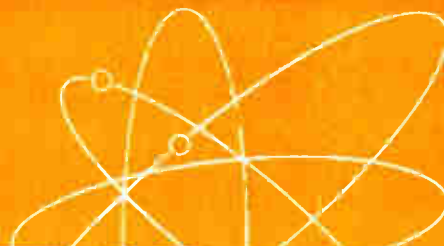


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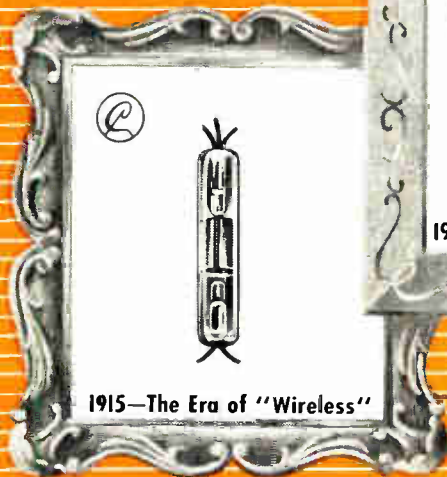
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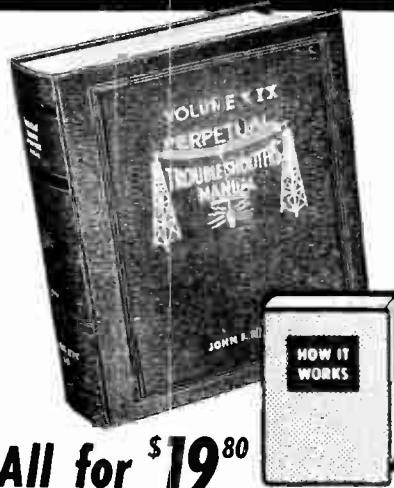
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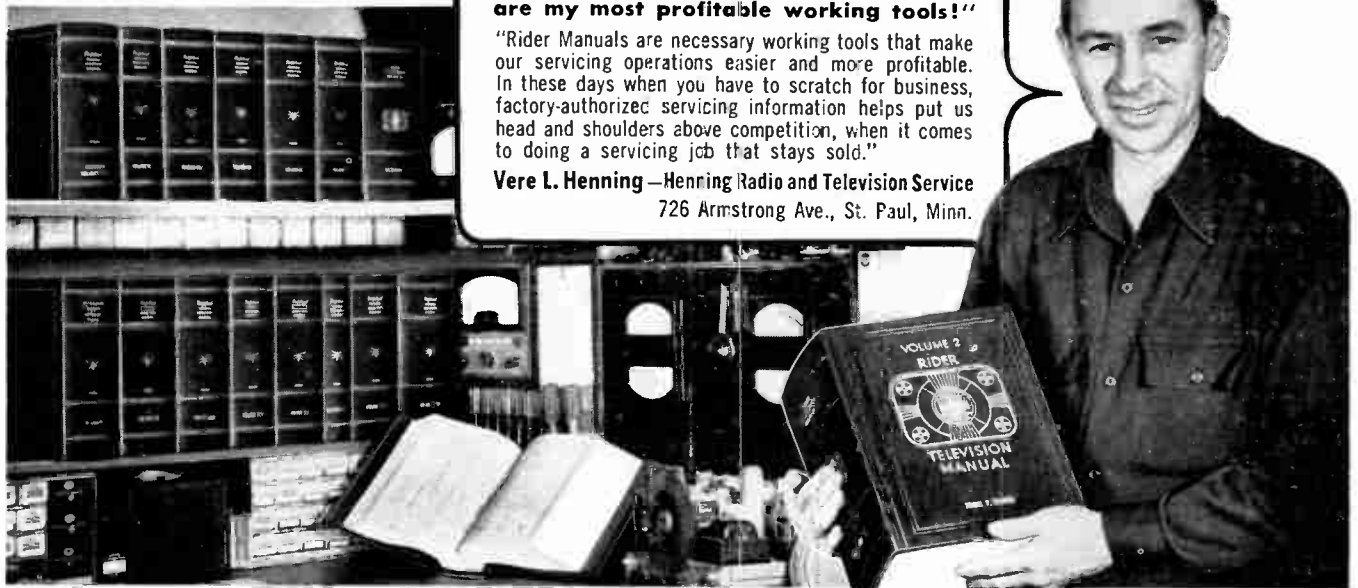
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NOTE: The Mallory Radio Service Encyclopedia, 6th edition makes reference to only one source of radio receiver schematics — Rider Manuals.

ANOTHER NOTE: The C-D Capacitor Manual for Radio Servicing, 1948 edition No. 4 makes reference to only one source of receiver schematics — Rider Manuals.

Test Pointers

ON RESISTANCE MEASUREMENTS

Experienced radio and television technicians are aware of the usefulness of electronic ohmmeters in service work. Conventional non-electronic type ohmmeters serve well for some point-to-point resistance checks, but are not suited for measurements of the very high resistance values which are encountered when obscure faults are to be traced. In such measurements, electronic ohmmeters offer advantages; in addition, they also automatically protect the meter movement against burnout in case of accidental contact with live circuits.

Audio distortion may be caused by leaky blocking capacitors which do not show up in a point-by-point resistance check. This situation is illustrated in Fig. 1. Because the blocking capacitor and grid leak are in series with the plate-supply voltage, any current which leaks through the capacitor causes a voltage drop to appear across the grid leak, and, as a result, makes the normal grid bias more positive. For the example shown in Fig. 1, the blocking capacitor has a resistance of 80 megohms and the resultant leakage current through the grid resistor causes the tube to operate at zero bias.

Although it might be considered that the voltage drop across the grid leak could be measured with a conventional voltmeter, such is not the case. Even if an electronic instrument with an input resistance of 10 megohms were used, the scale indication would be a small fraction of one volt. The reason for this low indication is that the leakage current represents a voltage source with an internal resistance of 80 megohms, which is very high compared with the input resistance of the instrument. A point-to-point voltage check will indicate trouble, however, because the plate current of the tube will be abnormally high and, therefore, the plate-to-ground voltage will measure too low; or if cathode bias is used, the cathode-to-ground voltage will be too high.

A resistance measurement of the blocking capacitor should be made next. For the illustrated circuit, this resistance should be in excess of 500 megohms for proper operation. It will be seen that a value of 500 megohms will cause a one-half volt drop across the grid leak; a value of 1000 megohms will cause a one-quarter volt drop. Accordingly, suitable electronic service meters should be capable of measuring resistance values up to 1000 megohms.

Leaky blocking capacitors also impair the operation of avc circuits, because the avc voltage is obtained from a delay circuit which has a high internal resistance. The characteristics of tone- and volume-control circuits are usually sensitive to minute leakage currents through the associated blocking capacitors; in fact, leaky blocking capacitors are responsible for a large percentage of noisy volume-control potentiometers. In general, whenever a blocking capacitor connects into a high-resistance signal circuit, a leaky capacitor is a potential troublemaker.

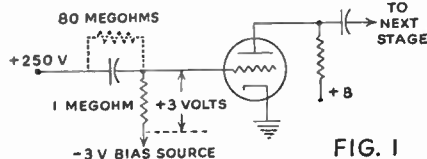


FIG. 1

GRID-TO-CATHODE BIAS = 0

Modern service ohmmeters should be able to measure very low values of resistance, as well as very high values. The normal resistance of transformers, deflecting yokes, speaker fields, peaking coils, and similar components is published in manufacturers' service data sheets. To measure such values, the ohmmeter range must extend down to approximately 0.1 ohm.

A good electronic ohmmeter saves hours of negotiable time each day in a busy shop, and eliminates the wasteful practice of replacing numerous capacitors and other components at random, in a desperate effort to locate an obscure circuit fault.

RCA 195-A STANDARD VOLTOHMYST*



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One for the shop... One for the field...
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TV, FM, AM, and PA service require the modern features designed into the RCA 195-A Standard VoltOhmyst.

The 195-A measures dc and RMS ac voltages up to 1000 volts, resistance values from 0.1 ohm to 1000 megohms, and decibel values (db, vu, or dbm) from -20 to +52.

Its dc input resistance is 10 megohms on all ranges. Zero-center indication is available for FM work. The ac input resistance is 200,000 ohms.

An isolating resistor in the dc probe permits dc voltages to be measured without disturbance of high-impedance high-frequency ac circuits.

When the 195-A is used with the accessory RCA Crystal Probe WG-263, rf voltages can be measured up to 100 Mc. With accessory RCA High-Voltage Probe WG-288, dc voltage can be measured up to 30,000 volts.

An electronic bridge circuit protects the meter movement against burnout.

Here is a portable electronic meter which measures dc and RMS ac voltages up to 1000 volts, dc current from 0.3 ma to 10 amps, and resistance values from 0.1 ohm to 1000 megohms.

The self-contained battery power supply lasts up to 10 months in normal service.

The WV-65A is supplied with an isolating resistor in the dc probe, and can be used with accessory RCA Crystal Probe WG-263, or with accessory RCA High-Voltage Probe WG-284.

The dc input resistance is 11 megohms on all ranges. This instrument will measure avc voltages, detect leaky coupling capacitors, and can be used to trace sync and deflection voltages in TV receivers.

At the sensational price of \$59.50, the RCA WV-65A is your best buy for service of two-way car radios, farm sets, marine, airplane, railway, bus, and theatre sound equipment.

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See your RCA distributor for further details about these famous electronic meters, or write RCA, Commercial Engineering, Section 51FX, Harrison, N. J.

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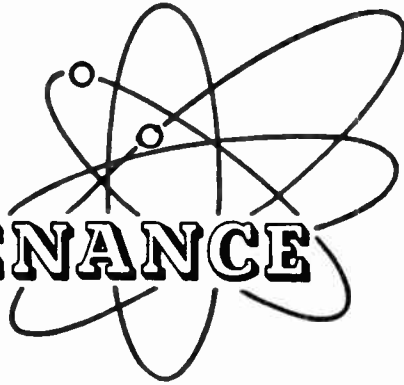
TEST AND MEASURING EQUIPMENT

HARRISON, N. J.

RADIO

MAINTENANCE

INCLUDING
ELECTRONIC
MAINTENANCE



Volume 5

June 1949

Number 6

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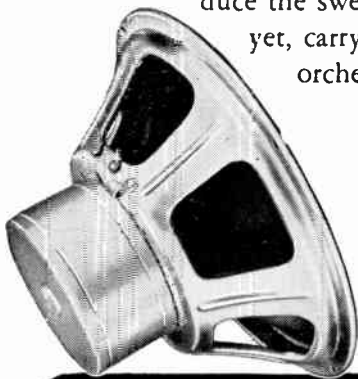
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What About Distribution

ACCORDING to Webster, the word distribution means "the economic process by which the value of a product is ultimately proportioned among the agents of a production by respective payments."

That's pretty hard to swallow all in one gulp, so let's translate it into simple English and determine just what it means. The value of a product in our industry is its list price—that price which the consumer pays. The agents are the manufacturer, the representative, the jobber, and the sales and service organization. The money which the consumer pays is divided among these individuals and organizations. There are other organizations involved, such as the railroads which furnish transportation, but those named above are the ones directly concerned with radio products.

To function properly, a distribution system must permit all involved to obtain their fair share of the value of the product. It must also permit a smooth and constant flow of goods. If it is erratic and unstable, the profit which rightfully belongs to the participants will be dissipated.

You may ask why you should be concerned with these problems. The answer is that distribution methods are constantly changing and by keeping informed it is possible for the individual to influence the factors which determine distribution policy. Today the various Associations in our trade are doing a great deal to improve the sales and service organization's position in the distribution set-up.

Several associations have pointed to the jobbers' practice of selling to consumers at the same discount which the sales and service organizations receive. They feel that this practice bypasses the retailer and deprives him of business which is rightfully his. We are inclined to agree with this feeling. The average buyer of a radio part feels that he has been treated unfairly when he finds that he can buy parts for forty percent less than the service technician must charge. The solution to the problem has not yet been found. It is not simply a matter of the jobber stopping all sales to the consumer. This would seriously affect his income and it is therefore not reasonable to expect him to do so.

Another reason why this not the solution is the fact that radio has many thousands of hobbyists whose requirements can only be fulfilled by the jobber.

The problem is a difficult and important one, and deserves careful study by all who are affected.

Frankly, we do not know the answer to this particular problem. But we are certain that a solution to this and similar problems can be found if everyone is properly informed and does what he can as an individual.

Today when developments in the radio and television industry are moving at a terrific pace, it is more important than ever to keep informed. As we write this, the biggest Radie Parts Show to date is taking place in Chicago, and we are reminded of the fact that full-scale competition has returned to the industry, television included.

Getting back to the general subject — distribution — we have been making a study of its various aspects and present trends in the radio field; and we expect to pass along some of our findings and opinions in future issues.

JJR

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**GET THIS HANDY
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Packed with 125 "Little Devil" Resistors
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\$12.50**

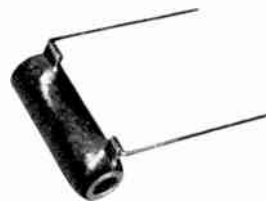
LITTLE DEVIL COMPOSITION RESISTORS

Guesswork's gone . . . when you use individually marked Ohmite "Little Devils." These tiny but rugged resistors are available in standard RMA values, 1/2, 1, and 2-watt sizes . . . 10 ohms to 22 megohms. Tol. $\pm 10\%$ and $\pm 5\%$. Values to 2.7 ohms available in 1-watt size, $\pm 10\%$ tol.

This lustrous, all-plastic cabinet not only adds a colorful, modern touch to your shop but saves you hours of valuable time by helping you find the resistors you need . . . fast. Factory packed in its five drawers—40 separate compartments—are 125 carefully selected Ohmite "Little Devil" Resistors in the 40 values (10 ohms to 10 megohms, 1/2-watt) most frequently used by servicemen.

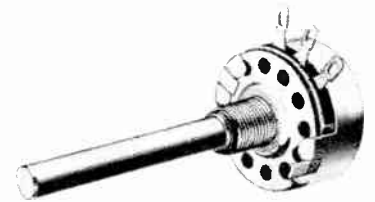
Extremely compact—only 9" x 4 3/4" x 5 1/4"—this Ohmite cabinet protects your resistors, and helps you check inventory at a glance. The cabinets are dovetailed top and bottom so they can be stacked one on top of another. Order yours today!

SEE YOUR DISTRIBUTOR



BROWN DEVIL RESISTORS

A favorite with servicemen, these dependable, wire-wound, vitreous-enameled resistors are easily mounted by their tinned wire leads. Tol. $\pm 10\%$. In 5, 10, and 20-watt sizes.



MOLDED COMPOSITION POTENTIOMETER

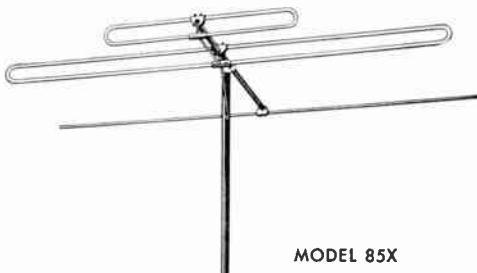
Built to last, this Type AB Potentiometer has a heat-treated, solid-molded resistance element—not just a film—and provides unusually quiet operation. It has a 2-watt rating.

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MANUFACTURERS OF THE RADIART TV-FM ANTENNAS AND AUTO AERIALS

ELECTRONICALLY SPEAKING



Admiral Reports: The annual report of the Admiral Corporation for 1948 showed sales up 39 percent over '47, earnings up 68%. Net worth of company at end of 1948 was almost \$11,000,000. Company expects television to account for 60% of all its 1949 sales (the other 40% being accounted for by radios, refrigerators, ranges).

And Stewart Warner. Net Sales were down 5.7% from 1947, but profits were up almost 30%; thanks to television.

And Sylvania. Net sales up 3.8% over 1947, net income up 52%. They expect to do even better this year.

TV in Cars. Walter H. Stellner, of Motorola, has come out in strong opposition against the installation of automobile television sets where they can be seen by the driver, recommends such installation for rear seat passengers only.

As Maine Goes. In Maine, a statute has already been enacted which makes illegal the installation of tele-sets in cars where drivers can see it. Twenty-two other legislatures are about to act on similar bills.

Video Lineage. In Europe a new standard lineage for the definition of video images has been established. It's 625 lines. United States has 525-line definition.

Stack of all Trades. General Instrument Corp. has come up with a changer for automatic playing of all types of records now on the market, using one pickup arm.

Telling 'em. Radio Manufacturers Association (RMA) is starting a public relations program to keep

everybody up to date with complete and accurate information on television broadcasting services and receiver sets. Perhaps they'll be able to lessen the recent confusion of government, trade, and public on matters television.

Receiver Production. February output of tele-sets was a little down from January (2%), f-m/a-m receivers down thirty percent, a-m receivers down approximately 10%. Television set production, however, is 78% above last year's average.

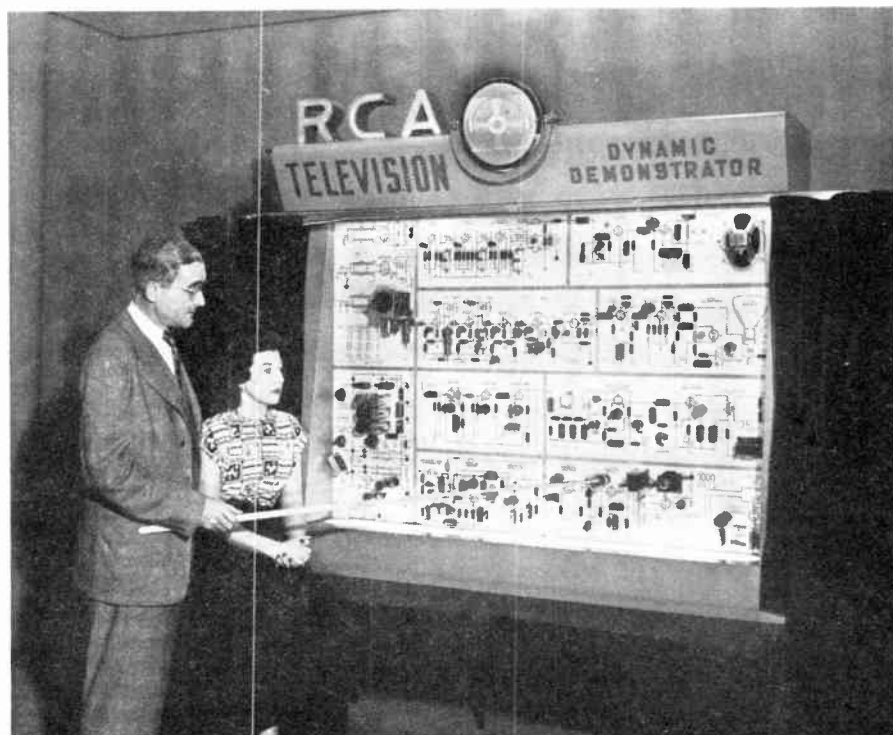
Try before you Buy. At Sun Radio in New York, service technicians interested in acquiring new equipment can sit down at fully furnished

benches and try it out. Live television receiver is provided for testing purposes. No obligation.

Du Mont School. Teleset Service Control Department of Du Mont continues to hold special seminars for franchised Du Mont dealers and servicemen. These seminars deal with general service problems as well as those peculiar to various areas in the country.

Emerson School. Emerson took the television technician personnel of its North-East distributing organization right to the production line at the factory to give them a solid foundation in television. Will repeat this for other sections of the country.

RCA School. The Television Dynamic Demonstrator, reported here two months ago, was used in the television service clinic sponsored by the Westchester Electronic Supply Co. of White Plains, New York. Technicians attending were unanimous in their praise of the clinic and agreed that more of same are necessary. We do too. Below is a picture of the device; man pointing the stick is John Meagher of RCA who designed and built the demonstrator.



RCA Television Dynamic Demonstrator, a complete and operating 30-tube television receiver laid out in an upright panel. John Meagher, RCA Tube Dept. television specialist, designed and built the demonstrator. The instrument has been used in a number of television clinics in various parts of the country, was acclaimed by all who watched it



AUTO RADIO VIBRATORS

have Ceramic Stack Spacers



A COMPLETE LINE OF VIBRATORS...

Designed for Use in Standard Vibrator-Operated Auto Radio Receivers. Built with Precision Construction, featuring Ceramic Stack Spacers for Longer Lasting Life.

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New Models... Designed for testing D. C. Electrical Apparatus on Regular A. C. Lines. Equipped with Full-Wave Dry Disc Type Rectifier, Assuring Noiseless, Interference-Free Operation and Extreme Long Life and Reliability.

NEW MODELS NEW DESIGNS
NEW LITERATURE

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See your jobber or write factory

AMERICAN TELEVISION & RADIO CO.

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SAINT PAUL 1, MINNESOTA-U.S.A.

Life-Size Television. RCA's new life-size television projection system features an optical barrel which is suspended from the ceiling, useful in night clubs, hospitals, taverns, clubs, and so on. Screensize up to six by eight feet.

Smaller and Smaller. The National Bureau of Standards is working on the development of subminiature i-f amplifiers which can be manufactured on a mass-production basis, some employing printed circuits. This will have important implications as far as airborne electronic equipment is concerned.

45-RPM. RCA expects to sell three million instruments to play its 45-rpm records in 1949. Nine radio and television manufacturers are already incorporating 45-rpm records reproduction facilities in their instruments, and one major record manufacturer has announced his decision to produce the new disc.

Film from Television The problem of how to record television images for delayed broadcast and for documentary legal, and advertising purposes, is being solved by the RCA kinephoto equipment which records the video image on motion picture film. Exposure is so timed as to avoid "banding." Already in operation in major key network stations.

Good Advice. Ross D. Siragusa, President of Admiral Corporation, had this to say to television manufacturers and merchants: "In molding the future of this great new industry, let us sell confidence, not confusion. Let us devote our time and energies to producing and marketing honest values—at prices which the public can easily afford to pay," with which we heartily agree.

Sylvania Crystal Ball. With improved selling techniques, 2,710,000 tele-sets may be sold in 1949, states F. Manfield of Sylvania. He bases this prediction on a survey recently made by Sylvania Sales Research. Survey also showed that a majority of people planning to buy in 1949 earn less than \$100 per week. Incidentally, RADIO MAINTENANCE predicted in April installation of 2,000,000 receivers during 1949.

Contest Results. Remember the Hytron Servicemen's Contest a little while back? The company has now produced the first shop tool growing out of the contest (as they said they would). It's a thin shank with forked end, helpful for unsoldering. Priced at 49c.

