of better relations between the technician and the industry. This organization would like to hear from other units regarding mutual problems. They are located at 3135 West 59th Street, Chicago 29, Ill.

WITH their election over and Dave Krantz again president, the **Philadelphia Radio Service Men's Association** is buckling down to a new program of increased activities. On the agenda are membership drives, education in advertising methods, and training in business procedures. The Philadelphia Association, always one of the most active in the country, is thus not only cognizant of the fact that the radio technician must be an expert in business as well as in radio, but is also one of the first service associations to do something concrete about it.

MR. E. MULLINS, a member of the **Associated Radio Technicians of British Columbia,** has been the first person to receive television pictures in Vancouver, Canada, according to the chairman of that organization. By stationing his tele-set at different locations, he has shown that television reception in Vancouver is good, with the signal being received directly from Seattle, Wash. Mr. Mullins is now giving lectures on the subject of television to the Vancouver chapter; and from what we hear, these lectures are well attended. Here is another instance where the service association is preparing the way for the industry.

WE WOULD like to quote from a recent statement by Mr. Bradley, President of the **Dallas Radio Sales & Service Association.** Said he: "A Chicago laboratory recently advertised butter at one-half price . . . Using one pound of regular butter and certain inexpensive ingredients, two pounds of real butter may be made . . . Servicemen know from hard years of experience that there is no easy or cheap way to make effective repairs. Essential parts must not be omitted, must be bought and paid for. Customers may not be willing to pay for a good job and there is where the serviceman must start selling. If the customer cannot be sold on the job needed, it is better to turn the job down. If repair jobs are taken at a price and work is cheapened, money is lost and the customer forgets that he has placed a limit on the job. To me, it is a compliment for a customer to tell his friend—Take your radio to this shop. They are high, but they do good work. . . ." We heartily recommend this advice to all technicians.

ANOTHER Canadian association, the **Associated Radio Technicians of Alberta,** is taking steps to acquaint its members with television. As reported in *The Log,* their official publication, the plan which is followed by them will draw on the experiences of the more advanced areas. They contemplate using recordings of lectures delivered in the United States on the various aspects of the subject, to prepare themselves for the day when television will arrive there.

THE **Radio Technicians Guild of Rochester** is planning a series of lectures and laboratory periods on the practical problems of television servicing. The price for these lessons is $2.50 each, with payment to be made in advance for the entire course of four sessions. The only restriction on registration is that member-applicants must be in good standing by the time the course is completed. Each of these sessions will be about three hours long, which makes the price of attendance quite reasonable. A further feature of this series is the fact that classes are limited to fifty persons, increasing the learning opportunities for all those who attend. The Rochester Guild is to be congratulated for instituting this series of lecture-laboratory sessions. It is fulfilling one of the prime functions of the servicemen's association: to provide the member-technicians with facilities to which they would have had no access without the existence of the association.

WE'D like to pass on to our readers an item that was sent to us by Frank J. Moch, President of the **Television Installation and Service Association of Chicago** *(TISA).* It's a little booklet called *"So You Bought Television!!!!!"*; and it is intended to distribute copies of it to members of the organization to be given to the purchasers of tele-sets. In simple, non-technical language it explains to the customer some of the main problems involved in television, going into such common faults as ghosts, snow, and the like. It then gives some suggestions which are intended to reduce the number of unnecessary service calls, and defines the limits within which the service policy operates. Toward the end, the booklet lists the 4-point code of ethics to which each member of *TISA* subscribes, and closes with the exhortation: "To assure yourself of technical ability, honesty, and integrity always look for the *TISA* seal when in need of service." We think that this is an excellent booklet, both in conception and in execution, and are only sorry to be unable to reprint it here in full. The idea should be suggestive to other organizations, however, and may be worth further investigation. ✓ ✓ ✓

