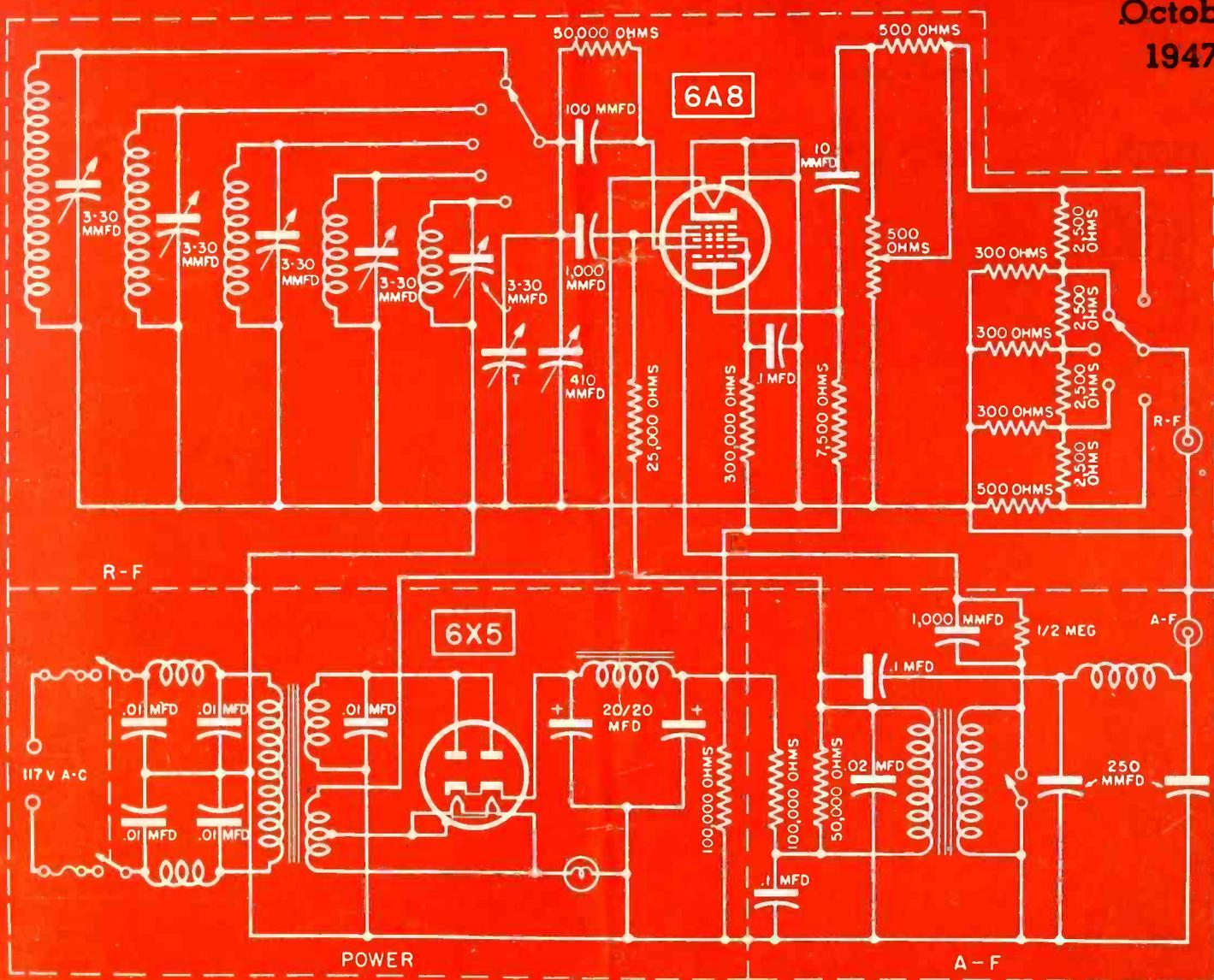


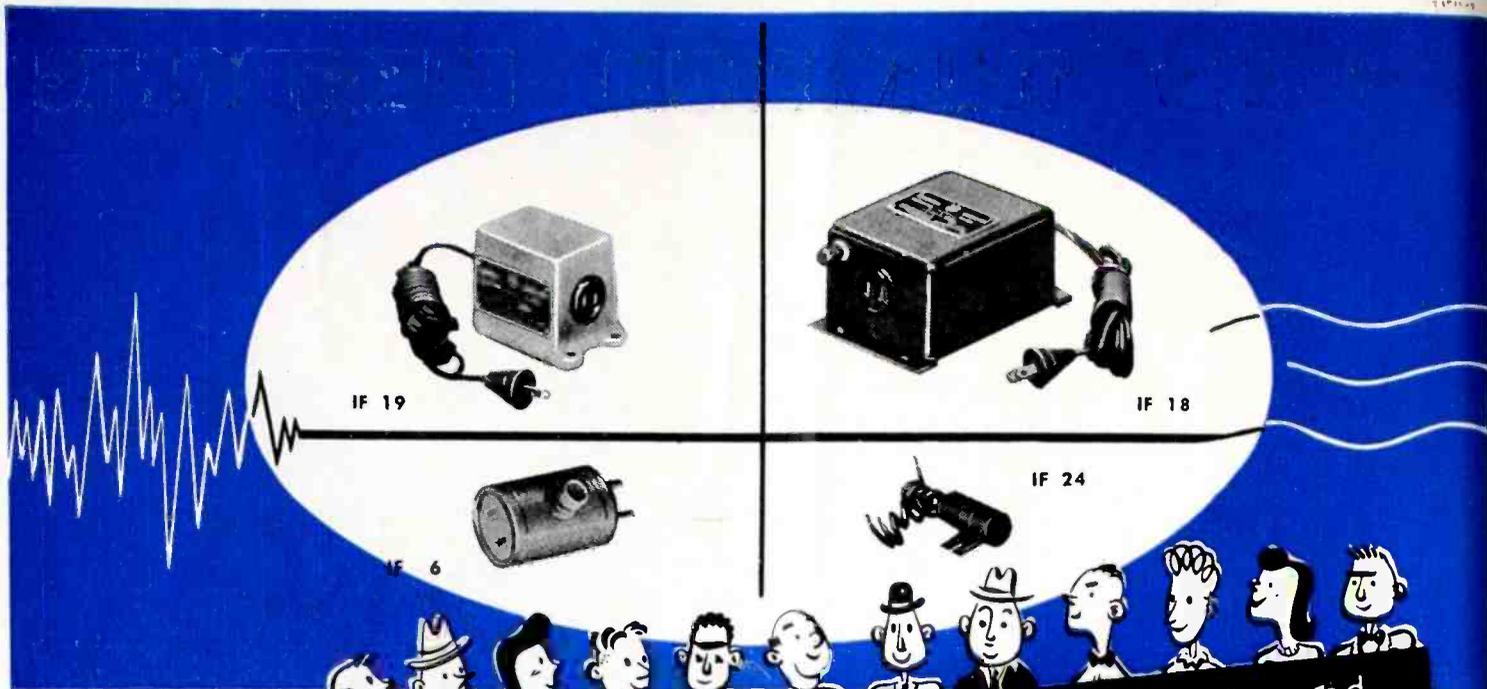
SERVICE

October
1947



Signal generator? with a 160-ke to 20-mc r-f range on fundamentals (20 to 140 mc on harmonics) and fixed audio-oscillator frequency of 400 cycles.

[See page 2]



87 out of every 100 service customers

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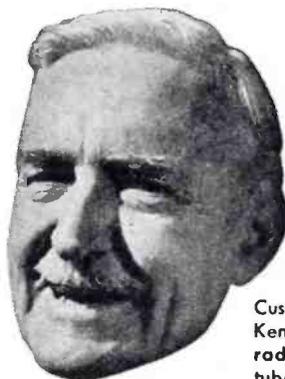
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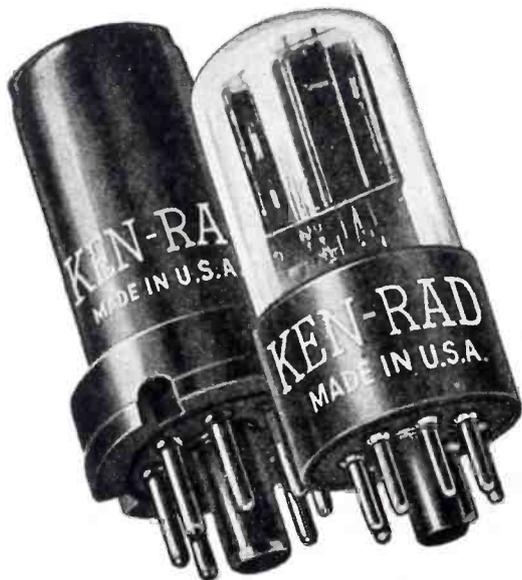
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EDITORIAL

WARRANTY PERIOD SERVICING, in which many Service Shops specialize, through a tie-in with dealers, was prior to the war quite profitable. While many receivers did not require attention during the 90-day warranty period, there were sufficient problems involving dial repairs, tube checks, speaker servicing and occasional part replacements to make this type of servicing worthwhile.

The postwar receiver has, however, dimmed the golden glow of this type of work in many areas. In the postwar rush to produce receivers quickly, many sets and components were not tested properly, designs were makeshift and breakdowns occurred frequently. Dealers were reluctant to cooperate completely with Service Men in replacing parts and compensating for service time. Unfortunately, the situation still exists on many fronts. Some manufacturers have been exceptionally cooperative in preparing a complete assortment of components for replacement and allowing the dealers a substantial discount to accommodate servicing requirements. Other manufacturers have, however, been a bit balky in providing this type of cooperation.

According to Service Man E. R. Frost of Salt Lake City, Utah, all components which go bad during the warranty period should be replaced by the manufacturer and the dealer should arrive at some procedure to reimburse the Service Man for his servicing time. Such across-the-board policy, says Frost, would probably increase the quality of the receiver and minimize unloading of makeshift sets.

The customer who receives rapid service during a warranty period is a big booster for the dealer, the manufacturers and the Service Man.

WE'VE RECEIVED A NUMBER of letters and phone calls from advertisers, especially in the midwest, stating that they had been told that another publication in the radio maintenance field had bought or was buying SERVICE. Such statements are absolutely untrue. SERVICE has not been sold, is not being sold and is not being merged with any other publication. We're still at the old stand after 17 years of service to radio and electronic Service Men exclusively!

DON'T FORGET to participate in National Radio Week, October 26 to November 1.

RADIO · TELEVISION · ELECTRONIC SERVICE

Vol. 16, No. 10

October, 1947

LEWIS WINNER
Editorial Director

ALFRED A. GHIRARDI
Advisory Editor

F. WALEN
Managing Editor

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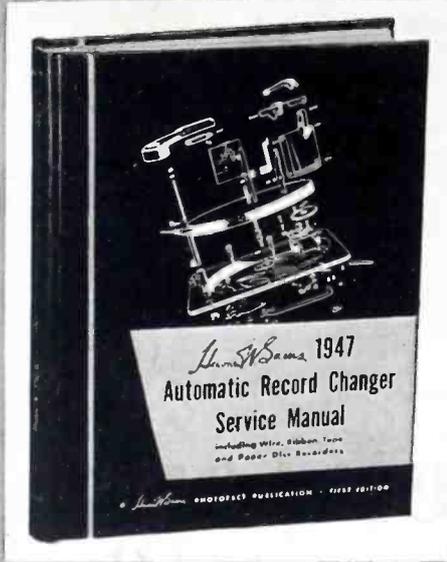
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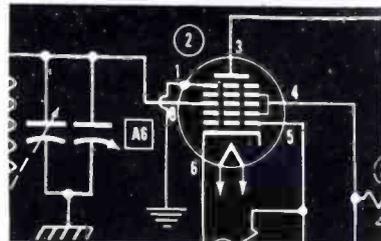
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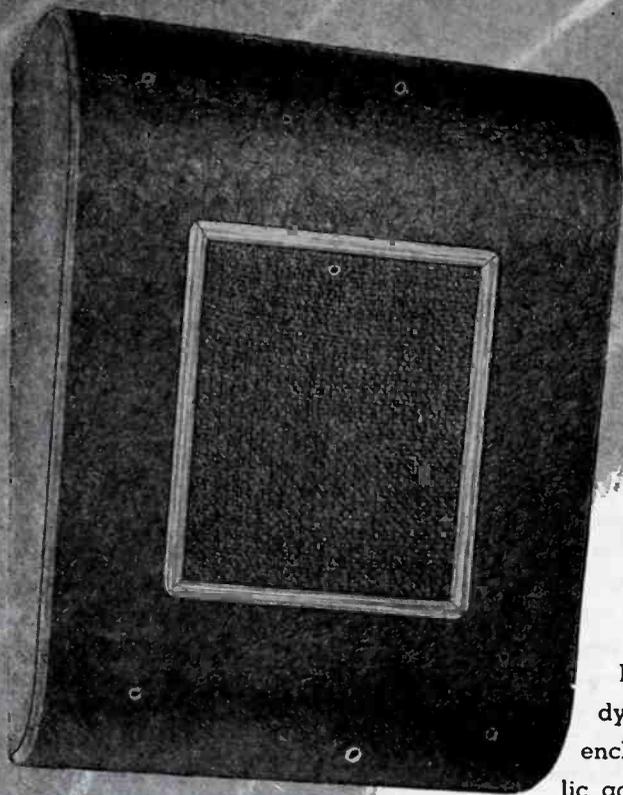
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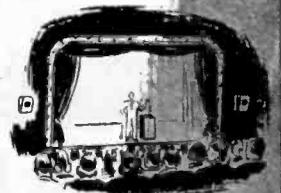
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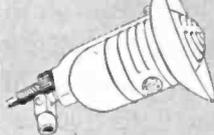
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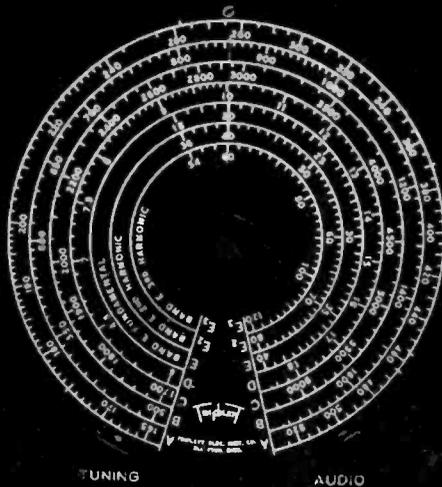


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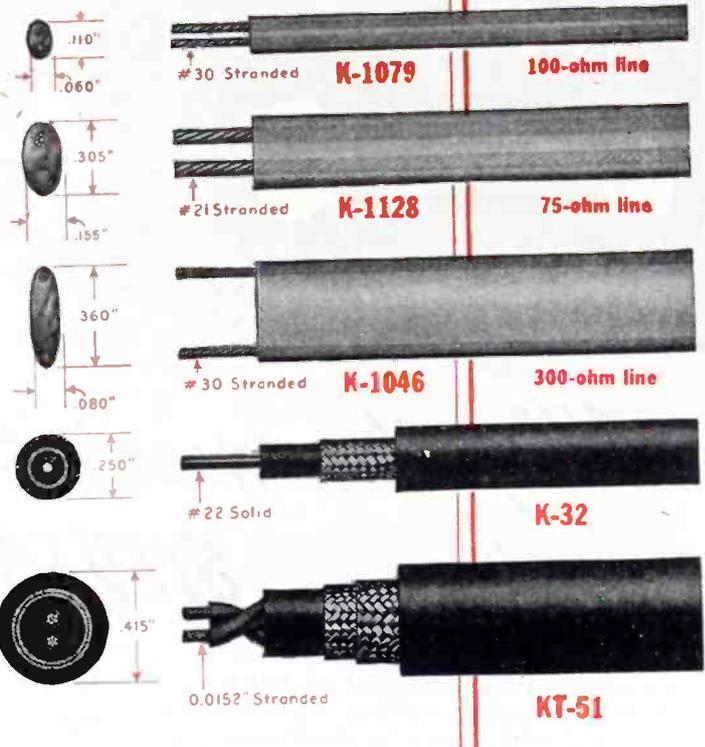


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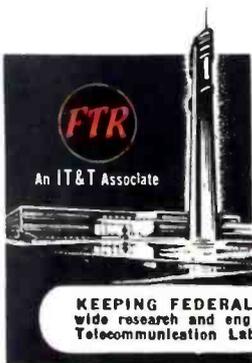
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				1.0	1.7	30	100	300
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K-1128	75	71	19.5	.3	.4	2.0	4.0	7.3
K-1046	300	81	4.0	.38	.57	.85	2.0	—
K-32	73	66	22	—	—	2.0	3.8	7.0
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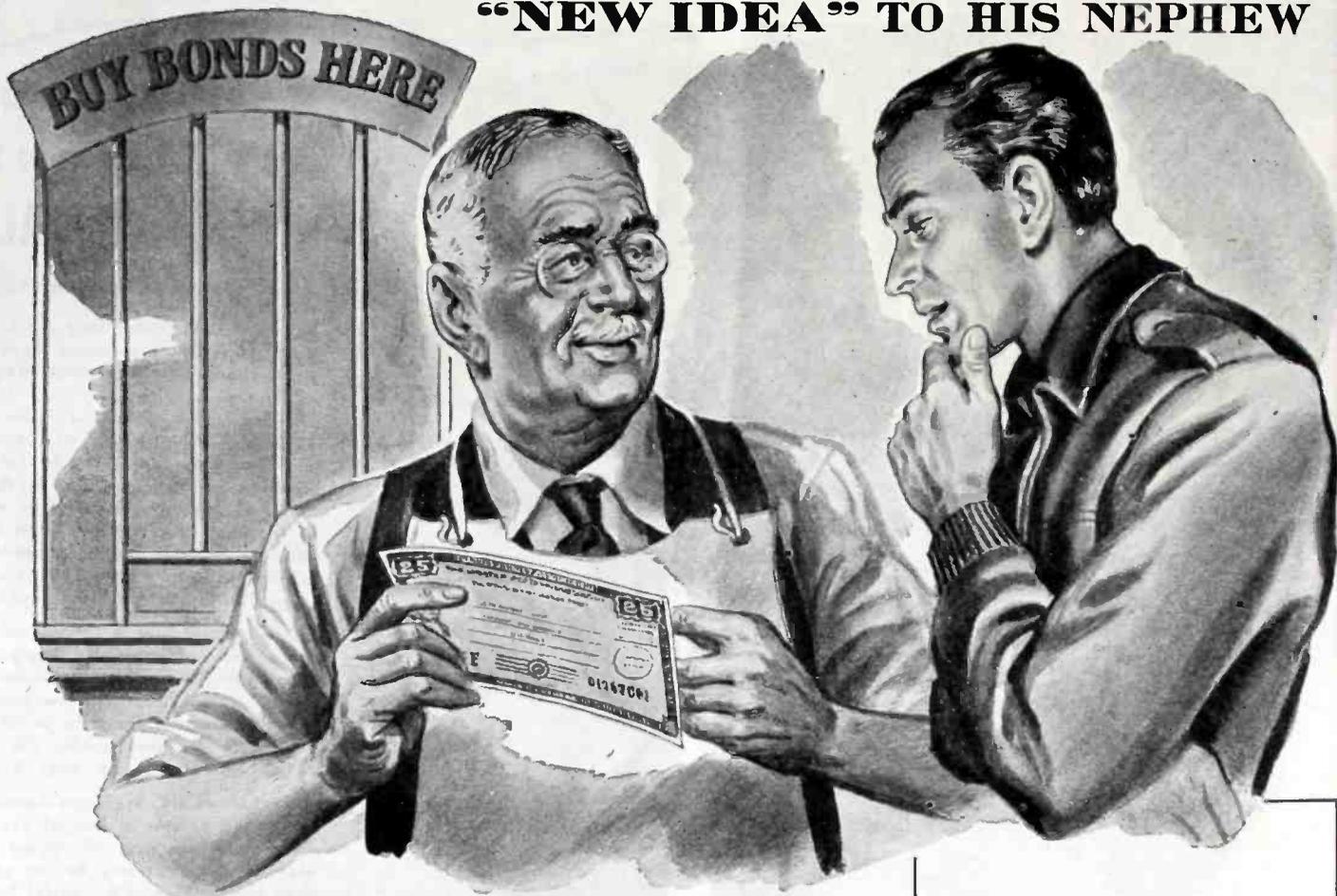
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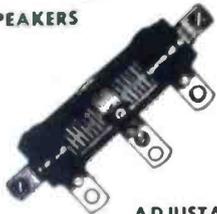
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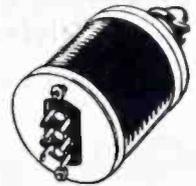
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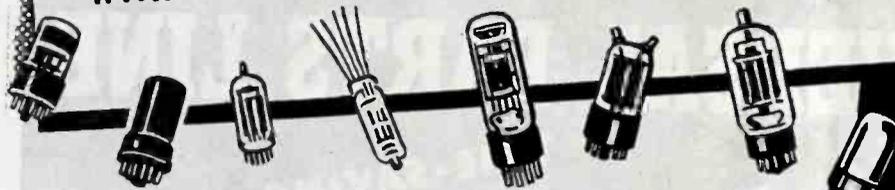


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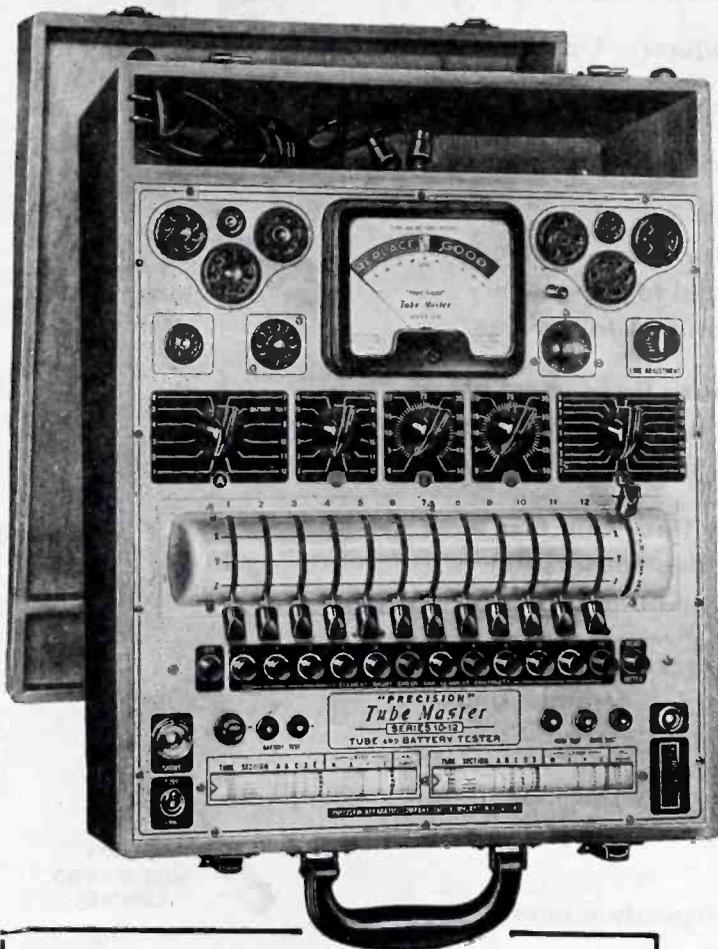
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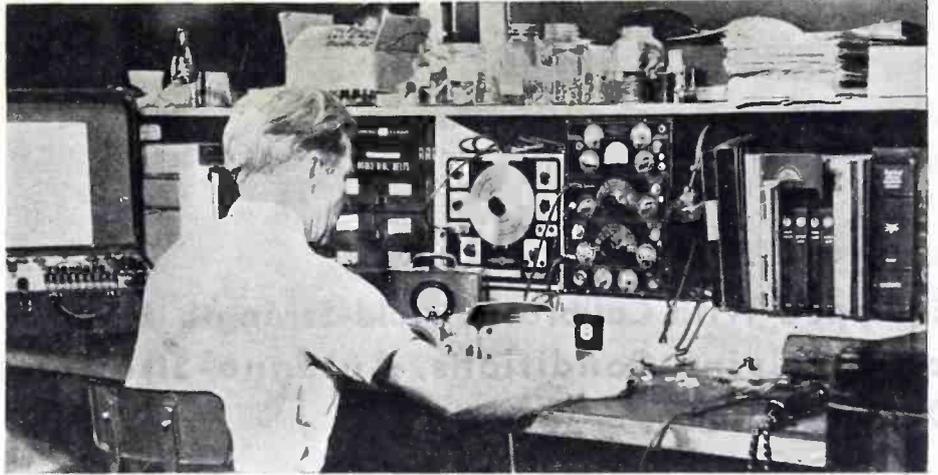
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SERVICE

The author at his service bench.