Town Meeting Note. Some interesting remarks of M. F. Balcom, President of RMA, made at a recent Town Meeting of Radio Technicians: "Radio will continue to provide entertainment for the home for many years to come, although readjustments of listening habits with viewing time will be necessary... The public today has about a half-million dollars invested in approximately 1,500,000 tele-sets."

More Town Meeting Notes. Total attendance at the first four Town Meetings of Radio Technicians during the current season was 10,280 technicians, dealers, and distributors. These came from 29 states in the U. S., from Canada, England, and Venezuela. Local expenses were financed by 125 set and parts distributors and representatives of RMA. Seventy-two speakers lectured at these meetings. Well done.

Decentralization. Motorola, claiming that industry must plan for voluntary decentralization of its key production units, has announced the opening of a new research laboratory in Phoenix, Arizona. Research will be strictly in military field.

Growing Up. Earl I. Sponable, President of the Society of Motion Picture Engineers, announced the appointment for the current year of William B. Lodge to fill a vacancy existing on the Board of Governors of SMPE. Mr. Lodge is V-P in Charge of Engineering for CBS. First time in the history of the society that a major appointment has been extended to a television engineer.

Augury. Crosley's sales of radio and television receivers during the first four months of 1949 were up 42% over 1948. "These results demonstrate to us how squarely the return of the so-called buyer's market can be met by good product values backed by full-scale, aggressive sales programs...," they say in explanation.

Newcomer. Alleviating the television picture tube shortage still further, a new firm has entered the field of cathode ray tube production. It's the National Video Corporation of Chicago, operating in a new 40,000 square feet plant. This shortage is about over.

TV Sales. Sales of television receivers by Motorola were three times greater in 1949 than for the corresponding period of 1948. But for the picture tube shortage, they say, they could have done even better.

And Still Growing. Sylvania has started construction of a new annex to its tungsten and chemical plant to increase manufacturing and warehouse space by one third. This is the second expansion within the year, and is an effort to meet the increasing demands of the television industry.

TV in Canada. Government of Canada is now making plans for the introduction of television in Canada (television, as radio will be government operated in the Dominion.) First stations will be in Montreal and Toronto. Canadian technicians have been getting ready for this day for some time now.

And N. Y. State. June will probably see the first television station in Rochester, N. Y. go on the air. Station (WHTM) will be operated by Stromberg-Carlson.

Cooperation. One source of interference on the television set may have been eliminated if the claims of Electric Auto-Lite Co. are born out. They have a new spark plug, incorporating a 10,000-ohm resistor, which they say will prevent interference with video reception caused by the ignition system of automobiles. Thank you.

Just To Be Sure. Motorola has incorporated a device in its latest models which is designed to eliminate ignition interference. Why be half safe.

For 7" Only. Webster-Chicago has come up with a new combination record player. This one plays seven-inch records automatically. Both RCA and Columbia put out 7-inch micro-groove discs. ✓✓✓

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video I-F amplifiers

by Martin Clifford

Special circuits have been developed to solve the problems posed by the particular requirements of video i-f amplifiers in television receivers. This discussion will be of help to the technician when he encounters these circuits in his work

IT might seem offhand that picture i-f amplifiers should constitute no major problem to the service technician. Video i-f amplifiers are radio amplifiers, and we have had radio frequency amplifiers almost as long as we have had radio. But although video amplifiers are nothing more than radio amplifiers, they are in a class by themselves. We want them to have high gain (hence fewer tubes), wide band pass characteristics (at least 4 Mc to give better picture detail), just the right amount of selectivity, good signal-to-noise ratio, and of course, good stability.

One of the most typical of the various video i-f amplifier systems and a logical carryover from straightforward r-f amplifiers is the video circuit shown in Fig. 1. This particular amplifier is used in the General Electric Model 803. The circuit is our familiar and strictly conventional

transformer-coupled, three-stage, band pass amplifier, using two high gain 6AC7 tubes. The necessary four-megacycle band pass is obtained by overcoupling the i-f transformers and also by loading the transformers with resistors. While overcoupling and loading give the band pass necessary for picture detail—by flattening the video i-f response curve—they also have the effect of reducing the overall stage gain.

The 4-Mc wide band pass can be kept, but somewhat higher gain secured through the use of impedance coupling. We see such a circuit in Fig. 2. It is used in the Philco 48-700 and the Stromberg Carlson TV-10.

It should be noted that both plate loading resistors are shunted across the plate coil and the grid coil. These resistors have the effect of

lowering the Q of these coils. Although a lowered Q means a sacrifice of signal, it is necessary to knock down the Q deliberately in order that all the picture information may be sent on to the grid of the cathode ray tube. The i-f signals from the plate of the mixer are transferred by impedance coupling to the grid of the first 6AG5 tube and amplified. In the impedance coupled video i-f amplifier, there is usually no magnetic linking between the plate coil and the grid coil.

The transfer of signal voltage from one tube to the next is ordinarily done through a small coupling capacitor. The plate and grid windings of the first video i-f impedance coupler are tuned to accept the video i-f signal. The sound trap is adjusted to reject audio i-f.

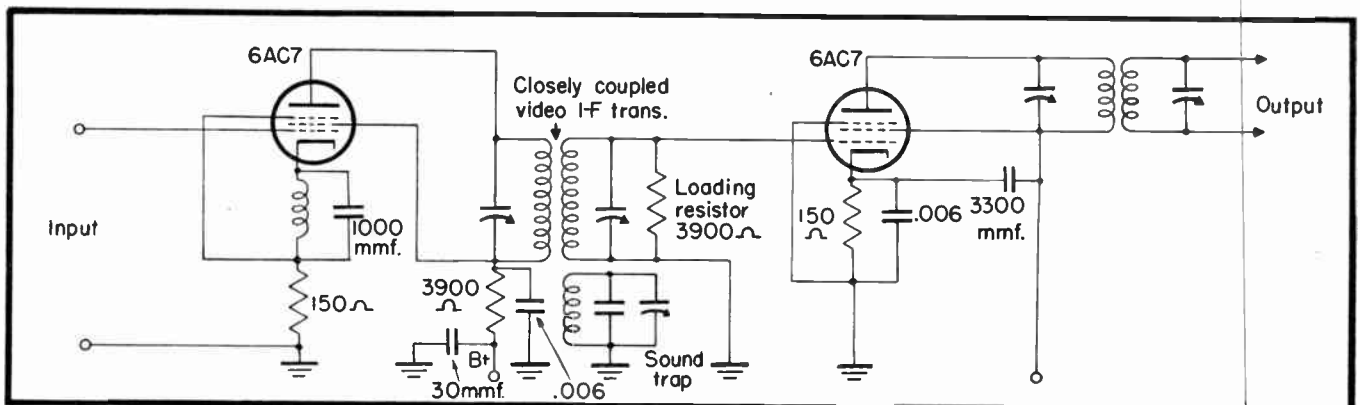


Fig. 1. Schematic of a transformer-coupled, double-tuned i-f amplifier used in the GE 803. Overcoupling and loading provide the necessary bandpass, but at the same time reduce the overall stage gain. This arrangement is a direct carryover from traditional r-f amplifiers

Stagger Tuning

The picture signal is again transferred by impedance coupling to the next stage. The second impedance coupler stage, and also subsequent coupler stages, are all tuned to a frequency slightly different from the coupling impedance in the first stage. This method of tuning each stage for maximum response at slightly separated frequencies is called stagger tuning. By stagger tuning each of the stages, the overall response (bandwidth) is much wider than if each stage were tuned to exactly the same frequency. In addition, the gain of the entire i-f system remains fairly high. In aligning such a stage, care must be taken to peak each of the i.f.'s to its proper frequency. Since these peaking frequencies will vary with the number of i-f stages used, it is advisable to get alignment data from the manufacturer.

Impedance coupling can be simplified by substituting a resistor for either the plate coil or the grid coil. The RCA Model 630TS makes use of such a stagger tuned impedance coupled i.f. The problem of magnetic coupling between plate and grid coils is completely avoided by substituting a grid return resistor for the grid coil. This also helps simplify i-f alignment by reducing the number of adjustments which have to be made. One more detail that should be observed in discussing video i-f stages is that the cathode resistors in such stages are often either unbypassed or only semi-bypassed. Omitting the cathode bypass capacitor introduces a small amount of degeneration (negative feedback). Although this results in some small loss of signal, it nevertheless helps keep the i-f bandwidth constant regardless of the setting of the contrasting control.

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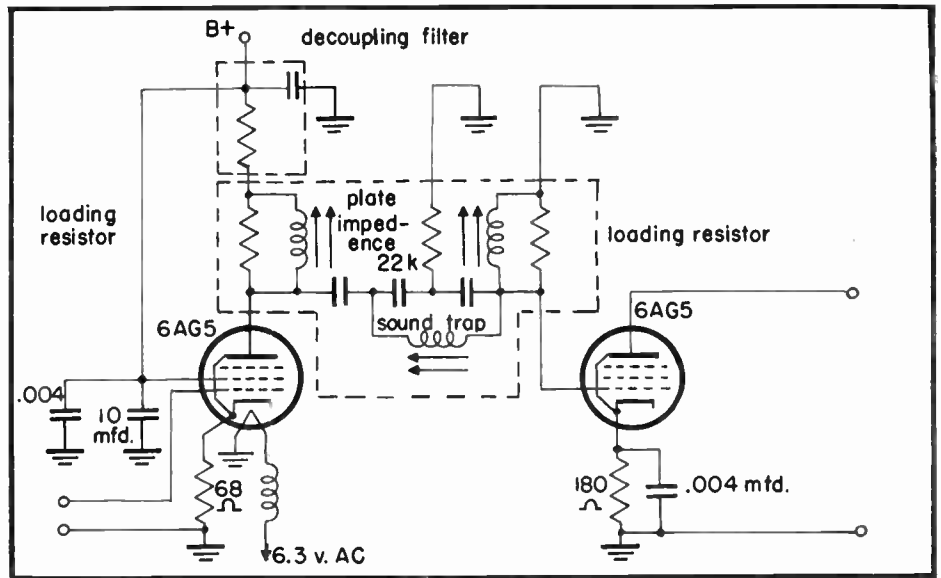


Fig. 2. Diagram of impedance coupled video i.f. The plate and grid windings of the first video i-f impedance coupler accept video i-f signal, sound trap rejects audio i.f.

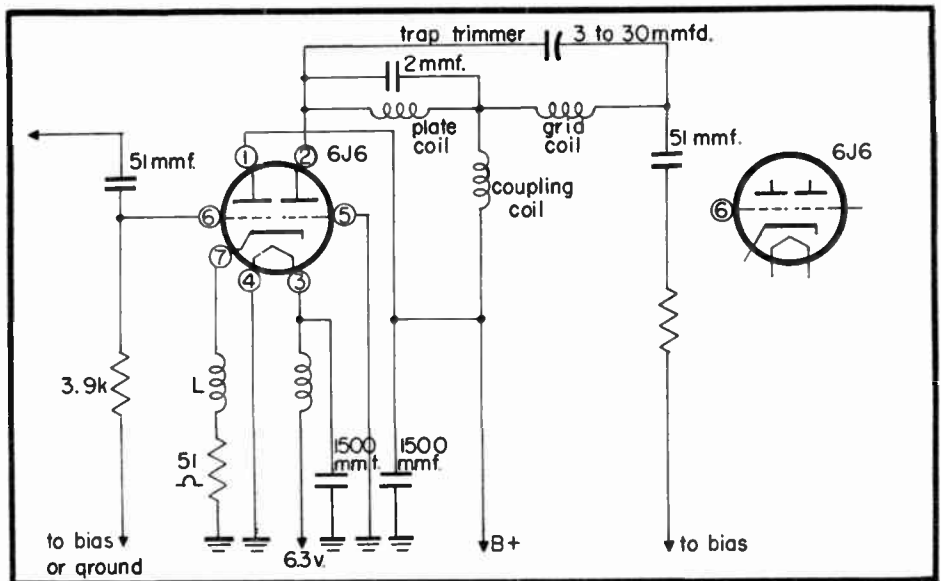


Fig. 3. Cathode-coupled, grounded grid, wide band video amplifier. The first triode section is used as a cathode follower, the second section is a grounded grid amplifier

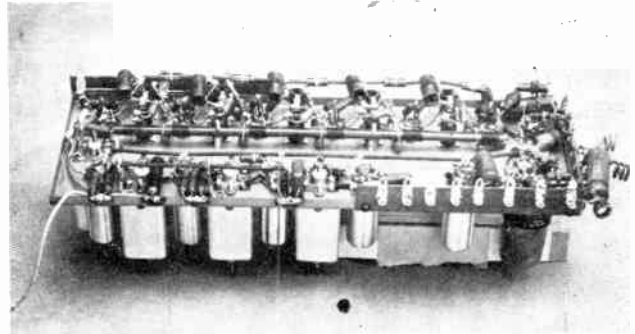
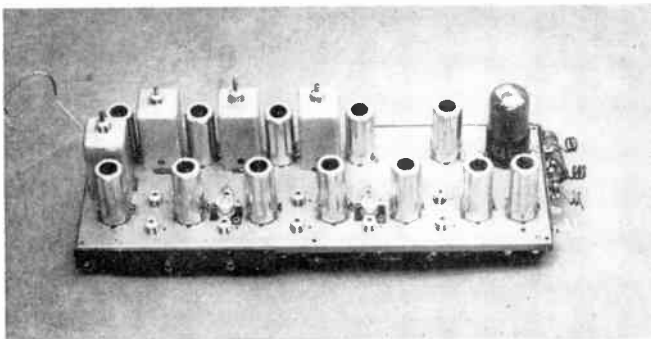
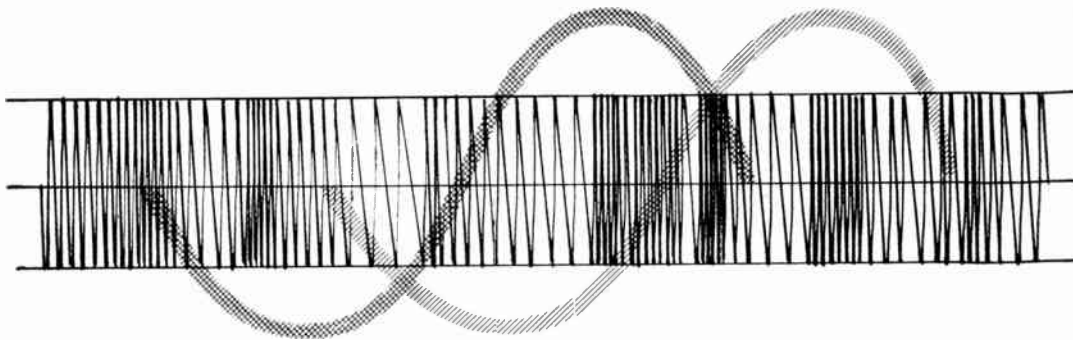


Fig. 4. Top and bottom view of the i-f strip used in the Television Assembly Company Model 1230, utilizing cascode circuit principles. Note the coil windings on a single strip. Mounted on the same chassis are the audio i-f stages. This is an exceptionally clean chassis design



F-M RECEIVER ALIGNMENT PART 1

by J. Richard Johnson

WHEN AND HOW TO ALIGN THE F-M RECEIVER

THE condition of alignment of an f-m receiver is much more critical than the condition of alignment of an a-m receiver. While a mis-aligned a-m receiver merely weakens the signal at the loudspeaker, a mis-aligned f-m receiver can produce an a-f signal with considerable distortion as well as weakness and poor selectivity. Accordingly, a large number of service jobs involving distortion in f-m receivers may require only slight adjustments and may not include any actual circuit or component defect whatsoever.

Knowing when to Align

While alignment adjustments often can solve distortion and weak signal problems in f-m receivers, the symptoms of mis-alignment should not be confused with similar symptoms resulting from other conditions. Complete alignment and adjustment of an f-m receiver is not a simple process if done properly. It therefore behooves the service technician to be awake to all other possibilities of trouble and make absolutely certain that alignment is *actually required* before spending valuable time and effort in setting up equipment and checking adjustments. What are some of the non-alignment troubles which should be recognized?

First, there are weak signal troubles. Obviously, a signal which

is weak at the antenna terminals of the receiver will produce the same effect on the detected a-f output signal as a mis-aligned i-f or r-f section in many cases. A weak signal in an f-m receiver is always accompanied by considerable distortion, for several reasons.

For instance, the limiting action is negligible on a weak signal. In practice, the limiting process is useful not only for reducing noise, but also for modifying the response curve to a certain extent, as illustrated in Fig. 1. As this illustration shows, the limiter threshold chops off the peak of the i-f response curve, flattening the top. With a weak signal, however, the peak may not quite reach the limiting value of signal voltage, as shown in Fig. 2. This causes the a-f peaks at the extremes of deviation to have a lower response voltage at the detector. Amplitude variations thus creep into the discriminator, and the weak signal takes on a muffled sound, somewhat as though it were being received on an a-m receiver, instead of an f-m model.

This condition is not necessarily caused by mis-aligned receiver circuits, but may equally often be the result of a poor receiving location, poor antenna, or a defect in the antenna system. Any component trouble (particularly weak tubes) is also a definite possibility.

Among some service technicians, experience with a-m receivers has developed the perfectly justified impression that whistles and interference from various sources are an indication of poor alignment. Such a condition is a similar indication with f-m receivers, but should never be considered conclusive evidence that alignment is necessary. While a well-aligned receiver will seldom be afflicted with interfering signals, there are a few circumstances under which such interference is possible. While the standard 10.7 Mc intermediate frequency is high enough to place the image interference frequency outside the f-m broadcast band at all times, the local oscillator frequency remains inside the band when the receiver is tuned to any channels from 88 Mc to 97.3 Mc if the oscillator frequency is on the high side, and from 98.7 Mc to 108 Mc if it's on the low side of the received signal frequency. This means, of course, that radiation of the oscillator signal from one receiver to another can result in interference noises which sound as though the receiver in which these noises are heard were out of alignment. Interference from other radio services, such as local mobile police installations, is also experienced in some locations.

Thus, before the re-alignment of any receiver is considered necessary, all other possibilities of trouble should be checked first, with the hope that

something less involved will solve the problem.

Test Equipment Necessary

Much has been written about the test equipment required for f-m receiver alignment. A complete analysis and adjustment involves a full complement, including the following:

1. **Signal Generator.** The generator must of course have an output frequency coverage including both the r-f and i-f signal frequencies. Frequency modulation or "sweep" is a desirable feature, although alignment can be accomplished without it. However, the time consumed for a complete job is greater without sweep. To reduce the requirements to specific figures, the generator output frequency must be adjustable from 88 Mc to 108 Mc and from about 7 Mc to 11 Mc. While the standard RMA intermediate frequency value is 10.7 Mc, many manufacturers do not use this value, making it desirable to have other than just the 10.7 Mc i-f signal output available.

It is desirable that the generator have sweep modulation *and* amplitude modulation, since the latter is often useful for such operations as setting the local oscillator to its proper range, and the like. The sweep should have an adjustment so the deviation can be set to any desired value from zero up to about three hundred kc or a little more. Visual alignment is not practical with sweep generators with deviations which cannot be adjusted to less than a megacycle or two, because the size of the response pattern on the oscillograph is then much too small for practical use.

2. **Oscillograph.** This instrument is obviously a necessity for any visual alignment, which is based on an oscillograph pattern. The oscillograph ('scope) also has its usual uses as an output meter and to observe wave forms, and so on. Reasonable sensitivity will be sufficient for most alignment applications.

3. **Meters.** An output or db meter has definite uses in f-m alignment, especially if the oscillograph is not available. The output meter can be used to indicate output a-f voltage when a sweep signal or an a-m signal is being applied to the receiver's input circuits. Vacuum tube voltmeters are useful for indicating discriminator voltages without loading down the circuit.

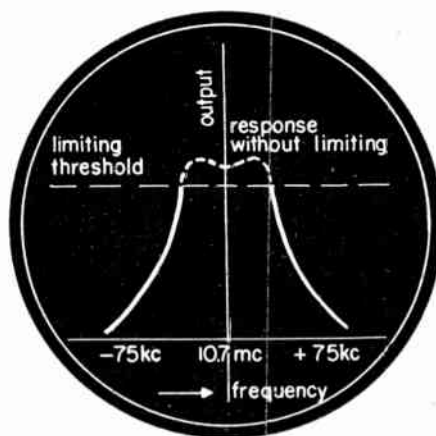


Fig. 1. Showing how the i-f response curve is modified by the action of the limiter

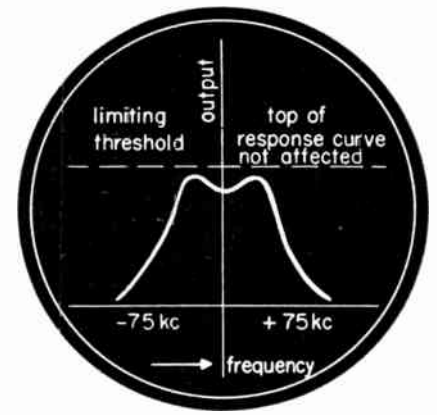


Fig. 2. Threshold of limiter is above maximum response value of a weak signal i-f response

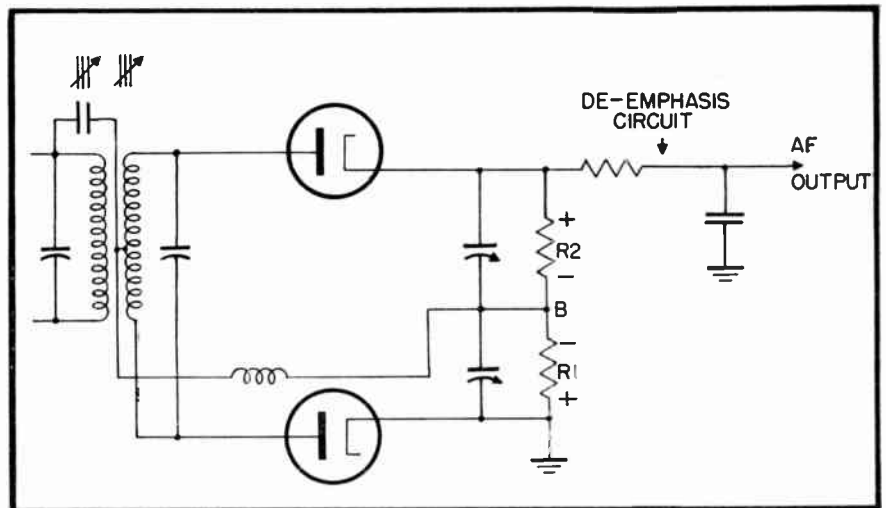


Fig. 3. To align Foster Seeley discriminator, signal is fed through i-f amplifier and voltage between A and ground measured. With zero voltage, discriminator is balanced at i-f.