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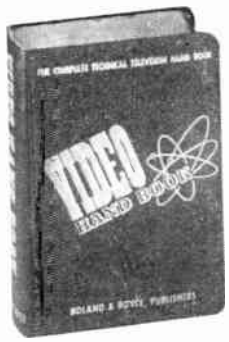

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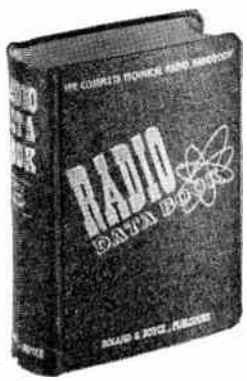

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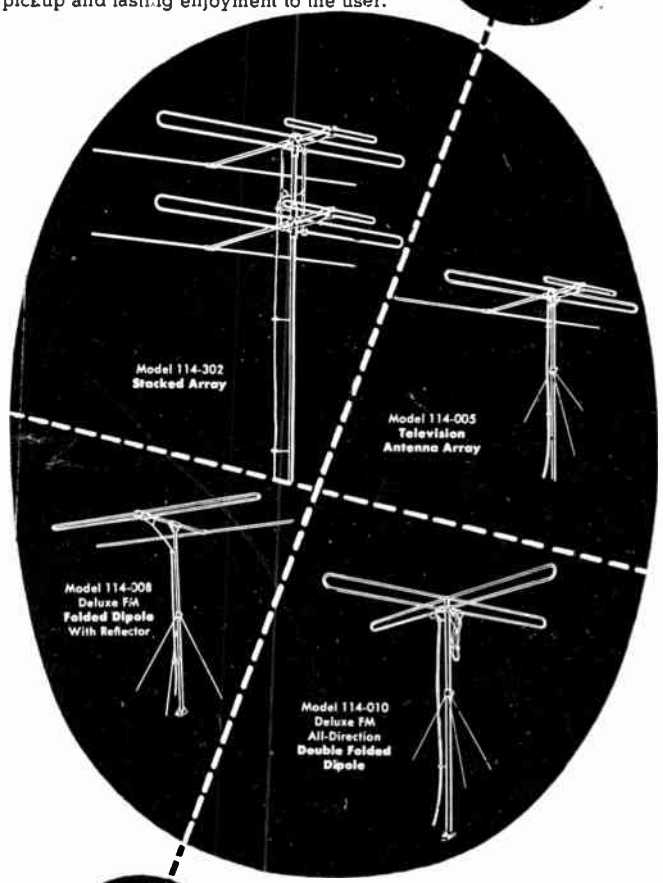
TV



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AMPHENOL
AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54TH AVENUE
CHICAGO 50, ILLINOIS

TV Expansion Circuits

→ from page 11

used to get the expanded sweep. This push button switch is of the push-push type, that is, the first push will close the circuit, and the next will open it. The remote control push button switch is connected to a two conductor lead. One side of this lead is grounded, while the other side is connected to a 6.3 volt a-c relay coil. If the cord connecting the "Presto-Vision" button to the set should break, or become detached, no shock or fire hazard is encountered; the relay will simply open and leave the picture in the expanded position. The 6.3 volt relay operates a four pole double throw switch. When the relay is energized the normal rectangular picture is obtained. When the relay is non-energized, the expanded picture is secured. Expanded sweep may be applied to any of the popular types of 10", 12", 12½" or 15" magnetic deflection picture tubes.

The "Presto-Vision" push-push button controls four separate circuits in the Garod receiver in order to get expanded sweep. Let's examine each of these four circuits in turn. The first of these is shown in Fig. 3 and is used to control picture brightness. The brightness control (sometimes called brilliancy control) is a potentiometer placed in the cathode circuit of the cathode ray tube, thus controlling the amount of d-c bias on that tube. This is the control that is used to vary the average light intensity of the received image, but at the same time must be properly set to prevent the appearance of the retrace sweep. In the circuit shown in Fig. 3 the switch is set for proper d-c bias for an expanded picture. When the switch is released and the relay is energized, an additional 4.7 K ohms is thrown into the cathode circuit. This additional value of cathode bias, used when normal rectangular picture is wanted, reduces the background illumination to the proper level. Thus the light brilliancy appears the same whether the picture is expanded or not. There is no necessity for getting out of your seat to change the setting of the brightness control when using Tele-Zoom.