Servicing in the Desert

SERVICE plays a major role in our shop which features servicing by specialists. One man services refrigerators, another does all washer repairs, and there's also a man for small appliance repairs, while the writer handles the servicing and modifying of sets to meet desert conditions.

In November, 1945, the old Riley shop was replaced by a new one. At this time yours truly joined the Riley staff. It soon became quite obvious that there were many unique servicing problems to solve in our area which is quite remote from broadcast stations. Here in the desert, reception is difficult, not only due to the distance from stations, but because of mineral deposits, sand static during the frequent wind storms, and in the older part of town, *home-grown* wiring that definitely bears no resemblance to code specifications.

Shop Servicing

No servicing is done in the customer's home. It has been found that the customer will receive more satisfactory, and just as economical, service if the receiver is brought to the shop where testing and repairing can be performed under more ideal conditions than would be the case in the

Shop Opened 22 Years Ago, in the Heart of the Mojave Desert, Provides Service Tuned to Remote Desert Conditions. Employed are Speed-Servicing Equipment and Techniques, and Novel Circuit Changes to Minimize Fading and Noise

by **W. BOWEN**

*Riley Electric Shop
Barstow, Calif.*

customer's living room. Incidentally the service department occupies a room 30' x 40', in the back half of the shop.

Probably the most prized piece of equipment, here where signal strengths are so low, is the *signal tracer*.

Our bench layout, including placement of equipment, parts, and books, stresses rapid testing and repairing. In addition to conventional equipment, several gadgets are used to speed service. One is an amplifier, utilizing the audio and speaker of an obsolete receiver, for checking record changers

which have been removed from cabinets for bench testing. Another is simply a small table, the right size and height to accommodate a chassis removed from a console. This allows testing and minor repairs to be made without the nuisance of removing the set's speaker and loop antenna.

Circuit Changes

In checking receivers several effective circuit-change arrangements were found. For instance although the nominal i-f frequency of most sets is 455 kc, many of them, especially mid-gets, will track far better, with consequent higher sensitivity and selectivity, if the i-f is shifted slightly, keep-

(Continued on page 42)

Portable F-M/A-M Receiver

Equipped With Calibrated Field-Strength Meter, Instrument Provides Check on Receiving Conditions, Antenna-Site Locations and Serves as F-M Demonstrator

AN IMPORTANT TOOL for the Service Man is a portable receiver which can be used to check the signal response in a specific location. For example, quite often the repair problem will involve noise, which the set owner will blame on the receiver, but which actually is due to purely local interference. Demonstrating, with the portable, that another receiver in the same location reacts to the noise similarly will save many an argument.

The portable set approach has also solved other problems; location of choice receiving point for loop-type receivers, selection of areas which will afford best loudspeaker reproduction and also improved-receiver demonstrations.

This type of service, had been, until recently restricted to a-m work. It is now, however, possible to use the portable system on f-m and a-m in

by **ALVIN A. BAER**

*Meybaer Radio
New York City*

view of the development of an f-m/a-m model¹ which is equipped with a collapsible auto type antenna and a field strength meter.

Sensitivity of the field strength meter can be switched from low to high, rod antenna can be switched to either the f-m or a-m bands or an outside antenna for either the f-m or a-m can be used, and a signal takeoff permits playing the receiver through the audio portion of another receiver,

¹ Bendix Factor Meter, model 847S.

in much the same way as a phono player.

This model has many applications, both in sales and service, particularly in f-m work. For example, when installing dipole antennas, the direction in which the antenna faces is very important. The test receiver can be used to locate the best antenna site by operation on the building roof, using a 75' outdoor connected to the apartment power source.

Two methods can be used in the antenna test to determine direction. First, a high clear location is determined, and the antenna installed. This antenna, or the one on the test receiver can then be used to log f-m stations, and incidentally a compass is very handy for this purpose. If the test set is for determination of optimum

Checking the antenna site in the home.



Arriving at a service call.



Comparing reception of a-m and f-m with the aid of the f-m test unit, which can also be used with the a-f system of the household set.



Rotating an f-m dipole for maximum signal response.



Checking antenna-location possibilities with f-m test unit. Receiver is placed in horizontal position for reception of horizontally polarized signals.

direction, it is stood on its side so that the self-contained antenna extends horizontally. The entire receiver is revolved for maximum response. The direction of the antenna is then noted on a log sheet. The log chart consists of four columns. The first column is for the station being checked, second shows the frequency of the station, next column shows antenna direction for maximum response, and the last the field strength as indicated on the field strength meter.

Use of Roof-Top Antenna

If the roof-top antenna is used, the rod antenna is disconnected and the newly installed dipole connected. The same logging procedure is followed, except that the dipole is rotated and stations logged for maximum response; the antenna is oriented for maximum response to the weakest station signals. This orientation process can be applied to an unmounted antenna, rotating it for maximum signal and then mounting in position.

Wave Fronts

Because f-m signals are transmitted at high frequencies, *wave fronts*, or signal peaks which are quite close together must be considered; at 100 mc these peaks are approximately five feet apart. Thus, when a station signal is weak, maximum signal will be picked up by an antenna at the point where the wave front is at a maximum. Therefore, once the directivity of a signal has been established, moving the antenna forward or back a few feet in line with this direction, will

increase or decrease signal strength. This procedure is only recommended where a specific signal is desired, but is so weak as to make it unusable. It is not recommended for general practice, since it requires some experimentation.

These orientated tests may seem to be a complicated and time consuming job, but it will pay off in customer satisfaction and reduced service calls.

The test receiver also has many uses in the customer's home, such as determining the best location for an f-m set, when the indoor antenna is to be used. In this instance the rod antenna is extended, and then checked in front of the window, or any other locations in the room. A log, similar to the one applied for the roof tests, is kept for the various locations.

The Field Strength Meter

The calibrated field-strength meter is very handy for this test. Two ranges, provided for both analyzing and comparing the signal strength of f-m stations, read from one to ten. A reading of over five on the high range denotes excellent reception, reading below five on the high range shows a signal strength of good proportions, and fair reception is indicated by a signal strength reading of five or better on the low range. Any signal under five on the low range is unsatisfactory.

If a high proportion of the f-m stations show readings on the low scale, then an outside dipole is indicated. Thus, even before the new set is delivered, it is possible to de-

termine and solve the specific antenna problem.

In New York City and other large metropolitan areas many buildings do not permit antenna installations, because of penthouses, a desire to keep unsightly wires away from the front of the building, and building and zoning codes. Thus it becomes doubly important to check locations. Because of the steel construction of the buildings, inside antennas are often ineffective. Window antennas of the auto type have been found to solve this problem. Here again, the use of a portable receiver simplifies installation, since some windows are better locations than others. Because of the spotty character of reception, almost any f-m signal will be found superior to a-m signals, since local interference sometimes makes the use of an a-m receiver in these buildings well nigh impossible.

F-M Demonstrations

This type portable can also be used to promote f-m sales by demonstration during a special visit or at the conclusion of a service sales call. Many believe that receivers in radio shops are 'souped up' to give an extra special performance, and that when the model is installed in their home, it will not sound as good. This sales resistance is completely removed by a demonstration in the home. In addition, the customer is completely relaxed at home and will listen with a more critical ear. F-m stations which duplicate a-m transmissions should be tuned in for comparison purposes. Thus, by switching

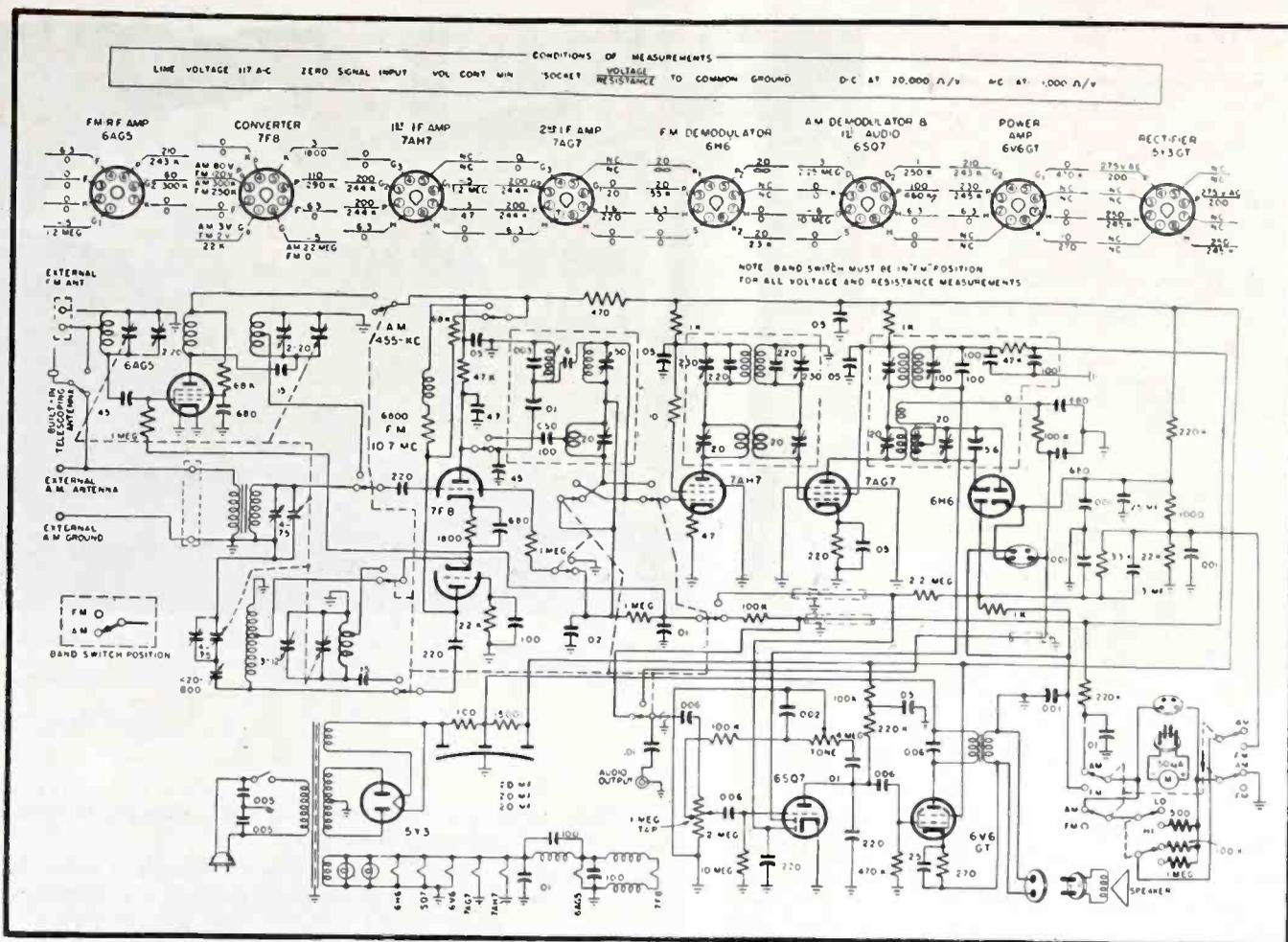


Fig. 1. Schematic of the Bendix 847S test model.

from the a-m signal to its f-m equivalent, the difference in tone quality can be readily demonstrated. The theory that good tone quality is wasted on the average listener has been thoroughly disproved. Experience has shown that good tone quality will sell at all times. In addition, the complete absence of any noise on f-m signals is its most important attribute.

A very dramatic demonstration can also be made via the audio system of a console receiver, if it is a combination with a phono player. As previously noted, there is a plug on the rear of the test receiver which permits playing through the audio portion of a second receiver. It is thus possible to show how f-m can sound

on a larger speaker and perhaps a heavier-duty a-f system.

Most people have heard of f-m, but have only a vague idea of its performance. Many will not go out of their way to listen to an f-m receiver, but when it is demonstrated in their home, they will be found quite appreciative of its many advantages.

Circuit Analysis

In Fig. 1 appears the circuit diagram of the model. The receiver, a standard f-m/a-m model, except for a low-power a-f, has been converted to serve as field strength indicator and

test receiver. Eight tubes are used: 6AG5 f-m r-f amplifier; 7F8 twin triode converter; 7AH7 first i-f amplifier, 7AG7 second i-f amplifier, 6H6 f-m demodulator, 6SQ7 a-m detector and first audio, 6V6 power amplifier, and a 5Y3 rectifier.

Figs. 2 and 3 show the r-f portion of the receiver, exploded into their respective a-m and f-m sections. The circuits shown are a generalized version, and do not follow the actual contours of the original circuit. This has been done to simplify circuit analysis.

In Fig. 2, the r-f section is seen to be a conventional two-gang tuner, using a fixed iron-slug antenna coil with a high-impedance primary. The signal is fed into one section of the twin triode 7F8, while the other section is used as a Hartley oscillator, with the cathode tapped off on the oscillator coil. A series padder in the plate circuit of the 7F8 oscillator provides compensation for the low-frequency end of the b-c band, while compensation for the high end is accomplished through the padder on the tuning capacitor.

Coupling between the two triodes is achieved through the cathodes of the two triodes; the r-f triode cathode returns to ground through the oscillator

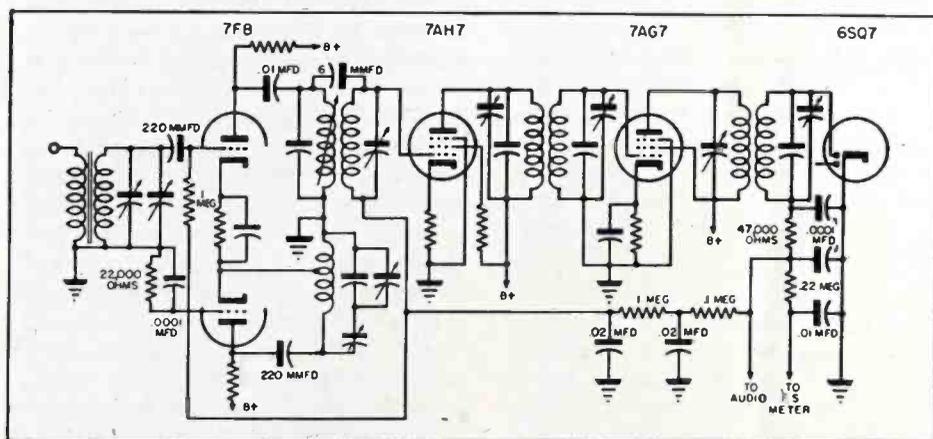
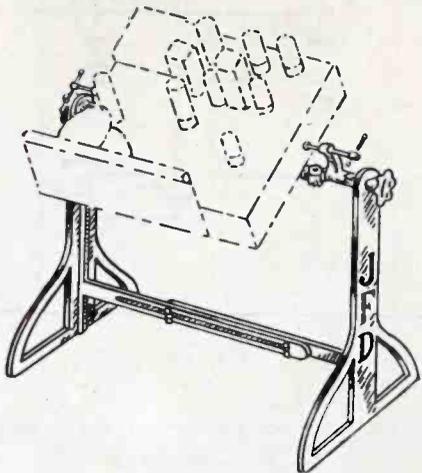


Fig. 2. The a-m portion of the test receiver.

NEW PRODUCTS

JFD CHASSIS HOLDER

A cast-aluminum chassis and phonograph turntable holder, *Repairack*, has been announced by the JFD Manufacturing Co., Inc., 4117 Fort Hamilton Parkway, Brooklyn 19, New York. Stand provides rotation of chassis through 360° in a horizontal plane. Bulletin 5479 contains further details.

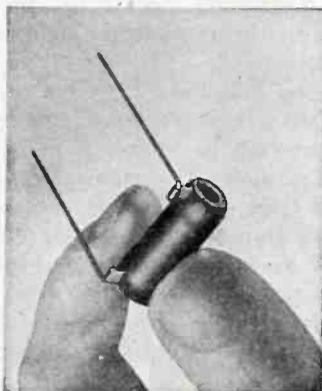


* * *

OHMITE 5-WATT WIRE-WOUND RESISTORS

Five-watt vitreous-enamel resistors (Brown Devil) have been announced by Ohmite Manufacturing Company, 4952 Flournoy St., Chicago. The 5-watt size ($\frac{1}{8}$ " x 1") may be obtained from regular stock in resistance values from 1 to 10,000 ohms. Standard tolerance is $\pm 10\%$.

Bulletin 132 gives complete information.



* * *

KORDLESS KWIKHEAT SOLDERING TOOL

A pencil-type Kordless Kwikheat soldering tool has been announced by the Sound Equipment Corporation of California, Glendale, California.

Unit is placed in operation by screwing heater-receptacle into a Kwikheat electric soldering iron. Forged tellurium copper alloy tip holds approximately 680° temperature for nearly one minute and reheats in approximately 20 seconds by reinserting into the heater-receptacle. The heater-receptacle and the normal soldering tip are interchangeable in the Kwikheat iron.

PRECISION APPARATUS TEST MASTER

A series of 10-20 *Electronic Test Masters*, which includes an *electronic tube performance test circuit* plus a complete push-button operated a-c/d-c set tester, has been announced by the Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.

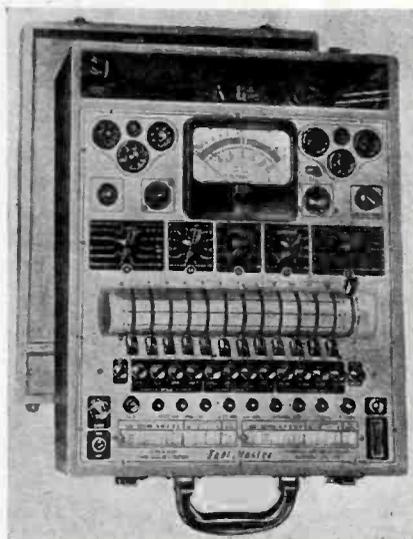
The *electronic tube test circuit* is said to subject tubes under test to appropriately phased individual element potentials which are swept over a complete path of operation, on a sinusoidal time base, encompassing a wide range of plate family characteristic curves. This path of operation is automatically integrated by an indicating meter in *replace—weak—good* terms.

Tube test circuit features direct facilities to accommodate up to 12 elements and tests all standard receiving and low power transmitting tubes including acorns, Noval 9 pins, dual capped h-f amplifiers, etc.

Set tester circuit is push-button operated.

Series 10-20 is available as a portable instrument (10-20-P); for counter as 10-20-C, or rack mounting as 10-20-PM.

Six a-c, six d-c and six output voltage ranges: 0-6-12-60-300-1200-3000. Four self-contained resistance ranges: 0-1000-100,000 ohms; 0-1-10 megohms (no a-c power required). Six d-c ranges: 0-600 microamperes; 0-6-60-300-1200 ma and 0-12 amperes. Six decibel ranges from -20 to +64 db.



* * *

TOBE MINIATURE CAPACITORS

Miniature capacitors molded in flat, mica-filled phenolic cases are now available from Tobe Deutschmann Corporation, Canton, Massachusetts.

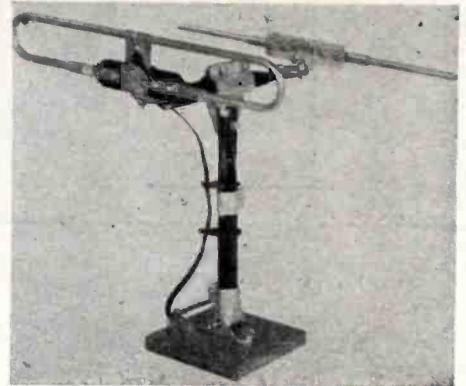
Has rectangular-wafer shape. Dimensions of available types are: .001 and .005 mfd. $\frac{1}{8}$ " x $\frac{1}{8}$ " x $\frac{3}{16}$ "; and .05 mfd. $\frac{1}{8}$ " x $\frac{29}{64}$ " x $\frac{3}{16}$ ". Working voltage of all units is 75 v d-c.

The .001 and .005-mfd units are paper-dielectrics impregnated with mineral oil; .01 and .05-mfd units are paper-dielectric wax-impregnated.

WARD F-M ANTENNAS

Straight or folded dipoles for either the 88 to 106-mc f-m band or the 44 to 88-mc television band, and reflector kits for these models are being made by The Ward Products Corporation, 1523 East 45th Street, Cleveland 3, Ohio.

Antennas are being advertised in national weeklies and newspapers. A special demonstration display has also been produced. Details on the display available from distributors or direct.



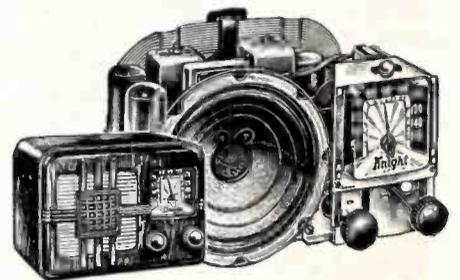
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ALLIED A-C/D-C KIT

A 5-tube a-c/d-c kit, the *Knight Ranger*, has been announced by Allied Radio Corporation, 833 West Jackson Blvd., Chicago 7, Illinois.

Kit, designed to tune the regular broadcast band, uses a 12SA7GT converter/h-f osc.; 12SK7GT i-f; 12SQ7GT det.-avc-audio amp.; 50L6GT audio output; and 35Z5GT rect.

Kit is supplied with all parts, hardware, solder, wire, tubes, loop antenna, walnut bakelite cabinet, and detailed instructions.



* * *

SYLVANIA CAPACITANCE BRIDGE

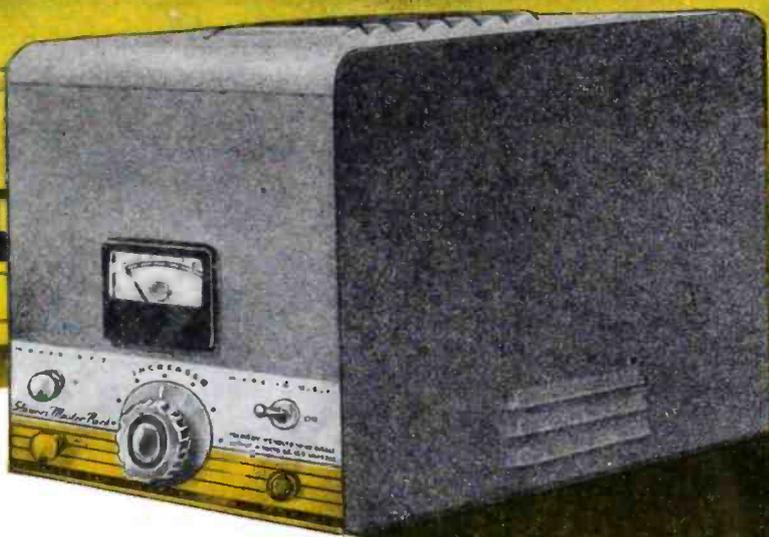
A capacitance bridge, type 125, for measurement of capacitance in multi-electrode systems has been announced by the electronics division, Sylvania Electric Products Inc., 500 Fifth Avenue, New York 18, N. Y. The instrument, particularly useful in measuring interelectrode capacitances in vacuum tubes, provides a range of 0 to 100 mmfd through the use of five multipliers and measurement at 465 kc. Rated capacitance ranges in mmfd are: 0-0.01; 0-0.1; 0-1; 0-10; and 0-100.