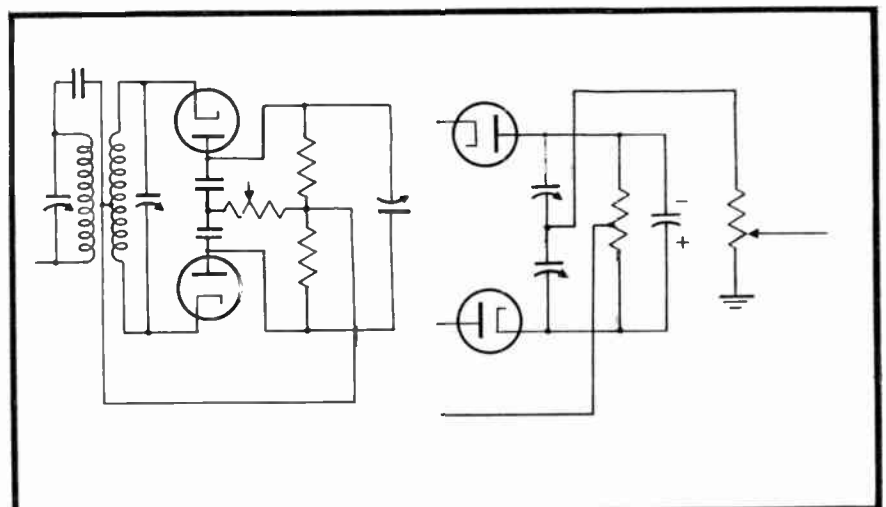


Fig. 4. Shown above are schematic diagrams of two variations of the ratio detector. The arrows (right) indicate the points of connection of meters for proper alignment

Analyzing F-M Alignment Requirements

Actually, the front end and i-f amplifier sections of an f-m receiver present no vastly different alignment

problems from those encountered in the same sections of an a-m receiver. The selectivity of the i-f amplifier is similar to that of an a-m receiver, in

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PHASE INVERTER CIRCUITS

Here is another in our series of articles on basic circuits, analyzing their operation and examining the various ways in which they are applied

by A. T. Parker

TO properly understand the operation of Phase Inverter Circuits, sometimes called Phase Splitter Circuits, it is desirable to review several fundamental facts.

The signal voltage appearing at the output of a vacuum tube is 180° out of phase with the signal voltage applied to the control grid or input of the tube. The reason for this can be shown by analysis of the simple circuit of Fig. 1. If it is assumed that the plate supply voltage is constant at 250 v, then the actual voltage at the plate will be 250 v minus the voltage drop in the plate load resistor (i.e., voltage drop equals plate current times resistance value). Consider what is happening in the plate circuit during the time that the

signal is making the grid more negative. The plate current will be decreasing and consequently the IR drop in the load resistor will be decreasing. The voltage appearing at the plate is 250 v minus this IR drop in the load resistor. Since the drop in the resistor is decreasing, the plate voltage increases. Putting it another way, the plate will become more positive as the grid becomes more negative. Similarly, the plate becomes less positive as the grid becomes less negative. Because of this effect it is said that the signal is "inverted" by transmission through a tube. When a tube is used for the sole purpose of

inverting or reversing the phase of the signal, it is known as a "phase inverter."

In a push-pull circuit, the signal appearing at the grid of one tube is 180° out of phase with the signal at the grid of the other tube. For proper operation, the signal voltages on the grids of a pair of tubes in push-pull must be exactly 180° out of phase with each other and exactly equal in intensity.

A variety of circuits are used to obtain the proper signal voltages for the push-pull grids. The voltages may be obtained by the use of either one or two tubes. When one tube is used, the signal on either push-pull grid is limited to half the voltage output of the inverter tube. When

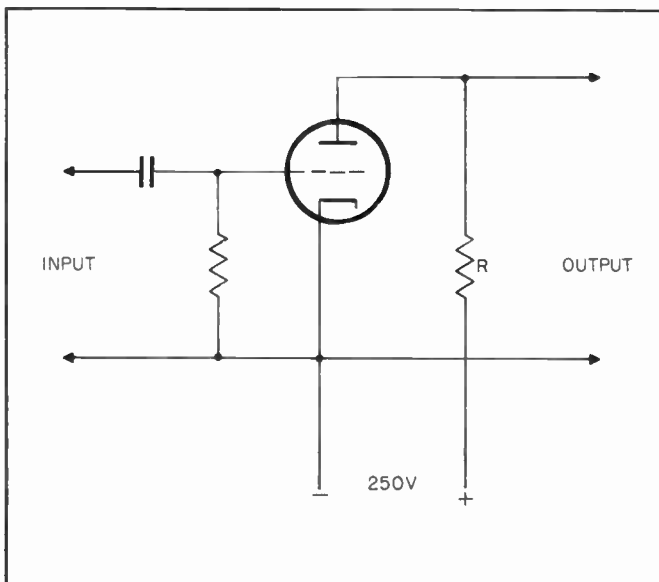


Fig. 1 The simple amplifier circuit shown in above schematic helps explain signal phase inversion by transmission through tube

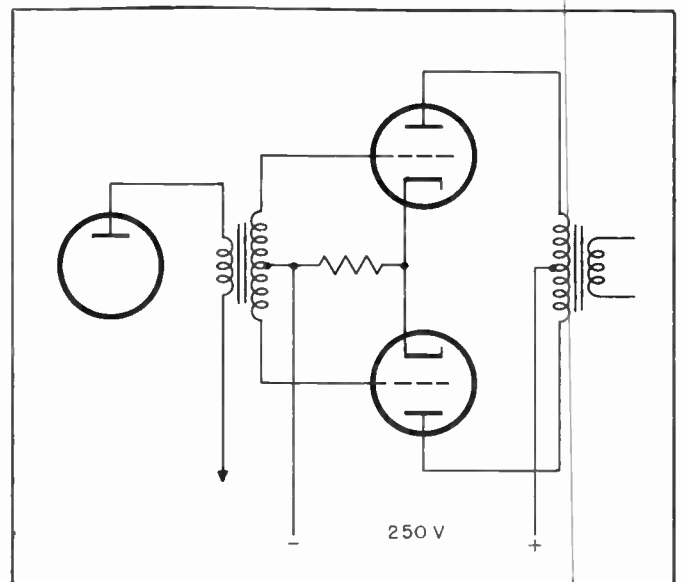


Fig. 2 Transformer coupled push-pull amplifier circuit. Secondary of transformer is center tapped to obtain out-of-phase voltage

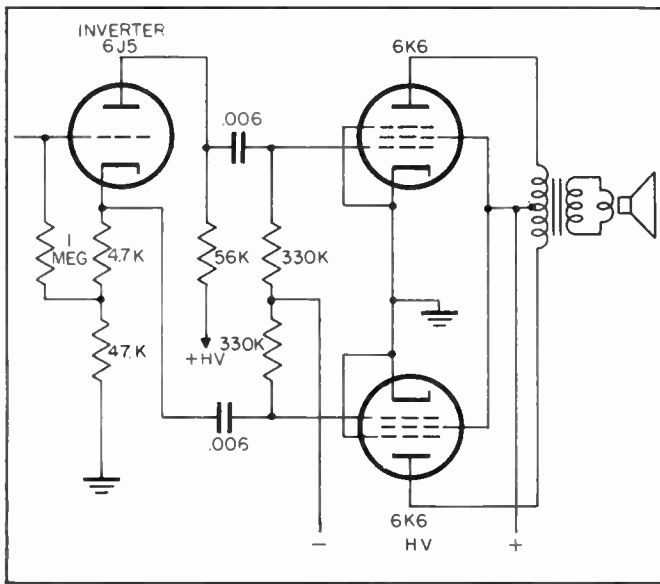


Fig. 3 Cathode and plate loaded inverter circuit as found in the Philco Model 46-1226. The inverter tube is self-balancing

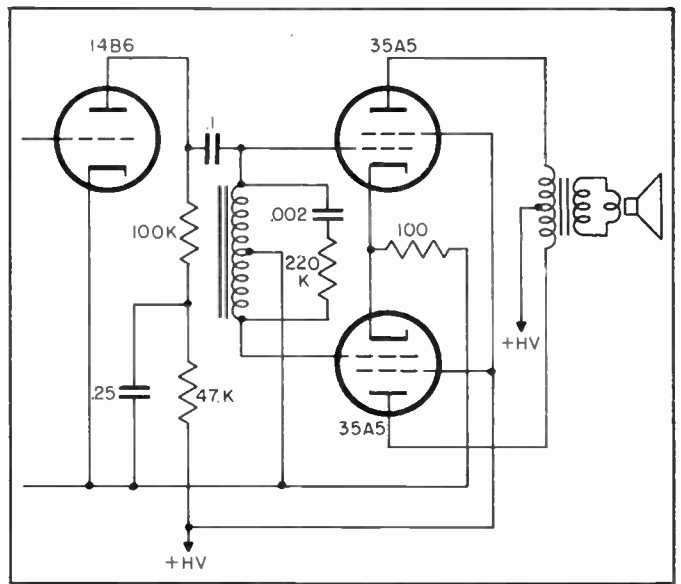


Fig. 4 A tubeless inverter circuit found in the Espey Model 20626A. Center tapped inductance provides the 180° phase shift

two tubes are used, each push-pull grid receives the entire voltage output of one of the inverter tubes.

Drawback of Using Transformers

The simplest and also the original method of obtaining the out-of-phase voltages was by means of a transformer with a center tapped secondary, as shown in Fig. 2. The voltages applied to the push-pull grids have the proper phase relation because the terminals of a transformer winding always have opposite polarity. Transformers were formerly used exclusively for providing inverted voltages to push-pull circuits. Their many disadvantages caused them to be superseded by the inverter circuits described. Among the

disadvantages were such things as:

1. Susceptibility to hum pickup from power transformers, etc.,
2. Poor bass response due to inadequate inductance except in expensive units,
3. Poor high frequency response due to large distributed capacity which shunted the winding and leakage inductance and which occurred in all but the most expensive types.

Several late model radio receivers use a single tube as a cathode and plate loaded inverter tube which is self-balancing. One of these is the Philco Model 46-1226 shown in Fig. 3. In this circuit one of the push-pull grids derives its signal from the plate of the inverter tube in conven-

tional audio amplifier fashion. The other push-pull grid receives its signal from the cathode of the inverter tube. This provides the necessary phase shift of 180°. The plate resistance, 56,000 ohms, and the sum of the cathode resistors, 51,700 ohms, is close enough for a fair balance of audio output voltages.

However, degeneration is employed to assure that the voltages are equal. The plate current flowing through the cathode resistors (4,700 and 47,000 ohms) is in opposite phase with the grid voltage appearing from the control grid of the 6J5 inverter tube and ground. Thus, degeneration takes place in the 4,700 ohm resistor. If the 6J5 plate current

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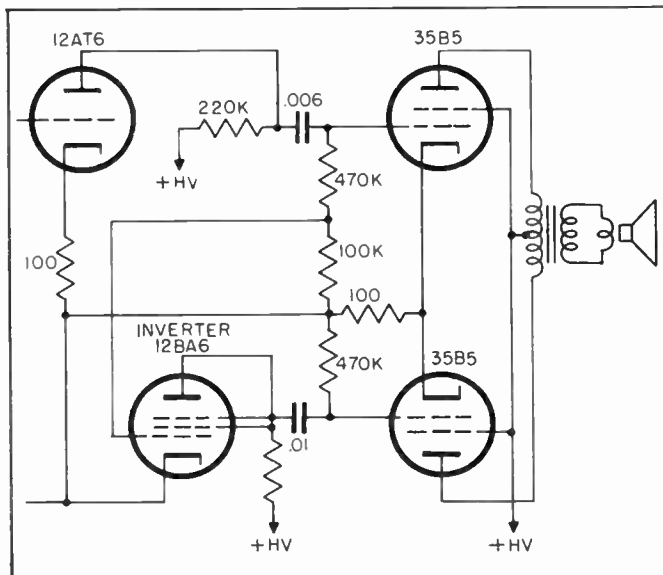


Fig. 5 The two tube phase inverter circuit illustrated in the above schematic is utilized in the Bendix Radio Model 697A

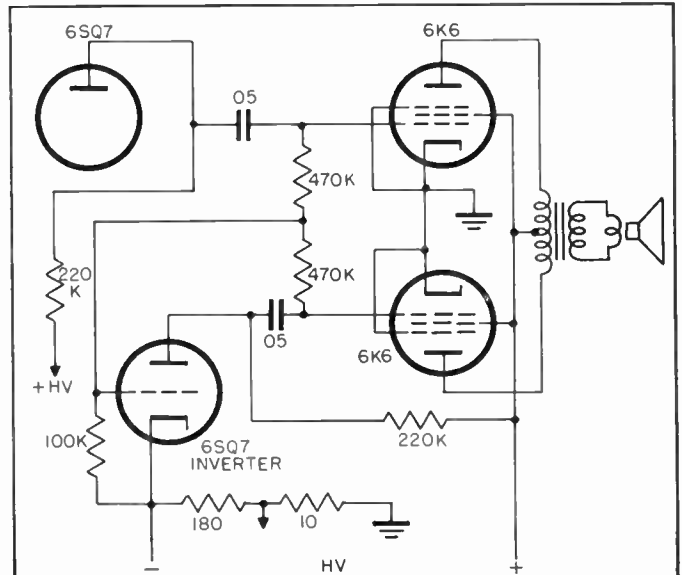


Fig. 6 This inverter circuit, found in Motorola Model 85F21, is similar to the one in Fig. 5 and of the self-balancing type

SIDEBANDS and THEIR FUNCTIONS

by Murray Barlowe

Why do we need wide bandpass i-f stages for high fidelity reproduction? Why must all sidebands be accommodated in i-f amplifiers? What happens to the sidebands at the second detector? This article throws some new light on an often neglected subject

WE have noticed a tendency in most radio courses and textbooks to omit any complete discussion of sideband theory. As a result, most of us seem to realize that the need for sidebands exists, but do not fully understand why that should be so. We realize that wide bandpass i-f stages are necessary for high fidelity reproduction because all of the sidebands must be accommodated, but again do not completely know why. What happens to these sidebands after we "worry" them through the i-f amplifiers? We have been taught that all that is necessary at the detector is a carrier frequency with the intelligence impressed upon it. We are also taught that the operation of the detector depends merely upon the rectification of the signal and the filtering out of the r-f component. There is a tendency to steer clear of any mention of sidebands when discussing detectors. Why then all this fuss about i-f amplifiers having to accommodate these sidebands if we do not intend to use them? We definitely depend upon the presence of these sidebands for the proper operation of the detector. In this article we shall attempt to elaborate on the operation of detectors, proving that the sidebands are necessary for their operation.

How Sidebands are Produced

The basic process of transmission of intelligence by radio is accomplished by modulating the r-f carrier, that is, varying the amplitude of the carrier in accordance with the intelligence. In this discussion, when we refer to the "carrier" we will think of it as a fixed radio frequency of constant amplitude, that is, an unmodulated carrier. When the carrier is modulated, we will refer to it as a modulated current wave.

Modulation is accomplished in the modulated stage by applying an audio signal voltage to the grid (as in grid modulation) and thereby varying the amplitude of the carrier in accordance with the audio frequency. This statement is usually misconstrued because a mathematical explanation is often omitted. As a result we get the impression that the carrier (a single frequency) is varying in amplitude, and we cannot readily see the need of wide bandpass i-f amplifiers to accommodate it.

When we put the audio signal on the grid of the tube being modulated, we inject this frequency into the circuit. This is similar to the action of a first detector of a superheterodyne receiver. In the first detector we also have an r-f signal introduced into the tube which is similar to the carrier frequency in the transmitter. Both tubes act as mixers.

In each case, both signals are heterodyned and new frequencies produced. These new frequencies are the sidebands and are the result of heterodyning the carrier and intelligence (audio) frequencies.

Let us take as an example a 100-kc carrier being modulated by a 1000-cycle note. This would produce in the output of the stage being modulated four frequencies, namely $F_1 = 100$ kc r-f carrier frequency, $F_2 = 1000$ -cycle modulating frequency, $F_1 + F_2 = F_3$, or the sum of the carrier and modulating frequency, and $F_1 - F_2 = F_4$, or the difference between the carrier and modulating frequencies. We can disregard F_2 because the plate impedance of the r-f stage being modulated is so low at this frequency (audio) that it will not effectively appear across it. The three remaining frequencies are then our carrier frequency and its two sidebands, as represented in Fig. 1. These three frequencies are the ones we transmit.

This is called dual sideband transmission, and is the most widely used method. Referring to Fig. 1, the distance between the carrier and its sidebands is directly proportional to the frequency modulating the carrier, in this case 1000 cycles. Usually, more than one frequency is modulating the carrier at one time, as in the case with speech and music. This

would be represented by the symmetrical distribution of sidebands about the carrier, each sideband representing each fundamental, as illustrated in Fig. 2a and Fig 2b.

Adding a Third Dimension

Now let us introduce another axis, the time axis, into Fig 1, making it three-dimensional, as shown in Fig.3. We can now represent differences in modulating frequencies and amplitudes as related to time. This has been done in Fig. 3 for the 1000-cycle note and the 100-kc carrier. One can easily see the carrier and both sidebands in this illustration, but it is quite difficult to obtain a similar picture when this modulation is expressed two-dimensionally, as in Fig 1a. In Fig 1a we are looking at a complex wave which is made up of the carrier and its sidebands.

The mathematical expression for an alternating current wave in which the amplitude is varying periodically is:

$$i = (A + B \sin 2\pi F_1 t) \sin 2\pi F_2 t$$

where F_1 is the modulating frequency and F_2 is the carrier frequency. The amplitude is the entire bracketed expression, and it is seen to vary with a frequency F_1 . If we work out the problem by simple trigonometric substitution for the products of the two sine terms, the above equation becomes:

$$i = A \sin 2\pi F_2 t + B/2 \sin 2\pi (F_2 + F_1) t + B/2 \sin 2\pi (F_2 - F_1) t$$

This definitely shows us that the current wave consists of three distinct frequencies, each of constant amplitude. First, the unmodulated current has an amplitude A . The second frequency has an amplitude which is half that of the modulation envelope amplitude B , and a frequency which is the sum of the carrier and the signal frequencies. The third is also of amplitude $B/2$, but has a frequency equal to the difference between the carrier and signal frequencies.

Now let us represent a 1000-cycle note, a 2000-cycle note, and a 3000-cycle note, each for a unit length of time, as in Fig. 4.

This would be represented three-dimensionally as in Fig. 5. In Fig. 6 we represent all three frequencies in a single unit length of time.

As yet we have made no mention of "percentage of modulation." The carrier with no modulation would be represented by a unit height above

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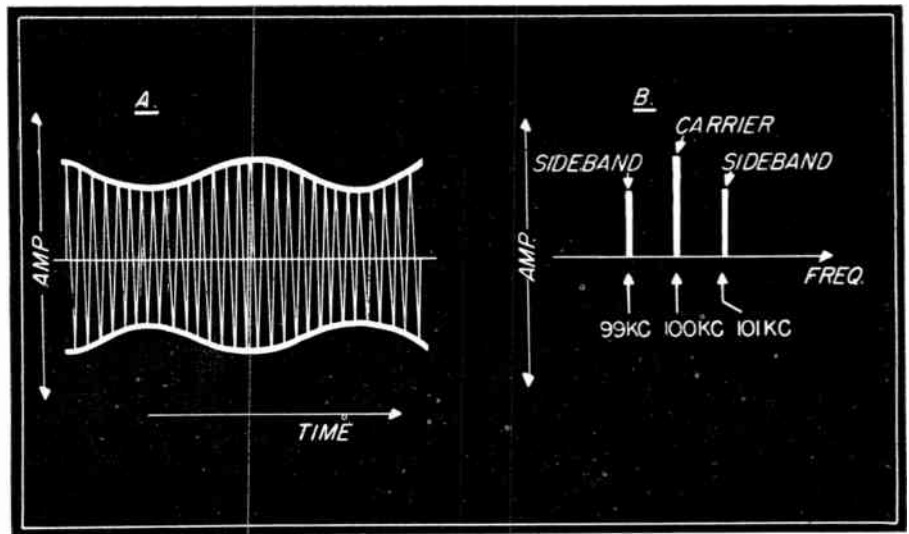


Fig. 1 100-kc carrier is modulated by 1000-cycle note. Sidebands are 99 and 101 kc.

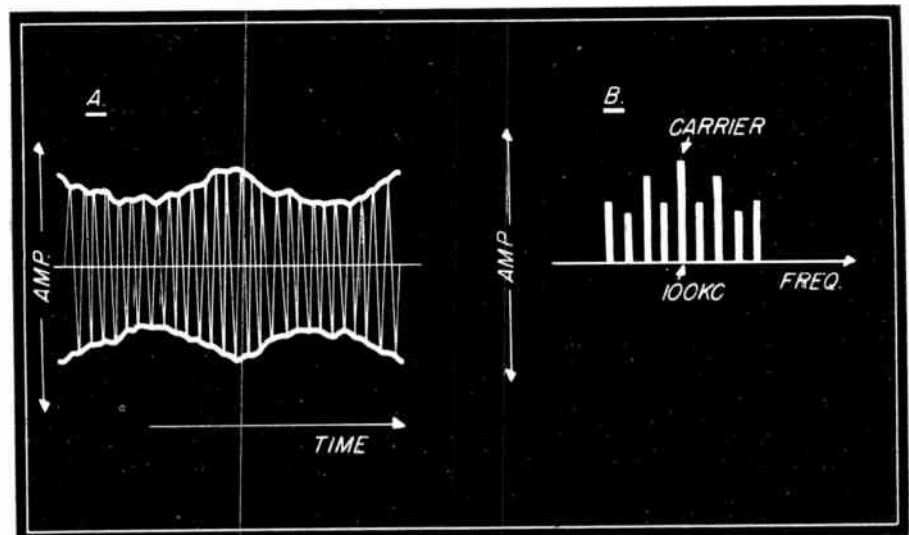


Fig. 2 Symmetrical sidebands about 100-kc carrier modulated by more than one frequency

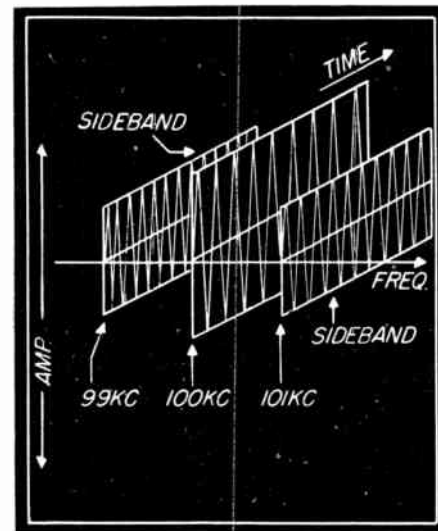


Fig. 3 Three-dimensional view of a 100-kc carrier being modulated by 1000-cycle note

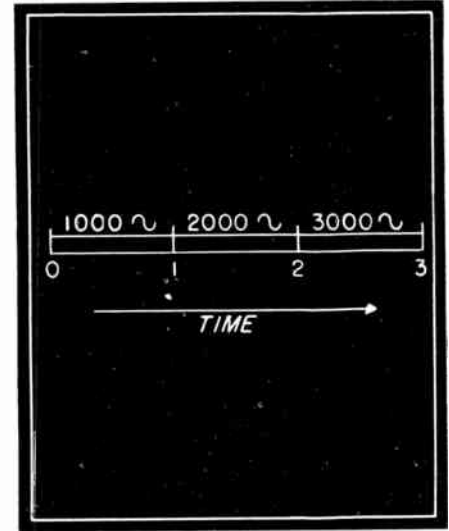


Fig. 4 Representing three frequencies of given value, each for a unit length of time

Some of our readers have written in concerning their advertising problems. Although these problems are faced by particular individuals, they are of fairly general interest to the service industry. For this reason, this article is devoted to their analysis.