Adjusting Picture Width

Now let us examine the method by which the picture width is adjusted. In the circuit shown in Fig. 4 we have a conventional horizontal blocking oscillator and discharge tube making use of a dual triode 6SN7. Potentiometer R135 is called the horizontal drive control, or in this case, horizontal peaking control. If you will examine capacitor C91 and potentiometer R135 you will see that it is a voltage divider network and is actually in shunt with the grid-cathode circuit of the 6BG6 horizontal output tube. It is this potentiometer R135 which fixes the amount of high peaking and saw tooth voltage to be applied to the control grid of the 6BG6. It's the job of the 6BG6 to produce in its plate circuit a peaked horizonal deflection voltage. But this tube is controlled by R135 and it is the setting of this potentiometer which determines when the 6BG6 will conduct. Normally, it is the setting of the potentiometer (R135) which fixes picture width.

Expanded width is secured in the Garod receiver without any re-adjustment of the horizontal peaking control. The circuit shown in Fig. 4 has the switch in the Tele-Zoom position. The horizontal peaking control is a 25 K ohm potentiometer, R140. When the switch is thrown over to the normal picture size position a new potentiometer, R135, is switched into the circuit. A change is also made in the value of the 560 mmf series capacitor C129 of the expanded position to C91 (820 mmf) for the normal position. The change in the value of this capacitor results in a change in discharge time for this RC circuit, thus resulting in a change in the time when the 6BG6 is triggered. In this way, the point at which horizontal retrace is begun is determined. Operating in conjunction with this expanded width system is a 2280 mmf capacitor, C-130, which is shunted across the horizontal deflection yoke, L94.

"Looks like your vibrator's on the blink."

Vertical Linearity

In increasing the size of the picture, it is essential that no distortion be introduced when increasing its vertical size. The method for securing vertical linearity is shown in Fig. 5. Here we have a 6SN7 acting as a vertical blocking oscillator and discharge tube followed by a 6AR5 vertical power amplifier. The switch shown in Fig. 5 is set for expanded picture. The usual method for controlling vertical linearity is the insertion of a potentiometer in the cathode circuit of the vertical amplifier tube. This tube is ordinarily a power pentode such as a 6K6 or 6V6. In this instance a 6AR5 miniature pentode amplifier tube is used. The d-c bias on the tube (determined by the value of resistance from the cathode to ground) helps fix the waveform of the sawtooth voltage output of the 6AR5. If you will examine Fig. 5 you will see that vertical linearity is maintained by switching an additional 2200 ohms into the cathode circuit of the 6AR5 when used for the normal rectangular picture. Note however, that both the potentiometer and the 2200 ohm resistor are switched at the same time. This 2200 ohm resistor is switched out of the circuit for the expanded picture. However, in varying the d-c bias on the 6AR5 by means of changing the cathode bias resistor, we are also affecting the gain of this tube and in this manner we are affecting the vertical linearity of the picture.

One more circuit is included to take care of expanded vertical size. The principle used to get expanded vertical size is shown in Fig. 6. The amplitude of the sawtooth vertical deflection voltage wave is determined by the setting of potentiometer R157 and R131. It is the initial setting of these controls which determines the height of the picture. These two potentiometers, although of the same value, are pre-set to two different resistance values for rectangular and expanded picture.

From both the sales and service viewpoint, Tele-Zoom has interesting possibilities for the serviceman. The simplicity of operation of Tele-Zoom —and the results achieved—are excellent sales arguments.