Bridge consists of three separate sections including r-f signal generator and power supply; r-f amplifier, detector and

(Continued on page 34)

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to meet your servicing needs



POWER PACK . . . Model 752

CONTINUOUS OUTPUT RATING—6 Volts @ 12.5 Amperes D.C.—5% max. ripple at full load.

INTERMITTENT OUTPUT RATING—25.0 Amperes D.C.
For use with push-button or floor-switch magnetic tuning of all popular car radio receivers.

CONTINUOUS VOLTAGE CHECK—Built-in voltmeter for visual checking of output voltage.

ADJUSTABLE VOLTAGE CONTROL—Tap switch provides selection of proper output voltage for various loads.

CONSERVATIVE RATING—Built with heavy duty components throughout.

HIGH OVERLOAD CAPACITY—Low internal resistance—good voltage regulation provide high output current capability for intermittent loads.

CONTROL PANEL—Readily accessible at front of case.

STURDY STEEL CASE—Featuring mechanical strength—neat appearance.

FOR DEMONSTRATING AND SERVICING

AUTO RADIOS AND
OTHER AUTO
ACCESSORIES

BATTERY CHARGING

OPERATING RELAYS
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REPLACING STORAGE
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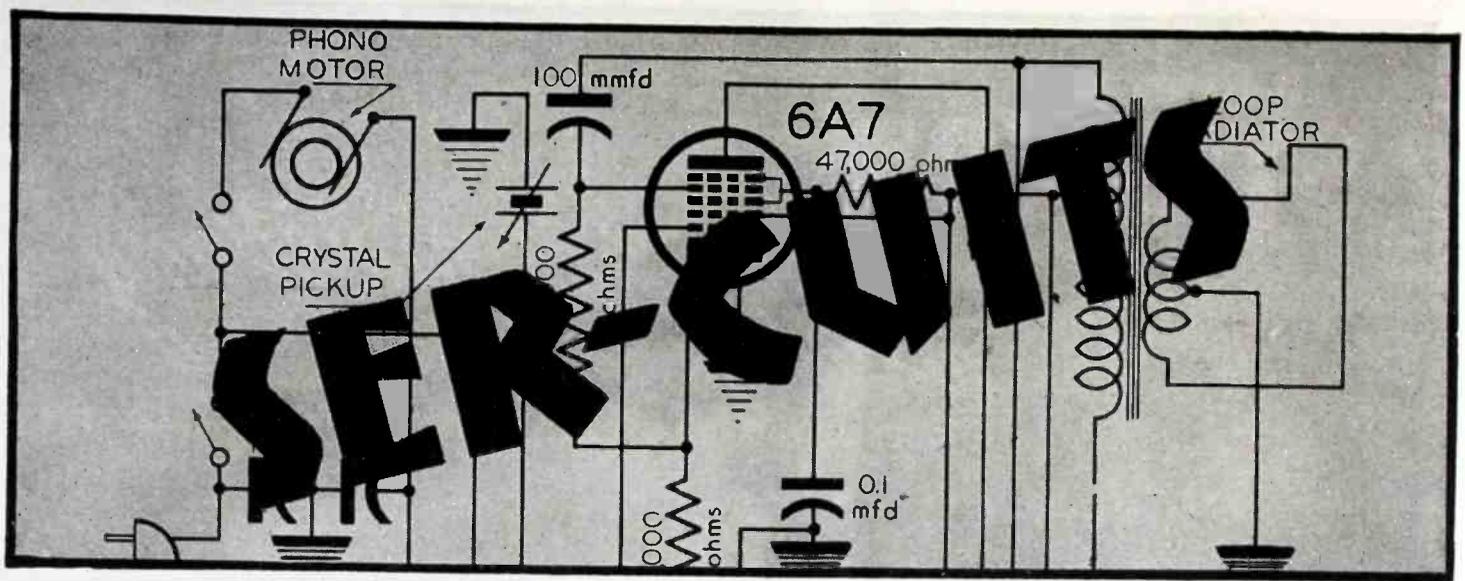
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THE LARGER TYPE CONSOLE receivers with up to 25 watts of audio power, dual speakers, phono provision, and s-w/bc/f-m coverage, are now being featured by quite a few manufacturers. The GE models 41, 42, 43, 44 and 45 are an interesting example of this type of receiver.

In these models (Fig. 1) a 6AG5 is used as an r-f amplifier; 6AK5 as converter; another 6AK5 as oscillator; 6SG7 as first i-f amplifier; 6SV7s in the second i-f amplifier, and f-m limiter /a-m detector stages; a 6AQ7GT as an f-m discriminator and first audio amplifier; 6SC7 as a phono pre-amplifier; 6SQ7 as second audio amplifier;

6AL7GT tuning eye; 6SN7GT as a third audio amplifier and phase inverter; four 6V6GTs in the power output stages and a 5U4G as rectifier.

Short-wave tuning ranges are 9.4 to 9.8 mc, 11.5 to 12 mc and 14.8 to 15.5 mc.

In the r-f end of the receiver variable inductance tuning is employed with the *guillotine* type of tuning. The guillotine tuners, L2, L7 and L9, are used as the tuned circuits for the

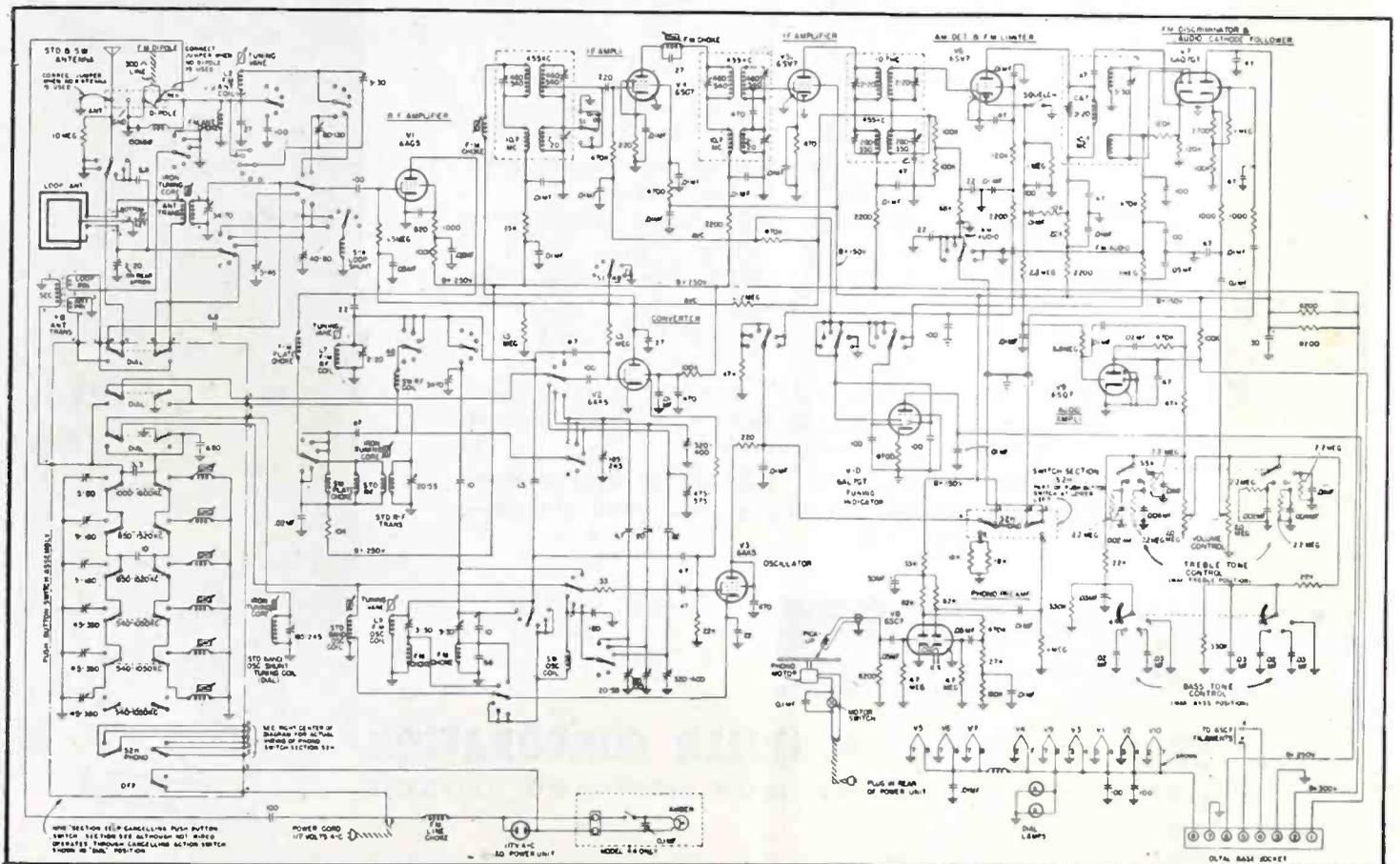
¹Services, SERVICE, April 1947.

Fig. 1. Schematic of the G.E. 41-45 f-m/a-m/s-w receiver.

r-f amplifier, converter and local oscillator in both f-m bands. In the higher frequency band, the tuner is used with only a small shunt trimmer for adjusting distributor capacity and in the low band a higher value shunt trimmer is used to reduce the frequency.

On the short-wave bands, band spread tuning is provided and is obtained in the converter and oscillator circuits, by the use of the guillotine tuners in series with a higher inductance, so that the two inductances together form the *L* part of the short-wave tuned circuit.

The i-f amplifier consists of a composite 455-kc and 10.7-mc circuit. A



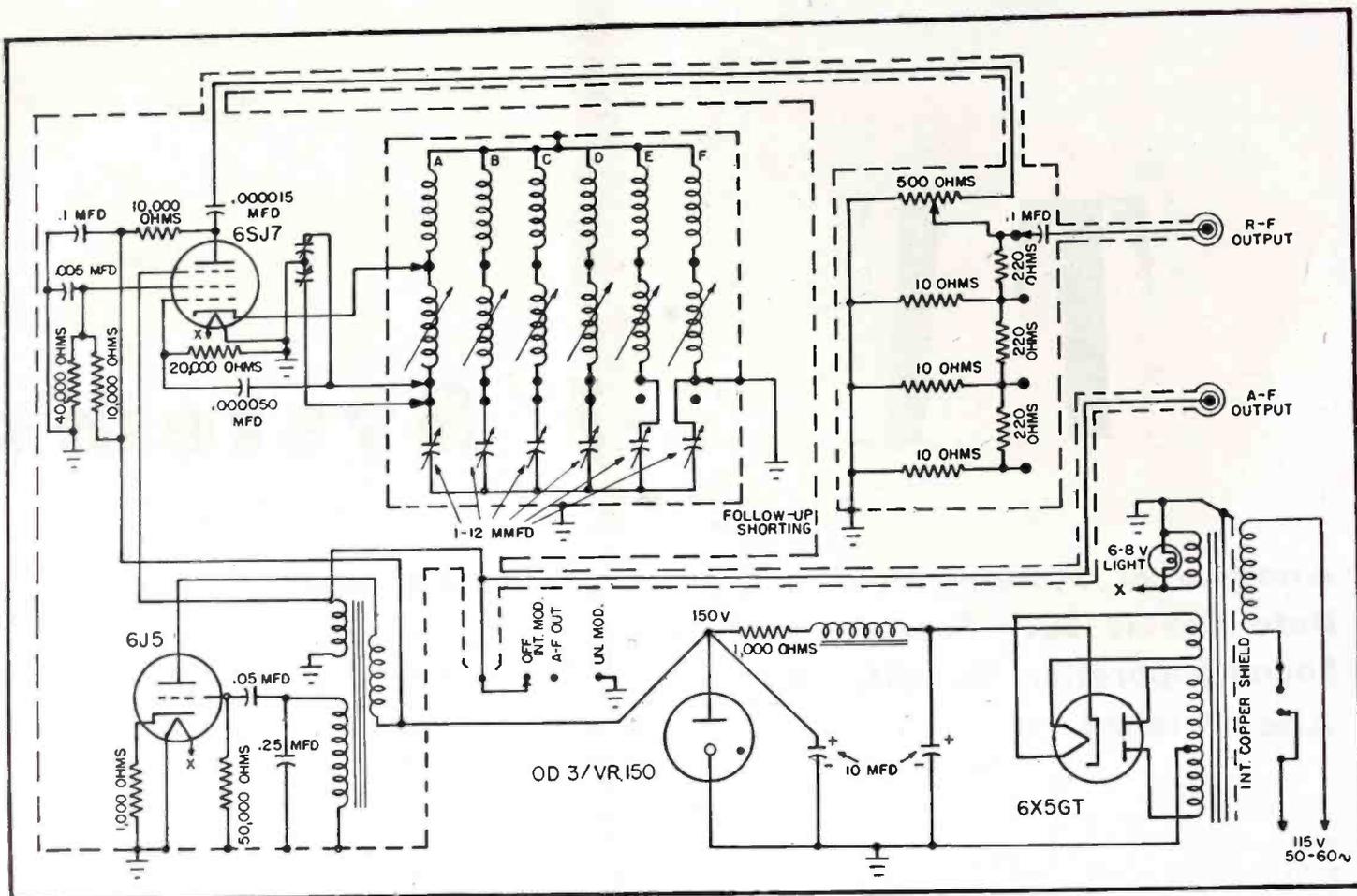


Fig. 3. Triplet 4-tube 75 kc to 50-mc signal generator.

bandswitch provides the changes from a-m to f-m service. This switch, incidentally, shorts out the avc bus when in the f-m position.

The variable reluctance type of phono pickup is used in these receivers. This unit has a d-c resistance of 250 ohms.

When manual tuning is used on the standard broadcast band, an r-f stage, converter and oscillator, all tuned by iron slugs, are switched into the circuit. The r-f stage is not used with push-button tuning. Instead a separate antenna coil is used to couple the antenna and loop directly into the converter. The separate coil is used so as to make the tuning circuit independent of the dial-tuning mechanism so that it may be tuned by trimmers in the push-button assembly.

Signal Generators

In response to many inquiries, we are presenting the circuits of several types of signal generators in this issue. On the cover we have an r-f and a-f type, and in Figs. 2 and 3 appear a beat-frequency a-f unit (Supreme 563) and a 75-kc to 50-mc instrument (Triplet 2432). The Supreme audio oscillator has a continuously variable range of from 30 to 15,000 cps. The

output voltage is obtained through an impedance matching transformer at 250, 500 and 5,000 ohms.

Two 6SK7s are used as r-f oscillators, a 6C5 serves as a mixer tube,

²See July, 1947, SERVICE, for complete analysis of 6-tube Triplet 1632 signal generator.

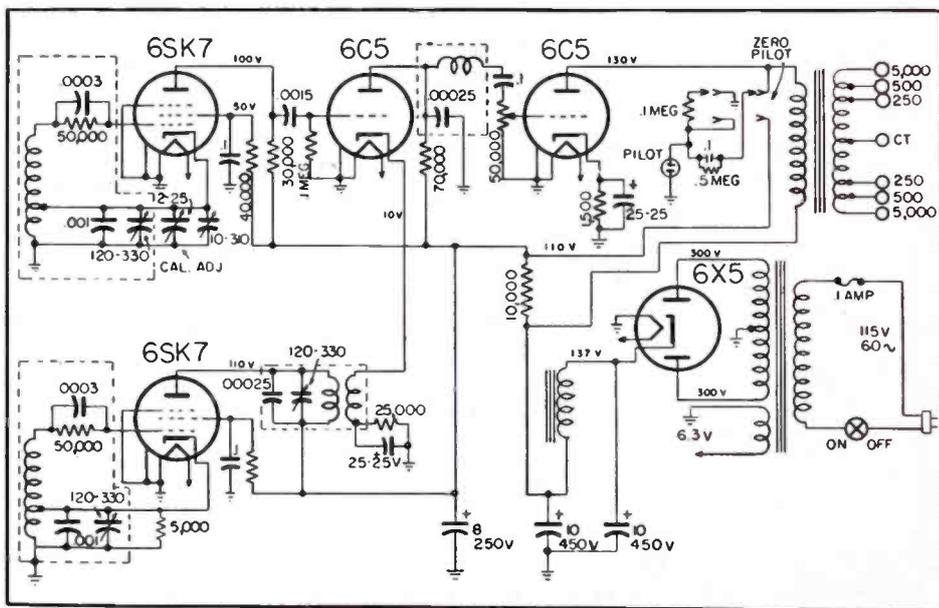
Fig. 2. Supreme 563 audio-generator. All voltages measured with an electronic voltmeter.

another 6C5 is used as an audio amplifier and a 6X5 is the rectifier.

Triplet 2432²

In Fig. 3 appears circuit of a 4-tube signal generator, which uses a 6SJ7 pentode oscillator, and covers a 75 kc to 50 mc range in six steps. The pentode is used as both an oscillator and amplifier by incorporating the oscillator circuit in the control

(Continued on page 55)



TV

I-F Systems

Analysis of Systems Used in Prewar and Latest Model TV Receivers. Data Covers Such Features as Sideband Compensation, Wavetraps and Sound-Separation Circuits. Advantages of Cathode-Coupled I-F Stages Also Detailed.

THE I-F SYSTEM OF THE TELEVISION receiver is complex because of the many functions it must perform and the precautions which must be taken to prevent interference. The primary function of the i-f system is to amplify the picture signal at the output of the mixer to a level which will produce a substantial detected output. It must amplify linearly a band of frequencies from 4 to 5 mc wide to take full advantage of the high-frequency components of modulation.

There are three other functions of the i-f system:

(1)—A means to separate the sound components.

(2)—Prevent interference by the associated channel sound, the adjacent channel sound and in some cases the adjacent channel picture carriers, through specially tuned circuits.

(3)—Compensate for the vestigial sideband method of picture transmission; picture i-f carrier frequency must be detuned 50% to 60%.

The ideal response for a television

by **EDWARD M. NOLL**

*Instructor in Television
Temple University*

receiver at the r-f and i-f ranges is shown in Fig. 1, with the i-f response at the new and the old frequencies indicated. Channel three was taken as a typical example; the picture carrier frequency is 61.25 mc and the sound carrier frequency 65.75 mc. The local oscillator frequency of the television receiver is always higher than the frequency of the incoming signals. Therefore with the new standard i-f frequencies of 21.25 per sound and 25.75 for picture we find the local oscillator frequency on 87 mc. In receivers with the old i-f frequencies (12.75-mc picture and 8.25-mc sound) the local oscillator frequency would be 74 mc. Thus if we trace the dotted line in the plot from the picture carrier frequency of 61.25 we can analyze the i-f spec-

trum. We find, for instance, that the i-f picture carrier frequency is detuned by 50% to 60%, on the i-f response characteristics.

Sideband Compensation

To conserve space in the television channel spectrum and to make transmission of a better definition picture with only a 6-mc channel a system called partial sideband suppression is used. As shown in Fig. 1 the high frequency sideband of the transmitted signal is flat over approximately a 4-mc range, while the low-frequency sideband is only flat over a .75-mc range. A 4-mc component of modulation nevertheless is transmitted by the system with only a 6-mc channel. Normally transmission of a 4-mc modulation component with symmetrical sideband transmission would require an 8-mc channel. It is apparent that a component of modulation less than .75 mc will have a high sideband and a low sideband, while a component of modulation greater than .75 mc will only have a high frequency sideband. Thus the video detector in the television receiver is excited by two sidebands for components of modulations less than .75 mc and for only one sideband for components of modulation in excess of .75 mc. To compensate for this non-linear detection it is necessary to start tapering the i-f gain at about a .75-mc point on the high-frequency side (actually this will be the low frequency side of the i-f spectrum because the local oscillator is

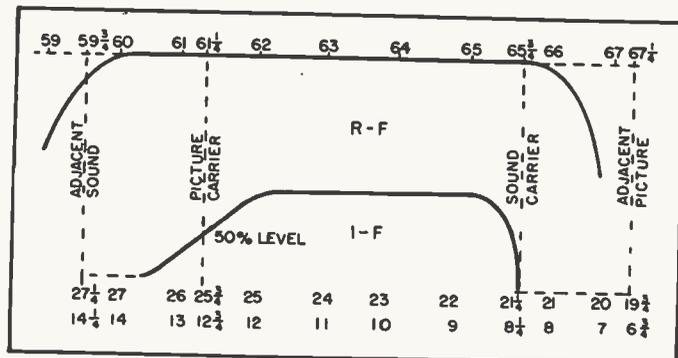
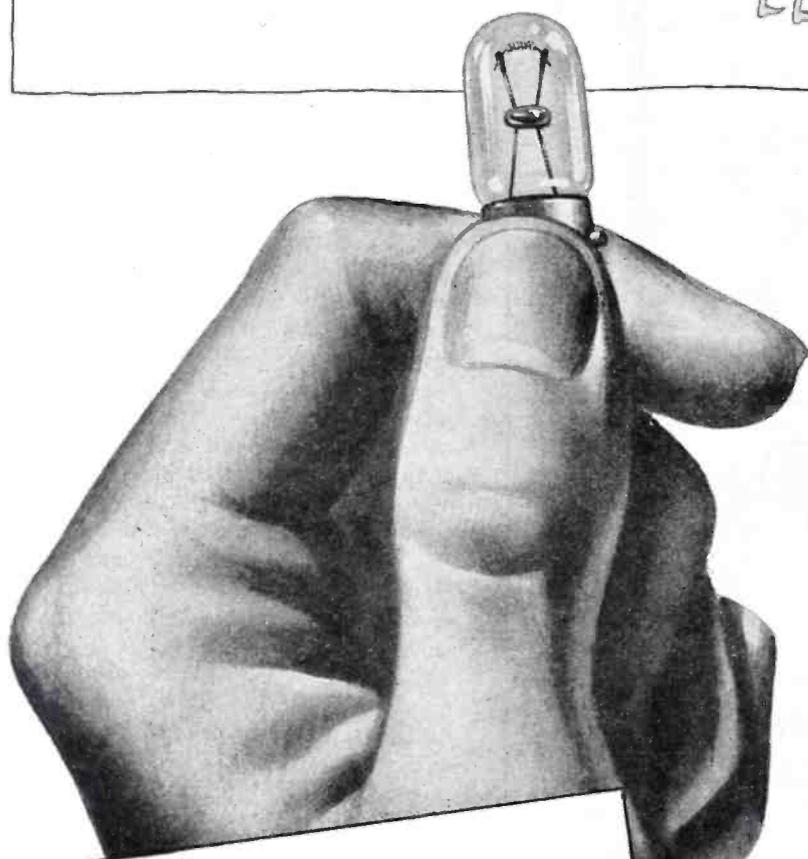


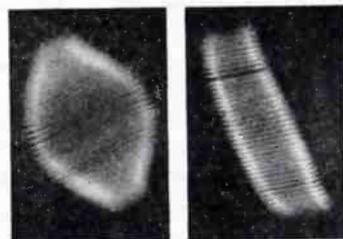
Fig. 1. Ideal r-f and i-f bandpass characteristics. Local oscillator frequency for new i-f frequencies is 87 mc, while the old i-f frequency is 74 mc. Values shown are in megacycles.

It's the shape
of the shimmy
that counts!



Radio
Dial Lights

CERTAIN radio frequencies cause considerable vibration in the filament and lead-in wires of a dial lamp. Testing old style lamps, General Electric research engineers found that the difference in natural frequency between the coil and the lead-in wires produced a destructive whipping action which eventually tore the filament apart. By "matching" these frequencies in the new lamps, they permitted the filament to vibrate without bending—and eliminated a common cause of lamp failure.