QUESTIONS AND ANSWERS ON ADVERTISING

THIS is the last in this series of articles on advertising for the radio service technician, so we'll devote it to a general discussion of a number of the questions sent in by our readers. Some of the letters we received presented problems which, though encountered by a particular individual, were of such a nature that you may meet many of them yourself. We hope that the answers to those problems will prove of value to all.

Other questions raised in these letters deal with some matters already covered in this series. However, since details are often clarified in explanations which are illustrated with actual cases, we shall go over these points again.

Trademarks

One reader wrote that he wished to use a trademark and wanted to know the procedure followed to register one.

by Victor M. Turner

Advertising Manager, Radio Maintenance

A copyright registering agency in New York told us that first a search is made to determine whether the particular trademark is available. By that they mean to make sure that no one else has registered this particular mark before. If the trademark is found to be available, it is then submitted to the government office for registration. The time involved in getting a trademark registered depends on how much backlog the government office has on hand, and is impossible to estimate. The total cost comes to about \$75.00, according to the agency. This figure may vary with the amount of work that has to be done in connection with a particular trademark.

As I said previously in this series, my opinion is that trademarks are most useful in identifying a product sold through many outlets and which meets competition from other products in the same line, very often displayed alongside it on a shelf or counter. Since you provide a service and do not manufacture an item, you can only display your trademark on your stationery, your advertising, and so on. It has undoubtedly a high prestige value, but it is not a necessity for the radio service technician.

Promoting a New Business

Another letter came from a young man who has started a service business using his home in a residential section of town as his shop. He wanted to know how best to promote his new venture, saying the sign he had put up in front of the house was not doing much good.

He should promote his business

just as other radio service technicians do, that is, by using direct-mail, newspaper ads, etc., in the way we have outlined in the preceding articles. This advertising will be even more important to him than to a man who has a regular shop centrally located, because the sign in front of his house will not "do much good," just as he says. Many flourishing businesses have had humble beginnings in back rooms, basements and garage corners, but as long as they remain in these locations they are working under a handicap, and virtually all trade must be brought in through advertising. As soon as it becomes financially possible, a regular shop—however small—which fronts on a desirable shopping or business street, should be obtained.

A Shop on a Highway

While on the subject of shop location, we would like to bring up a letter from one reader whose shop is situated on a busy highway where there is a great deal of vehicular traffic, but where few pedestrians pass by. He said that he has a large sign over his shop and does quite a bit of auto radio service work, but wanted to know how to increase this even more.

In a case like this, the main feature will be the natural opportunity for auto repair jobs, and this should be exploited as much as possible. In addition to the sign over the shop, a billboard should be placed some distance from the shop itself, facing the oncoming cars. This billboard should announce the auto radio specialty, and do this in large, bold lettering. Much of the motorist trade has been lost by roadside establishments because they did not provide such a "warning" sign on the approach, which would have given the driver time to slow down and prepare to turn off the road. You know yourself how reluctant one is to turn back while driving. It's much less trouble to find another place further on than to retrace your way back to a spot which you had already passed.

This same service technician also wanted to know how best to draw in farm business from the rural sections.

Being on the highway which the farmers might use on their way into town gives this man another good point to stress in his promotion. He should bring this point out in direct-

mail advertising to the farmers, explaining the convenience of his location as well as his servicing ability. Direct-mail is about the best way to reach rural customers, unless there is a country paper which shows good returns on ads. A list of farmers' names may be available from a farm equipment shop, or the local telephone company.

The Tourist Trade

One reader mentioned that he did quite a bit of portable radio repair for tourists, as he lived and had his shop in a small town that was principally a summer resort. About the best way to get more of this type of business is to list your shop with the hotel managements. Sometimes they reserve a bulletin board in the lobby where local tradesmen may post small cards. But it is very important to get the hotel management to recommend your shop verbally to its guests, since they will ask at the desk for this information in the majority of cases. This holds true in larger towns and cities as well—if you are conveniently located near one or more hotels.

Increasing Television Service

Several readers have requested information on techniques for getting more television repair work. The same advertising principles hold true for television as for radio, but the word "Television" must appear in your ad just as bold as the word "Radio": and your copy should be devoted to both subjects. No one will take it for granted that you are capable of doing television servicing work. You must make this clear in all your promotion. It is a good idea to list your name in the classified telephone directory under the heading "Television" as well as under the heading "Radio," and the sign on your shop and truck should include the word "Television."

We want to stress again the importance of stating all the services you provide in your advertising—radio and television receiver sales, appliance sales, radio, television, appliance and record player repair, etc. It is also a good idea to headline one feature of your service in one ad, another in the next ad, and so on. But though you

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SERVICE + SALES = SUCCESS

by Philip Brenton

West Coast Technician Finds Selling a Natural . . . So Will You

THE first time you enter Paul's Radio Service at 8870 Santa Monica Blvd., Los Angeles, California, you are likely to be impressed by its obvious air of prosperity. But you soon discover that there is a lot more than you at first imagined. The attractive building and show room are simply good merchandising. The business itself is operated according to methods which would assure its success anywhere.

Paul started his own radio business in 1933, in back of a gasoline station. "Times were tough and nobody was getting rich," he recalls. "But I got along." He got along so well in fact, that after a year he moved to another station on a more prominent street, still in Beverly Hills. His old customers followed him to the new location. He finally opened his own shop in 1933, and became a dealer for Motorola auto radios. The backbone of the business, however, was still service. By this time, his reputation



Paul's wife plays an increasing role in the business since he has started receiver sales

was so well established that ten automobile agencies were sending him all their car radio service business. It seemed that once he got a customer he couldn't lose him.

Then in 1945 he moved to his present location, partly because he wanted to expand, but mostly because it would enable him to obtain some dealerships he wanted. He had come to realize that the most logical person

to sell radios was the service technician, the person most likely to know when a new radio was needed by the customer. He had done very well indeed in Beverly Hills, but there just weren't any franchises available.

He continued to handle Motorola auto radios in his new spot, and a little later began handling Stromberg Carlson and Zenith radios and radio-phonographs. Once again, the old customers followed Paul to a new location and the business continued to grow and expand.

Reliable Service

Customer loyalty is undoubtedly Paul's greatest asset, and it is not something he secured by chance. For one thing, he is a competent technician who takes pride in his craft. When he delivers a radio to a customer, that radio is as good as he could possibly make it, practically as good as new. If doing a job right means losing

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**MR. SERVICEMAN:
This is for YOU**

**CREI Presents Just the
Course You Need and
Want to Safeguard Your
Future—Earn More Money**

"Television and FM Servicing"

**Practical On-the-Job Training Program for the
Better Serviceman Who Wants Greater Earn-
ings and Security In This Expanding Field**

THIS basic CREI Servicing Course paves the way to greater earnings for you. Since 1927 thousands of professional radiomen have enrolled for our home study courses in Practical Radio Engineering. Now, CREI supplies the answer to the need for a Practical Servicing Course. You do not have to be, or want to be, an engineer to benefit from this course. It is written for *you*—the average *good* serviceman! It's not too elementary for the experienced. It's not "over the head" of those who have limited experience—if they have real ambition and natural ability.

CREI developed this course at the request of several large industrial organizations. The urgent need of capable, trained servicemen is one of the big problems of the industry. Hundreds of thousands of Television Receivers will be marketed in 1949. By 1953

—just 4 years—it is estimated that there will be 12 million TV sets in use. With Television comes FM receivers and circuits. This new field demands a tremendous increase in the number of properly trained television and FM technicians to install and service this equipment.

**CREI EQUIPS YOU TO INSTALL AND SERVICE
ALL TYPES OF TELEVISION AND FM RECEIVERS**

Now... with the help of this new CREI streamlined Service course you can move ahead to unlimited opportunities in your chosen field. CREI has again taken the lead by offering a course so entirely new that for the first time in our twenty-two year history we can offer a down-to-earth course of training for servicemen. In offering this course at a popular price, CREI is enabling thousands of the "top

third" now engaged in service work to enter the ultimate profitable field of television and FM installation and service.

This can be your big year! Don't waste another day. CREI has the answer to your future security in this new servicing course. Write today for complete information. The cost is *popular*. The terms are *easy*. The information is free. Write today.

Radio Service Division of

CAPITOL RADIO ENGINEERING INSTITUTE

An Accredited Technical Institute

Dept. 226-A, 16th & Park Rd., N. W., Wash. 10, D. C.

Branch Offices: New York (7) 170 Broadway • San Francisco (2) 760 Market St.

**MAIL
TODAY**

CAPITOL RADIO ENGINEERING INSTITUTE

16th & Park Road N.W., Dept. 226-A, Washington 10, D. C.

Gentlemen:

Please send me complete details of your new home study course in Television and FM Servicing. I am attaching a brief resume of my experience, education and present position.

NAME

STREET

CITY ZONE STATE

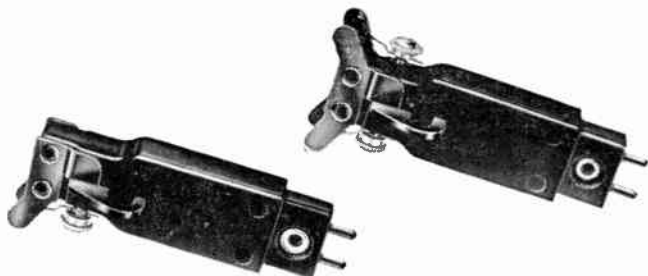
I AM ENTITLED TO TRAINING UNDER G. I. BILL

The little **SHURE** cartridges

that fill the Big need

for High Fidelity

Phonograph Reproduction . .



THE
NEW SHURE "VERTICAL
DRIVE"

CRYSTAL PICKUP CARTRIDGES

Big things often come in little packages . . . So it is with the superlative new Shure "Vertical Drive" Crystal Cartridges. They reproduce *all* the recorded music on the new fine-groove recordings—a reproduction that meets the strict requirements of high compliance and full fidelity. The "Vertical Drive" cartridges are requisite for the critical listener—the lover of fine music. They are especially recommended for those applications where *true fidelity* is essential.

SINGLE MODELS:
W 23 A for standard width-groove records.
W 21 A for fine-groove records.

TURNOVER MODEL:
W 22 A for both standard and fine-groove recordings.

Unusually highly compliant, these "Vertical Drive" Cartridges will faithfully track standard records with a force of only 7 grams—micro-groove records with a force of only 5 grams (an added protection for treasured recordings). Will fit standard or special mountings. Have more than adequate output for the average audio stage.



SHURE BROTHERS, INC.

Microphones and Acoustic Devices

225 WEST HURON STREET, CHICAGO 10, ILL. • CABLE ADDRESS: SHUREMICRO

Sales & Service

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money, then he is willing to lose money. Even with his many years of experience behind him, he is not content to sit back, and he reads all available information of new developments in the field.

When a customer brings a radio into the shop for repair, Paul tells him approximately what the charges will be. He makes it plain that it is impossible to give an exact price in advance and that, if the customer wishes he will call him before undertaking expensive repairs. The customer is also told when the job will be done, and Paul tries his utmost not to let him down. If for some reason he cannot complete the job when promised, he always calls the customer to let him know.

Paul's Radio Service guarantees all its work and stands behind this guaranty one hundred percent. Only the best in replacement parts is ever used. "There is always a temptation to save money on parts," explains Paul, "but you only lose in the long run. You can't stand back of a job if you aren't sure of the parts you put in it."

People don't mind paying for service when they are sure they are receiving value paid for, and Paul is strictly honest in computing bills. "People aren't so dumb" he feels, "and they always catch on to the crooked operator sooner or later. Charge a fair price for your services and nothing extra, and you'll make more in the long run."

In spite of the fact that many of his customers are wealthy, the bulk of his business is done with people of ordinary income who could not afford high service bills, and his prices are reasonable enough for all.

You can't do good work without adequate equipment. Paul has a Hickock Universal crystal controlled signal generator, an electronic volt-ohmmeter, a signal generator, a portable voltmeter for radio cars, and a portable tube tester which he carries in his car. He makes it a practice to take along about 150 tubes of all descriptions when he goes on a home service call. For best working conditions, his workshop is lighted with two five-foot 100-watt fluorescent lights, far more light than is customarily used.

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FOR EVERY RADIO SERVICEMAN!

The new Sylvania FM-AM Signal Generator Type 216

Supplies all signals necessary for complete stage-by-stage alignment of AM and FM receivers.

Frequency Coverage:

80 kc to 60 mc AM and 80 kc to 120 mc FM, continuously variable in seven bands on fundamental frequencies. Useful AM and FM harmonics to 240 mc.

For FM service:

±350 kc Sweep: up to 120 mc with 60 cps modulation.
±75 kc Sweep: up to 120 mc with 400 cps modulation.

In addition, sawtooth external modulation may be used.

For AM service:

±15 kc Sweep up to 61 mc with 60 cps modulation.
0 to 100% Modulated AM with 400 cps modulation.

In addition, external modulation may be used.

Check these Sylvania features! They're "musts" for complete FM and AM servicing:

AM modulation: 0 to 100%, continuously variable.
Accurate calibration: 1/2 of 1%.

High rf output: 1 volt on all ranges.

True rf meter for constant reference level.

Both step-by-step and smooth attenuator output controls.

Regulated power supply.

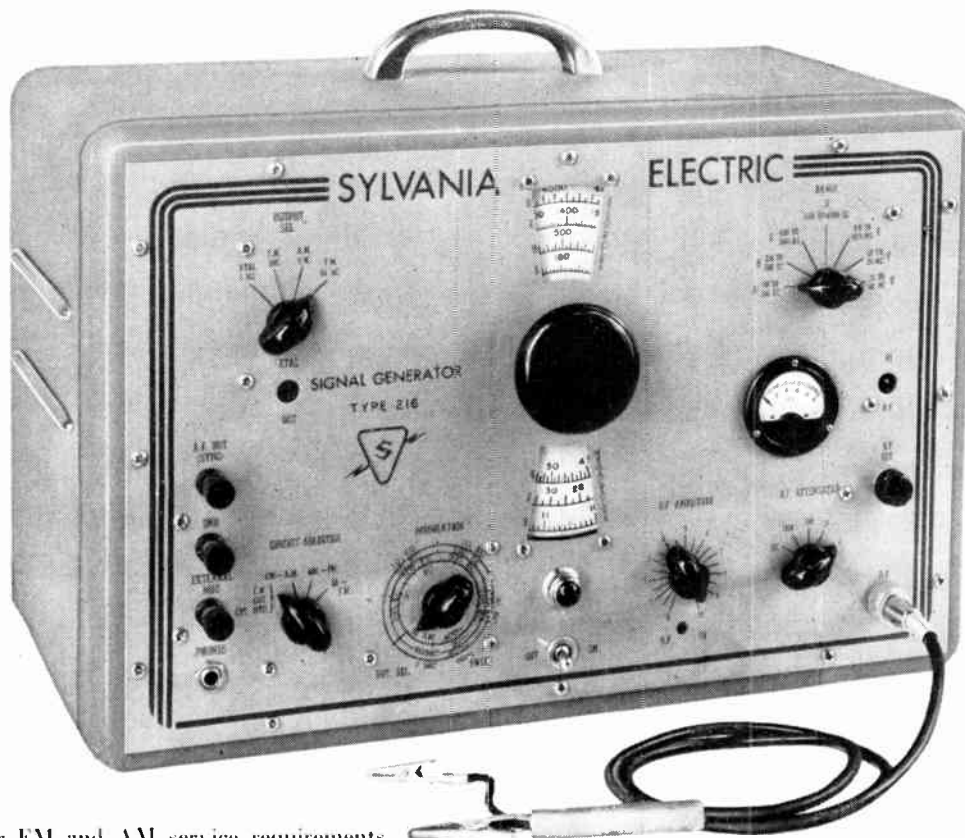
Oscilloscope synchronizing voltage output.

Crystal check point circuit.

Multiple shielding and filtered for minimum leakage.

Heterodyne detector for frequency comparison.

Mar-resistant, pearl-gray crackle finish baked on a treated steel case.



To meet your FM and AM service requirements, you'll want Sylvania's new Signal Generator Type 216! With it you can align the rf and if sections of all FM and AM receivers, adjust all types of FM detectors, and make overall receiver checks. Its high level output and accurate calibration make it also a valuable instrument for other service and laboratory uses requiring a high quality rf signal source. Beautiful styling in keeping with modern service shop environment. Dimensions: 11-3/8" x 17-1/16" x 10-5/8". Weight: 21 1/2 lbs. Priced at \$189.50. Mail coupon for complete details!

SYLVANIA ELECTRIC

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

Sylvania Electric Products Inc.
Advertising Dept. R-2006
500 Fifth Ave., New York 18, N. Y.

Gentlemen: Kindly forward full details on your new Sylvania FM-AM Signal Generator Type 216.

Name.....

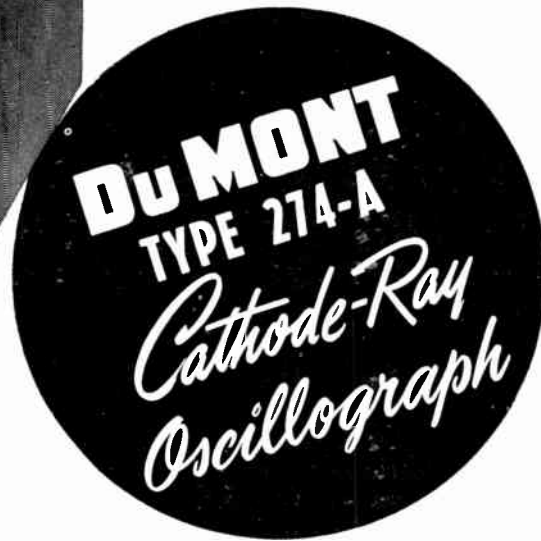
Address.....

City.....State.....

You're backed by Du Mont



**when you do your
servicing with a**



★ These advantages are worth remembering when it comes to your oscilloscope investment:

- 1) The Du Mont guarantee is an absolute guarantee. No strings attached! It entitles you to a full year of expert, quick, FREE service.
- 2) Exclusive of any service, the normal life of a Du Mont oscilloscope is many times that of the guarantee period. Such long-life expectancy reflects Du Mont's superior engineering, conservatively-rated components, excellent workmanship.
- 3) Du Mont's advisory service is yours for the asking. A postcard brings prompt technical advice on your Du Mont oscilloscope problem.

4) The cathode-ray oscilloscope business is a specialty business. And Du Mont is in this business to stay. This means replacement parts will always be available for Du Mont oscilloscopes; service will continue; technical guidance will be maintained; refinements and accessories will provide for still better oscillography.

5) For your purse and purpose, Du Mont Type 274-A is your best buy. It's capable of performing most radio and television servicing jobs. And it's portable, low-priced, GOOD.

6) And if you require more elaborate equipment, Du Mont offers voltage calibrators, wide-band oscillographs, choice of tube screens, etc.

Consult us now about your radio and television servicing requirements.



INSTRUMENTS DIVISION • 1000 MAIN AVENUE • CLIFTON, N. J.

Parking space is important everywhere now, but especially so in Los Angeles where everybody drives. Paul has it aplenty on his 100' by 100' lot and it is a real asset to his business. He still does a lot of automobile radio repairing and has a special place set aside for these customers to park for quick service.

Selling Radios

Paul had a few uneasy moments when he branched out as a dealer, but he soon found that his old service customers were quick to make their purchases from him. To put it simply, they knew him and they trusted him. Then too, he chose an opportune moment to break into the field, just when radios were appearing in abundance and everyone wanted to buy. Demand has leveled off somewhat now, he reports, but he is still doing a substantial volume of business selling radio receivers.

The significant factor in his success as a radio service technician and dealer is that all his initial sales were to old service customers. He has never done much advertising, except for listing his business in the classified telephone book, and all new business comes by way of recommendations from satisfied customers.

"I'm not really much of a salesman," Paul states, "but I have a big advantage because my customers trust me and believe that what I tell them is true, and that I know what I am talking about. Then, too, I get right into peoples' homes on service calls and I have first crack at selling them a new set when the old one is no longer working. A salesman could tell them that their best bet would be a new receiver, and they might believe him—or they might not. They might believe that he was telling the truth to the best of his ability, but they would have doubts about this ability of his. With a technician whom they know and trust doing the selling, things are a little different. They have little doubt as to his ability. I've sold and delivered sets without the customer leaving his home. Just selling ability couldn't do that.

Give the customer a fair deal, and he will beat a path to your door, whether he is a movie star or a street-car conductor, says Paul Miethke, and he ought to know because he gets them both. ✓✓✓

TV Installation Specialist

Some of the opportunities which are offered to the technician who is prepared when television invades his service area are illustrated in this little story of an organization which took full advantage of them

by Harry J. Miller

TELEVISION antenna installation and service has blossomed into a business of staggering proportions. Proof of this fact is the record of J. E. Griffin & Co., Inc., of Philadelphia.

In the past eighteen months, Joe Griffin has installed over 10,000 antennas on Philadelphia roofs. He is keeping a staff of 78 people running 26 trucks on the road, and is averaging over 200 installations a week. In fact, Joe thinks he could use another 78 men were he able to find them.

Not bad for a comparative newcomer.

Trained personnel is one of the greatest shortages in this business according to Joe. Television is too new a phenomenon and proper servicing too technical to make for an over-supply of the right kind of men to handle the jobs. To cope with this problem, Joe has a training program in his shop now, and is instructing ex-GIs in the use of the complex testing equipment which the up-to-date shop finds necessary for television work.

Joe, in a way, is rather new at this business.