TV Automatic Controls

→ from page 15

short duration pulses having amplitude modulation characteristics.

In the ratio detector, the secondary of the last i-f transformer feeds a plate and a cathode of the detector. This distinguishes it from the discriminator, where the secondary of the limiter transformer feeds the two plates of this type detector.

AFC Service Notes

Changes in component values and tube aging have little effect on correct oscillator frequency, since the a.f.c. circuit maintains constant control. However, if faulty operation of a.f.c. is encountered, a careful check should be made of alignment, particularly ratio detector alignment. The transformer between the last i-f and the detector must be correctly tuned so that it is resonant at center frequency, and establishes a balance between each half of the secondary.

A.F.C. failure may also be due to a bad tube, and the 6J6 should be checked, as well as all the other circuit components associated with the a.f.c. sections. Tube failures are the most common trouble, however, because the low a.f.c. control voltage does not shorten resistor or capacitor life, and for that reason they give little trouble. Twin diode detector tubes should also be checked, for their performance affects a.f.c. as well as the audio output. An unbalance between the two sections of diodes will upset the symmetry of the ratio detector circuit and thus affect peak performance.

As a rule, alignment holds exceptionally well for sound i-f stages as well as video i-f, because of the wide band-pass employed. If the set has not been tampered with, or no new circuit components installed, all other checks should be made before realignment is attempted. When audio i-f alignment is necessary, the a.f.c. voltage is ideal for scope or v.t.v.m. use, for it provides a ready means of indicating gain changes during alignment procedures. Test jacks provided for this purpose, make these points readily available to the repairman. ✔✔✔

Service with Ammeter

→ from page 29

As this is given in amperes, comparison can be made directly with meter readings.

This is the procedure that I follow.

Remove the vibrator from the set and insert a known good vibrator. Turn the set on and measure the input current.

If the rectifier tube is bad, the needle will not move off the starting point.

If the meter shows a higher reading than one ampere above normal, it indicates that some other component than the vibrator is faulty.

If the set is allowed to run with an excessive input current, the vibrator will be damaged. The vibrator would gradually reach a temperature which would cause its contacts to stick, resulting in a dead short or blowing of the fuse.

When the meter shows excessive current consumption, be sure to turn the set off at once.

The procedure for car radio service is otherwise much the same as for home radios.

The rectifier tube is replaced with one that is known to be good, and input current is checked again.

The other tubes are checked for shorts. Secondary buffers, electrolytics and all bypass condensers are checked for leakage and shorts.

After the trouble has been found and repaired, the original vibrator can be re-installed. A further check with the ammeter should show normal current consumption if the original vibrator is good. A voltmeter can be used to check the B+ voltage and if it is at least 90% of that obtained with a good vibrator, the vibrator need not be replaced.

Neon Tester

I have incorporated a neon tester in my test panel which gives a reliable indication when testing capacitors. I use alligator clips with phono tips in the test terminals when testing electrolytics.

Insert a condenser in the clips, turn S1 on, then S2, to charge. The neon will flash. Then turn S1 off and S2 to discharge. The neon will again flash with a good condenser. Steady glow indicates a short. No flash indicates an open. ✔ ✔ ✔

AC-DC Hints

→ from page 27

ceiver. This is better than removing the tubes one at a time for testing, because in many cases the filament will have closed again by the time you get to the defective one, and it will test o. k.

The second type of intermittent will have you using a number of terms that you never learned from your English teacher. Generally the set will play beautifully for a while, then pop and drop down to a whisper. If you touch the radio with a tool, it will of course pop back to normal and stay that way all day. The most common cause is a faulty audio coupling condenser. Shaking these vigorously will generally cause the trouble to show up if they are at fault, and you can verify your analysis by shunting a new condenser across the one that you were shaking when it cut out. Another common fault is intermittent speaker trouble, caused by the voice coil leads becoming frayed. You can generally tell this by the complete absence of normal noise from the radio. If neither one of these turns out to be the cause of the trouble, give the radio a very careful inspection, probing all joints and parts with a wood or bakelite rod. Quite often a badly soldered connection will be the cause of your trouble. If you still can't find it, you must resort to tedious conventional troubleshooting methods, the discussion of which has no place in an article of this type.