Old Filament New Filament

This example is typical of the constant research which makes G-E miniature lamps the leaders in quality and service. Features like these assure satisfied customers and satisfying profits when you sell G-E lamps for radio dial lights and similar uses:

1. Dependable, trouble-free performance.
2. High level of maintained light output.
3. Low current consumption.
4. Long life.
5. Profitable to handle.
6. Greater dealer acceptance.

FOR INFORMATION on prices and types of G-E miniature lamps, see your nearby G-E Lamp Office. Or write to General Electric Co., Div. 166, S-2, Nela Park, Cleveland 12, Ohio.

G-E LAMPS
GENERAL  ELECTRIC

tuned to a higher frequency than the incoming signal). Thus for a fixed amplitude modulation component, the detected signal will have the same amplitude for a low-frequency component of modulation, as for a high-frequency component of modulation. To produce the properly tapered i-f gain it is necessary that the picture i-f carrier be down about 50% at peak amplitude.

Wavetraps

Inasmuch as the picture i-f bandpass is broad it is very susceptible to interference from other signals, with frequencies in the bandpass or near to the supposed ends of the bandpass. For example, the high-frequency limit of the received r-f signal produces an i-f sideband component of 21.75 mc, which is only .5 mc away from the i-f sound carrier frequency of 21.25 mc. The i-f system must be capable of amplifying the 21.75-mc sideband component and still have no response to the 21.25-mc sound which would put an interfering bar modulation pattern on the screen. A wavetraps is used to completely reject this sound carrier signal and to absorb any trace of sound signal in the picture i-f system.

Another source of interference in the television i-f system is signal which originates at the adjacent carrier sound frequency. For example, if the receiver is set on channel *three*, the local oscillator is tuned to 87 mc. Now if there is a station telecasting on channel *two* its sound carrier frequency of course is located at 59.75 mc, which is only .25 mc away from the frequency limit of the channel to which you are tuned. Thus if the receiver is a bit sensitive to 59.75 mc this adjacent sound carrier will enter the receiver and beat with the local oscillator frequency (tuned to 87 mc) and produce an i-f signal in the plate circuit of the mixer. This undesired i-f frequency will be, of course, 87 mc minus 59.75 mc or 27.25 mc. As shown in Fig. 1, 27.25 mc is very close to the end of the high frequency limit of the i-f bandpass. Consequently, if the i-f system is the least bit sensitive to 27.25 mc, modulation from this adjacent sound signal will reach the video detector. It is necessary, therefore, that we also have tuned wavetraps in the picture i-f system tuned to 27.25 mc to block these frequencies from the video detector.

Occasionally there is interference from the adjacent channel picture signal on the channel immediately above the channel to which the receiver is tuned. Thus if the tv set is tuned to channel *three*, the oscillator tuned to 87 mc and if the receiver is the least

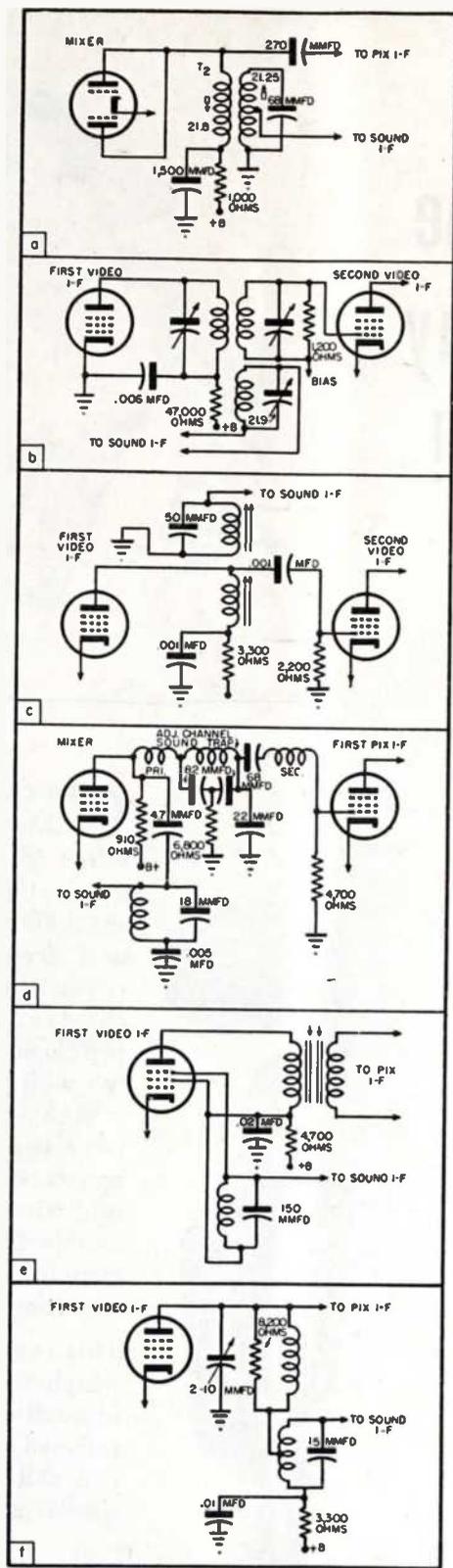


Fig. 2. Picture and sound separation systems of RCA 630-TS (a); G.E. 801 (b); Viewtone VP101A (c); RCA TRK-5 (d); G.E. HM 171 (e) and Philco 10-TK (f).

bit sensitive to channel *four* when tuned to channel *three*, a picture carrier frequency of 76.25 mc will enter the receiver and beat with the local oscillator to produce an i-f frequency of 19.75 mc. It is necessary in some receivers to employ a 19.75-mc trap to reject this adjacent channel picture signal. In summation, the three traps in the picture i-f system must be tuned

to the sound i-f frequency, adjacent channel sound i-f frequency, and adjacent channel picture i-f frequency.

Sound Separation

In the television receiver, tuned circuits are used to separate the sound and picture i-f carriers and sidebands. The sound i-f is, of course, very narrow with respect to the picture i-f channel and consequently, a rather sharply tuned circuit can be used to remove the sound from the output mixer or one of the i-f stages. In Fig. 2 appear a number of picture and sound separating systems. In the new RCA 630TS receiver (a), which uses a single-tuned, stagger tuned i-f system, the sound is taken off in the converter transformer. The sound is taken off in a sharply-resonant circuit tuned to the sound carrier frequency and coupled near to the regular plate load inductor of the mixer. Thus a proximity tuned circuit is used to absorb the sound carrier frequency and sidebands which are present in the output of the mixer.

In the new G. E. 801 receiver, (b), sound is again picked up with a proximity tuned circuit. In this case the sound signal is withdrawn from the secondary of a double tuned i-f transformer between the first and second picture i-f stages. Of course, in all cases when the sound is removed it is again further amplified in a sound i-f system. However, the sound i-f bandpass is not very broad and only one or two stages are necessary before the signal can be applied to the limiter and discriminator of the sound channel. The Viewtone VP101A receiver, (c), also uses a proximity-tuned circuit which is coupled to the single-tuned transformer between the first and second picture i-f amplifier. In the RCA TRK television receiver, (d), proximity-tuned circuits were not used to absorb the sound carriers. Instead energy was coupled directly through a small capacitor from the plate of the mixer output directly to the sound tuned circuit. This capacitor was only a few mmfd and did not seriously load the output of the mixer on the regular i-f frequencies of the picture.

One of the most novel methods of mixer and sound separation were used by G. E. in their HM 171, (e), and 90 receivers. In this system two parallel-tuned circuits are present in the first i-f stage, one in the suppressor and another in the plate circuit. Thus the suppressor of the i-f stage serves as a plate and, of course, across its tuned circuit sound signal is developed and coupled to a sound

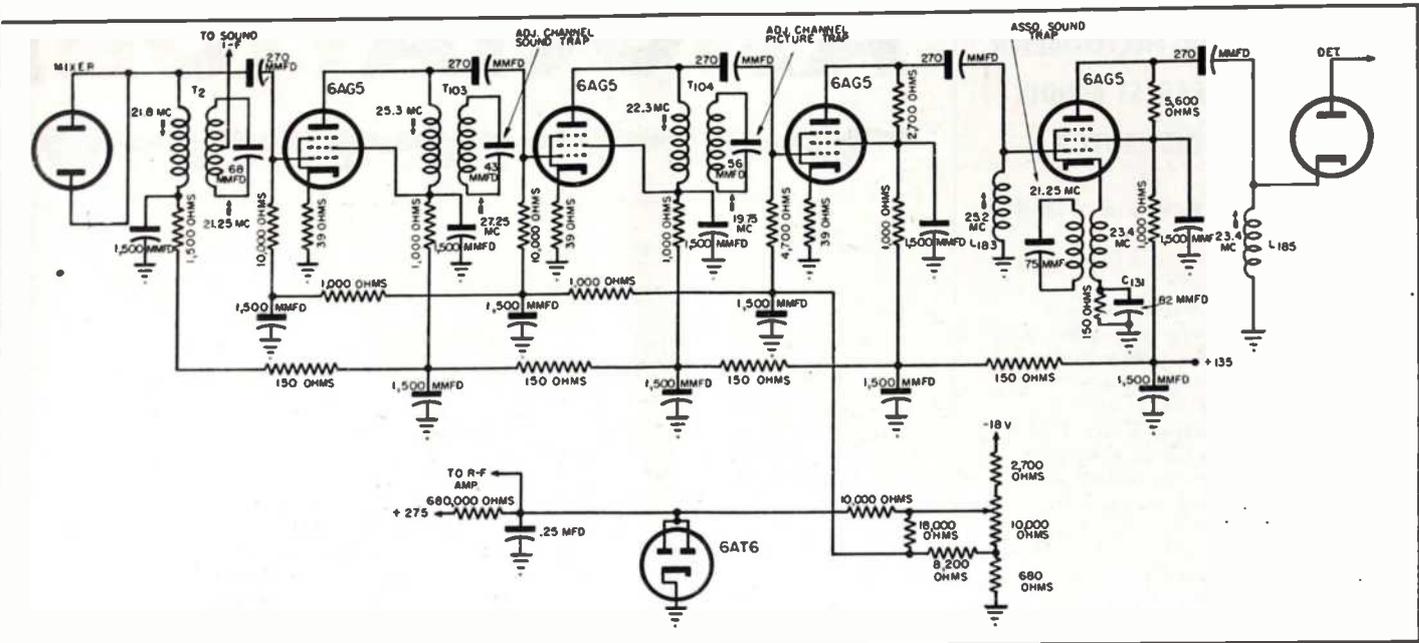


Fig. 3. I-f system of the RCA 630-TS.

i-f system. The picture i-f and sideband frequencies are developed across the plate tuned circuit as usual. It must be remembered that in all of the picture and sound separation systems we do not completely remove one signal from the other. Here, in the first step, in picture sound separation, the picture or the sound is made to dominate in a given tuned circuit. Thus in the sound take-off tuned circuit the sound dominates the picture, and in the picture-tuned circuit, from which the sound was absorbed, the picture dominates the sound. In subsequent stages, this ratio is raised and the picture more and more dominates until we reach a point where the picture is the only signal present in the picture i-f change. Likewise, in just a few sharply-tuned circuits the sound dominates the picture in the sound i-f change. In the Philco 10TK television receiver, (f), two tuned cir-

cuits are present in the plate circuit of the first i-f stage. These two tuned circuits are effectively in series, one of them tuned to the picture carrier frequency and the other to the sound-carrier frequency. They present a maximum impedance to the frequency to which they are tuned and a lower impedance to the other frequencies. Thus in one tuned circuit picture frequency dominates, and in the other sound dominates.

TV Receiver I-F Systems

The picture i-f system of the RCA 630 TS receiver is shown in Fig. 3. This receiver employs a stagger tuned i-f system with single tuned transformers. Four miniature 6AG5 tube i-f stages are used. Each tuned circuit is resonant to a slightly different frequency producing the characteristics shown in Fig. 4. The composite

response of each of the individual tuned circuits produce the desired overall response characteristics. It can be seen that the converter transformer T₂ and the plate tuned circuit of the first picture i-f are tuned near the extremities of the bandpass of the i-f system. The remainder of the tuned transformers are tuned at intermediate frequencies, producing the desired overall characteristics. The sound i-f takeoffs is a tuned circuit placed close to the plate circuit of the converter transformer. The first sound trap, which is an adjacent channel sound trap, absorbs this frequency from the primary of transformer T₁₀₃. A proximity trap, associated with transformer T₁₀₄, absorbs the adjacent channel picture signal from the i-f system. The associated channel sound trap is a proximity trap in the cathode circuit of the fourth picture

(Continued on page 46)

Fig. 5. The i-f system of the G.E. 801.

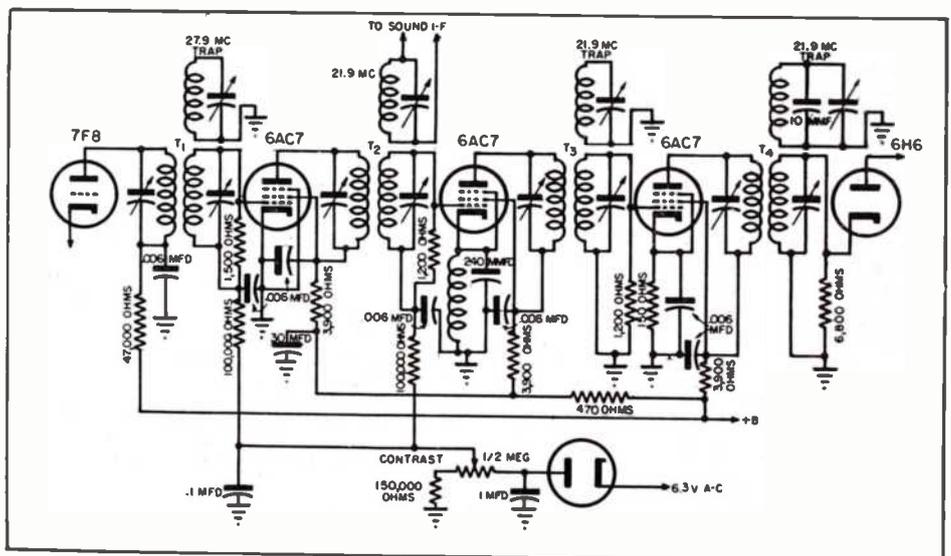
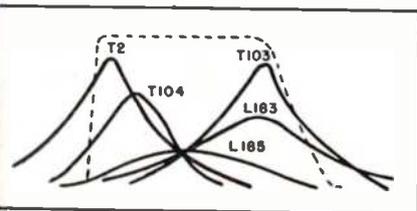


Fig. 4. Stage and overall response curves of the 630-TS.



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 Sacramento, Calif., Graybar Electric Co., Inc.
 St. Louis, Mo., Crest Corporation
 St. Paul, Minn., Kelley-How-Thomson Co.
 Salt Lake City, Utah, Graybar Electric Company, Inc.
 San Diego, Calif., Graybar Electric Co.
 San Francisco, Calif., Graybar Electric Company, Inc.
 Seattle, Wash., F. B. Connelly Company
 Shreveport, La., Interstate Appliance Company
 Sioux City, Ia., D. K. Baxter and Company
 Spokane, Wash., F. B. Connelly Company
 Springfield, Mass., Edlee Distributors, Inc.
 Syracuse, N. Y., Edward Joy Company
 Tampa, Fla., Florida Radio & Appliance Corp.
 Toledo, O., The Buckeye Appliance & Sports Equip. Co.
 Washington, D. C., Mid-Atlantic Appliance Distributors
 Wichita, Kan., Loya Distributors

ASSOCIATIONS



Radio Technicians Guild of Rochester

THERE WILL BE a two-day meeting of the Guild on November 15 and 16 at the Seneca Hotel, Rochester, during which several interesting papers on f-m, television, tubes and business management will be presented. Meetings will be called to order at 11 A.M.

The annual dinner will be held on Saturday, November 15.

The Saturday session will be devoted to a first organization meeting of the State of New York Federation of Radio Technicians.

All Service Men in the New York area are urged to attend these sessions. For further details write to the Radio Technicians Guild, 703 Temple Building, Rochester 4, N. Y.

Long Beach Radio Technicians Assn.

A LETTER FROM HARRY E. WARD, in charge of public relations of RTA, discloses that Edward Edison of RCA Labs. gave an interesting talk on television during the last meeting.

A drive is being made for old sets for use in apprentice training at schools and boys clubs.

Wes Farrell is president of the association; John J. Sawyer, vice president; Verne Preston, secretary and Clare Reese is treasurer. Directors include P. N. Nibbelin, M. E. Mattox, H. M. McNeill and R. J. Hayden.

The address of the association is P. O. Box 4085, Long Beach 4, Calif.

Radio Technicians Assn.

A MEMO FROM SCOTT ADAMS of RTA, 314-316 11th Street, Huntington, W. Virginia, provides interesting membership-qualification data. To qualify for membership in the association, it is necessary to have two years experience in the repairing of home or car receivers and have access to such test equipment as tube testers, vtvm or multimeter and a signal generator to cover 30 mc or fundamentals. The prospective member must also take an examination on 10 written questions and receive a passing grade of 80%.

The meetings held monthly, third Thursday of each month, provide discussions of newest developments and methods of servicing.

All members advertise in local 'phone directories.

The by-laws of the association include a pledge to protect customers from being overcharged or not giving justice on work rendered.

Radio and Electronic Technicians Assn. of Indiana, Inc.

ELBERT LEAR, secretary-treasurer, reports that a twice-a-month newspaper advertising campaign is now being run by the association. The ads, two-column units, list the members.

Present officers of the association are John Lackman, president; John Davies, vice president; Charles Palmer, publicity director. The board of directors include Robert Tate, Harold Gibson, Carlton Kindig, Charles Palmer and Claude High.

A technical program similar to that conducted last year is planned for the winter. Last year, Arthur J. Quigley, assistant professor of electrical engineering at the University of Notre Dame, held classes on the use of the oscilloscope.

TEN YEARS AGO

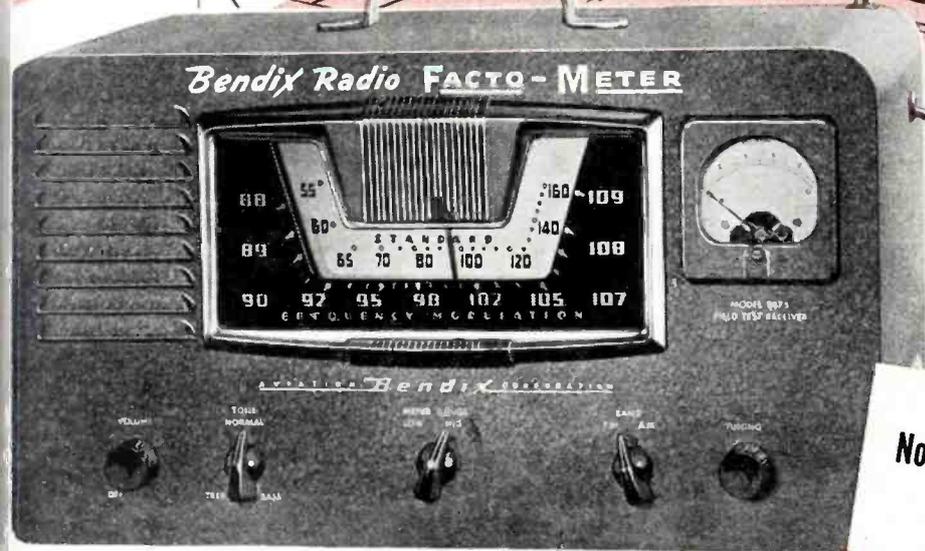
From the Association News page of SERVICE, December 1937.

MORRIS KNOX was president of the Radio Service Association of California. His inaugural address, as president, was entitled "How To See New York In Two Days and How To Get Lost in the RCA Victor Factory at Camden". . . . PRSMA was host to Ed Hayes, field technical engineer of G. E., who explained the principles of degeneration incorporated in the G. E. receivers selling under the trade name of "Tone Monitor". In his talk, Hayes pointed out that the circuit, using a 6L6G, provided a gain of 4.5. . . . The Second Annual RTG Exposition and Convention was held at

Boston in the Hotel Lenox on September 20, 21 and 22. A series of interesting talks were presented and displays of test equipment were on view at the hotel. . . . George Conner of Sylvania presented a talk before the Association of Radio Service Engineers of Buffalo. Ted Telaak, president, and Tony Schreide were delegates from the association to the dinner held by the Jamestown Association at the Lenhart Hotel at Bemus Point. Sam Scheer of Philco presented a talk at this meeting and was interrupted by the news that Mrs. Scheer had just given birth to a 7-pound baby boy.

THE NEW Bendix Facto-Meter

OPENS THE DOOR TO GREATER FM SALES



EXPLAINS FM! . . . SELLS FM!

Now you can demonstrate clearly the vast difference in FM reception—right in the prospect's home! The Facto-Meter provides both AM and FM reception enabling the listener to make a direct comparison. Furthermore, you can show where the FM set should be installed for maximum power and efficiency—often making possible the elimination of an expensive antenna installation. Here's the ideal way to *Sell* FM by *Showing* FM! See it at your nearest Bendix Radio Distributor!

AVAILABLE TO ALL RADIO DEALERS EVERYWHERE FROM BENDIX DISTRIBUTORS . . . COMPLETE WITH SPECIAL COVER, FM MERCHANDISING KIT AND SELLING AIDS.

Now You Can Show Your Prospects IN THEIR OWN HOME . . .

1. Why they ought to have FM radio!
2. How it sounds right in their own home!
3. Whether they need an aerial!
4. Where to place the FM set for maximum range and reception!



BENDIX RADIO DIVISION of
BALTIMORE 4, MARYLAND



TUBE News

TWO NEW MINIATURE tubes, the 6BA6 and 6BE6, will soon be found in the r-f and converter stages of many a-m/f-m receivers. These tubes, briefly described in this section, in the March issue of SERVICE, are quite unique in their construction.

The 6BA6

The 6BA6, a high-frequency pentode, has a double-helical heater coil to minimize difficulties with hum. A reduction in microphonics is obtained by an inverted pinch-weld which is used in making the cathode assembly. This method of construction is accomplished by drawing an embossing on the cathode against the under side of the mica and pinching the portion of the sleeve above the mica. Because the cathode is free to slide in the bottom mica, it cannot become bowed due to expansion. To take maximum advantage of the coated area of the cathode, the control grid is formed to the shape of the cathode. This formed grid permits greater grid-to-cathode spacing for a given transconductance and, consequently, the possibility of grid-to-cathode shorts is reduced.

The 6BE6

The 6BE6 is a single-ended, glass, miniature converter, and is equivalent

in most characteristics to the 6SA7. In construction, it is similar to the 6BA6 in that it has a formed oscillator (1) grid, an inverted and pinched cathode and a double-helical heater coil.

F-M Band Operation

To study the characteristics of the 6BA6 and 6BE6, a test setup, as shown in Fig. 1, can be used.

In this circuit, the converter is followed by an i-f amplifier having two 6BA6 stages. The i-f system, which has a bandwidth of approximately 200 kc centered at 10.7 mc, is terminated by a square-law, vacuum-tube voltmeter. The voltage gain from the first i-f grid to the voltmeter is 1,750. The overall i-f gain, measured from the converter grid, is 18,000. The first i-f transformer is over-coupled to obtain a substantially uniform gain throughout the 200-kc band. The second and third transformer are approximately critically coupled.

It is desirable, of course, to obtain performance data both with and with-

out the r-f stage. In either case, the signal is applied to the signal circuit through a 300-ohm resistor. The effects of induced oscillator voltage in the signal circuit, interaction between oscillator voltage in the signal circuit, interaction between oscillator and signal circuits, and input loading can be observed with and without the r-f stage. Likewise, the improvement in signal-to-noise ratio, selectivity, and image rejection due to the use of an r-f stage can be ascertained. When the signal is applied (through 300 ohms) to the signal-grid (grid 3) circuit of the converter, the measured gain from the terminals of the signal generator to the first i-f grid is 5.5. The equivalent noise is 7 microvolts. For optimum performance, the signal grid is placed $1\frac{1}{2}$ turns from the ground end of a coil of $1\frac{3}{4}$ turns. The antenna connection is made at $1\frac{1}{4}$ turns on the same coil.