Several years ago he was just another radio service technician. When the war began, Joe was inducted into the Fleet Air Arm of the Navy and worked on radar equipment as an

Electronic's Technician's Mate. He saw the possibilities of television while in the service and resolved to get into the business as soon as he could.

His company has been fortunate in being able to find competent help, and the progress it has made bears this out. Joe's brother has been a major help in the operation of the business, and his other workers have been quick to assume responsibilities.

Joe is close to television installation problems and his opinions on various equipment may help others to solve similar problems.

Some Pointers

He has found the best kind of television antenna to be one which provides high band and low band frequency coverage. At first, when Philadelphia had only one television

station on the air, almost any kind of antenna which would bring in that one station was adequate. But when two other stations were added, the necessity for high and low frequency reception was realized. Now Joe insists on this type of antenna wherever it can be used.

Out in the fringe areas, Joe is making good use of television boosters. Some of the earlier models which he tried were bringing in better pictures but were raising the noise level along with them. However, Joe finds that television boosters work and he feels that they will insure good reception in these troublesome fringe sections.

Summing up what his customers think about the prospects for television and the result of his own experience, Joe has this to say.

"This television industry is still in its swaddling clothes. We are developing shortages in supply, in picture tubes, aluminum masts and, more than anything else, in good and well-trained help. Our trade wants bigger and better television pictures, and receivers at a lower cost. I think we are going to get these. In the coming years, television is going to be a lot bigger and better than any of us realize or imagine. The wise businessman will prepare for that day." ✓ ✓ ✓



Over the

BENCH



by John T. Frye

FELLOWS, it looks as though we are going to have to start having our shoes shined, our trousers carefully creased, and our hair combed. Worse yet, we are going to have to forget those magic salty words that have proved so helpful in blasting a stubborn loktal tube out of its socket or in coaxing a reluctant chassis to come out of one of those "cute" armchair doghouses. In short, gang, not only do we have to be good technicians; we are going to have to look and act like gentlemen yet.

The cause behind these harsh conditions is the same as the cause of most changes in the servicing picture at present: that big overgrown lout, television. Television installation and service requires that you meet the customer on his own stamping ground, his home; and there you will be under the critical surveillance of his Little Woman. For some reason or other, women, whose perceptive faculties and renowned intuition give them such a disturbing penetrating insight into many matters, are absolutely no good at recognizing a diamond in the rough. If Marconi himself were to call to fix their radio and had a soup-stain on his necktie, they would have serious doubts as to whether or not he knew his business.

Yes, it is almost as hard for a woman to realize that a carelessly-dressed man can be a good technician as it is for a man to grasp that a homely girl can have a charming personality.

It is not too difficult to see the woman's point of view. To her, that radio is not just a mechanism; it is often the most expensive and cherished article of furniture she owns, the show-piece of her home. She feels somewhat like the musician we read about a short time ago who insisted that only soft-handed girls unpack his beloved piano. He could not bear the thought of its being touched by the coarse, work-roughened hands of ordinary workmen. When the serviceman presents himself at her door dressed more as though he were going to shoe a horse than to adjust the delicate mechanism of her TV set, she cannot be blamed for having misgivings.

At the same time, you cannot go scampering around over the rooftops dressed in white-tie and tails; so some sort of compromise has to be reached. Shopcoats are probably the best answer for ordinary service calls, with roomy overalls being used for climbing. I know that you cannot *keep* clean while you are climbing

around over soot-covered roofs, but you should *arrive* looking all spic and span. The lady of the house is usually very laundry-bill conscious, and when she sees how soiled your overalls become while installing *her* TV antenna or making adjustments on it, she will receive your bill in a much more sympathetic frame of mind.

Making a good impression, however, is not confined to personal cleanliness and meticulous dressing. It also takes in the appearance of the instruments you use, your deportment—a word most forget as soon as we are out of grade school—and what you say.

In regard to the first item, how would you feel about it if your physician were to listen to your heart with a rusty old stethoscope; or if he had to wipe a smudge of lipstick off his thermometer before inserting it in your mouth? That is something that never happens, does it? His instruments are always gleaming and spotless.

Do you not suppose that a housewife may feel the same way when you drag out a dust-covered meter with a cracked dial glass with which to test her tele-set? or if you have to beat on your signal generator to make it "take off?" It is an old axiom that a good mechanic loves and takes good care of his tools; so a little time devoted to improving the appearance of your instruments is well spent. Not only will they make a better impression on the customer, but you will find that you tend to handle them more gently yourself when they are kept new-looking. A little "carbon tet," a little varnish, a little furniture wax, and a modicum of elbow grease can work wonders toward sprucing up your "old faithfuls."

This business of deportment is something like a sense of humor: not many of us will admit that our own particular brand is not just as good as anyone else's. However, it will not hurt to check yourself against the following list of questions:

Do you attend strictly to business while in your customer's house, or do you allow yourself to be easily led off on a tangent?

Do you know how to be friendly without being forward?

Do you handle the customer's set with an obvious gentleness and care that is certain to impress him with

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Show your Customers how to DOUBLE their Radio Enjoyment

The Webster-Chicago *Electronic Memory* Wire Recorder Model 178 Is Profitable Plus Business for You!

Your customers look upon you as an advisor on radio, television and recorded music. Make the most of it! When you sell a radio or television set or an album of records, show them how an *Electronic Memory* can open a new world of entertainment for them and *double*—treble their enjoyment. Perhaps you are simply repair-

ing a set. It is a perfect opportunity for you to install a connecting socket for the wire recorder!

Look at what a Model 178 *Electronic Memory* can do—tell your customers about it and add to your profit!

1. Records rare and outstanding musical or dramatic programs *direct from the radio*. Plays them back with beautiful quality again and again.
2. Records favorite radio programs while listening on other networks or to the television—Plays the program back later—just as it sounded on the air.
3. Records voices or music through the microphone with magnificent fidelity for parties, family records, speech development or business dictation.
4. Records music lessons in the teacher's studio and plays back the lessons during the week for practice . . . this use in itself will pay for the *Electronic Memory* quickly by speeding student progress and cutting the cost of lessons!



Electronic Memory Model 178 is easily installed in a console with connecting cord furnished and slide drawer hardware kit SD-30 available from your distributor.



Electronic Memory Model 178 can be connected to any radio. It has Record-O-Magic Controls for easy operation and the full play-back tone quality of the radio with which it is used.

When you demonstrate the Model 178 *Electronic Memory* your customers will fall in love with its smart styling and utter ease of operation. When they hear the really fine tone

of the play back they will have a new high regard for wire recording. The Webster-Chicago *Electronic Memory* gives the most for the money of any wire recorder anywhere.



Model 178 is approved by Underwriter's Laboratories for your protection.

Keep in touch with your Webster-Chicago Distributor. He can help you with the demonstrations and with advertising helps prepared for you by Webster-Chicago. Capitalize on this profitable market.



WEBSTER-CHICAGO

CHICAGO 39, ILLINOIS

THIS MAY SHOCK YOU!

by Cyrus Glickstein

TEN CASES OF SHORTS AND SHOCKS, HOW THEY CAME ABOUT, AND WHAT TO DO TO AVOID THEM

PART of the education of most radio technicians consists of finding out how that shock was received, how that short was caused. Have any of the following happened to you? If not, don't let it.

WHY DID HE JUMP? A receiver came into the shop for repair, but when it was plugged in nothing happened. The service technician remembered that the cartridge fuse was not replaced. In making the change, he touched both ends of the fuse clip and jumped, even though the fuse was in one side of the line only. Why?

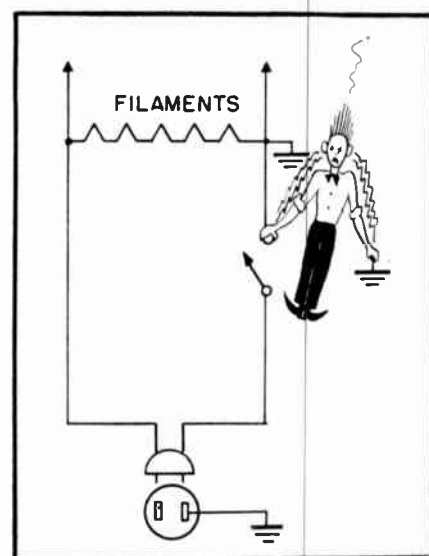
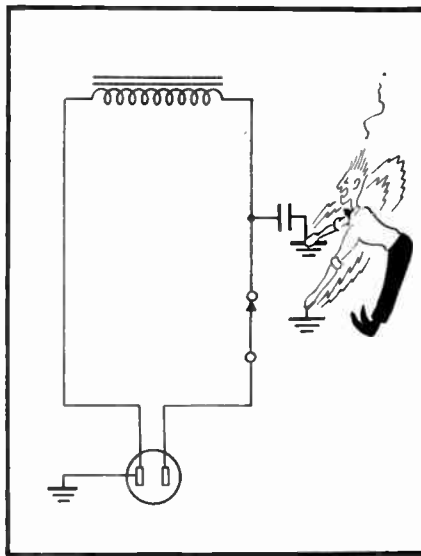
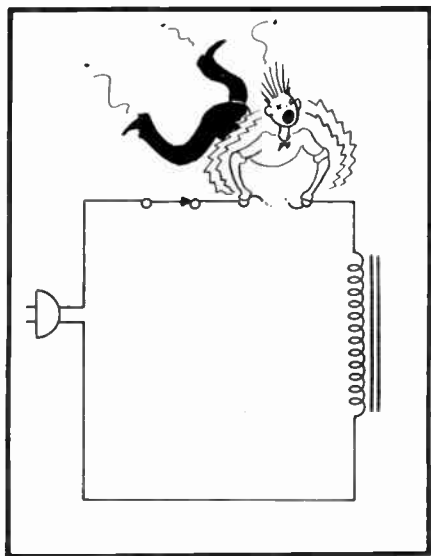
BECAUSE: A break in a series circuit puts the full line voltage across the break. The technician became a series resistor across the break. Since he had most of the resistance in the completed circuit, he received most of the voltage.

TOUCH CHASSIS AND GROUND. Is it possible to be buzzed when touching the chassis of an a-c set (neither side of the primary being grounded directly to the chassis), and an external ground? Yes.

BECAUSE: One side of the primary goes to one side of the line, and generally to the chassis through a line filter condenser. If that happens to be the hot side of the line, the 110v line voltage divides between the Xc of the condenser and the body resistance.

SHOCK WITH SWITCH OFF. Is it possible to get a shock by touching the chassis of an a-c/d-c receiver, even though the switch is in the 'off' position? Yes.

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Over the Bench

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your consideration for his receiver?

Are your general manners always of the high level that you would want a stranger to exercise in your own home?

Are you able to show by your behavior that your time is valuable without giving the impression that you are "hurrying" the operation on the customer's set?

If you can honestly answer "Yes" to all of these questions, your grade in deportment is *A*, and you need feel no more concern about the matter.

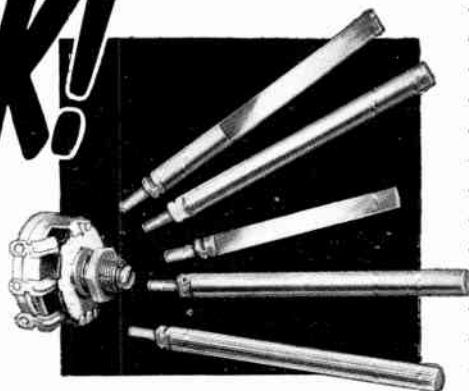
What you say is pretty well tied in with how you act. The cardinal rule is not to talk too much. If, after you leave, someone in the house says, "That bird surely is a windbag," you have undone all of the good that clean hands, careful dressing and shining instruments could have accomplished.

Take a look at how the doctor handles this matter. (You need hardly be told that I am a great admirer of the way in which physicians have established a position of respect for themselves, and I think we "radio doctors" can learn much from their example.) A doctor's conversation with the patient consists mostly of questions—with now and then a knowing but non-committal "uh hm-m-m" thrown in—and of concise directions. You never hear him thinking his way through the case out loud, criticizing other doctors, gossiping about his patients, etc. Don't you suppose, though, that there are many times when he realizes that he has made a mistake and has to start out on a new line?

Yet you never hear him going through anything like this: "By golly, it is not that tube after all! I sure thought it was. I wonder what is the matter with this heap, anyway. Sure is a headache. I get all of the tough sets to fix. Guess that is what I get for having such a good reputation. After the other servicemen mess them up, they bring 'em to me to straighten out. Guess we'll cut out this resistor and see what happens. Wups! I cut the wrong lead! Boy, this thing sure is a headache. How was that you said it acted again?"

Did you ever hear anything like that? ✓✓✓

CLICK!



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THE RIGHT CONTROL & THE RIGHT SHAFT EVERYTIME!

Select the right control electrically — ohmage, taper, tap, etc. Then select the right shaft mechanically — ten types to choose from. Aluminum shafts for ready cutting to exact

length. Insert shaft in slot and bang it — CLICK! You've got a trouble-free job — no wiggle, no wobble, no trouble. A free shaft with each Pick-A-Shaft Control.

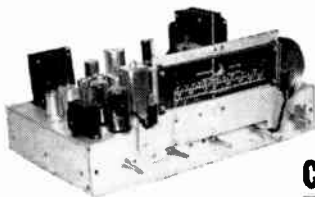
Ask our jobber for Pick-A-Shaft Clarostat controls. You'll like them. Catalog on request.



Controls and Resistors

CLAROSTAT MFG. CO., INC. • DOVER, NEW HAMPSHIRE • In Canada: CANADIAN MARCONI CO., LTD. Montreal, P. Q. and branches

The Meissner 9-1091-C AM-FM Tuner



... THE IDEAL COMPONENT FOR CUSTOM INSTALLATIONS

COMBINES FIDELITY WITH STABILITY

Servicemen and others interested in custom installations will be quick to appreciate the many top features of the MEISSNER 9-1091-C AM-FM Tuner. Here is real quality — precision workmanship — outstanding design, all combined to give you the very highest fidelity reception and at remarkably low price. Frequency response — sensitivity both are phenomenal! Compare the specifications below and your choice will be the MEISSNER 9-1091-C Tuner. MEISSNER is designing a high fidelity amplifier for this tuner. Watch for the release announcement.

See The 9-1091-C Tuner At Your Jobber
Or Write For New Meissner Catalog

Features

- Frequency Response flat with plus or minus 2 db 30 to 15,000 cycles
- Bass Control provides 10 db boost at 40 cycles
- Treble suppression of 12 db at 8,000 cycles
- Input Jack for Crystal or high level magnetic type phono pickup
- Sensitivity less than 10 microvolts
- "Broad" or "sharp" selectivity for AM
- Hum level 60 db below full output
- Output 11 volts high imp. terminals, 2 volts on 500 ohm terminals
- 300 ohm FM antenna input. FM antenna and line act as efficient AM antenna

MEISSNER

MEISSNER MANUFACTURING DIVISION
Maguire Industries, Inc., Mt. Carmel, Illinois

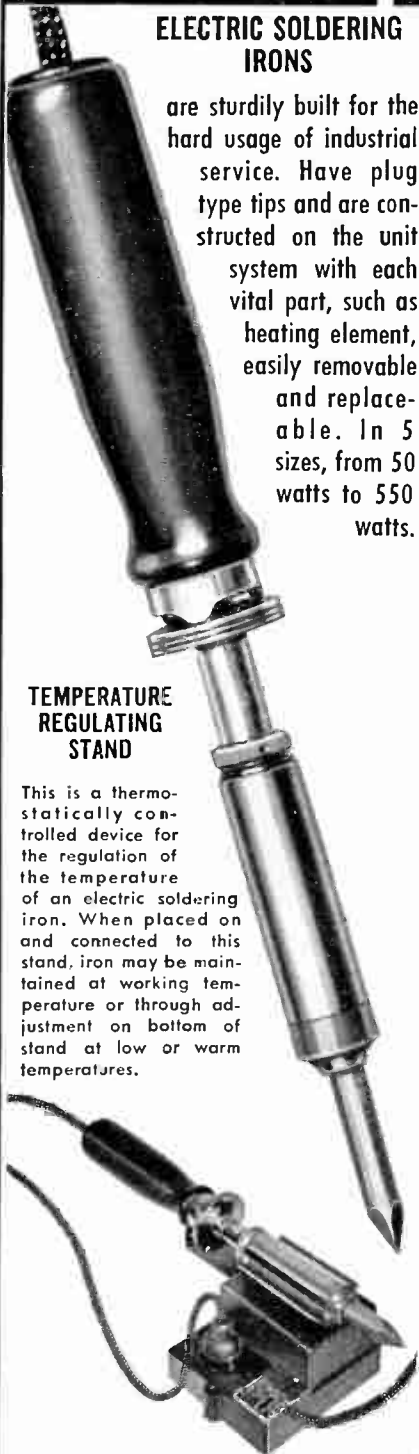
American Beauty

ELECTRIC SOLDERING IRONS

are sturdily built for the hard usage of industrial service. Have plug type tips and are constructed on the unit system with each vital part, such as heating element, easily removable and replaceable. In 5 sizes, from 50 watts to 550 watts.

TEMPERATURE REGULATING STAND

This is a thermostatically controlled device for the regulation of the temperature of an electric soldering iron. When placed on and connected to this stand, iron may be maintained at working temperature or through adjustment on bottom of stand at low or warm temperatures.



For descriptive literature write

110-

**AMERICAN ELECTRICAL
HEATER COMPANY**
DETROIT 2, MICH., U. S. A.

the INDUSTRY Presents



G-E OSCILLOGRAPH

A new five-inch oscillograph, designed specifically for television work, has been announced by General Electric. Some of the features included are d-c amplifiers, straight resistive coupling, input attenuator to the vertical amplifier which is said to attenuate voltages by as much as 1000 to 1 without discrimination. The cathode ray tube is cradled in rubber and is provided with a 1/4" thick safety window. The intensity of the beam may be modulated from a "Z-axis" input jack on back of instrument. Full details available from Specialty Division of Company.

Manufacturer: General Electric Co., Electronics Park, Syracuse, N. Y.

HEADSET

The new feature in the Twinset, a twin receiver headset weighing only 1.6 ounces, is the fact that it delivers sound directly into each ear canal through two miniature receivers without any part touching the ear. Resembling a physician's stethoscope, the headset has a single cord, rather than a Y-cord connection. The two receivers are connected through the headband, made of Z-Nickel steel encased in Tenite plastic.

Manufacturer: Telex Inc., 1370 Northwestern Bank Bldg., Minneapolis, Minn.

SILENIUM RECTIFIERS

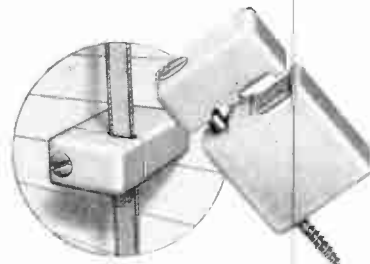
With current ratings of 400 ma and 500 ma, two new selenium rectifiers are now available which will find definite applications in the television and radio field. RS 400 and RS 500 can be used in television receiver, for example, to enable the employment of the simple half-wave rectifier circuit used in most radio sets. These two new stacks will be of particular interest to television designers and may have an influence on future TV receiver models.

Manufacturer: Federal Telephone and Radio Corporation, Clifton, N. J.

FIRE EXTINGUISHER

A compact, handy fire extinguisher is now available to the radio service technician. It is hermetically sealed, needs no refilling or inspections. The extinguisher contains 90% carbon tetrachloride and 10% other chemicals. Carbon dioxide acts as propellant. Comes with free wall bracket.

Manufacturer: Bostwick Laboratories, Bridgeport 5, Conn.



LEAD-IN SUPPORTS

Two of the causes of television blackout and f-m fade-out are twisted lead-in cables and shorts. Now this series of lead-in supports aims at removing both of them: by preventing the twisting and going slack of the wire, and stopping shorts by giving quick moisture drainage at the support. These supports are constructed with an alligator pressure grip which holds the wire tight without cutting or chafing. Tying or taping the conductor to the insulator is therefore no longer necessary. Screws are rust-proofed, and ample clearance is provided between the lead-in wire and the building. The supports look neat, too; something that will please the customer.

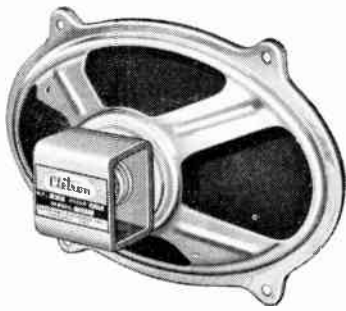
Manufacturer: Porcelain Products, Inc., Findlay, Ohio.



TV ELECTRONIC CAPACITORS

Sprague has announced the availability of a complete line of television replacement electrolytic capacitors. This line of TVA and TVL "Twistlock" electrolytics includes 93 separate ratings, comprising the units most often needed by television technicians. Bulletin M-429 gives complete description. It's available upon request.

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



REPLACEMENT SPEAKERS

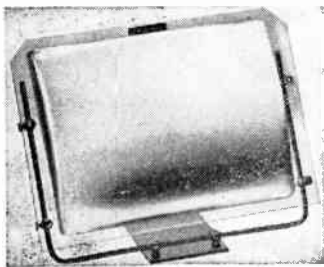
"Cletron" is the brand name of the first line of replacement speakers now put on the market by this company. They produced speakers for original equipment in the past. The speakers included in the line are manufactured in a variety of sizes and types, include both electro-dynamic and permanent magnet types for use in home, auto, and television receivers, outdoor movies, public address systems, f-m and laboratory sound applications.

Manufacturer: Cleveland Electronics, Inc., 6611 Euclid Ave., Cleveland 3, Ohio

PRE-AMP AND POWER SUPPLY

The Model A65 Amplifier provides 18 combinations of bass and treble curves and accommodates turnover frequencies of 300, 500, and 800 cycles. The high frequency control permits adjustment to any six response curves. The Model P6-300 D. C. Power Supply supplies d-c for the tube heater as well as the plate supply, with low hum level.

Manufacturer: Brociner Electronics Laboratory, 1546 Second Ave., New York 28, N. Y.



TELEVISION LENS STAND

This stand has a "tilt lock" arrangement, which permits tilting in the vertical plane, in addition to the usual up-and-down adjustment. The instrument stands by itself and is not dependent upon the weight of the television set to support it.

Manufacturer: Thall Plastics Engineering Co., 155 Chambers St., New York 7, N. Y.

BATTERIES FOR PORTABLES

Batteries for interlocked construction were introduced in 1948. The latest additions to that line consist of a 90-volt "B" battery and a 4½-volt "A" battery for use with portable radios. The batteries are said to give superior power, range, and reception.

Manufacturer: Olin Industries, Inc., New Haven, Conn.