Low Volume

Low volume is a frequent complaint of people who have moved from a city to a small town. They expect their receiver to pick up just as well on the inside loop as it did when they were only a few miles from half a dozen powerful stations. It just won't! Sometimes you can pep the set up a little by touching up the antenna and i-f trimmers for volume, or better still, by carefully realigning the entire receiver. But the best thing you can do for the customer who wants to get a station three hundred miles away in daytime on a five tube set is to sell him on the idea of putting up a good outside aerial. Some of the cheaper a-c/d-c receivers won't even have an outside antenna connection. In this case, run a single stranded wire around the *outside* of the loop, taping or gluing it in place. Anchor the ends close together, leaving one several inches long for the outside connection. The other end can be connected to B minus through a small condenser, or even left entirely unconnected. It is a good idea to touch up the antenna trimmer after this is done. Often an indoor aerial ten to fifteen feet long will help a good deal.

Noisy volume controls should be replaced with a new unit instead of attempting to repair the old one. You should keep several half-meg controls on hand, some with knurled and some with the solid shafts that can be filed to fit. The Centralab NK-140 and N-103 and the Philco 45-5007 are good examples.

Rubbing speaker cones give a lot of trouble. For a really permanent and satisfactory repair job, sell the owner a new speaker! About the only trouble here will be getting it mounted, which will often require considerable improvising. It is well to learn this art early, because you will use it a lot before you repair your last receiver. ▼▼▼

TV Booster Amplifier

→ from page 17

figure is realized. When dealing with low signal levels, any improvement in this direction is of importance, especially when it is considered that an increase of 3db in the signal-to-noise ratio of a receiver is the equivalent of doubling the transmitter power or reducing the effective distance to the transmitter by about 16%.

The cascode derives its good noise figure (the best obtainable at the present state of the art) from the fact that, beside being low noise triodes, both tubes are driven from source resistances which are adjusted to give minimum noise. It has been demonstrated that the noise performance of a vacuum tube amplifier can be markedly improved by over-coupling the input circuit to its driving source. An optimum degree of over-coupling exists at which the reduction in noise more than compensates for the decrease in gain occasioned by the mismatch. A net improvement in the signal-to-noise ratio results. The resistance which is presented to the amplifier grid at this optimum coupling is called the "optimum source resistance."

The cascode has high stability. This stability is achieved in the inherently instable grounded-cathode stage by loading it heavily with the low input resistance of the grounded-grid stage so that oscillation does not occur. At the same time, the plate resistance of the first stage is roughly the optimum source resistance of the grounded-grid stage. A neutralizing coil (L3), is shown in Fig. 2, which contributes to the stability of the circuit, but is used principally because it effects a reduction in the noise figure.

Thus, with its desirable combination of characteristics as outlined above, the cascode circuit offers an ideal approach to the problem of a practical television booster. Let us now examine the modifications necessary to adapt it to that application.

Modifications

In addition to being tunable to each of the channels to be received, the booster amplifier must have a bandpass at least equal to the six megacycle width of each television channel. The type of response curve generally