When the 6BA6 r-f stage is added and the circuit adjustments necessary for stable operation are made, the measured gain from the signal generator to the first i-f grid will be 70. The equivalent noise is approximately 5.8 microvolts, or 17 db above the thermal noise of the 300-ohm resistor. Noise-free reception may properly be assumed when the signal is at least three

Fig. 2. The warm-up capacitance shift of the 6BE6 in the f-m band; Oscillator frequency, 110 mc and signal frequency, 100 mc. ΔC = effective capacitance of oscillator LC circuit.

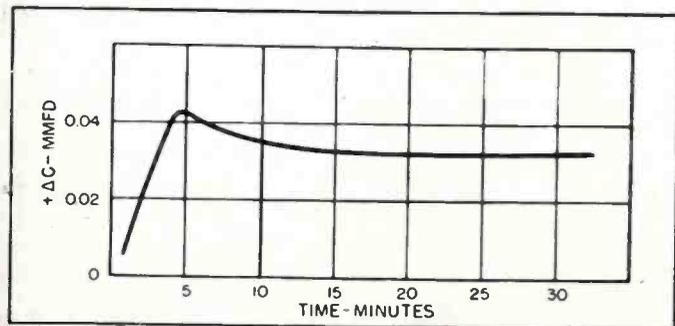
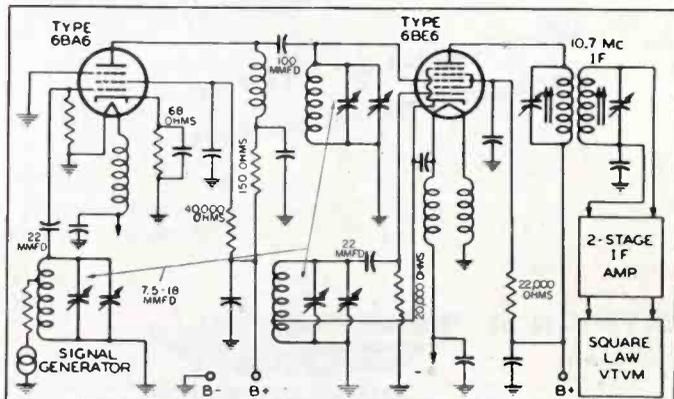


Fig. 1 (left). Self-excited 88 to 108-mc converter circuit used to study the characteristics of the 6BE6 and 6BA6 tubes.

AMPHENOL

TWIN-LEAD TRANSMISSION LINE AND ACCESSORIES

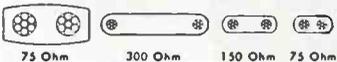
Assure low-loss FM and television antenna installations

• Expert electronic technicians quickly recognized the excellence of Amphenol Twin-Lead and accessories for FM and television lead-ins.

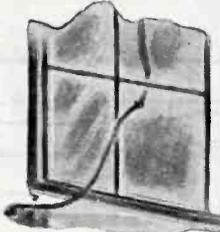
Designed to transmit signals with minimum loss, Twin-Lead is durable, simple to install and inexpensive. Its extruded polyethylene dielectric is full thickness edge to edge, and it is available in four impedances: 300, 150 and 75 ohm for lead-ins; and in a 75 ohm impedance for transmitting.

The uniform conductor spacing and dielectric thickness of Amphenol Twin-Lead holds noise pickup to a low level, and insures uniform impedance so important in eliminating ghosts in the reception of television. It also simplifies matching antenna and transmission line. Below are shown actual cross section diagrams of all four sizes of Twin-Lead, and more detailed information on Amphenol Twin-Lead accessories.

Radio Amateurs insist on Amphenol Twin-Lead for transmitting antennas.



AMPHENOL CLEAR PLASTIC WINDOW PANE ends broken glass and drilling through sash. It is easy to cut to size and drill, ordinary woodworking tools do the job. Of polystyrene, its dielectric properties are ideal. Available in 12"x16" sheets in 1/16 to 1/4 inch thicknesses.



AMPHENOL SILICONE COMPOUND minimizes changes of impedance, and maintains high surface resistivity, on radio transmission lines. It causes surface moisture to break up into isolated drops. A thin coating does the job. Available now in one-ounce tubes (enough to last 6 months to a year on average antenna installations).

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COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS



Amphenol Polystyrene Insulators and Line Spreaders

Screw Eye Insulators with polystyrene insert are available in two types: one for Twin-Lead, one for coaxial cable. Twin-Lead types do not have to be strung. You merely insert the conductor in the slot, turn the insert and squeeze the screw eye closed with pliers. The No. 14 wood screw on both types is three inches long.

Stand-Off Insulators are of Amphenol low-loss polystyrene. Offset mounting hole permits easy mounting. Holds Twin-Lead in a strong, permanent grip.

Line Spreaders are used for separating feeder lines, and for constructing folded dipoles from wire. They are light weight and easy to use. Set screws keep the wires firmly in place. Wire holes are .085" D. Available for 2, 4, and 6 inch line spacing.

New Products

(Continued from page 20)

vacuum tube voltmeter; and associated switches, controls and 500 microampere meter indicating bridge balance. Tube complement includes 5Y3G, 7A6, 7B4, 6OC3 and two 7A7.

IRC FUSE RESISTORS

A wire-wound resistor which serves as a resistor and a fuse has been developed by International Resistance Co., Philadelphia. The difference between the two functions is one of power level. At a relatively low level the unit functions as an ordinary resistor, at a higher power level

it functions as a fuse and open circuits when the wire burns out.

Resistor, type OWA, is custom designed to individual circuit requirements, and is available in RMA values from 15 to 150 ohms. Power rating is one watt.

BLILEY CRYSTAL OSCILLATOR

A crystal-controlled oscillator (CCO model 2A) for 2-6-10-11 meters has been announced by Bliley Electric Company, Erie, Pennsylvania. Oscillator employs a

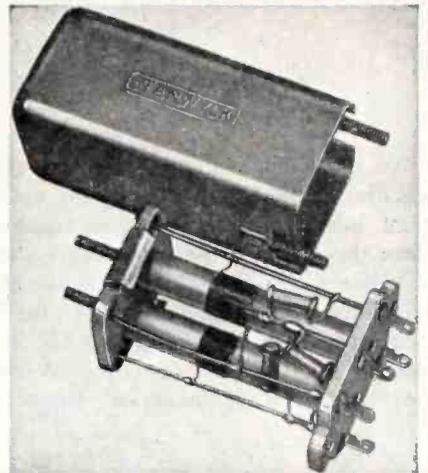
6AG7 tube. Has direct output on 6-10-11 meters and ample output to drive tripler stage in 2 meters. Uses Bliley AX2 20-meter crystals for output on 10 and 11 meters, and Bliley AX3 crystals for 6 and 2 meter operation.

Full details available in bulletin No. 34.

STANWYCK F-M TRANSFORMERS

A line of 10.7-mc f-m transformers has been developed by the Stanwyck Winding Company, 102 South Landers Street, Newburgh, New York.

Iron cores used. Ceramic fixed capacitors are of the compensatory type. Uses separate ceramic tubes for primary and secondary windings.



STROMBERG-CARLSON INTERCOM SYSTEM

A paging and intercom system, the IM-3, has been announced by Stromberg-Carlson Co., Rochester 3, N. Y.

The master unit of the intercom is built into a telephone instrument base and handset and derives its power from a remotely located amplifier which it controls.

ASSOCIATED RESEARCH OHMMETER

An ohmmeter, model 246, for checking resistors from one ohm up to 100,000 ohms on four overlapping scales of 0-100 ohms, 0-1,000 ohms, 0-10,000 ohms, and 0-100,000 ohms, has been announced by Associated Research, 231 South Green Street, Chicago 7, Illinois.

Bulletin 350 contains further data.

RCA TEST OSCILLATOR

A test oscillator, type WR-67A, which provides three fixed frequencies, has been developed by the RCA test and measuring equipment section. A 455-kc position is provided for aligning the i-f channels, and 600-kc and 1500-kc signals for the alignment of r-f and local oscillator circuits.

Contains a compensated Hartley-type oscillator which is said to maintain stable operation over frequency range of 100 kc to 30 mc. Has an internal source of modulation of 400 cycles. The degree of modulation is adjustable up to 50%. A jack is provided for external amplitude modulation. When it is used, the audio oscillator serves as an amplifier.

Test oscillator also has a signal injection probe to simplify the application of i-f, r-f, or audio test signals to any part

of receiver without the use of clip connections.

Four-step attenuator levels, in addition to fine adjustment, provide continuous control of r-f output from 4 microvolts to one volt without having to change leads.

Test oscillator also has a line filter and dual shielding to reduce r-f leakage, both through the a-c line and through the case. Miniature tubes are used.

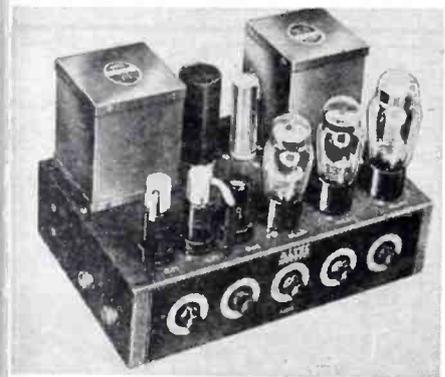


* * *

ALTEC LANSING AMPLIFIER

A 15-watt amplifier, A-323B, with two high-impedance inputs, for phono and receiver, has been announced by Altec Service Corp., 250 W. 57th St., New York 9, N. Y.

Amplifier features built-in equalization to operate direct from the G.E. variable reluctance or Pickering magnetic pickup cartridges; a treble tone control consisting of a low-pass filter adjustable by steps to give sharp cut-off of noise frequencies; and a hum-balancing potentiometer.



* * *

AEROVOX MOTOR CAPACITORS

A line of bracket-mounted, armored motor-starting capacitors, series SRVC, has been announced by Aerovox Corporation, New Bedford, Mass. Has a steel (Continued on page 36)



Lick any RADIO REPAIR JOB

... in LESS TIME ...
with LESS WORK!



Written by Alfred A. Ghirardi, servicing expert and author of the most widely used books in radio training history.

and a lot MORE PROFITABLY!

Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK quickly helps you diagnose and repair common troubles in over 4800 receiver models and automatic record changers of 202 manufacturers. **ONLY \$5**

4 radio repair jobs out of every 5 can be handled as easily as falling off a log—without tedious testing. Try this servicing short cut that really works—the one that pays for itself in time saved on the very first job! There's no magic about it. Just common sense. In this big 4 lb., 744-page manual-size TROUBLESHOOTER'S HANDBOOK, Ghirardi supplies you with a carefully tabulated and indexed compilation of the common Troubles (and their Remedies) that occur in over 4800 models of home radios, auto radios and automatic record changers of 202 manufacturers—the data that account for well over 90% of all service work today! Clear instructions tell you exactly WHAT the trouble is likely to be—exactly HOW to fix it. No guessing or lost time!

NO OTHER HANDBOOK LIKE IT

This priceless Trouble Case History section of the HANDBOOK eliminates the need for all troubleshooting and laborious testing on 4 jobs out of 5. Tells you HOW to make the necessary repairs QUICKLY . . . SIMPLY . . . DIRECTLY! Ghirardi passes on to you the priceless experience from thousands of hours of tedious troubleshooting so you can save MORE THAN HALF your precious time and do your work Easier, Faster, more Profitably.

NOT A STUDY BOOK!

Over 300 additional pages contain parts repair data, diagrams, tube charts, tuning alignment and i.f. transformer data for more than 20,000 receivers, complete RMA color codes, and dozens of graphs, diagrams and other service data, all designed to help you repair ANY RADIO EVER MADE easier and twice as fast! You get all this for only \$5 complete!



744 PAGES MANUAL SIZE

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Trouble Case History repair instructions on over 4800 models of all these makes:

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| Belmont | Philco |
| Brunswick | Pilot |
| Capehart | RCA |
| Chevrolet | Silver-Marshall |
| Clarion | Silvertone |
| Colonial | Sonora |
| Crosley | Spartan |
| Emerson | Stewart Warner |
| Fada | Strom-Carlson |
| Farnsworth | Westinghouse |
| G.E. | Wilcox-Gay |
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... and 172 more!

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Enclosed find \$..... for books checked; or send C.O.D. (in U.S.A. only) for this amount plus postage. If not fully satisfied, I may return either or both books within 5 days for full refund of my money.

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- MODERN RADIO SERVICING \$5 (\$5.50 foreign)

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Sound-System CONTROLS

Would you like to control individual loud-speakers without upsetting the multiple-speaker network and introducing distortion? If so, this Clarostat Series CIB Attenuator is the happy solution, because . . .

This compact, inexpensive, constant-impedance output attenuator dissipates 10 watts at any setting.

Operates noiselessly, without distortion. Linear attenuation in 3 db steps up to 30 db. and then final step to infinity. Zero insertion loss. Highly recommended as an individual speaker control in multi-speaker P-A systems.

Can also be used as an output level control for power amplifiers.

Available in 8, 15, 50, 200, 250 and 500 ohm impedances.

Dimensions: 2" dia. x 2 3/4" long. One-hole mounting. 1 1/4" bar knob standard equipment.

Ask Our Jobber . . .

Ask to see the Clarostat Series CIB Attenuator. Also the L- and T-pads. Ask for latest catalog. Or write us.



CLAROSTAT MFG. CO., Inc. - 285-7 N. 6th St., Brooklyn, N. Y.

New Products

(Continued from page 35)

casing 2 1/2" in diameter x 2 7/8" to 3 3/4" long depending on voltage and capacitance ratings.

Standard ratings are 110, 220, 330, 440 and 660 volts a-c, while capacitances range from 1 to 8.5 mfd. Flexible pigtail leads from the encased capacitor are brought out through an insulated hole in the cap.

* * *

B&W AUDIO-FREQUENCY METER

An a-f meter, model 300, has been introduced by Barker & Williamson, Inc., 237 Fairfield Avenue, Upper Darby, Pa. Six frequency ranges cover from 0 to 100; 300; 1,000; 10,000, and 30,000 cycles, respectively.

The circuit consists of an input voltage gain amplifier followed by two limiting amplifiers. The second of these feeds on RC integrating circuit and full-wave rectifier, the d-c voltage output of which increases linearly with frequency. The unit has an integral power supply. A high-impedance input circuit plus low-input operating voltage permits operation from the 'phone jack of a standard receiver for measuring the audible beat between two r-f carriers.

Sensitivity is a minimum of .5 volt input.

* * *

KAY ELECTRIC MEGA-MARKER

A variable marker oscillator, the Mega-Marker, covering the range of 19 to 29 mc has been announced by the Kay Electric Co., 34 Marshall St., Newark, N. J. A crystal oscillator is incorporated for the f-m i-f band of 10.7 mc.

Accuracies of .02 mc are said to be available from the calibrated scale, which is over 12" long.

* * *

ELECTRICAL REACTANCE COMPENSATING CERAMIC CAPACITOR

To compensate for the drift in the isolating circuit of f-m receivers where 6SB7 or similar tubes are used, the Electrical Reactance Corporation, Franklinville, New York, have designed a drift stabilizer that can be produced with any temperature coefficient or capacity required. For example, unit may consist of a steatite capacitor rating of 5 mmfd combining a resistor element of 15 ohms as an inherent part of the unit.

Manufacturer claims that the curve of compensation can be controlled by the amount of resistance wire or heating element placed around the steatite base tube.

* * *

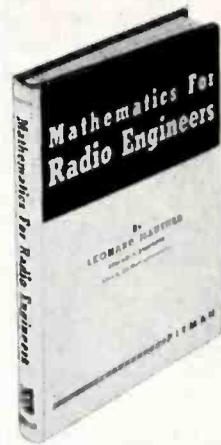
STAR FUSE TESTER

A pocket-electric tester, SureTest Universal Tester, has been developed by the Star Fuse Company, New York.

Consists of an insulated sprocket around which is wound 6' of test wire. The test cord terminates at one end in a standard base plug, at the other end in two test prods. The test lamp is located in one of the test prods.

Tester can be used for continuity test-

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 - Radio Service Men
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Illustrated Graded Problems and Answers

Here is an outstanding new book that covers practically all the mathematics needed to solve everyday design problems in radio, electronics, radar, and allied fields. Relates fundamental concepts to physical applications. Deals with the solution of typical problems and gives applications that represent most recent advances in radio engineering.

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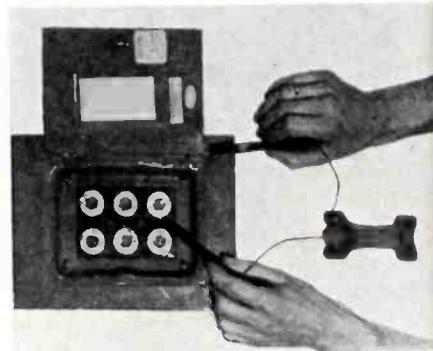
By Leonard Mautner, Research Engineer, Allen B. Du Mont Laboratories

This practical, easy-to-read text includes mathematical analysis of frequency, amplitude and phase modulation—spectrum analysis of television sawtooth and synchronizing pulses—Wien bridge circuit analysis—determinant solution of networks for phase-shift oscillators—differentiation, integration and sawtooth generation circuits for television.

Send for a Copy on Approval

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ing. Inserting the attached plug into a base receptacle enables the user to check continuity with the test prods.

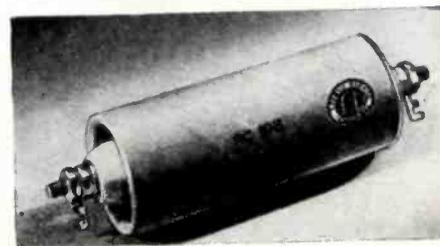


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C-D TV CAPACITORS

A tv capacitor, RC-108, with a rating of .05 mfd, 3,500 v d-c has been introduced by Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Built in a cylindrical metal container 1 1/2" in diameter, 3" long with screw-type



terminals mounted on ceramic insulators protruding 3/4" from each end of the case. Wax impregnated cardboard sleeve.

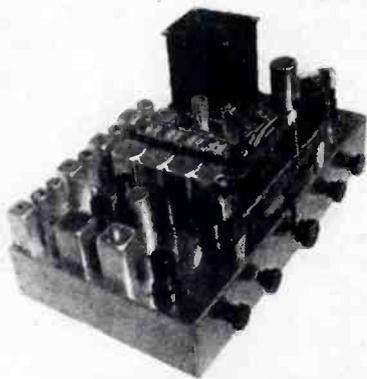
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COLLINS AUDIO F-M/A-M TUNER

An 11-tube f-m/a-m tuner has been announced by the Collins Audio Products Co., 126 Park Street, Westfield, New Jersey.

Tubes used in the f-m tuner include a 6J6 r-f amplifier, 6AG5 converter, 6C4 oscillator, 6AG5s as first, second and third i-f amplifiers, 9001s as first and second limiters, 6AL5 discriminator, 6J5 audio, 6AL7GT tuning eye and VR-150 voltage regulator.

Image ratio of receiver is said to be 150 to 1, minimum.



* * *

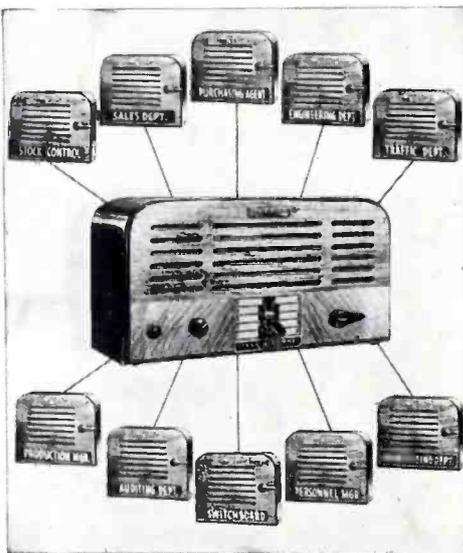
TALK-A-PHONE INTERCOM SYSTEMS

A line of a-c/d-c intercom systems, consisting of a master station, which delivers a maximum of 2 1/2 watts, and sub-stations have been announced by Talk-A-Phone Co., Chicago, Ill.

Sub-stations may be placed up to 3,000' from the master station.

Models are available in either 10-20-30 or 40-station models.

Privacy earphone is optional on the master station.



* * *

FEILER SIGNAL TRACER

A signal tracer, model TS-5 *pocket stethoscope*, has been announced by the Feiler Engineering Co., 422 S. Dearborn St., Chicago 5, Ill.

Size, 4 1/8" wide, 2 3/8" deep and 8 3/4" high; weight, 3 1/2 pounds.

Units contain a p-m speaker, but provisions are also made for headphone op-



KX-30 Deluxe
30-Watt Amp.

COMPLETENESS: Two complete lines of amplifiers and portable systems . . . utility and deluxe . . . provide great flexibility in meeting various customer requirements.

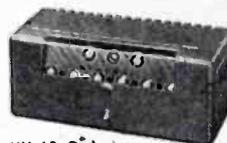
QUALITY: Top-flight performance and dependable, low-cost operation . . . these qualities are carefully planned and built into every Newcomb amplifier.

PRICE RANGE: No other line of amplifiers offers so wide a price range . . . from very moderately priced utility models to the finest deluxe amplifiers for your most discriminating customers.

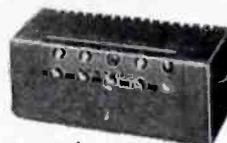
The proven quality of operation . . . the perfect suitability to every requirement . . . the wide price range . . . these mean greater customer satisfaction and more REPEAT SALES for you.

NEWCOMB — the logical choice of the quality-minded buyer — is your key to a continued, expanding success in the sound equipment field.

Let us send you complete information.



KX-60 Deluxe
60-Watt Amp.



KX-6 Deluxe
Mixer Pre-Amp.



K-60P Deluxe
Power Amp.



KXP-30 Deluxe
Phonograph Amp.



H-10 Standard
10-Watt Amp.



H-14 Standard
14-Watt Amp.



H-30 Standard
30-Watt Amp.

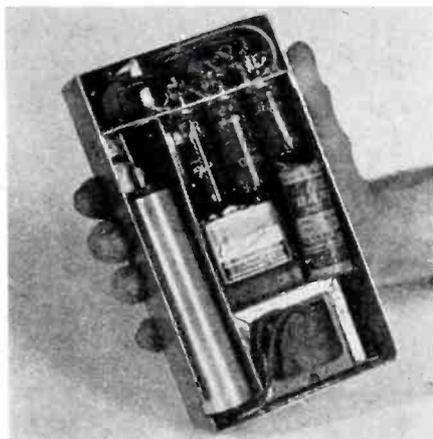


H-60 Standard
60-Watt Amp.



Dept. E, 6824 Lexington Ave., Hollywood 28, Calif.

"NOT MERELY AS GOOD AS THE OTHERS . . . BUT BETTER THAN ALL OTHERS."



eration. Standard type volt-ohm-milliammeter may be plugged into jacks so that the unit may be used as an effective r-f vacuum tube voltmeter.

* * *

SPECO SIGNAL-TRACER KIT

Kits of parts for assembly of battery-operated and a-c operated signal tracers have been announced by Special Products Company, Silver Spring, Md. Components are packaged in individual envelopes or tagged for accurate identification by the assembler. Circuit diagrams, assembly pictorials, instructions for assembly and an operating handbook are included with each kit. Battery-operated tracer kit is designated as model Stab-Kit, a-c-operated kit, model Stac-Kit.