RADIO MAINTENANCE • JUNE 1949

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Series E-400 WIDE RANGE SWEEP SIGNAL GENERATOR

★ **APPLICATION ENGINEERED** for TV, FM and other modern electronic requirements. Every necessary feature **BUILT-IN** without costly and cumbersome duplication of instruments you already own.

★ **PERFORMANCE DESIGNED** for practical operational simplicity and ruggedness, insuring long-lived trouble-free service.

NET PRICE **\$124.70**

Complete with test cables, quartz marker crystals and Technical Manual. Size 10½ x 12 x 6".

Convenient Terms Available See your PRECISION Distributor



SUMMARY OF IMPORTANT FEATURES

- ★ Direct Frequency Reading 2 to 480 Mc. 5 ranges to 240 MC. 280-480 MC bands harmonically calibrated.
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- ★ High Output and Accuracy.
- ★ Voltage Regulated Oscillators. Crystal calibrated plus crystal control
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- ★ Wide Range Phasing Control.
- ★ Multiple Crystal Marker-Calibrator Oscillator built-in. 4 rotary selected crystal sockets. 10.7MC and 2MC crystals furnished.
- ★ Terminated RG/U Coaxial Output cable and dual R. F. attenuators, triple shielded, stepless, quiet.
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- ★ Double-Pi Shielded Line Filter.
- ★ Tube Complement: 3 each 6J6 & 6C4. 1 each VR-105 & 6X5.
- ★ Fully Licensed under W.E., A.T.&T. and Remco patents.
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20 millivolt sensitivity, wide range vertical amplifier! The ideal companion unit to Series E-400 to complete your TV — FM service lab.

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Export Division: 458 Broadway, New York, U.S.A. • Cables—Morhanex

NOISE METER

Latest in the Kay Electric line of test instruments is the Mega Node. Enables reading the noise figure of high frequency receivers (television, f-m, radar, etc.). It is a calibrated source of random noise, covering range 0-220 Mc. Meter reads directly in db on linear scale. Provides reliable method of evaluating r-f front ends.

Manufacturer: Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

TELEVISION ANTENNA

The "Snap-out" line of television antennas comes complete in three compact parts and no hardware. It is preassembled and, to erect it, all that is required is to straighten the elements into place from their folded

position, slide booms on mast, hand-tighten wing nuts.

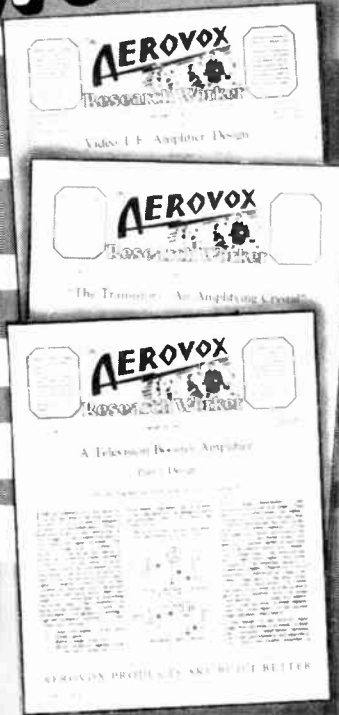
Manufacturer: Hy-lite Antenna, Inc., 528 Tiffany St., New York 59, N. Y.

CATHODE RAY OSCILLOGRAPH

Series ES-500, 5" oscillograph, recently introduced, is said to have been specifically engineered for the alignment and adjustment requirements of modern electronic apparatus. It is part of a new group of instruments currently being developed by this firm to meet the increasingly complex test requirements of radio and television. For full details and specifications, contact Gerald Goldberger, Chief Engineer.

Manufacturer: Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.

BACK AGAIN!



• Ever since 1927 the Aerovox Engineering Department has shared its studies and interpretations of current radio-electronic developments with thousands of radio engineers and experimenters via the monthly Aerovox Research Worker. Suspended for a brief period because of production difficulties, this highly-regarded publication is back again!

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POCKET SIZE BATTERY TESTER

This Model 698 Battery Tester makes tests, under actual load, of all dry batteries (1.5 to 90 volts) used in hearing aids, portable radios, and other equipment. The condition of any battery is shown on the LOW-GOOD three-color scale, actual voltage readings may be made on calibrated scales. Instrument also designed to indicate ability of battery to supply power required of it in actual use. Dimensions: 3-1/16 x 5-7/8 x 2-9/16 inches, weight: 1 1/4 pounds. *Manufacturer: The Triplett Electrical Instrument Co., Bluffton, Ohio*

TUBE AND SET TESTER

Combination tube tester and multimeter is offered with the following specifications. Tube tester: tests 4, 5, 6, 7, 7L, octals, locals, television, magic eye, thyratons, single ended, floating filament, mercury vapor and miniature tubes, pilot light. Multimeter ranges: d-c voltage: 0-10-100-1000-5000; a-c voltage: 0-10-100-1000-5000; d-c current: 0-10-100-1000 ma; resistance: 0-10,000, 0-100,000, 0-1 megohm; output volts: 0-10-100-1000-5000. *Manufacturer: Test Craft Instrument Co., 42 Warren St., New York 7, N. Y.*

SOLDERING IRON

An extra-heavy soldering iron has been announced, said to be 40% more powerful than largest iron heretofore available. Iron has a 1 3/4" diameter, screw-type tip. Cooling fins deflect heat away from handle. Operates on any cycle, a.c. or d.c., 110 or 220 volts. *Manufacturer: Hexagon Electric Company, 250 W. Clay Ave., Roselle Park, N. J.*

ANTENNA POWER

Just put on the market is a line of self-supporting antenna towers. Guy wires and similar attachments unnecessary. They come in two heights and are designed to accommodate a pipe extension which can be raised and lowered for ease of installation and service. Inclusive of the pipe-extension, these towers support television and f-m receiving antennas 10' and 20' above the roof, respectively. All standard antennas may be securely attached to extension pipe. These towers are said to be capable of bearing 3000 foot pound pressure, enough to withstand 70-mile per hour gale. *Manufacturer: Wincharger Corporation, Sioux City, Iowa*

HIGH-VOLTAGE PROBE

A high-voltage probe for use with any vacuum tube voltmeter is now available. The multiplier extends the range of the v.t.v.m. a hundred times. The probes are rated for use up to 30,000 volts and guaranteed up to 35,000. The hot portion is slenderized for easy access to tight places. *Manufacturer: Reiner Electronics Co., Inc., 152 W. 25th St., New York 1, N. Y.*

MAGNETIC TAPE ERASER

A device which provides complete and instantaneous erasure of recorded reels of magnetic tape without running the tape past the erase head is currently being produced. Tradenamed "Magnerasor", the device accomplishes erasure by being moved around the circumference of the reel. Full technical description and additional data upon request. *Manufacturer: Amplifier Corporation of America, 398-29 Broadway, New York 13, N. Y.*

AC-DC TV RECEIVERS

Two new television receivers for operation on a-c/d-c have been introduced by Raytheon. Both have 10" tubes with circular viewing area. The Coronet uses a 24-tube (plus three rectifiers) chassis, and has a simplified tuner, preset at the factory. The Model B-10DX22 features a tilted screen for eye comfort in viewing from a sitting position. The viewing tube recedes into the cabinet as the cabinet door is closed. Closing the door also turns off the receiver. *Manufacturer: Raytheon Manufacturing Co., 60 E. 42nd St., New York 17, N. Y.*

SCREWDRIVER KIT

A new screwdriver kit has been announced which includes a handle and five different interchangeable shanks, enabling the user to service most screwdriver needs. The kit comes in a seven-section leatherette holder which can be rolled up for carrying in pockets. The holder has also top corner eyelets for hanging near workbench if desired. *Manufacturer: Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill.*



2-WAY COMMUNICATION

Another two way sound-powered communication system consists of two high-impedance sound powered telephone handsets. The cord set of each unit is equipped with two rubber-insulated test clips. System is activated by attaching clip leads of handsets to two-conductor full metallic wire or single wire, ground return circuit. *Manufacturer: The Wheeler Insulated Wire Co., Inc., Waterbury 91, Conn.*

SOLDERING PLIERS

Electric soldering pliers employing the current-resistance principle have recently been placed on the market. The wires or parts to be soldered are held by the pliers, the foot switch of the unit is depressed for an instant, heating the wires sufficiently to melt the solder. The pliers thus do the work of both pliers and soldering iron.

Manufacturer: Durst Manufacturing Co., 11110 Cumpston St., North Hollywood, Calif.

TV ANTENNA COMPASS

A new television antenna compass is now being marketed. It takes the form of a pocket tester which is connected by an insulation-piercing alligator clip to the video input of the picture tube in the television receiver. By an extension cord it is carried to the antenna site. With the test pattern tuned in on the area's weakest station, the antenna is then simply rotated for maximum deflection of the compass.

Manufacturer: Simpson Electric Co., 5200-18 W. Kinzie St., Chicago, Ill.

HAND TORCH

The "Torchmaster" is a general utility, self-contained handtorch, 2 1/4" x 13", burning liquid petroleum gas. Holds enough fuel for an average day's burning. Does light brazing, soldering, and other heating operations. Operates at any angle and upside down. Single control valve turns it on and off and adjusts intensity of flame. I. C. C. approved. Descriptive literature available upon request.

Manufacturer: Industrial Engineered Products Co., 7415 Melrose Ave., Los Angeles 46, Calif.

CONVERTER

A new instrument, Model 915, which converts any signal generator/test oscillator to a direct reading resonance indicator has been placed on the market. The instrument has continuous frequency range of from 100 kc through 300 Mc by use of three specially designed probe coils.

Manufacturer: McMurdo Silver Co., 1249 Main St., Hartford 3, Conn.



SOUND POWER PHONES

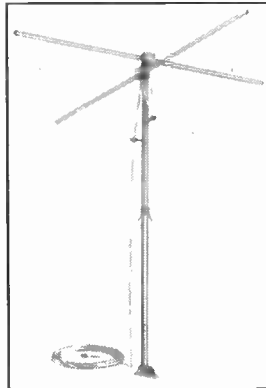
For use in television installation, this two-way phone system is powered by the sound of the voice, and requires no batteries or other source of power for its operation. Each set of phones consists of two specially adapted headphones and microphones, and is said to afford ample volume and good sound quality.

Manufacturer: Edward Sales Company, 168 Washington St., New York 6, N. Y.

NEON-INDICATOR VOLTMETER

Instead of the conventional meter movement, the Hi-Volt Model 500 utilizes a neon lamp indicator. The knob is turned until the neon lamp extinguishes, when the voltage is read directly off the dial. A 15 megohm multiplier is incorporated in the 7" long prod which is integral with the meter. This meter covers a range from 1,600 to 15,000 volts a-c and may be used for d-c readings by employing a conversion factor.

Manufacturer: Industrial Devices Inc., Edgewater, N. J.



ALL DIRECTIONAL FM ANTENNA

The Poly-Point Antenna is a double-folded dipole that provides an essentially circular radiation pattern, receiving signals from all directions without turning. A special matched quarter wave phasing stub makes it comparable to a half-wave folded dipole, over the entire FM band. It is provided with a mounting base, adjustable to flat or sloping roofs. Of aluminum alloy construction, the antenna comes factory assembled, including a 65-foot 300-ohm transmission line and 4 standoff insulators.

Manufacturer: Belden Mfg. Co., 4647 W. Van Buren Street, Chicago 44, Ill.

PORTABLE RECORDER

The feature of the Model 710-B Twin-Trax Recorder is that it comes in two equally-weighted sections for easier carrying. These two sections are attached at location to form one compact unit. This model provides one hour of continuous play with a frequency response of 50 to 9000 cycles \pm 3 db on standard 1/4" wide magnetic tape. Inputs are provided for microphones and radio-phonograph.

Manufacturer: Amplifier Corp. of America, 398-29 Broadway, New York 13, N. Y.

MULTITESTER

Model 447A multitester, streamlined version of former Model 447, has following ranges: d-c volts: 0-5-50-250-500-2500; a-c volts: 0-10-100-500-1000; d-c milliamperes: 0-1-10-100-1000; d-c amperes: 0-1-10; ohms: 0-10,000-1,000,000 (ohmmeter range extended to 10 megohms by using external battery);

output volts: same as a-c volts.

Manufacturer: Radio City Products Co., 152 W. 25 St., New York 1, N. Y.

SQUARE HOLE PUNCH

As an aid to the job of attaching hard-to-mount parts, a new punch has been developed which cuts square holes in sheet metal. This device, known as the Pioneer Chassis Punch, can also be used to cut angular, rectangular, L-shaped, or any other square corner patterns by making a combination of cuts. Pioneer Chassis Punches come in 2 sizes: 5/8" and 3/4". Additional information and descriptive literature is available from the firm.

Manufacturer: Pioneer Broach Co., 1424 S. Main St., Los Angeles 15, Calif.



YOU CAN PUT ALL YOUR EGGS IN THE QUAM BASKET! . . .

In spite of the old adage, you'll find it pays to specify Quam Adjust-A-Cone Speakers for all your replacement jobs.

The Quam Line is complete, there's a speaker for every standard receiver. Quam Speakers are listed in the Radio Industry Red Book for your convenience.

Quam Speakers are built by a reliable organization that has been manufacturing quality speakers for over a quarter century.

Customer Good Will is important in your business—you can be sure of building it when you install Quam Speakers. Their fine performance and trouble-free service reflect to your credit!

It pays to replace with Quam!

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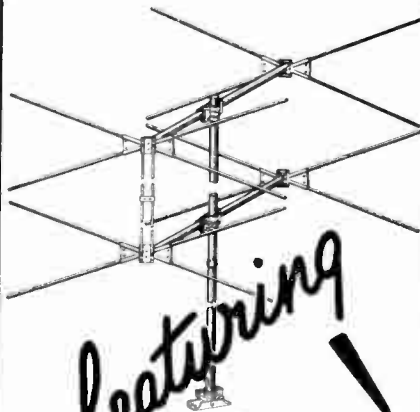
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TACO**LAZY X**

*featuring
Jiffy-Rig!*

• First introduced by TACO in 1940 as the Double Vee, the new TACO Lazy X incorporates all the outstanding features that have made TACO antennas the leaders in the field.

An all-band antenna, available in single or stacked arrays, the TACO Lazy X gives very flat response over the entire TV band. All-aluminum construction assures long service life. A twist of the wrist, a few nuts to tighten, and the antenna is ready for use without sacrificing any mechanical or electrical characteristics due to the TACO JIFFY-RIG construction.

**TACO INDOOR
ANTENNA**

• An indoor antenna that works! Engineered as only TACO engineers. Beautiful appearance. Mounting feet for attic installations. Low cost.

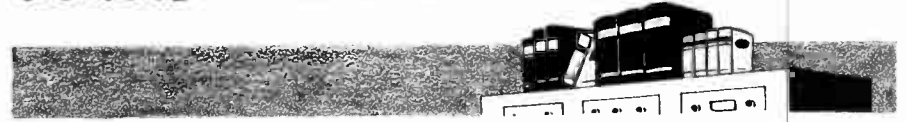
AT ALL LIVE-
WIRE JOBBERS...
SEE YOUR JOB-
BER TODAY!



TECHNICAL APPLIANCE CORP.
SHERBURNE
N. Y.

TACO
Radio and
Electronic Equipment

trade **LITERATURE**



Rider Television Manual, volume II (John F. Rider, Publisher, ca. 2,300 pages, \$18.00)

Continuing its series of television manuals, John F. Rider, Inc. has just placed on the market its second volume. It follows closely the style of the first. Covered in the book are the products of sixty-seven manufacturers, and included in the coverage are television booster. This volume, as the first, is supplemented by the *TV—How It Works* book, volume 2. Needless to say that the manual is an essential part of the technician's service equipment.

Rider Manual, volume XIX, (John F. Rider, Publisher, over 2,100 pages, \$19.80)

This latest in the series of Rider Manuals contains authoritative, factory-authorized service data on a-m, i-m, and communications receivers made by over 100 manufacturers. Also included is the Rider "Clari-Skematix, a breakdown of the hard-to-trace multi-wave band sets. A special section is devoted exclusively to record changers. The companion *How It Works* book explains the circuit theory of new systems.

TV Picture Projection and Enlargement, by ALLAN LYTEL, (John F. Rider, Publisher, 250 pages, \$3.30)

As the title of this book indicates, the text is concerned with the optical systems employed in home television receivers, with the greatest emphasis on the projection types. The book goes into details of the theory and operation of optical elements, lenses and mirrors. Included are discussions of the how and why of servicing such equipment. Chapter headings include: Properties of light, Refraction and Lenses, The TV Picture, Modifications of Schmidt Projection System, Refractive Projection, TV vs. Motion Pictures, and others.

The author is lecturer in electronics at Temple University and has in the past contributed to *Radio Maintenance*.

The Amplification and Distribution of Sound, by A. A. GREENLEES, (The Sherwood Press, 302 pages, \$6.00)

This second edition of the book covers the subject of sound amplification in a practical manner. It provides information required by those responsible for the specifications, layout, operation and maintenance of sound amplifying equipment. Included in the volume are the most recent developments in the field. Such subjects as components, amplifiers, special features of amplifiers, power supplies for amplifiers, performance of amplifiers, radio receivers, microphones, record production, loudspeakers, installation, operation, test equipment, and the like are covered.

The book should be of interest to the technician working with p-a systems.

Photofact Auto Radio Manual, (Howard W. Sams & Co., Inc., 392 pages, \$4.95)

Of particular interest to auto radio service shops, this manual includes service information on more than one hundred post-war auto radio receivers. Practically every auto radio made since 1946 is covered. Found in the manual are special sections dealing with replacement information, as well as a chapter on the layout and operation of a complete auto radio service shop.

The manual is well illustrated throughout.

The A.R.R.L. Antenna Book, 5th Edition, by THE HEADQUARTERS STAFF OF THE AMERICAN RADIO RELAY LEAGUE, (288 pages, \$1.00)

The fifth edition of the ARRL Antenna Book is said to represent an accumulation of ten more years of the amateur's experience in antennas. The book has two principal divisions. Chapters 1 through 5 deal with the principles of antennas and transmission lines, wave propagation and its

relationship to antenna design, and the performance characteristics of directive antenna systems. These five chapters might be called a textbook on antennas.

Beginning with chapter 6, there is a series of sections in which data are given on specific designs for the various amateur bands. The remainder of the book is devoted to features of antenna construction and related subjects, such as determining geographical directions.

The book is profusely illustrated, and includes numerous charts and tables, as well as seventy-two basic formulas.

Catalogs and Pamphlets

Encyclopedia No. 163. A request to the Jobber Division, Cornell-Dubilier Electric Corporation, South Plainfield, N. J., will bring you a free copy of a 57-page booklet listing the firm's capacitor line for motor and other a-c applications. The book is well done. A system of cross-reference makes its use very simple. Worthwhile to have around.

Catalog No. NC-49 is the latest published by the Newark Electric Co. The 146-page book lists a complete line of radio parts and electronic equipment, television kits, sets and parts, test instruments, sound equipment, amateur gear, etc.

Radio Shack Catalog. This is a 116-page parts catalog of electronic equipment covering the fields of communications, television, sound, testing and research. Listings range from smallest components to complete equipment, include hardware, accessories, and literature. Index lists products by parts name as well as by manufacturer. Free upon request to Radio Shack Corp., 167-N Washington Street, Boston 10, Mass.

Cathode-Ray Tube Book. Allen B. Du Mont Laboratories, Inc. has published a second edition of their booklet describing the modern cathode-ray tube entitled "The Cathode-ray Tube and Typical Applications." This new edition contains 63 pages on the history, development, design, and structure, as well as uses of the tube. 68 illustrations are included. Booklet is available at all radio-parts jobbers.

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Streamline your shop and sharpen your service with these attractive IRC *All-Metal* Kits and Cabinets.

New *All-Metal Resist-O-Kit* is the latest addition to IRC's family of popular METAL kits. Small, flat size makes it ideal for service calls. Choice of 2 assortments—45 half watt, or 30 one watt resistors in popular ranges.

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Output Transformer Chart. Simplifies the selection of the proper transformer for use as replacement in radio receivers or in the construction of audio amplifiers. Ninety tubes listed, with corresponding Stancor output transformers. Available free on request to G. C. Knoblock, Adv. Mgr., Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill.

Engineering Bulletin 4. This bulletin describes the complete line of audio attenuators, fixed pads, special attenuator networks, and other communications equipment components

produced by the Shallcross Manufacturing Co., Collingdale, Pa. Helpful attenuation data are included. Free copy sent on request to manufacturer.

Clarostat Catalog 49. This latest Clarostat catalog lists the complete line of resistors, controls, and resistance devices. The listings concentrate on universal numbers wherever feasible whereby minimum inventory takes care of maximum replacement needs. Catalog free upon request to Clarostat Mfg. Co., Inc., Dover, N. H.

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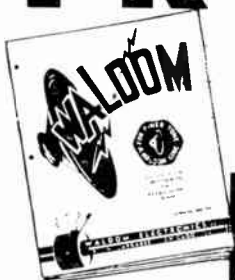
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THE Notebook



Two dollars will be paid by Radio Maintenance for each item published here

SPEAKER ADJUSTMENT

Speakers of the non-adjustable type on midget sets often distort, rattle and produce rasping noises because of their voice coils rubbing against the pole piece. With a little practice you will find yourself adjusting over 99% of them by doing a few simple steps.

(a) turn volume down to a low level.

(b) run your finger around the ridge of the cone to locate the point where the cone rubs.

(c) Take your pliers and bend the speaker housing slightly backward, thus drawing the coil away permanently.

Joseph A. Palmer
Chicago, Ill.

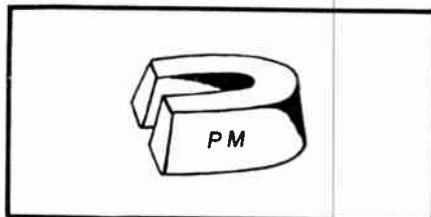
WIRE TRIMMING

When trimming very fine wire in order not to destroy or tear any strands, I use a lighted match to burn the covering and then wipe the wire clean with an old rag. When you do this, be careful not to burn the wire. A few trials will show you the trick.

Frank W. Herrmann
Balto, Md.

DRILL SHAVINGS

I have found a slug from an old P.M. speaker a good item to help keep drill shavings from getting all over a set, especially the type slug



SILVERTONE MODEL 101.808 ID

This model often develops a severe crackling noise at the slightest vibration, such as that caused by certain loud notes from the speaker. The noise is not present with the chassis removed from the cabinet. The trouble is caused by the metal arms of the push-buttons touching either the metal screen that is used for a grille on this particular model, or touching the metal push-button cover that rests against this screen. The cure lies in the judicious application of scotch tape to prevent such contact.