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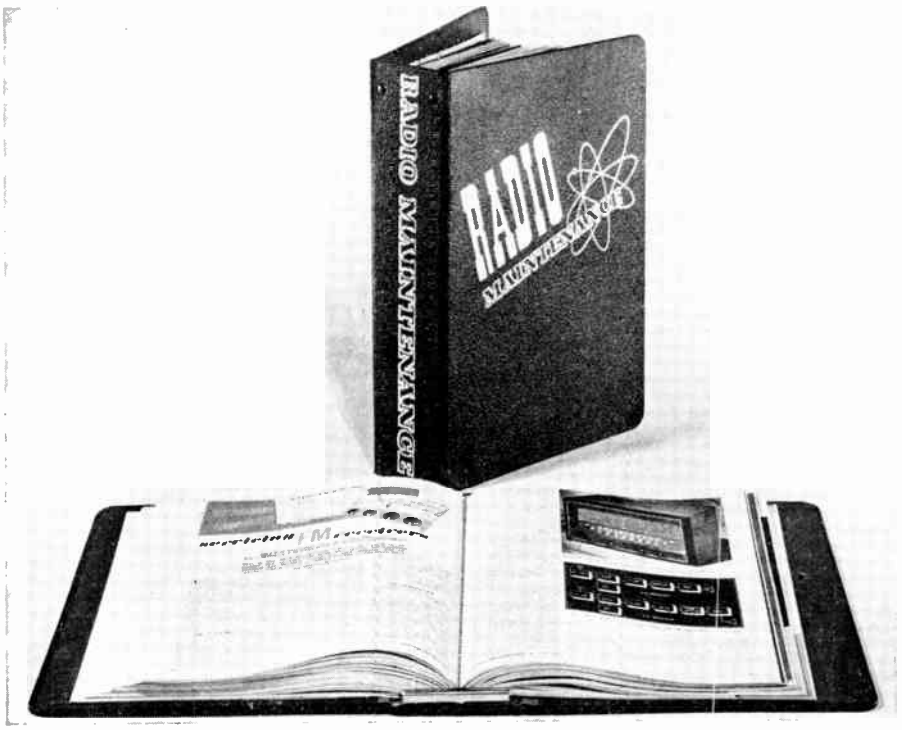

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TV Booster Amplifier

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accepted as standard for television r-f front ends is shown in Fig. 3. This bandwidth is not difficult to obtain at frequencies in the television spectrum since the loading effect of the tubes used is appreciable. The band-pass achieved is also greatly influenced by the type of tuning circuits used. Fig. 4 shows the cascade circuit as modified for use as a television booster.

The problem of tuning the cascode circuit is somewhat simplified by the fact that it is not necessary to tune the interstage coupling. Because of the heavy loading of the grounded-grid stage, as explained above, this coupling may be made broad enough for all practical purposes. As an example, if a tube, such as the 6J4 with a transconductance of 12,000 is used for the second tube, the interstage coupling is loaded by the grounded-grid input resistance of only about 86 ohms. At this loading, the bandwidth of the "tuned" circuit at the 3 db points approaches 200 megacycles. Thus, variable tuning need only be accomplished in the input circuit of the first tube and the output circuit of the second tube.

Considerable care must be exercised in the design of the input circuit. Several conditions must be satisfied for optimum performance. They include:

1. The antenna coupling should be of the balanced type, or at least semi-balanced, since balanced 300-ohm twin-lead is standard in television practice.

2. Broadbanding should be accomplished by means other than the addition of physical "loading" resistors, because such resistors in this low-level circuit would contribute excessive thermal noise.

3. The antenna impedance should be transformed by the input circuit to a value close to the optimum source resistance of the first tube.

4. Capacity tuning should be avoided unless it is desired to reduce the bandwidth of the circuit.

5. A voltage step-up should be effected, if possible.

These requirements are most easily met by the use of a semi-balanced transformer coupling between the transmission line and the grid of the first tube. Conditions 2. and 3. above are fulfilled by adjusting the turns ratio of the input transformer for optimum noise rather than perfect impedance match. The overcoupling required by this condition also broadens the response of the circuit appreciably.