FOR FASTER SOLDERING
2 NEW WELLER
SOLDERING GUNS
 with

Solderlite

LONGER REACH—Gets through wiring

SOLDERLITE—Spotlights the work

5 SECOND HEATING—Saves time and power

FLEXITIP—Loop tip easy to form

DUAL HEAT—35% reserve heat for chassis soldering

S107 Single heat
 D207 Dual heat
 100 watts
 110 volts
 60 cycles

The new Weller Soldering Guns with Solderlite plus the fast 5 second heating help make service work more profitable for radio, television and appliance service men, electrical maintenance men, electric motor rewinding and repair shops automotive electrical service.

A useful and time-saving tool for laboratory workers, experimenters, hobbyists, telephone installation and maintenance men. S107 100 watts single heat, D207 100/135 watts dual heat.

See your radio parts distributor or write for bulletin direct.

WELLER
MANUFACTURING CO.
 820 Packer St., Easton, Pa.
 In Canada: Atlas Radio Corp., Ltd., 560 King St., N. W., Toronto, Ont.
 Export Dept.: 25 Warren St., New York 7, N. Y.

NEWS

SAMS' RECORD-CHANGER SERVICE MANUAL AND DIAL-CORD STRINGING GUIDE

A 400-page 1947 *Automatic Record Changer Service Manual* has been published by Howard W. Sams & Co., Inc., 2924 East Washington Street, Indianapolis 6, Indiana. Volume covers more than 40 automatic record changers, including wire, ribbon, tape and paper disc recorders. Each unit is described in 8 to 12 pages of original photos, diagrams, and text. Information is compiled from actual analysis of the equipment in the Sams' Photofact laboratories. Exploded view diagrams are also presented. Full data are provided on change cycle, adjustments, service hints, and kinks. Uniform style and treatment is featured throughout the volume.

Manual, selling at \$4.95, is available at parts jobbers.

A 100-page pocket-sized *Dial Cord Stringing Guide* has also been published by Sams. Book illustrates how to repair dial cords in receivers produced from 1937 through 1946. Sells for 75¢, and on sale at parts jobbers.



DOYLE NOW ASTATIC GENERAL SALES MANAGER

William J. Doyle has been named general sales manager of the Astatic Corporation, Conneaut, Ohio. In his new post, Mr. Doyle will coordinate all sales activities, including original equipment for manufacturers, jobber and export sales, service, and government contracts. Ray T. Schottenberg will head the jobber sales division, and C. O. Brandes of Cleveland will continue in his export capacity.



JENSEN CATALOG

A 24-page catalog, No. 1010, covering standard and concert speakers, extended range single-radiator, coaxial, bass reflex reproducers and cabinets, and professional equipment, has been published by Jen-

accurate tube testing
 in half the time . . .



with RCP's
exclusive value DYNOPTIMUM
 Model 322 Reduced to **\$37.95**

Here's the best value anywhere in an up-to-date tube tester. With less trouble, in less time, with perfect accuracy, you can test any new or old tube around. No other tube tester comes near this value; only 5 controls to manipulate and equipped with the new sub-miniature tube socket.

FEATURES:

- Checks individual sections of multi-purpose tubes as well as miniature and sub-miniature receiving tubes.
- Alnico A.C. meter and low test circuit voltage drop permit close tolerances.
- Convenient jack is provided for head-phone noise test to check noisy swinging or high resistance internal tube connections.
- Neon lamp for rapid short and leakage tests between elements.
- New booklet tube chart contains approximately 800 tube listings.

For More Profitable Service Business Write for RCP's New Catalog—No. 129 Now!

RCP INSTRUMENTS—BEST FOR EVERY TEST

RADIO CITY PRODUCTS CO., INC.

127 West 26th Street, New York 1, N. Y.

sen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill. Professional series includes such items as heavy-duty theatre equipment, hypex and S projectors, and Speechmaster reproducers. Three pages are devoted to a listing of impedance matching transformers in both fixed and adjustable impedance designs. Offered too is a comparison chart showing all models in their relative gap energy levels. Each band of gap energy is separated from the next by 1.5 db.



MALLORY VIBRATOR BOOK

A 139-page *Vibrator Data Book* with 64 charts and diagrams has been published by P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind. Book contains descriptions of basic

structures, designs and vibrator characteristics. Discussed too are the selection of correct types for specific problems; applications; circuits involved and modern inspection procedures.

Loose-leaf vibrator characteristic data sheets supplied to Service Men on special request. Data book, priced at \$1, is available through all Mallory distributors or direct.

* * *

**SNYDER OF CONCORD RADIO NOW
PRESIDENT OF CHICAGO NEDA
CHAPTER**

Jack E. Snyder, assistant general manager of Concord Radio Corporation, has been elected president of the Chicago chapter of NEDA.



* * *

**PAUL TARTAK BECOMES PRESIDENT
OF TARTAK SPEAKERS, INC.,
ON WEST COAST**

Paul H. Tartak has been elected president of Tartak Speakers, Inc., formerly known as United Speakers, Inc.

Al Dresner, formerly with Emerson Radio, is vice-president and general manager. Line of speakers being made for manufacturers and jobbers, include 3", 4", 5", 6", 8", 10", and 12" speakers, both p-m and e-m.

Tartak Speakers, Inc., are situated at 3120 East Pico Blvd., Los Angeles 23, California.



Paul H. Tartak

* * *

MERIT TRANSFORMERS IDENTITY DATA

A metal strip, with specification data, affixed to the top of the transformer, is now supplied on all transformers by Merit Coil & Transformer Corporation, 4427 N. Clark St., Chicago 40, Ill.

* * *

**S/C LABS APPOINTS RADELMA
EXPORT AGENTS**

The S/C Laboratories, Inc., 20 Van Wagenen Street, Newark 4, N. J., manufacturers of f-m, television and amateur antennas, have appointed The Radelma Company, 53 Park Place, New York 7, N. Y., to handle export sales.

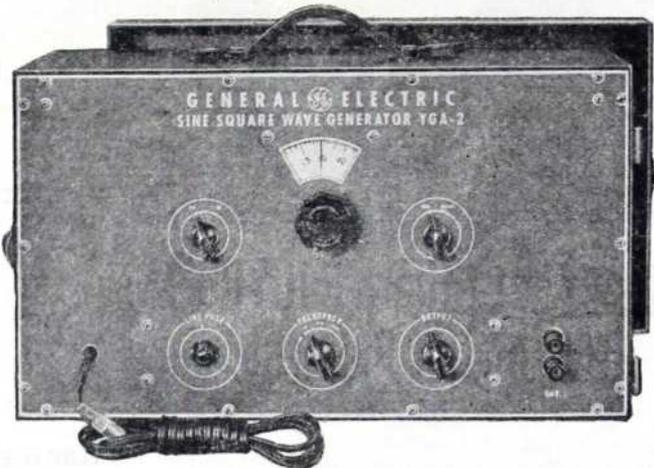
S/C Lab literature is available from The Radelma Co.

* * *

**SOLAR TO SHIP TO WEST AND PACIFIC
COAST FROM CHICAGO PLANT**

Solar Capacitor Sales Corp., 1445 Hudson Boulevard, North Bergen, N. J., has inaugurated shipments of capacitors, radio noise filters and capacitor test instruments from its Chicago plant at 4501

**NEW!
TIME-SAVING!
VERSATILE!**



**Sine or Square Wave
at the Flick of a Switch!**

Now—the General Electric Sine-Square Wave Generator YGA-2 provides you with greater facilities for better, more efficient service work. A top quality equipment, it incorporates two units in one; a high quality, stable oscillator and a square wave generator. It features a low distortion sine wave, stable RC oscillator and instantly available square waves.

SINE WAVE APPLICATIONS

Testing and adjustment of audio amplifiers, transformers, phase inverters, audio filters, etc.

SQUARE WAVE APPLICATIONS

Two point testing of response and characteristics in audio devices. Checking frequency response of wide band amplifiers. Determination of phase shift, distortion and high frequency peaks in audio equipments.

For complete information on the Sine-Square Wave Generator and other General Electric Service Test units write today to:
General Electric Company, Electronics Park, Syracuse, N. Y.

GENERAL  ELECTRIC

164-F7

South Western Boulevard, to Western and Pacific Coast parts distributors.

* * *

**OLSON WAREHOUSE OPENS
CLEVELAND BRANCH**

The Olson Radio Warehouse has opened a branch store at 2020 Euclid Avenue, Cleveland, Ohio.

* * *

CORNISH WIRE BULLETIN

A four-page catalog describing antenna kits, p-a wires and cables, lapel-microphone cables, antenna accessories, intercom cables, etc., has been published by Cornish Wire Company, Inc., 15 Park Row, New York 7, N. Y.

* * *

MILLER COMPANY CATALOG

A 36-page catalog, No. 48, describing r-f and i-f coils, radio-interference

filters, static chokes, dividing network coils, r-f chokes, replacement coils, loop antennas, f-m tuner foundation kits, etc., has been released by J. W. Miller Co., 5917 South Main Street, Los Angeles 3, Calif.

* * *

RIDER TO PUBLISH F-M AND BROADCAST OPERATOR'S BOOKS

Two books, *FM Transmission and Reception* and *Broadcast Operator's Handbook*, have been announced by John F. Rider, 404 Fourth Ave., New York 16, N. Y.

The *FM Transmission and Reception* book will contain 300 pages and cover transmitters and receivers. Wide-band, medium-band and narrow-band equip-

(Continued on page 40)



Don't Let Others Put YOU Out of the Picture!

CREI Courses in Radio-Electronics Keep You Ahead of Competition—Earn You More! Never before have so many men like you had the opportunity to step ahead in the many specialized fields of modern radio servicing. Men with up-to-date technical training are needed because radio's maintenance *manpower* has not kept pace with radio's *technical* development.

You must improve your technical knowledge to qualify for maintenance and service work in this new broadened service field. CREI offers you a proved program of technical self improvement that you can study in your spare time, at home.

No matter what your radio experience—CREI offers complete training in radio-electronics for *any* man who wants to improve his ability and his chances for advancement.

FREE SAMPLE LESSON !

Now, see for yourself! Mail the coupon for free sample lesson and see how simple it is to study at home and improve your ability the CREI way.

"ELECTRON PHYSICS AND ELECTRON THEORY"—This interesting lesson from the Radio-Electronics course discusses modern theories of the composition of matter, including *atomic energy*, and their relation to present-day radio and electronics.

"PICK-UP TUBES — ICONOSCOPE AND IMAGE DISSECTOR TUBES"—An informative lesson from the Television course. These are the fundamental pick-up tubes of the television camera. It precedes the study of the Orthicon and the Image Orthicon.

MAIL COUPON
FOR FREE
BOOKLET &
SAMPLE LESSON



CAPITOL RADIO ENGINEERING INSTITUTE
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Mail me ONE FREE sample lesson and your 24-page booklet, "CREI Training for Your Better Job in Radio Electronics." I am attaching a brief resume of my radio experience, education and present position.

Check ONE PRACTICAL RADIO-ELECTRONICS Course PRACTICAL TELEVISION

Name
Street
City Zone State

I am entitled to training under the G.I. Bill.

News

(Continued from page 39)

ment will be discussed, including regular broadcasting, ham and police equipment, etc. The book will present pictorial representations of f-m as well as phase modulation.

Special emphasis will be given to alignment and servicing problems.

F-m will be available in a paper cover for \$1.80, and clothbound for \$2.70.

Broadcast Operator's Handbook, intended for the broadcast station operator, is being authored by Harold E. Ennes of WIRE, Indianapolis.

* * *

W. E. BOYCE BECOMES MICAMOLD JOBBER S-M

William E. Boyce has been appointed sales manager of the newly-formed jobber division of the Micamold Radio Corporation, Brooklyn, New York. A new catalog covering available capacitors has also been announced by Micamold.

* * *

WALDOM ELECTRONICS CATALOG

A catalog, No. 48, covering replacement cone assemblies and universal field coil replacements, has been released by Waldom Electronics, Inc., 911 North Larrabee Street, Chicago 10, Illinois.

* * *

SIGHTMASTER TV RECEIVERS

A television line, which will be made available to Service Men on a franchise basis, has been announced by the Sightmaster Corporation, 220 Fifth Avenue, New York 10, N. Y., (telephone, Murray Hill 3-6087).

The key item in the line is a combination 10" model with a f-m radio receiver.

Choice of cabinets includes hand-rubbed mahogany, walnut, or blonde types.

* * *

SUPREME SERVICING BOOK

A 224-page book, *Advanced Radio Servicing*, by M. N. Beitman, has been published by Supreme Publications, 9 South Kedzie Avenue, Chicago 12, Illinois.

Book contains 30 lectures on a variety of servicing problems, including f-m and tv. Priced at \$3.00.

* * *

AT G.E. F-M WORKSHOP MEETING

At the recent G.E. f-m servicing clinic in New York during which theoretical and practical aspects of f-m operation servicing were discussed. Thirty-three of these meetings are being conducted throughout the country.



S.S.S.

"Servicing by Signal Substitution"

Learn about this modern dynamic approach to radio servicing with ONLY BASIC TEST EQUIPMENT.

... Fully described in a 120 page book available from your Precision Distributor or factory at 35¢.

... Schools are invited to inquire regarding quantity orders from our Educational Division.

PRECISION

APPARATUS COMPANY INC.
ELMHURST 1, N. Y.

Manufacturers of Fine Test Equipment
RADIO • TELEVISION • ELECTRICAL • LABORATORY

AMPLIFIER KIT

HI GAIN 6L6

10 WATT

4 Tubes

Separately Controlled Mike and Phono Inputs

Tubes \$3.29

Matched Output Transformer, .59

All parts including circuit diagram, descriptive information, drilled chassis, hardware, solder, etc.

Write for free data, circuits designed by ROBERT G. HERZOG, and also lists of Radio and Electronic Bargains.

Universal General Corp., Dept. K

365 Canal St., New York 13, N. Y. WAlker 5-9642



Above: R. D. Payne, sales manager of service test equipment for the G.E. specialty division, who is in charge of the tour, describing use of the scope and signal generator in f-m alignment.

Left: J. D. Duffield, district representative of tubes and accessories for G.E., and George Devine, commercial engineer of the specialty division, with the YGS-3 signal generator and CRO-5A scope used during the demonstrations.

Tube News

(Continued from page 31)

be somewhat reduced. In the circuit shown, this expedient was not necessary.

[Data based on application notes prepared by the tube department of RCA.]

RCA 6S8GT, 12AX7, 5653

THREE TUBES, a triple diode-triode (6S8GT), a high-mu twin-triode amplifier (12AX7) and a phototube (5653) have been announced by RCA.

The 6S8GT combines three diodes and a high-mu, audio-frequency triode in one bulb. One of the diodes has its own cathode, while the other two diodes and the triode share a common cathode.

This arrangement provides for the detection and amplification of either a-m or f-m signals without the necessity of switching detector circuits.

The 12AX7 is a small, high-mu, twin-triode amplifier, whose characteristics are similar to those of the larger types 6SL7GT and 12SL7GT, except that it has an amplification factor of 100 instead of 70. It utilizes a small-button noval 9-pin base and a glass bulb slightly larger than that used on the regular miniatures.

12 AX7 Uses

The 12AX7 can be used in phase inverter, multivibrator, and other similar circuits where high voltage gain and low heater power are important design factors. Tube has a separate terminal for each cathode, with a mid-tapped heater to permit operation from either a 6.3- or a 12.6-volt supply.

The 5653 vacuum phototube is intended for light-operated relay use.

Has S-4 response, and is particularly sensitive to blue radiation, with good response to light from an incandescent lamp.

G.E. Miniatures

Three nine-pin miniature tubes, 6T8, 19T8 and 12AT7, developed for f-m and



a typical RADIART VIBRATOR testimonial

A typical example of the testimonials to Radiart performance which come in to us regularly from Radiart users everywhere is contained in a letter recently received from Mr. W. E. Hopper, a Mid-Western Service man of North Vernon, Indiana.

Back in 1935, Mr. Hopper installed a Radiart Vibrator, Type 3315. Eleven years later, Mr. Hopper writes in to order a new Radiart to replace the original which had finally worn out AFTER 11 YEARS OF TROUBLE-FREE PERFORMANCE. This amazing record is only one of the many in our files attesting to the superiority of Radiart products . . . Designed to exacting specifications, of the highest quality materials, Radiart Vibrators, Vipowers and Aerials are as perfect as modern methods of manufacture can make them.

Radiart

ELECTRONIC DISTRIBUTOR & INDUSTRIAL SALES DEPARTMENT
MAGUIRE INDUSTRIES, INCORPORATED
500 WEST HURON STREET • CHICAGO 10, ILLINOIS
EXPORT—SCHEEL INTERNATIONAL, INCORPORATED
4237 N. LINCOLN AVENUE • CHICAGO 18, ILLINOIS, CABLE—HARSHEEL

tv, have been announced by the tube division of the G.E. electronics department.

The 12AT7 is a miniature twin triode designed for use as a grounded-grid r-f amplifier or as a frequency converter at frequencies below approximately 300 mc. A center-tapped heater permits operation of the tube from either a 6.3 or a 12.6-volt heater supply.

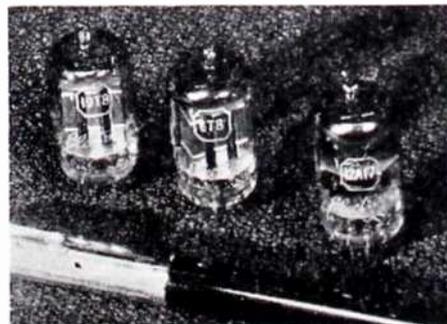
The 6T8 and 19T8 are triple-diode triodes containing three high-perveance diodes and a high-mu triode in the same envelope. One of the diodes has a separate cathode connection. The tubes are designed for use as combined a-m and f-m detectors and a-f amplifiers.

The heater of the 6T8 is designed for 6.3-volt operation at 450 milliamperes, while the 19T8's heater is built for 18.9-

volt operation at 150 milliamperes.

The miniatures are $\frac{7}{8}$ " wide and $2\frac{3}{8}$ " high.

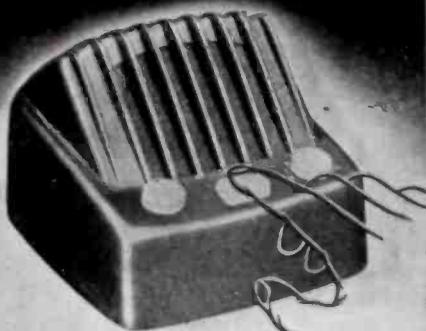
The G.E. 6T8, 19T8 and 12AT7.



Most Outstanding of All

FLEXIFONE

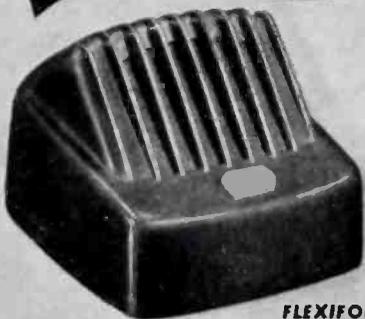
INTERCOMMUNICATION EQUIPMENT



FLEXIFONE
6-STATION MASTER

"Official" and
"Supervisor"
Models

... THE LINE THAT GIVES YOU
SALES LEADERSHIP TODAY!



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**FLEXIFONE Models Are
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FLEXIFONE offers you two profit lines, Official and Supervisor Models for small, low-cost systems and Executive Models for large installations. FLEXIFONE's smart new styling, quality construction, and free sales helps mean new business for you! ... Investigate FLEXIFONE today!

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OPERADIO

FLEXIFONE

INTERCOMMUNICATION SYSTEMS

Servicing in the Desert

(Continued from page 15)

ing, if possible, within the protected band from 450 to 460 kc. With the analyst probe connected to the diode plate, and the set on the air, it is possible to quickly determine the optimum i-f frequency. If necessary, a slight, and very careful amount of capacitor blade bending will complete the job of making the most stubborn receiver track satisfactorily.

Reception Problem Solutions

During the day the principal obstacle to good reception in our area is high noise-to-signal ratio. At night, an additional factor is fading of signals. Both these troubles have been somewhat alleviated by a slight change in avc circuits. This change, shown in Fig. 1, consists of utilizing a separate diode to develop avc voltage, feeding it from the primary instead of the secondary of the last i-f transformer. This develops considerably more volt-

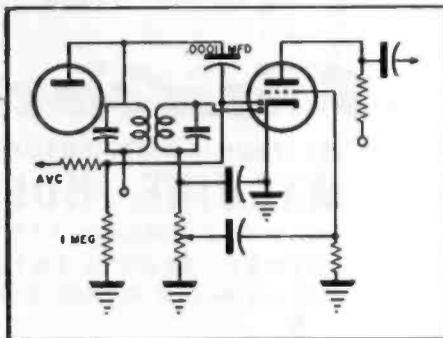
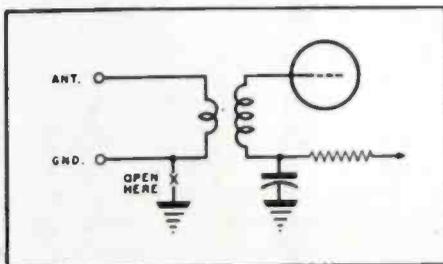


Fig. 1. Improved avc circuit devised by the author.

Fig. 2. A noise-reduction circuit used by Bowen.



age for a given signal input, thus reducing the sensitivity of the receiver to noise, in addition to keeping the volume more constant during periods of signal fading.

Power-Line Noise

Noise, another desert bugaboo, has been minimized by the system shown in Fig. 2. The noise coming via the power line has been reduced, in the case of sets using conventional antenna coils, by disconnecting the bottom of the antenna coil primary from chassis. A good external ground must, of course, be used.

Locating Noise

In tracking down noise to its source, a sensitive portable has been used with good results. After the cause of noise is located, it can usually be cured without too much trouble. In the majority of cases, it is caused by such simple things as a flickering fluorescent tube, a light bulb with bad internal connections, corroded plug or socket contacts, etc. When noise is traced to devices using vibrators or universal motors, it is usually not too difficult to induce the party concerned to purchase one of the several good capacitive-inductive filters now available.

Squirtcan Routine

A squirtcan routine has been evolved for all servicing, regardless of the size of the repair. Using a small oil can filled with one of the excellent contact cleaners now on the market, a drop or two is applied to tuning capacitor wiping contacts, dial cord pulleys, all control shafts, switch contacts, push-button contacts, in fact at every point at which metal rubs against metal. In addition, after tubes are checked, contact cleaner is rubbed on the prongs, before reinserting in sockets. The effort results in less come-backs and better satisfied customers which more than justify the few minutes extra time involved.

Presenting the NEW Ferret Line.

Matched, aluminum test units with all miniature tubes.
Blue-gray Hammertone finish. Uniform size—10 1/4 x 10 1/4 x 5 1/2.

SIGNAL GENERATOR Wide Range FM-AM Television Model 701

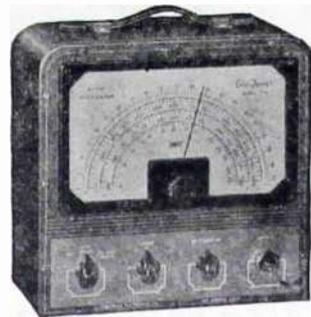
Range: 170 K.C. to 115 M.C.—all fundamentals.
Crystal calibrated, low loss permeability tuned coils. Internal 400 cycle sine wave modulation —to 100%. Follow-up shorting Turret coils with no dead spots. Tubes: 6C4, 6AU6, 6X4. Vernier drive—9" easy-to-read scale. Ladder attenuator —triple shielded.

\$74 95
Net

AUDIO OSCILLATOR Sine Wave—Square Wave Model 710

Range: 20 to 24,000 Cycles. Oscillator: RC type. Sine or square wave through-out range by rotating panel switch. High impedance output. 2% accuracy over all bands. Three color, completely enclosed 9" dial for ease in reading. Tubes: 6X4, 6AQ5, 6AU6, A4522, 6SL7.