John T. Frye
Logansport, Ind.

that has a space in the middle. The slug also serves as a stop to prevent the drill from going too far through the chassis.

Manuel Orique
Atwater, Calif.

HALLICRAFTERS 7" PUSHBUTTON

The picture creeps upward and out of the screen on this television receiver. Replacing the blocking condenser in the line between the vertical output circuit, and the vertical deflection plate may help. This condenser may check good on a cold test, or on a low testing voltage. The original is a .005 mf, 6M volt unit. This was built especially for Hallicrafters and is unusually small in size. A standard .0005 mf replacement will not fit in the allotted space. Use a .0003 mf condenser which will work well enough for practical purposes.

Max Alth
Yonkers, N. Y.

RUBBER INSULATION

I have found that for an extremely high grade insulation and new rubber for phono pickup hoods, nothing surpasses the thin sheet rubber known as "dental dam." It is obtainable from dental supply houses in strips about 6 inches wide. By coating with rubber cement, it can be laminated or rolled to any thickness.

Marion L. Rhodes
Knightstown, Ind.

PHILCO 46-250

Reception on this receiver was intermittent. The oscillator coil was checked and it was found that the secondary of this coil shorted itself out on the lug. This condition was discovered when the wax near the lug was removed.

Llewellyn Williams
Brooklyn, N. Y.

TUNABLE HUM

In checking for tunable hum in the universal a-c/d-c receiver, watch for cathode-to-heater leakage in the power tube, or an open by-pass condenser from the a-c input to ground. This condenser should be tied in where the a.c. enters the rectifier tube filament and plate. Also, watch for improperly dressed wiring, especially near the oscillator coil.

D. South Travis
Sherman, Texas

EMERSON EA-357

Short life of battery tubes when operated on a.c., caused by excessive filament voltage which is the voltage drop produced by the cathode current of the 117L7 output section. If the grid capacitor C18 is not leaky, replace the 117L7. Many beam power output tubes build up a positive grid voltage after being in operation for a short time. They check okay in a tube tester, as well as in the set when first turned on.

Ralph H. Mercer
Lake Worth, Fla.

HEATER HUM ELIMINATION

With certain tubes, such as the 6SL7, where the heater and cathode are in close proximity, heater hum is introduced into the space current and reproduced in the speaker. If this type of hum is suspected, the following method for locating the faulty tube may prove of value. Keeping the signal and hum at an audible level, short out the filament of the suspected tube momentarily (not to ground). If the hum stops at the instant of shorting, and the signal fades out gradually without the hum, the trouble will be remedied by replacing the tube.

If, upon shorting the filament, the hum increases, then the suspected tube is okay and the hum increase was

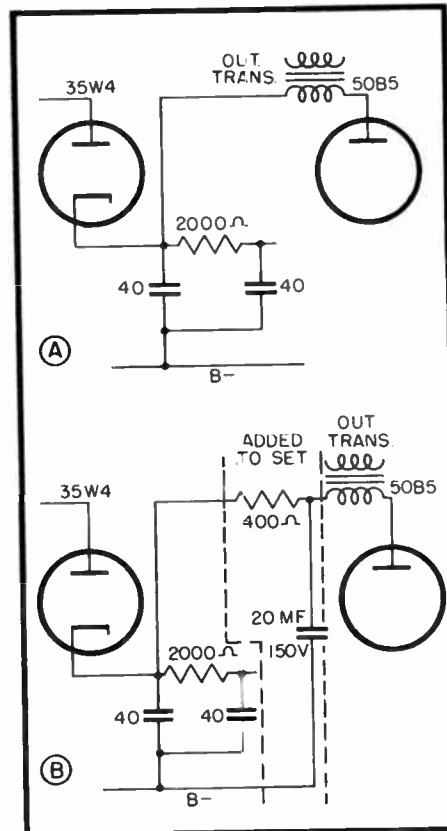
due to the greater filament current flowing through the defective tube. This process will then have to be repeated until the faulty tube is isolated. This will usually prove to be an audio voltage amplifier or a phase inverter stage.

It is not recommended that any filaments rated above 25 volts be shorted, even momentarily, without supplying a series resistor in the filament supply.

Leo Rozman
Brooklyn 14, N. Y.

EMPRESS MODEL 55

The filter condenser in this receiver was listed as a dual 40 mf, but measured 25-25 with good power factor. I shorted power tube grid to B— to make sure that the hum which was heard was a ripple in the power supply, and found this to be so. Replacing law capacity 40-40 did not help much, so it was necessary to add a



separate power tube plate supply filter to the set consisting of a series resistor of 400 ohms, 1 watt, and filter condenser of 20 mf connected as shown below.

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Association NEWS

THE first television clinic of the *Dallas Radio Sales and Service Organization* was held during March. From reports received from Dallas, the meeting was eminently satisfactory. Television is still fairly recent in Dallas and, although six thousand sets have already been installed in the area, technicians are still in the early stages of gaining full familiarity with the problems of installation and servicing.

This original meeting was followed by another get-together on April 11, dealing specifically with RCA Victor television receivers. The Crosley television clinic was held on April 25.

These clinics, if additional proof were needed, are a clear indication of the desire of the industry to help create highly skilled technicians to handle television. This, of course, is not surprising. It is pretty much realized by all concerned that the success of the television industry is to a large extent dependent on the qualifications of the technicians who sell, install, and service the receivers.

Manufacturers have been holding such instruction meetings all over the country. However, the effort in Dallas is one of the few instances where they rendered the service through the local association of service technicians.

Incidentally, the Dallas Association is putting out a very informative newsletter, which not only reports on its activities, but also contains a brief digest of radio and television news, as well as service hints. Thus, we saw this item in a recent issue: "Did you know that a small amount of talcum powder dusted over the deflection yoke and focusing coil rubber fittings will allow them to slip smoothly over the neck of the kinescope?"

WE don't know how many other service associations have similar ar-

rangements, but we thought we'd pass on the setup which the *Philadelphia Radio Servicemen Association* has with station KYW. The association has a contract (just renewed) with that station, which makes it the official testing station for the group. All members are asked to give KYW preference on all push-button receivers, loop adjustments, and do anything else they can to help it. In return, and in addition to being the official testing station, KYW has turned over to members of the Philadelphia organization over five hundred service calls which it received during 1948. You may want to contact the association for more details on this arrangement. They are located at 1643 South Wilton Street, Philadelphia 43, Pa. Dave Krantz is President.

THE annual dinner meeting and election of officers of the *Vancouver Chapter of the Association Radio Technicians of British Columbia, Canada*, was held at the Alhambra Dining Room on April 13, 1949. Once again this proved to be a most successful and interesting evening for a large number of radio technicians. Apparently they wanted to get away from radio, television and things electronic in general. Because the guest speaker for the evening was Benjamin Trevino, Mexican Consul, who gave a talk on "Life in Mexico," and illustrated his travelog with very excellent color film.

The following is the list of officers elected at the meeting: J. Baird, President, succeeding F. Stucky; W. Filtress, Vice President; Al Clark, Secretary; S. Beyer, Treasurer; and F. Lewis, Recording Secretary.

According to Frank J. Moch, President of the *Television Installation and Service Association of Chicago*

(TISA), House Bill 702, introduced by Representative John G. Ryan in the State Legislature of Illinois, is in direct opposition to the welfare of the television set owners and the industry. The bill would place controls upon television technicians in the State of Illinois. Mr. Moch states that the bill is not necessary, since the service profession, in cooperation with the rest of the industry, has already established self policing. TISA has already completed plans for an extensive and continuing training program in cooperation with the distributors. An industry committee is at the present moment establishing standard rates and practices and a system for guaranteeing performance of contract. The association feels that any other controls will only result in added cost to television set owners.

Radio Maintenance Magazine invites Communications from all Service Technicians Groups

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The Premax V can be adjusted to the proper vertical or horizontal position to make the two signals combine in phase, thereby increasing rather than reducing the received signal.

Another Premax feature is that, properly mounted, it permits a sufficient signal energy at the antenna terminals to minimize the importance of the otherwise difficult task of perfect impedance matching.

Service men, installing the Premax V, find it insures optimum reception of signals from ALL of the TV stations within the line of sight.

Premax V is a low-cost antenna, easy to install and profitable to the service man. Send for details.

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4907 Highland Ave., Niagara Falls, N. Y.

RADIO MAINTENANCE • JUNE 1949

This May Shock You

→ from page 29

BECAUSE: If the chassis is grounded, if you touch a grounded object at the same time, and if the line cord is in the outlet, a shock may be felt. The filaments of the receiver complete the circuit even when the switch is off and there is a voltage distribution according to the laws governing a series circuit—the greatest voltage drop will occur across the largest resistor. Now, since body resistance is much greater than the sum of the filament resistances, practically all of the line voltage is felt.

NO SHOCK WITH FLOATING GROUND? Does a floating ground on an a-c/d-c receiver eliminate the possibility of a jolt when the chassis and an external ground are touched? No.

BECAUSE: As in the preceding example, one side of the power line goes to the chassis through a condenser.

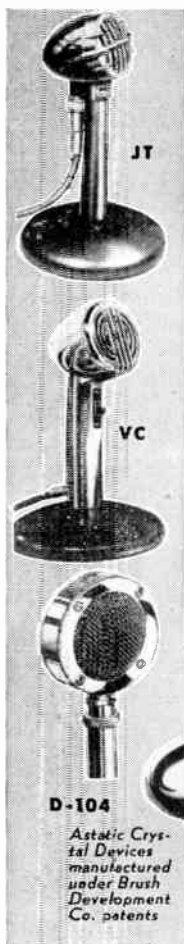
WHY DID THE FUSE BLOW? Two a-c/d-c receivers were being checked for intermittents and were allowed to play on the bench. The chassis of the receivers touched, and the fuse blew. Why?

BECAUSE: Each chassis was connected to a different side of the line, and a direct short was created when they touched. An a-c voltmeter, with the prods touching the two chassis, would show 110 volts. One of the line plugs should be reversed in the outlet to avoid the possibility of a short.

WHY WAS THIS SHOCK FELT? A voltage check was being made on an a-c/d-a set. The chassis, and only the chassis, was touched with one hand. The other hand was not touching anything. A shock was felt. Why?

BECAUSE: The service technician was standing on a concrete floor, which is a conducting ground. The chassis was connected to the

→ to page 42



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JT-40-C	16.15	7'	-62 db.	30 to 10,000
T-3-C	25.55	7'	-62 db.	30 to 10,000
VC	13.15	7'	-62 db.	30 to 10,000
VC-1	13.15	7'	-62 db.	30 to 10,000
CC	8.95	7'	-62 db.	30 to 10,000
CC-1	8.95	7'	-62 db.	30 to 10,000

*0 Reference Level = 1 volt per bar

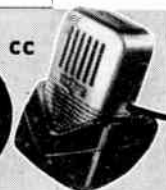
D-104

Astatic Crystal Devices manufactured under Brush Development Co. patents

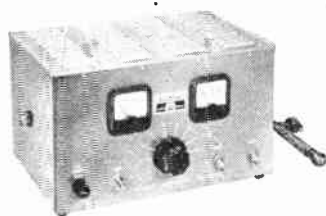
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Television I-F Amplifiers

→ from page 11

Cathode Coupled, Grounded Grid I-F Amplifier

Thus far we have examined transformer coupled i.f.'s and impedance coupled i.f.'s. All of these circuits make use of pentodes, although triodes would be more desirable because of the lower noise characteristics of triodes. Until recently, however, triodes were not used because of their lack of stability. Triode instability is directly due to the large interelectrode capacitance, permitting easy feedback of the signal voltage from the plate circuit to the grid circuit.

This feedback — called positive

feedback or regeneration—causes the triode to become unstable and to have a tendency to spill over into oscillation. Old timers will recall that r-f triodes in early radio receivers were neutralized in order to prevent self-oscillation. This tendency to oscillation becomes more pronounced as we go into the higher frequencies. For this reason, triodes are not used in the average video i-f amplifier.

The cathode coupled, grounded grid, wide band video i-f amplifier overcomes this problem. This circuit is shown in Fig. 3. This particular video i-f section is used in the Television Assembly Co. Model 1230. The i-f strip, shown in Fig. 4, employs miniature 6J6 duo-triodes. The first triode section of each tube is used as a cathode follower. The second triode

section is a cathode coupled, grounded grid amplifier. This arrangement is a typical application of the cascode circuit, discussed in an earlier article (*Television Booster Amplifier Design*, RADIO MAINTENANCE, May 1949).

Before we try to understand how this circuit works, let us take a look at Fig. 5. Here we see three ways of feeding a signal into, and taking a signal out of, a triode vacuum tube amplifier.

In the first method, A, we have the conventional method of feeding the signal into the grid-cathode circuit and taking it out of the plate-cathode circuit. This is one of the most widely used types of amplifier systems.

The circuit is slightly modified in Fig. 5B. Although the signal is still fed into the grid-cathode circuit, we note that the grid is grounded and that the output is taken from the plate-grid circuit. In such an amplifier, called a grounded grid amplifier, the grid acts as a shield between the plate and the cathode, thus isolating the plate and cathode circuits (input and output circuits). Use of the control grid as a shield reduces the tube interelectrode capacitance, and prevents feedback. This helps avoid oscillation, and as a result, a grounded grid amplifier is very stable at the high frequencies at which video i-f amplifiers work.

The last of the three circuits in Fig. 5, C, shows that the signal is fed between grid and plate, and is taken out in the cathode-plate circuit. Such an amplifier is called a grounded plate amplifier, or more commonly, a cathode follower. Since the plate of the cathode follower requires B+ voltage, it is not possible to ground the plate directly. The plate is placed at r-f ground potential by means of a capacitor (approximately 1500 mmf). This circuit provides its own degeneration (as does the grounded grid amplifier), thus further reducing any possibility toward instability and oscillation.

The Signal in the Amplifier

Now let us take another look at the circuit shown in Fig. 3. The input i-f signal appears across the 3.9 K ohm resistor and also across the cathode coil L. Since the 6J6 has

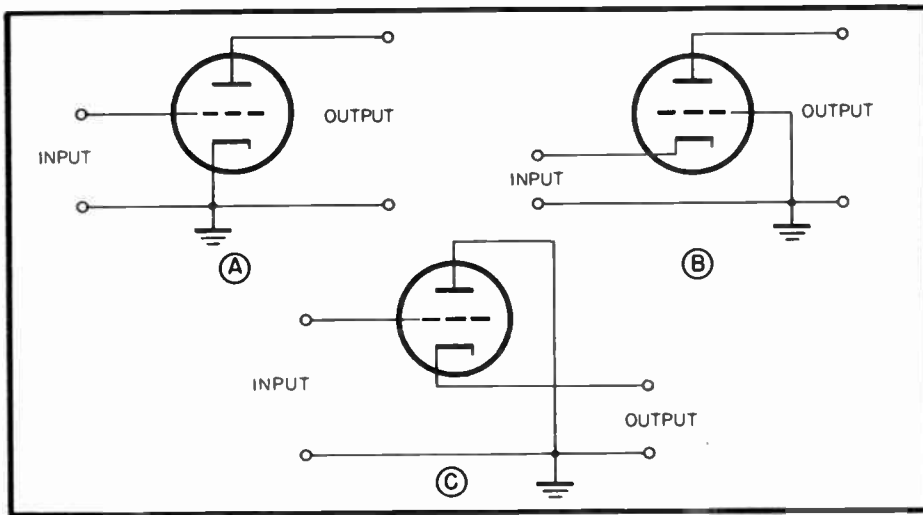


Fig. 5. Illustrating three methods of feeding signals into and taking them out of triode amplifiers. A conventional, B grounded grid, C grounded plate or cathode follower

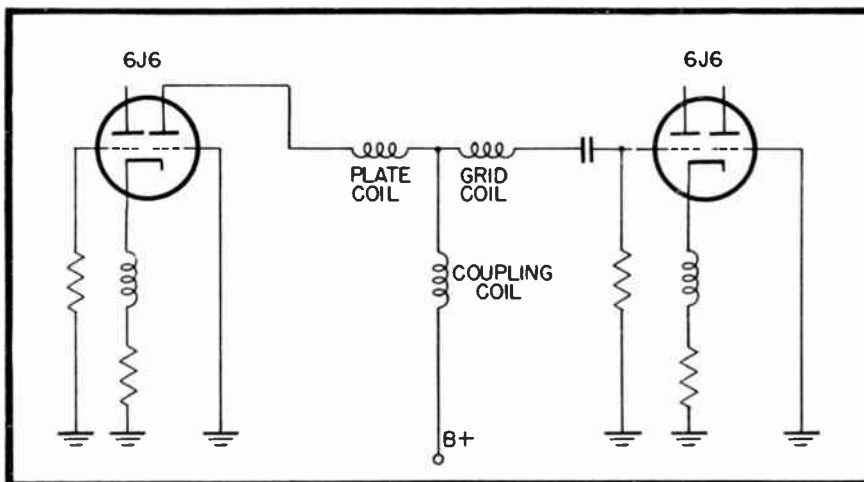


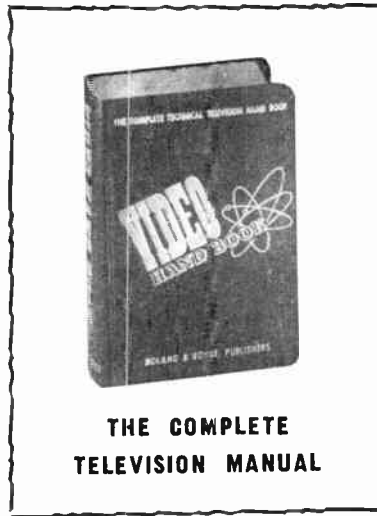
Fig. 6. Bridge T coupling system. The plate coil, the grid coil, and the coupling coil, when used together, appear to be forming the letter T, hence the term bridge T

→ to page 46

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Questions and Answers on Advertising

→ from page 19

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Car Cards

One reader wanted to know how to make up car cards for a bus line going past his door.

Car cards and other posters can either be done by a printer or at a silk screen shop. A good silk-screen shop can do excellent color work. The term silk-screen is derived from the use of silk to which a gelatinous film is adhered. The design and lettering have been previously cut out of this film so that, when color is squeegeed over the silk, it passes through these cut-out spots only, and unto the poster or card. Silk-screen shops as well as printers will usually help you with your design and layout if you have no other assistance.

For any job which you want to have done, you should ask price quotations from several places. For a car card get bids from several printers and silk-screen shops. For printed circulars, get bids from printers and offset houses, etc. Much money can be saved in all these operations by carefully shopping around. In doing this, you also learn a lot about the mechanics of reproduction and this too will help you save money in many ways which are far from evident to a beginner.

Direct-Mail Houses

We were asked by one service shop owner if there were organizations which sent out mailing pieces. Yes, there certainly are. Direct-mail houses, as they are usually called, are a big business. They will provide any phase of direct mail operation you wish, designing your mailing piece, printing it, sorting and collating sheets, stuffing envelopes, addressing envelopes, applying postage, and mailing. They will do all or any one operation for you.

While on the subject of mailing pieces, remember that some of the radio manufacturers can provide you with printed postcards, and similar

material, all ready for promotion mailing. This furnishes you with direct-mail material at a cost well below that which you would have to pay for your own printing. The manufacturer puts his brand name somewhere on the card or the letter-head; and it is because of this advertising for the manufacturer that the material is distributed to you at very low cost.

The manufacturers also provide signs, posters, window displays, stationery, file cards, counter displays, calendars, note pads, and many other items. All of this is attractive and effective advertising matter and much of it is free to you.

Display Signs

Another question concerned the best type of sign to hang outside your shop.

A good sign should be an illuminated one that is also an eye-catcher in the daytime when it is not lit. It is of course very effective to have a sign hanging at right angles to the store front, so that it can be seen from the corners of the block in which your shop is located. An illuminated sign which flashes on and off, or one which gives the illusion of animation, is much more effective than one of the stationary type. The sign as well as your window display should be lit up even after your closing hour, and should stay on as long as pedestrian or motor traffic prevails. You can set an automatic switch to turn off all lights at the hour when traffic usually becomes negligible. In conjunction with this, your business hours should be posted on your door, so that those who are attracted by your sign will know when they can find your place open. Needless to say, the shop should be open as long as customers are likely to seek service.

The sign which hangs over your shop should state the nature of your business in the larger letters and your own name, if it appears, should be subordinate. If the name of your establishment is "Smith's Radio and Television Service," do not show a sign that simply says "Smith's." This will not mean anything to anyone except your friends who happen to know what business you are in. "Radio and Television Service" is what the customer who wants his receiver repaired will look for, and those are the words to feature. ♪ ♪ ♪

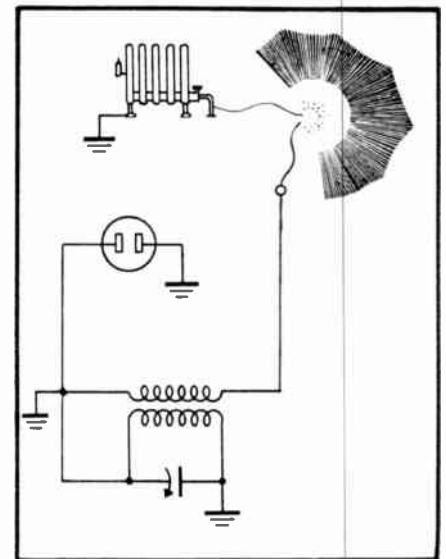
This May Shock You

→ from page 39

hot side of the line. Since every power line has one side grounded, the body of the technician was across 110 volts. To remedy the situation, the plug should be reversed in the outlet.

ANTENNA HANK? Is it advisable to attach an antenna hank to an antenna coil primary or loop of an a-c/d-c set in cases of weak reception? Definitely not, unless there is an isolating condenser (usually about 500 mmf) between the coil and hank.

BECAUSE: Otherwise, the free end of the hank becomes a household menace. This is true whether the set has a floating ground or chassis ground. The bottom end of the coil goes to B minus, which is one side of the line. Assume that the line cord of the receiver is plugged in so that B minus is attached to the hot side of the power line. The set will generally still operate properly, no matter which way the line cord is plugged in the outlet. But the end of the antenna hank is directly connected to B minus (the hot side of the power line) through the antenna coil primary of a few ohms. If the end touches a grounded object, such as a radiator, a short circuit will result; or even more seriously, if a child should touch the end of the hank with one hand and a grounded



object with the other, he would be across practically the entire 110 volts, which might conceivably be fatal to the child. Where an isolating condenser is used between the coil and the hank, most of the voltage would be across the condenser.

WHAT CAUSED THIS SHORT?

Voltage readings were being taken on an a-c/d-c receiver with a chassis ground. The chassis touched the brass plate of the line outlet, where the set had been plugged in. There was a short circuit. Why?