Since the optimum source resistance varies inversely with frequency, the turns ratio of the input transformer cannot remain constant throughout the television band, but must be varied so as to transform the antenna resistance to the optimum source resistance at the tube grid. For the 6AK5 tube used as a triode, the optimum source resistance is approximately equal to the constant 70500 divided by the operating frequency in megacycles. From this it is seen that optimum driving resistance varies from about 1400 ohms at 50 megacycles, to only slightly greater than 350 ohms at 200 megacycles. The turns ratio to effect the necessary transformation can be computed from the familiar equation:

$$k\frac{N_s}{N_p} = \sqrt{\frac{R_{opt}}{R_{ant}}}$$

Where:
N_s = Number of secondary turns
N_p = Number of primary turns
R_{opt} = Optimum source resistance
R_{ant} = Antenna resistance
k = Coefficient of coupling

The adjustment of turns ratio with frequency can best be accomplished by switching input transformers by means of a standard rotary wafer switch. This also allows for pruning or slug-tuning each input coil to resonate with only the tube and circuit capacity so that condenser tuning may be eliminated. Channel selection is simplified by the fact that a separate input circuit is not needed for each channel to be received. Tube loading and the necessary over-coupling broaden the input circuit so that two or more channels may be "doubled-up" on each switch position is necessary for simplicity.

In the interstage coupling circuit, the neutralizing coil L3 may be eliminated without serious effects, since it would require tuning. To provide a d-c path for the cathode current of the grounded-grid stage, L2 may be bifilar wound by twisting two wires together and winding them on a form as one wire. The resulting unity-coupled transformer carries both the plate current for the first stage and the total cathode current for the second stage. The bifilar winding, appearing as a single inductance, is resonated with the tube and circuit capacitance at mid-band.

In the output circuit, conventional variable capacity tuning may be used for simplicity. Loading resistance is used to increase the bandwidth of this circuit without serious degradation of the noise performance of the booster since the signal has been considerably raised above the noise level by the gain of the preceding stages.

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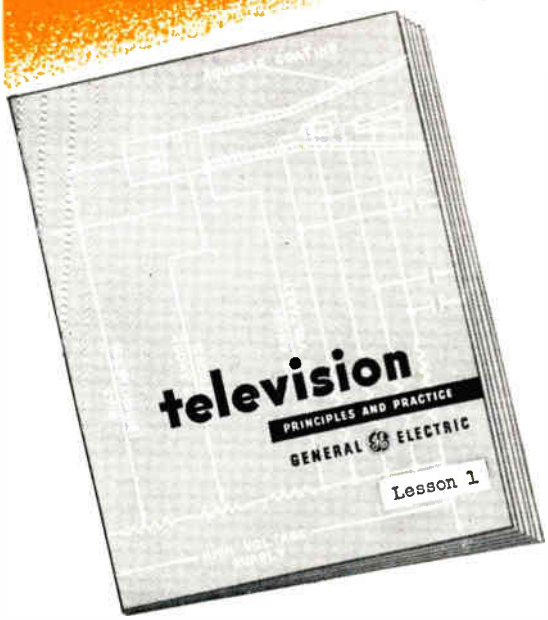

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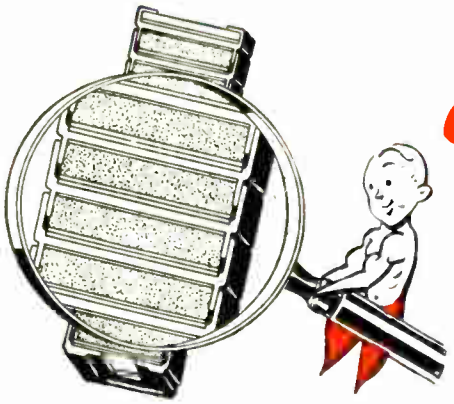

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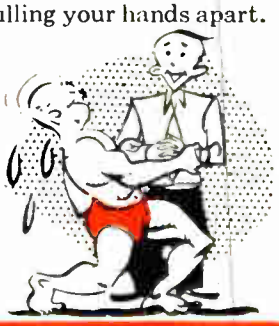

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