\$89 95
Net



Combination Signal Tracer and Electronic Volt Ohm Meter with Germanium Crystal Probe

Model 730

Range: AC-DC 1v to 3000v (7 bands.)
Zero center scale for F.M. alignment.
Ohm Scale: 10 Ohms to 10 Megohms.
Frequency Range: Audio to 110 MC.
Input: 100 Megohms AC or DC.
Tubes: 6X4, 6A2, 6AQ5, 2-12AU7, 2-A4522.

High gain Signal Tracer with enclosed speaker. No amplifications needed in receiver—no hum. 8" illuminated dial.

\$89 95
Net



DELUXE TEST SPEAKER And Universal Substituter

Model 721

Eliminates need for removing set speaker from radios for servicing.

Provides substitution for choke, electrolytic and by-pass condensers, coupling, and a wide range of resistors.

Field substituter—500, 1000, 1500, and 2500 Ohms.

Voice coil connection permits substitution of any output transformer. 6" P.M. dustproof speaker.

\$29 95
Net

All prices slightly higher in Eastern States



COASTWISE ELECTRONICS CO., INC.

130 North Beaudry Ave.
Los Angeles 12, Calif.

Designers and Manufacturers of Electronic Equipment

New York Office & Warehouse
258 Broadway, New York 7, N. Y.

F-M/A-M Portable

(Continued from page 19)

ing of a 47,000-ohm resistor and two 680-mmfd capacitors.

Fig. 4 shows the tone-control system used in this receiver. The tone control is a 4-megohm pot, which is applied to the volume control at a mid-point tap. When the control is set at the low end, it shunts out the .002-mfd capacitor, and returns the tap to ground through a .1-megohm resistor. Assuming the volume control is set at its midpoint, where the tone control would have maximum effect, the ratio between the impedance of audio coupling capacitor, which is .006 mfd, and the load resistance between control grid and ground, would be decreased. Since the impedance of a capacitance increases at lower frequencies, the voltage drop across the capacitance at low audio frequencies would be increased, and the low frequencies attenuated.

The metering system is shown in Fig. 5. In both a-m and f-m position, the meter operates off the avc system. Two ranges are used and marked low and high. A multiplication factor of

5 between the two ranges is used for the a-m band, and 10 for the f-m band. The terms *high* and *low* are used to designate the strength of the signal being received. For example, a reading of 2 on the high scale on a-m will read 10 on the low scale, while a reading of 1 on the high scale on f-m will read 10 on the low scale. The meter also serves another purpose, in that it can also be used as a tuning meter. Since the meter is connected into the avc system, it is necessary to keep it in the circuit when aligning the receiver, otherwise the alignment may be off

due to variation of the avc voltage.

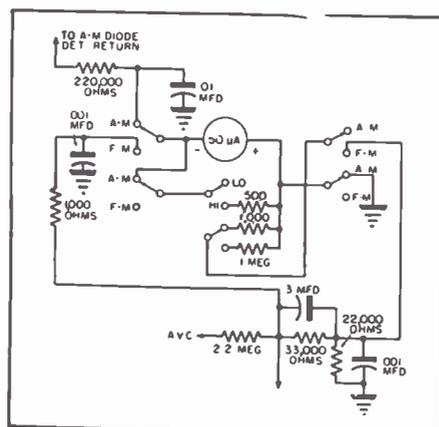
Alignment of the a-m section of the receiver is conventional. Reference marks on the dial are used to align the r-f section at 580 and 1475 kc. The i-f is aligned at 455 kc. If a modulated signal generator is used, the audio signal is taken off at the voice coil by means of a vtvm. The alignment procedure should be repeated several times to insure an accurate calibration. This is necessary since the reading of the field strength meter will be affected by any misalignment.

Because of circuit layout, the a-m section should always be aligned first. In the i-f section, it will be noted that the f-m i-f coils return to ground through the a-m transformers. Since the reactance of the a-m trimmers is low at the i-f frequency of the f-m transformers, they are, in effect, ground shunts for the f-m i-f transformers. However, any variation in their capacitance will affect the frequency of the f-m i-f transformers to some extent.

Two methods may be used in aligning the f-m section. The first method uses a scope and an f-m signal generator, and

(Continued on page 44)

Fig. 5. The metering system of the test unit.

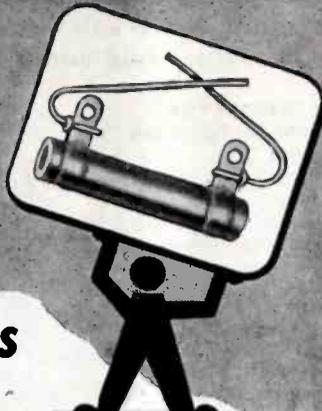


Now **Small Size, Heavy Duty, Trouble-Free**
5-WATT
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F-M/A-M Portable

(Continued from page 43)

the second method employs a standard a-m signal generator and vtm.

Fig. 6 shows the connections necessary for visual alignment of the f-m section. If the signal generator is not equipped with a synchronous signal output, the horizontal amplifier of the oscilloscope may be synchronized directly from a 60-cycle line.

In aligning f-m receivers, a polystyrene insulated type adjustment screwdriver must be used. The use of any other type will only result in misalignment, due to its influence on the trimmer capacitance.

A socket is provided in the front of the chassis for connecting in the vtm. As shown in Fig. 7, the vtm is connected between terminals 1 and 2, which places it across the return cathode and plate of the diode demodulator. The generator is then connected to the antenna terminals and alignment completed for maximum avc signal, as read on the vtm. All r-f circuits are thus aligned. The alignment should be repeated several

times to insure best results. A suitable dummy antenna may be constructed as shown in Fig. 6a. The same procedure is followed for i-f alignment, with the exception of the secondary of the demodulator transformer.

For visual alignment of the demodulator secondary, the signal generator is set for 60-cycle f-m modulation at a minimum bandwidth of 200 kc. The generator is then set at the i-f frequency of 10.7 mc, and the secondary of the transformer adjusted for maximum symmetry, providing an S curve; Fig. 8. Both primary and secondary should be adjusted alternately until the best possible figure is obtained.

Some phase shift between the signal generator and the oscilloscope horizontal sweep may result in a double image as shown in Fig. 8b. When this occurs, inserting a capacitor of approximately .01 to .1 mfd in series with the 60-cycle feed to the horizontal amplifier of the oscilloscope will correct this condition. The capacitor value will be determined by the amount of phase shift.

The oscillator of the f-m section has been designed to operate on the high side of the incoming signal. Three points are used to check dial

calibration. These are 106, 97, and 90 mc. To check whether the oscillator is above or below the incoming signal, the receiver is first aligned at 106 mc. The dial pointer is then left at this setting, and the signal generator reset to 84.6 mc, the image frequency. If no signal is picked up on the receiver, the oscillator setting is correct.

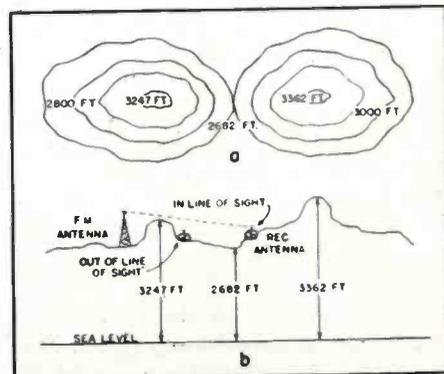
The f-m section may also be aligned with a standard signal generator. The vtm is connected between terminals 1 and 2 as shown in Fig. 7. The r-f and i-f sections are then aligned the same as any a-m receiver, for maximum avc voltage. All circuits except the demodulator secondary are thus aligned.

The demodulator secondary is aligned as follows: Two 100,000-ohm resistors are connected, as shown in Fig. 7, between terminals 1 and 2. The vtm is connected between the center of these two resistors and terminal 4, which is the audio return. The demodulator secondary is then adjusted for zero reading. This step is alternated with a readjustment of all the i-f trimmers until no increase in avc voltage is obtained with adjustment of the i-f trimmers, and a zero reading results for the adjustment of the demodulator secondary. Ordinarily, a center reading vtm should be used for the zero adjustment. However, the same results may be obtained with an ordinary vtm, by setting the pointer so that it reads at some arbitrary point on the vtm scale, and designating this point as zero. This can be easily done on any vtm with a zero set.

Credits

The author is grateful to D. H. Kresge, manager of radio and television service of Bendix Radio, for his valuable assistance in the preparation of this article.

Here we see how the line of sight usually affects reception in f-m.



F-M/A-M Portable

(See page 44)

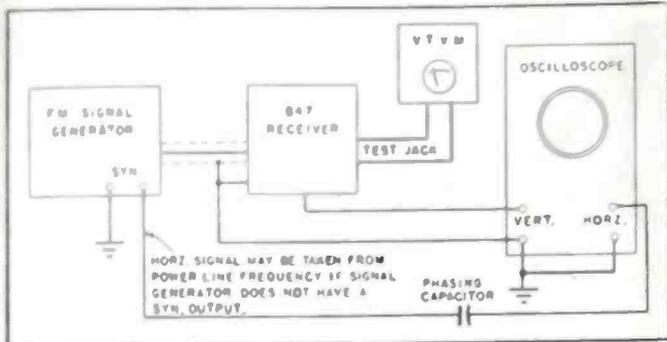


Fig. 6. Setup for visual alignment of the f-m section of the test receiver.

Fig. 6a. Shows how a dummy antenna can be constructed for use in alignment work.

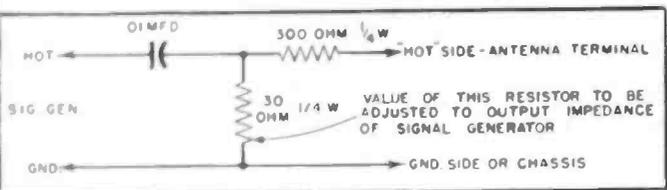


Fig. 8. At left (a), S curve obtained after maximum symmetrical adjustment of the demodulator transformer. A phase shift between the signal generator and scope horizontal sweep results in a double trace pattern as shown at the right (b).

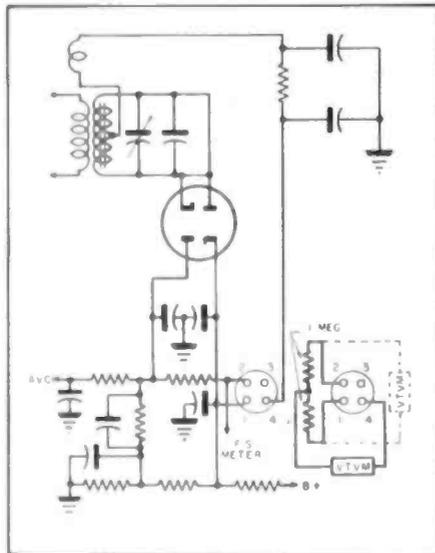
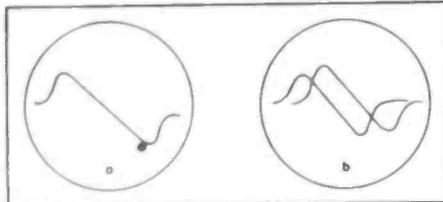
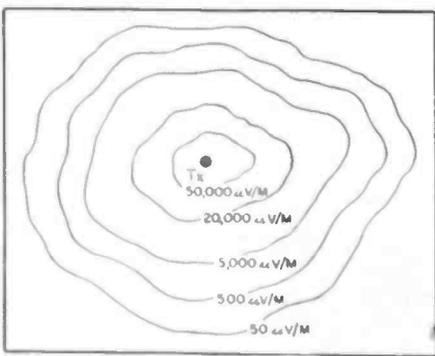


Fig. 7. Setup for alignment of the demodulator. The resistor between terminals 1 and 2 of the vtvm circuit is a 1-megohm unit.



Field strengths of f-m transmitters showing primary and fringe areas of reception.

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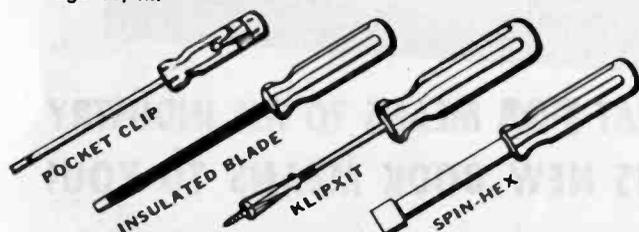
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173 TYPES AND SIZES

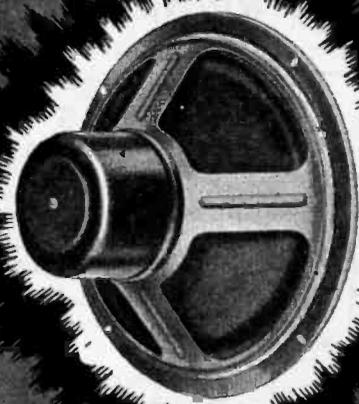


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TV I-F Systems

(Continued from page 27)

i-f tube. It absorbs the undesired sound signal from the primary winding of the transformer, which in conjunction with C_{im} resonates at 23.4 mc. Thus, so far as the desired signal is concerned the cathode is at absolute ground potential and maximum 23.4-mc signal is developed across the output of the stage. The gain of the i-f system is varied by means of a grid-bias control which varies the grid bias on the i-f stages. The picture control varies the grid bias on these tubes and therefore the gain of the i-f system, controlling peak-to-peak amplitude of the detector signal and, therefore, the contrast of the picture signal as it is applied eventually to the grid of the picture tube.

Loaded Tuned Transformers

Each of the tuned transformers is loaded by a grid or plate resistor which broadens the response of the tuned circuit for the required bandwidth. To reduce hum pickup in the i-f system and to reduce i-f frequency loss and tendency to oscillate, the heater circuits are returned very efficiently to ground by means of a filter capacitor and choke. This combination is used in the heater circuit in all of the i-f tubes. The screens and plates are also returned to ground through the proper decoupling resistors and capacitors.

Bias Control

A novel bias control system is used in the i-f amplifier which permits the bias of the i-f amplifier to be varied with the picture control, but does not affect the bias of the r-f amplifier until there has been a considerable change in the picture control potentiometer of the i-f system. It can be seen that the bias for the r-f stage is mainly controlled by the diode current of the 6AT6 and it is not until the arm is well down on the picture-control potentiometer that the negative voltage is applied to this cathode of considerable amplitude to cut the

diode off and apply bias to the r-f amplifier.

G.E. 801 I-F

The i-f system of the G. E. 801 is shown in Fig. 5. In this receiver the picture i-f carrier frequency is 26.4 and the sound i-f carrier is 21.9 mc. The i-f transformers consist of the conventional double-tuned close-coupled transformers to give you best gain at required bandwidth. An adjacent channel sound trap is placed in close proximity to the secondary of the first transformer T_1 , while an associated channel sound trap is placed in close proximity to the secondary of T_2 , T_3 and T_4 . The adjacent channel sound trap is tuned to 27.9 mc, while the associated channel sound trap is tuned to 21.9 mc. A pre-tuned trap is also present in the cathode circuit of the second video i-f tube and is used to broaden the attenuation around the associated sound-channel frequency to prevent serious overshoot or a sharp characteristic. A novel contrast control arrangement consists of a potentiometer and a diode. The diode rectifies 6.3 a-c voltage which passes through the contrast potentiometer and another series resistor to ground. The 6.3 volts (a-c) is applied to the cathode of the diode and a negative voltage, which is the contrast potentiometer, appears across the diode load.

The tuned transformers are, of course, loaded with shunt resistors to broaden the frequency response and the plate and screen circuits are all properly decoupled and filtered.

Viewtone I-F

The i-f system of the Viewtone VP101A receivers is shown in Fig. 6; p. 54. This also consists of a stagger tuned i-f amplifier with single-tuned transformers, each transformer tuned to a slightly different frequency to produce the desired overall characteristics. A proximity sound takeoff is used, as well as a proximity sound trap for the associated channel sound. There is no i-f gain control in this receiver and consequently a contrast control must be associated with the video amplifier.

RCA TRK-5

A typical bandpass T i-f system, as used in the RCA TRK tv receiver, is shown in Fig. 7; p. 54. The windings of the first detector transformer assembly are: L_{17} , primary; L_{18} , secondary; L_{19} , along with capacitors C_n and C_{22}

is the adjacent channel sound trap, and L_{20} , the sound tuned-circuit inductor. The mutual capacitor which broadens the response is C_{21} . In the second picture i-f transformer, the mutual element is L_{27} , while the primary is L_{25} , and the secondary winding, L_{26} . In this receiver only the gain of the first picture i-f tube is varied with the contrast control which varies the amount of cathode bias applied to the first picture i-f tube.

G.E. 90 I.F.

The G. E. model 90 i-f system is shown in Fig. 8. This receiver uses

closely-coupled tuned circuits, to get the required bandwidth. Over-coupling between the windings of transformers T_7 and T_8 occur through the parallel tuned circuits connected across the high side of the windings. These tuned circuits serve as a means of overcoupling and also are the adjacent channel sound traps and the associated channel sound traps, respectively. The parallel resonant trap associated with T_8 is used to precisely detune the picture carrier frequency to the 50% level. The bias of the first two i-f

(Continued on page 54)

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TOOLS And SERVICE AIDS

For the NEW SERVICE SHOP

by ALFRED A. GHIRARDI

Advisory Editor

[Supplementary Special-Purpose Tools and Servicing Aids*]

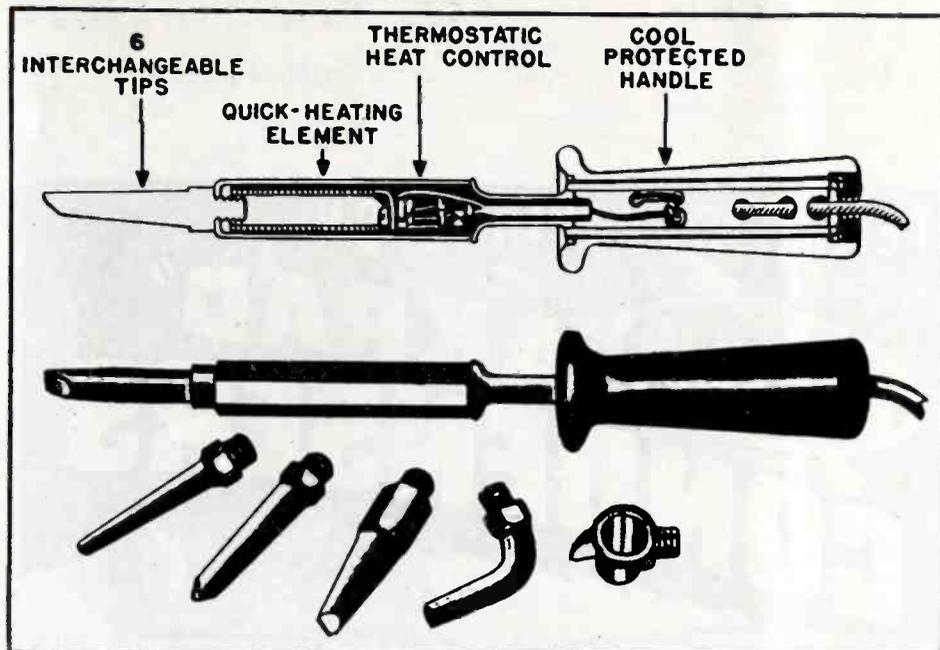


Fig. 2. An all-purpose 225-watt quick-heating iron with built-in thermostatic heat control and choice of six interchangeable tips of various sizes and shapes for all types of work. (Courtesy Sound Equipment Corp. of California.)

TEMPERATURE-REGULATION stands for soldering irons are extremely handy in the Service Shop. It is possible to use the usual standard type iron with a thermostatically-controlled temperature regulating stand, such as the model¹ illustrated at (A) of Fig. 1, which regulates the temperature of the iron while at rest. When placed on this stand, a soldering iron is maintained at full working temperature ready for instant use or, if desired, at a lower temperature. Through an adjustment at the bottom of the stand, the thermostat may be set for the maintenance of any desired temperature—from *very low*, or *warm*, to *full working* temperature. The regulator is designed for use with electric soldering irons up to 660 watts capacity.

Another thermostatic control stand² is illustrated at (B). In this model the iron also can be maintained at any desired temperature while in the stand. Since the tip is inserted in the stand, the tip temperature is controlled. When the iron is removed from the control, the full current is instantly applied to the iron.

The use of thermostatically-controlled temperature-regulating soldering iron stands cuts cost of electric

current. It also prolongs the heating element, tip life, and tinning on the tip, and permits the use of high wattage elements in small irons, as they cannot overheat when the iron is not in actual use.

Soldering Irons with Built-in Heat Control

Also available are soldering irons containing a built-in thermostatic heat control designed to maintain constant heat at all times and prevent overheating and need for frequent retinning, even when small tips are used; Fig. 2³. A 225-watt quick-heating element, held in check by the thermostat, makes it possible for the iron to heat up ready to use in 90 seconds after plugging in.

The six different sizes and styles of interchangeable tips illustrated are available for both light and medium-heavy work. They make it possible for a single iron to do practically any

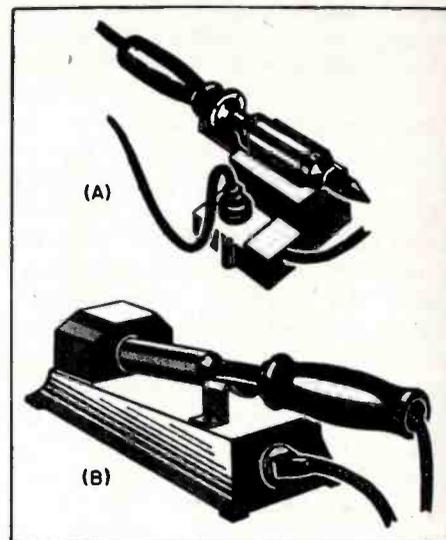
¹American Beauty No. 475.

²Esico No. 5.

³Kwickheat type

*See SERVICE, January 1947, for other Service Aids data.

Fig. 1. Two models of thermostatically-controlled temperature-regulating soldering iron-stands. A, courtesy American Electrical Heater Company; B, courtesy Electric Soldering Iron Co., Inc.



job encountered in service work since the 225-watt heating element, held in check by the thermostat when the small tips are used, provides ample heat for the large tip when it is being employed.

Riveting and Eyeletting Tools

Rivets and eyelets are widely used for fastening parts in receivers and accessories and they often must be replaced when replacing components that have been fastened by them. Where riveting and eyeletting needs to be done only occasionally, the simple punch set that can be used for either riveting or eyeletting, will serve the purpose.

Many ingenious new fasteners were developed in war production, and some of them will find increasing use in the assembly of radio equipment. The Cherry rivet is one of these. A hand-operated riveting gun⁴, for these rivets, which may be operated above-board without jarring the sensitive radio components already mounted, and which is good for fastening tube sockets, nameplates, transformers, speaker shields, and other applications, is at Fig. 5 (B).

Steel Staple Driver

Whenever wires or cables in radio, public address and intercommunicator

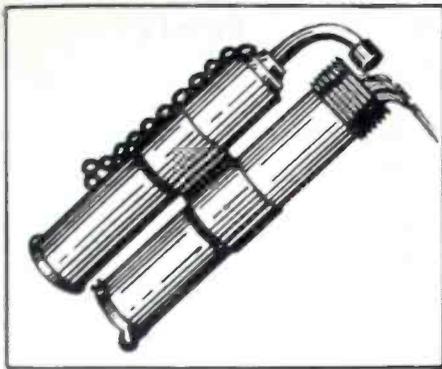


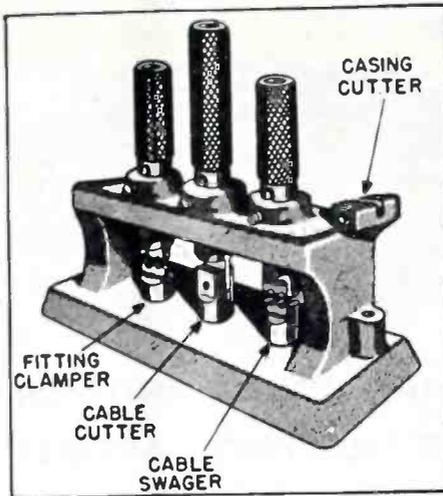
Fig. 3. Compact electrician's type alcohol soldering torch for outdoor work.