BECAUSE: One side of the power line was not only connected to earth ground, but also to the brass plate of the receptacle. If a set is plugged in so that the chassis is connected to the hot side of the line and the chassis touches the plate—pfft.

WHY DID PICKUP JOLT HIM?

Fellow came into the shop and told of an experience he had. He had taken his phonograph into the garden the night before to give a recorded concert for a party of friends. The record player was on an extension cord. He received a shock whenever he touched the pickup. Why?

BECAUSE: As in the preceding situation, the man was standing on a conducting ground.

WHY THE BUZZ? Two pieces of a-c test equipment were on. When the technician touched the metal cabinets of both, he felt a buzz. Why?

BECAUSE: The situation is very similar to that described above in connection with the touching of the chassis of an a-c receiver and an external ground, with neither of the primary being grounded directly to the chassis. In this case, the remedy is to reverse the line plug of one instrument, or put a clip lead connecting both cabinets directly to each other, so that it will not be possible to complete a circuit across the line by touching both. The clip lead will short out the technician. Naturally, the clip lead is not advisable for two a-c/d-c sets with the chassis going directly to the line. " " "

Phase Inverter Circuits

→ from page 15

decreases due to an increase in signal applied to the grid, providing a larger voltage to the upper push-pull grid, the plate current flowing through the 4,700 ohm cathode resistor will decrease. The lower plate current will not cancel as much of the audio voltage appearing across the combined cathode resistances, thus supplying a larger voltage to the lower grid of the push-pull stage.

Inverter Circuits without Tubes

A tube-less inverter circuit is incorporated in the Espey Model 20626A as shown in Fig. 4. (This same principle is used in Buick auto radio models 980744 and 980745, where a saving of a tube means lower battery drain.) This circuit uses a center tapped inductance to provide the 180° phase shift. The audio voltage developed across the upper half of the winding is induced into a lower half of the winding by transformer action. The winding provides a d-c path for the grid returns of the push-pull tubes. Due to cost considerations and the possibility of induced hum pickup, the physical size of the auto-transformer is small and doesn't permit a very large amount of inductance, which would be desirable for good bass response. For this reason, the inductance tends to accentuate the higher audio frequencies. A fixed tone control circuit consisting of a condenser and resistor in series connected across the coil attenuates the higher frequencies and gives the illusion of bass-boost.

A two tube phase inverter is used in the Bendix Radio Model 697A shown in Fig. 5. The first audio stage is a 12AT6 which provides an audio signal voltage to the control grid of the upper 35B5. This voltage is developed across the grid resistance made up of the 470,000 and 100,000 ohm resistors in series. A portion of the audio voltage (about one-fifth) is tapped off at the junction of the two series resistors and fed to the control grid of the 12BA6 inverter tube. This reverses, or inverts, the phase of the voltage and, with a gain of about 5, presents a signal voltage to the control grid of the lower 35B5 that is approximately equal to the voltage present on the grid of the upper tube. The .01

mf coupling condenser from the plate of the 12BA6 to the lower push-pull grid is purposely made large so that it will not shift the phase of the signal voltage.

Since the amount of signal appearing at the grid of the lower tube depends directly on the amount of gain in the inverter tube, this circuit will produce distortion and reduced volume if the 12AT6 tube becomes low in emission or develops other faults.

To compensate for differences in tubes and voltages, some circuits utilize negative feedback in a self-balancing arrangement. This was discussed in connection with Fig. 3. Another example of this is shown in Fig. 6. A study of this circuit will show that it is quite similar to Fig. 5 except that the grid return path of the push-pull tubes is by way of the 100,000 ohm resistor in the grid circuit of the 6SQ7 inverter tube. Some of the audio voltage delivered to the grid of the lower 6K6 from the plate of the inverter tube is fed back through the lower 470,000 ohm resistor to the grid of the inverter tube. Some of the audio voltage appearing on the grid of the upper 6K6 is also supplied to the grid of the inverter tube by way of its grid resistor. Since the voltage from the two push-pull grids are 180° out of phase with each other, they will tend to cancel at the grid of the inverter tube. If the voltages at the lower push-pull becomes larger than the voltage at the upper grid, the two will not exactly cancel, and the resulting voltage at the grid of the inverter is degenerative, reducing the gain of the inverter tube until the voltages at the push-pull grids are equal.

Good balance in inverter circuits depends to a large extent on the resistance values being properly matched. In servicing inverters, use a vacuum tube voltmeter to determine whether the audio voltage on one push-pull grid is the same as on the other. It is best to use a constant audio input signal from an oscillator for this test. If the voltages are not substantially the same, replace the resistors with units having identical values. It is sometimes better to replace just one of the resistors in a cut-and-try manner until the two voltages are equal. The degenerative methods mentioned cannot compensate for extremely poor tubes, so test them first. " " "

F-M Receiver Alignment

→ from page 13

percentage bandwidth, although the design usually attempts to provide a more "flat-topped" response curve.

The heart of the f-m alignment problem is in the detector section. The detector may be a discriminator, ratio detector, or a single stage oscillator detector. The circuits and characteristics of these detectors were discussed in detail in a previous article in this series (*FM Detectors*, RADIO MAINTENANCE, November 1948, December 1948). Primarily of interest here are the methods of connection of the instruments to obtain a proper alignment adjustment.

Consider the Foster-Seeley discriminator shown in Fig. 3. When a steady, unmodulated carrier is being received, equal and opposite d-c voltages (of the polarities indicated) are developed between points A and B and between point B and ground, if the discriminator transformer is properly adjusted. The simple way to align this transformer, then, is to feed a signal of unmodulated intermediate frequency through the i-f amplifier and measure the voltage between point A and ground with a vacuum tube voltmeter. When the indicated voltage is zero, the discriminator is balanced at the intermediate frequency. However, this does not guarantee that the tuned circuits of the transformer are adjusted



Fig. 5. Double discriminator S curve, useful for maximum amplitude adjustment of the detector

for best amplitude response, a desired condition for best signal to noise ratio. Maximum amplitude can be checked for by measuring the voltage across either R1 or R2 alone, since this voltage is proportional to the i-f voltage across the secondary winding of the transformer. When optimum adjustments obtain, the voltage across either resistor is a maximum and the voltage across the two in series is zero.

Fig. 4 shows two variations of ratio detector schematic diagrams. The ratio type is easily tuned to resonance by measuring the d-c voltage across the load capacitor and adjusting for maximum.

In any receiver in which a separate limiter stage is used (discriminators), the limiter grid resistor makes a good location to obtain an indication for aligning r-f and i-f stages and the local oscillator, but of course is not useful for detector alignment.

The circuit and operation of the single stage locked oscillator detector were covered in a previous article. This detector is aligned by two separate operations. A vacuum tube voltmeter is connected to the output, or an oscillograph if one is available. The oscillator circuit of the detector is disabled by shorting pin 2 of the FM 1000 to ground. The i-f amplifier stages are then aligned, with the detector acting as though it were designed for a-m reception. The oscillator operation is then restored and its frequency adjusted to exactly that of the i-f signal. This can be done by means of a frequency meter, a receiver which tunes to the intermediate frequency, or by passing an i-f signal through the receiver and "beating" the oscillator frequency to a zero beat setting.

Visual Alignment

All the above operations are made easier and faster if the receiver is aligned by the visual method. A frequency modulated signal from the generator is applied to the receiver antenna terminals and an oscillograph connected to the output circuit of the

detector or at the loudspeaker circuits. The details of the connections and equipment have been covered completely in previous articles in this magazine (*Using Sweep Generators for FM Alignment*, Radio Maintenance, February 1948, March 1948).

If the oscilloscope connected at the output circuit of the detector is properly synchronized with the input signal, a discriminator double curve, as shown in Fig. 5, results. The detector transformer and the i-f transformer trimmers or slugs are adjusted for maximum vertical height of the pattern, for maximum amplitude response, and so that the cross-over point occurs in the center of the pattern, for best symmetry and balance.

The balance of the discriminator is very important for distortionless reception and a variation of only a few kilocycles from symmetry can cause the received signal to deviate over non-linear portions of the detector response curve. This also explains why tuning of an f-m receiver is very critical, requiring careful adjustment for best quality.

The application of the above general principles of f-m receiver alignment to a modern f-m receiver will be discussed in a subsequent article. ✓ ✓ ✓



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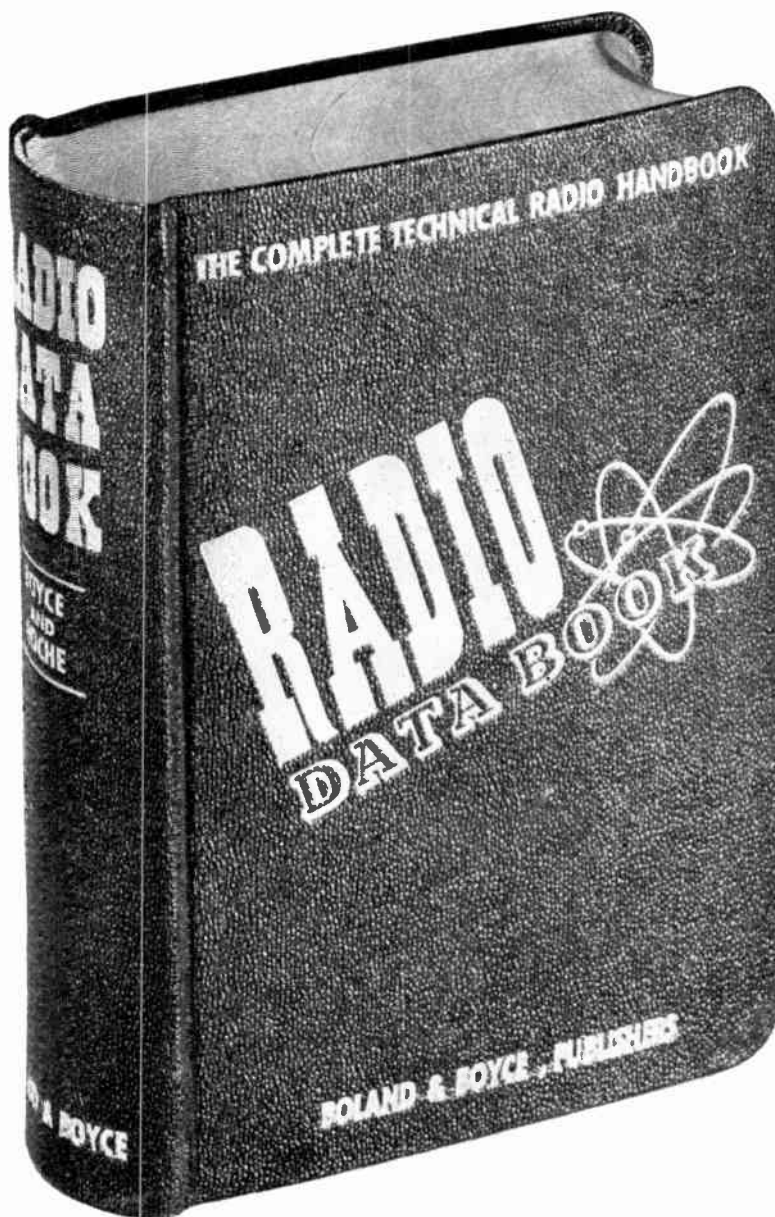
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Video I-F Amplifiers

→ from page 40

only one cathode, any signal appearing across the cathode coil L will automatically be transferred from the first half of the tube (the input triode) to the second half of the tube (the output triode). The cathode coil L is often referred to as a common impedance.

The first half of the duo-triode 6J6 acts as a cathode follower—and the second half is designed to work as a grounded grid amplifier. Each 6J6 is coupled to the next duo-triode stage through what is called a bridge T network.

A simplified form of bridge T network is shown in Fig. 6. The name bridge T is given because the plate coil, the grid coil and the coupling coil, when used together, seem to form the letter T. This circuit is modified in the Television Assembly Company i-f strip to include a sound trap. A capacity type trimmer, used in conjunction with the bridge T network resonates with the inductances of the bridge T to trap out the sound i-f signal.

The plate coil and the grid coil are fixed-tuned to the proper video i-f frequency. They are mounted underneath the chassis and placed at right angles to each other (and to the coupling coil) in order to prevent any magnetic interaction between the coils. Transfer of video signal voltage through the coupling coil is possible since the coupling coil is common to the plate circuit of one video i-f stage and the grid circuit of the succeeding stages.

Since the video i-f strip in this particular receiver is fixed-tuned, there is no alignment necessary. There are no slugs or trimmers available. The only alignment possible is the adjustment of two sound traps, and these should not be touched unless sound bars appear in the picture. ✓ ✓ ✓

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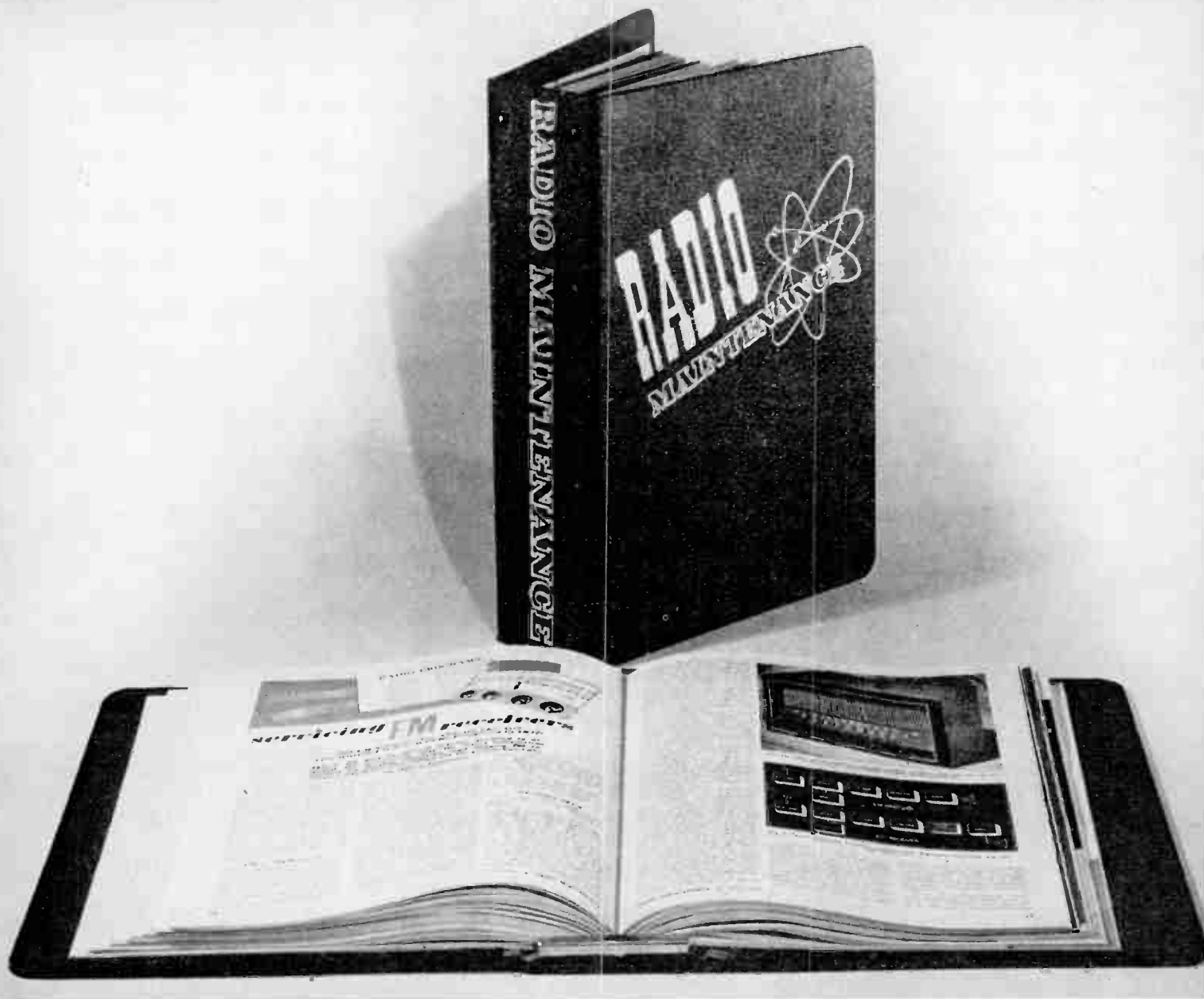
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Sidebands and Their Functions

→ from page 17

and below the frequency axis, representing all the energy of the transmitter being expended in the carrier. When we modulate, the energy from the modulator is expended in the sidebands. The percentage of modulation constitutes the ratio between the energy in the sidebands and that in the carrier. It is obvious, therefore, that all the intelligence is being transmitted by the sidebands. So much for the basic theory of transmission of intelligence and how sidebands fit into the picture.

The Signal in the Receiver

Now we shall see what takes place in the receiver. The signal passes through the tuned circuits of the r-f stages, which are usually broad enough to pass the carrier and its sidebands without discrimination. Entering the mixer tube of a superheterodyne receiver, the three signals F_1 , F_2 , and F_4 are heterodyned against the local oscillator signal. The local oscillator produces in its plate circuit many new frequencies. We are only interested in three of these new frequencies, and the plate circuit of the mixer tube (1st i-f transformer) will only accept these three, namely F_1-F_0 , F_3-F_0 , and F_4-F_0 , which is the case when the local oscillator is below the incoming frequency. If the oscillator is above the incoming frequency, the resulting three frequencies would be F_0-F_1 , F_0-F_3 , and F_0-F_4 . The new result-

ing frequencies will be equal to and slightly above and below the i-f frequency, thus retaining the characteristics of the carrier and its two sidebands. The bandpass of the i-f stages must be sufficiently broad to pass three frequencies without discrimination.

The Signal in the Detector

Now let us see what happens in the detector. For analysis let us use a simple diode detector as shown in Fig. 7. In the diode, all three signals are rectified. In this process of rectification, a heterodyning process also occurs which is quite similar to that in the first detector. As a result we obtain more new frequencies. These again are the sums and differences of the frequencies being heterodyned. Because of the action of bypass condenser C_1 , the original r-f frequencies and any other resultant r-f frequencies will be bypassed, leaving only an audio frequency which is equal to the difference between the sidebands and the carrier, namely 1000 cycles, and is developed across resistor R_1 . This is the original intelligence.

As a result, we can see that the action of the second detector is quite similar to that of the first detector of a superheterodyne receiver. The sidebands are necessary at the detector to produce the audio frequency. We can also see more readily how we can utilize single-sideband transmission, as in television. Transmitting a carrier and one sideband, we have all the components necessary for the reproduction of intelligence, as one sideband is merely a duplicate of the

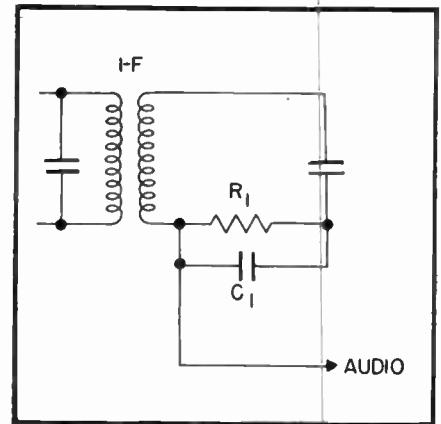


Fig. 7. Simple diode detector circuit.

other. We can again see that, if we transmitted either or both sidebands and suppressed the carrier, the intelligence could normally not be removed unless the carrier were replaced with a local oscillator at the receiver, which would serve as a reference frequency when heterodyned. Therefore, we are primarily interested in a difference frequency between the sideband and the carrier in detection. ✓ ✓ ✓

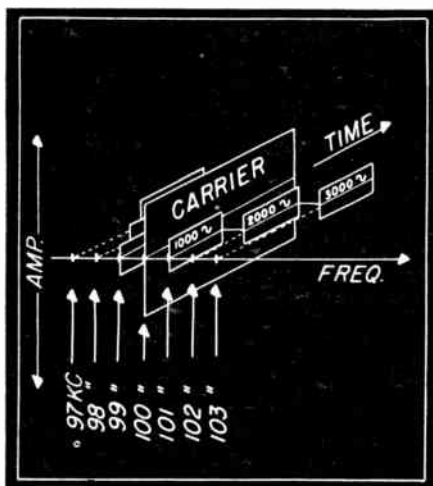


Fig. 5 The wave represented in Fig. 4 (page 17) is shown here three-dimensionally

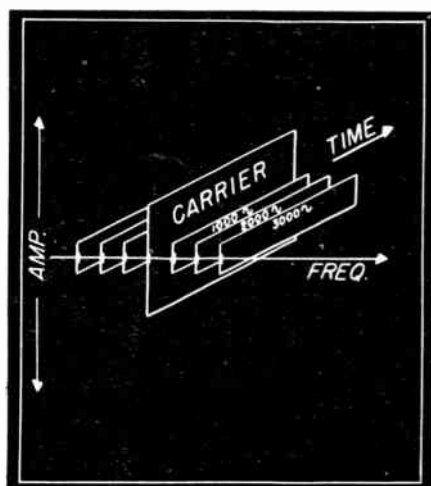


Fig. 6 The three-dimensional wave of Fig. 5 is shown here for one unit of time

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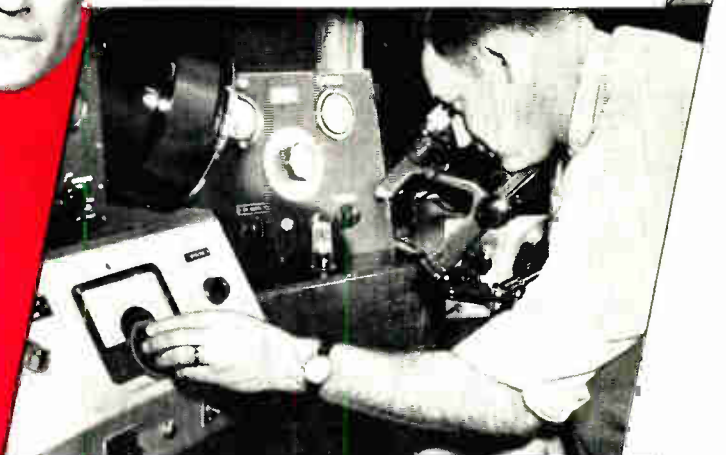
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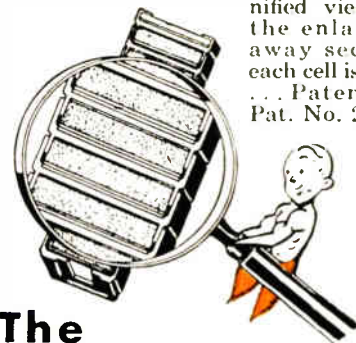
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