Fig. 4. Versatile Remote-O-Cable auto radio remote-control cable-servicing machine. (Courtesy J.F.D. Mfg. Co.)

installations must be fastened into corners, into moldings, behind pipes, and on to hard surfaces such as plaster, cement and even soft concrete, the stapler illustrated in Fig. 6 will enable a neat, fast job to be done. It automatically positions the special steel staple. Then one or two strokes with the palm of the hand drives the staple home. An adjustable regulator controls the depth to which the staple is driven into the surface, thus preventing damage to the insulation of the wire. The stapler easily reaches places inaccessible with a hammer and ordinary staples. The stapler is also useful for general stapling work, sign posting, refrigerator gasket work, etc.

The staples are made of tool steel and have their inside surface coated with special clear insulating lacquer. They come in strips of 250 staples that can be loaded in a few seconds into the

¹Cherry Rivet type.
²Speedex type.



container fastened on the nose, and are large enough for cables and wires up to 1/4" diameter.

Wire Strippers

Wire-stripping for making connections, splices, etc., can be done perfectly satisfactorily with the aid of pliers, as every Service Man knows. However, there is always danger of nicking solid wire or cutting a few of the strands of stranded wire when doing so—especially when working in a hurry.

For servicing and p-a installation work involving a great deal of wire stripping the speedy hand-operated wire stripper⁵ (Fig. 7, p. 53), will come in mighty handy. When the handles are squeezed together, the slot in the left-hand *holding* jaw grips the wire (including the insulation); the V-cutter in the right-hand *cutting* jaw

(Continued on page 50)

BUILT FOR SERVICE



Technical Tips

Spotting Weak Converter Tubes

● Low cathode emission affects both oscillator and mixer functions of a frequency converter. It reduces the oscillator voltage which, in turn, lowers the conversion transconductance; it also tends to reduce mixer gain. The net result is a marked drop in tube output.

A more serious difficulty is that the oscillator may cease to function because of low emission. When this happens, no signal can reach the i-f stage and the receiver goes dead.

Either or both results are usually sufficiently marked to cast first suspicion on the converter tube. The easiest and speediest check is to replace this tube with one known to be good. You can always count on a Cunningham.

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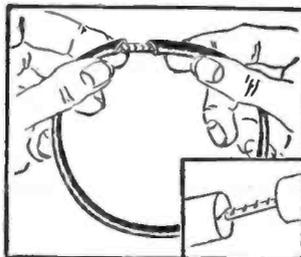
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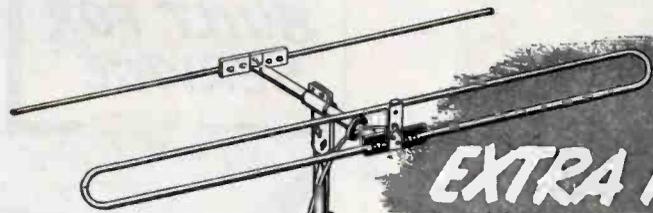
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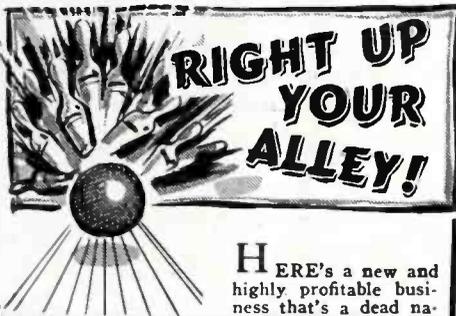
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NEW JERSEY

Tools

(Continued from page 49)

cuts the insulation, and the simultaneous spreading of these two jaws causes the insulation to be pulled completely off the wire. The tool can also be used as a wire cutter. It is made in three sizes, to accommodate 10 to 18, 12 to 20 and 14 to 24 wire.

Tube and Knob Pullers

A tube extractor, (A) Fig. 8 (p. 53) is useful for extracting and inserting delicate miniature and straight-side glass receiver tubes that frequently are so difficult to get at in a crowded-chassis. Rubber-covered gripping surfaces, and handles having sufficient springiness to prevent over-tension, help to prevent damage to the tubes. Every Service Man who has wrestled to pull out a tight-fitting tube where space was very limited will appreciate what a time-saver and tube-saver this tool is. The same can be said even where there was ample space but a hot, or particularly stubborn tube was encountered.

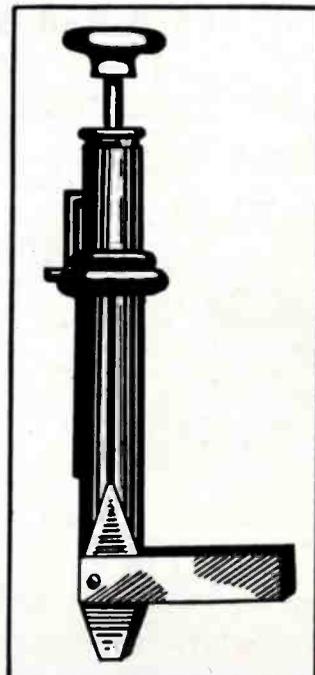
A receiver knob that is hard to grip may be easily removed from the shaft by slipping the jaws of a simple knob-puller behind it, as shown at (B), and pulling. The puller is long enough to provide a good grip for the hand.

Tweezers

Delicate wires, small machine screws and nuts, pins, and other parts some-

Fig. 6. Handy staple driver for quickly stapling wires to molding, walls, etc.

(Courtesy Walter L. Schott Co.)



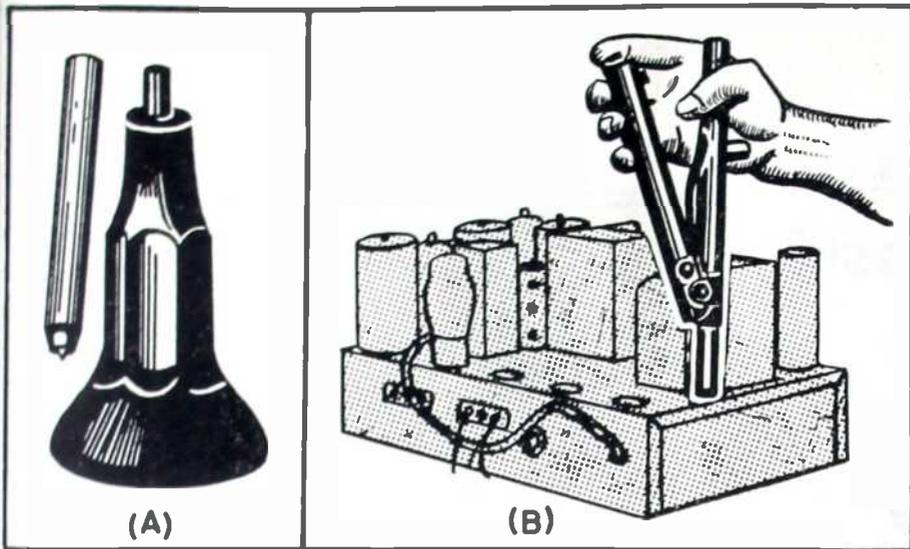


Fig. 5 (A): A simple riveting and eyeletting tool. (Courtesy Insuline Corporation of America). At (B): Hand type gun for installing improved rivets on radio equipment. (Courtesy Cherry-Rivet Company)

imes have to be handled on a job, and nothing helps more than a set of tweezers. The points of tweezers are made in various styles and shapes. The five styles illustrated in Fig. 9 are (top to bottom): strong beveled, hollow, long slim, heavy strong, and light fine. In addition to these, adjustable four-legged, self-locking, serrated, and threading tweezers are manufactured.

Perhaps the most emphatic selling argument for tweezers is given when a metal or wood splinter must be extracted from the Service Man's flesh by one of these tools.

Trouble Lights

Good illumination must, of course, be provided for the entire test bench. Even though this has been accomplished, strong spot illumination of some particular component, portion of the intricate mass of parts and wiring on the underside of a chassis, or inside of a console radio cabinet, etc., may be required at times. For this

purpose, an adjustable, flexible goose-necked bench light of the type shown at (a) of Fig. 10 is satisfactory. This may be plugged into one of the test bench line sockets when needed, and stored out of the way when not required. The hemispherical shield over the light, of course, is essential.

A large 3-cell flashlight, (b), or better still one of the larger battery-operated emergency lights, (c), that are made to sit on the floor or anywhere and illuminate a good sized area, is another useful type of light—especially to carry in the service truck. Among other things, you will often find it useful when changing tires, or finding articles in the truck, in darkness. It is also useful for all emergency purposes, checking over outdoor antenna systems at night, tracing wiring in cellars, etc.

If you intend to do much service work in homes (some Service Men in rural areas will find this to be lucrative business), a full sized trouble
(Continued on page 53)



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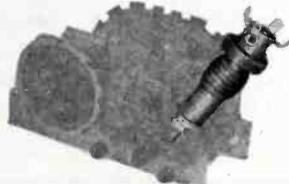


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Signal Generator

[See Front Cover]

AN R-F AND A-F OSCILLATOR¹ employing a 6A8 pentagrid and providing an r-f fundamental range of 160 kc to 20 mc and a fixed a-f frequency of 400 cycles, appears on the cover this month.

The 6A8 is used in both the r-f and a-f circuit. The basic r-f oscillator is a two-terminal transitron type, while the a-f oscillator is of a tuned-plate feedback type with the oscillator grids of the 6A8 being used for plate and grid.

The a-f output of about 10 volts may be used externally to modulate the r-f signal of the generator at approximately 30%.

The r-f output voltage is adjustable from approximately zero to 100,000 microvolts by means of two controls. Coarse adjustment is available with a five-stage attenuator or multiplier switch, while fine adjustment is accomplished by a continuous variable potentiometer. The fine attenuator is connected between the oscillator and step attenuator and provides a continuous impedance load for the oscillator.

The harmonic range of the r-f oscillator is 20 to 140 mc. There are r-f blocking filters in the power circuit and audio-output leads.

The output impedance is about 200 ohms and the r-f output voltage is zero to approximately .1 volt.

¹Northeastern Engineering Model 700A.

MAUTNER'S MATH BOOK



Leonard Mautner, research engineer, Allen B. DuMont Labs, presenting one of the first copies of his new book "Mathematics For Radio Engineers" to ye editor.

The book is a practical text on applied mathematics and provides analysis of typical problems encountered in f-m, television, servicing instruments, etc. Chapters are accompanied by graded problems with complete answers.

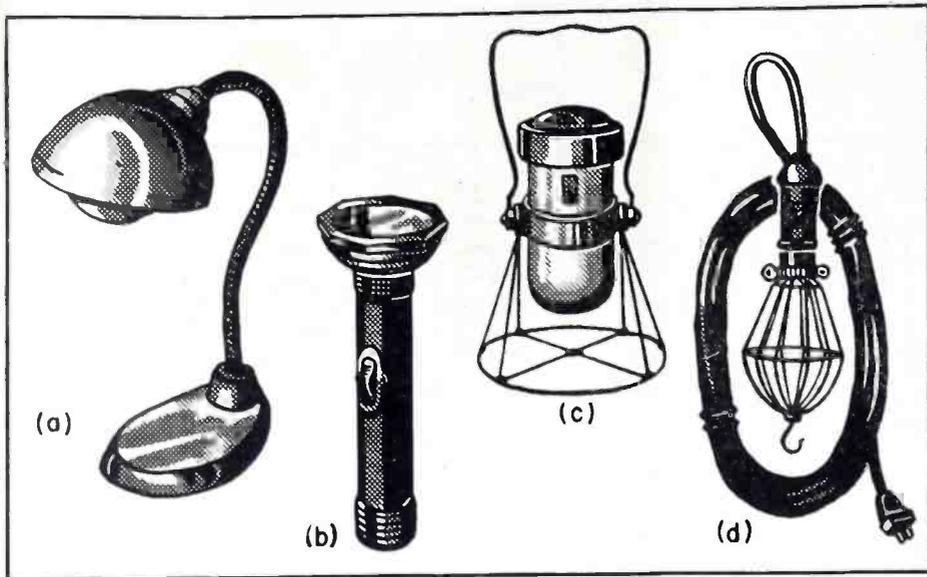


Fig. 10. Several battery-operated and line-operated trouble lights that are useful.

Tools

(Continued from page 51)

lamp containing a 60-watt bulb and having a guard, as shown at (d) will often prove to be a lifesaver when you are obliged to check the operation of that radio set or automatic record changer in a dark corner of the room. You should make certain that the lamp has at least 25' of lamp cord and some means (a protected hook on the end of the guard will do) for hanging it from the top edge of the cabinet.

A difficulty which confronts those Service Men whose business is such that they have to work on receivers of many different makes, is that there are quite a few sizes and designs of alignment trimmer adjustments in use. Some employ screws, others use nuts. The sizes of these, as well as the amount of clearance provided for insertion of the adjusting tool and the ease with which the screw or nut may be reached on the chassis, vary considerably. This makes it extremely advantageous to have a much more varied assortment of alignment tools than is included in a *basic* supply of tools.

Fig. 8 (A): Handy tube extractors for pulling out miniature and straight-sided tubes. (Courtesy BMP Company). At (B): A handy knob puller. (Courtesy General Cement Mfg. Co.)

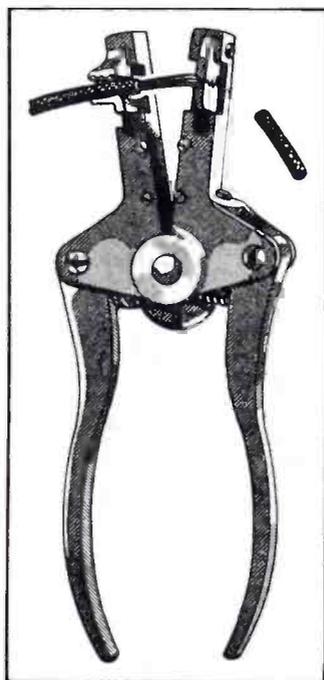
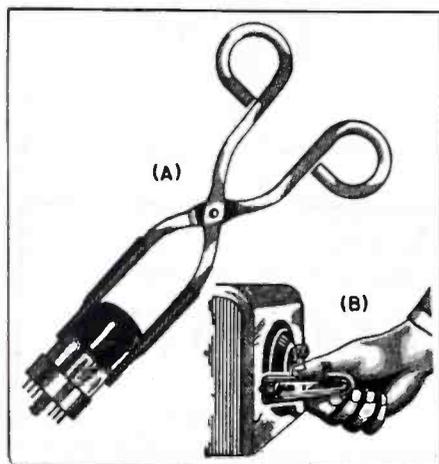
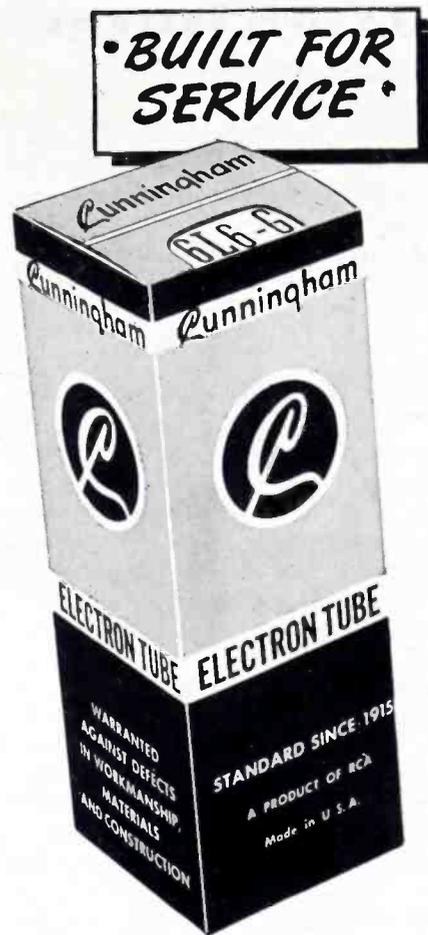
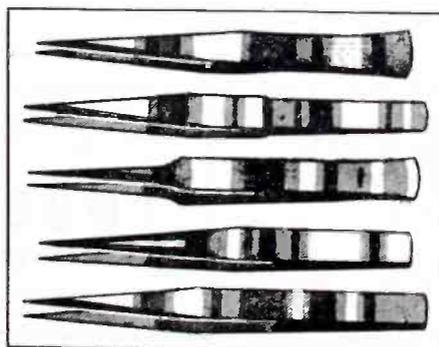


Fig. 7. A speedy hand-operated wire stripper. (Courtesy General Cement Mfg. Co.)

Fig. 9. Tweezers having points of various styles and shapes as shown here are useful around the shop. (Courtesy New Jersey Jeweler's Supply Co.)



Cartoon Displays!



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TV I-F Systems

(Continued from page 47)

stages is controlled with an automatic gain-control system. This takes care of fading and variations in signal strength.

Another type of i-f stage which may become popular in television receivers is the cathode-coupled stage as shown in Fig. 9. In this stage a duo-triode miniature tube is used as an i-f amplifier. The first section of the tube serves as a cathode follower while the second section is a grounded-grid amplifier. It is apparent therefore that the stage is a low-impedance stage because of the cathode follower arrangement and also the fact that the triodes are being used instead of pentodes. For wide-band amplification it is possible that triodes may perform as well as the pentodes because the favorable characteristics of pentodes are nullified when the plate is shunted by a very low impedance, as is necessary for wideband amplification. In the cathode-coupled stage input capacity is low, not only because a miniature tube is used, but because of the cathode-follower connection. The second section of the triode or the grounded-grid amplifier section is an efficient amplifier and has no tendency to oscillate because of the grounded grid connection. In summation, the advantages of this type of circuit are:

(1)—It is a low-impedance circuit which is ideal for high L -to- C ratio

(Continued on page 55)

Fig. 9. A cathode coupled i-f stage.

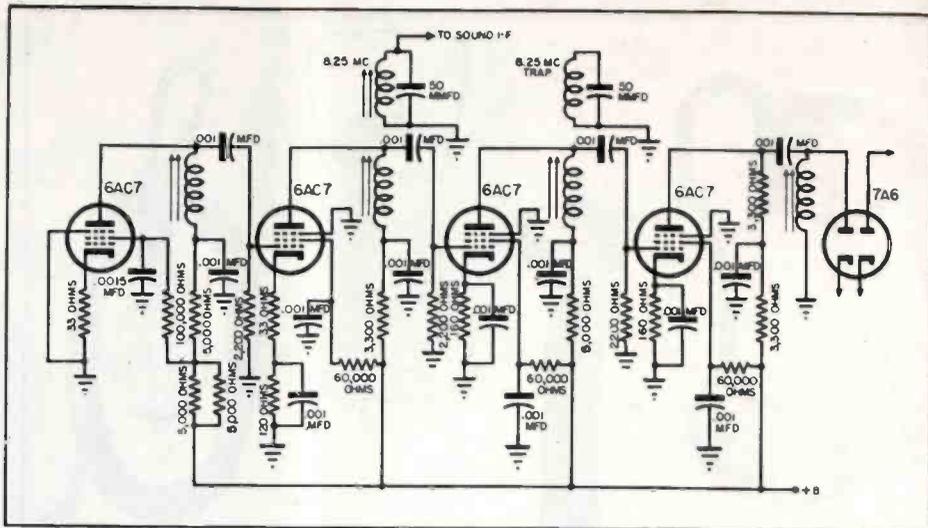
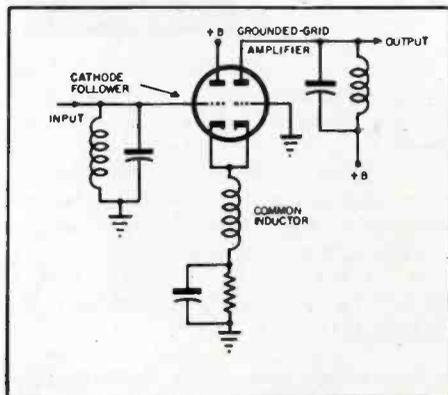


Fig. 6. Viewtone VP101A i-f system.

Fig. 7 (below). The i-f system of the RCA TRK-5 tv receiver.

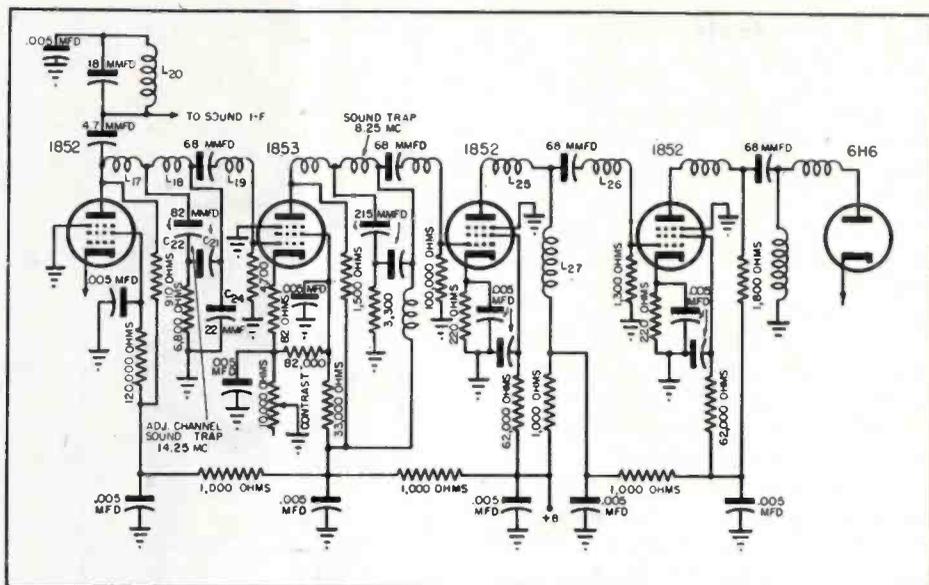
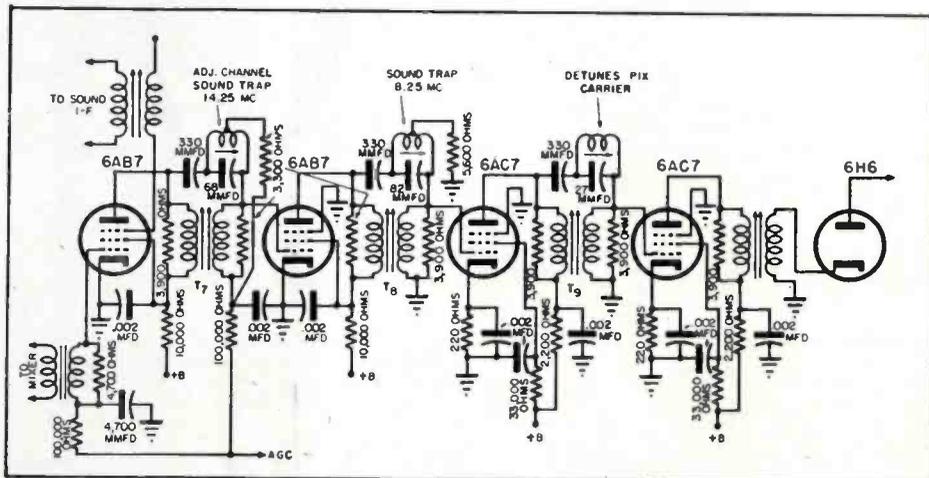


Fig. 8 (below). The G.E. model 90 i-f system.



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TV I-F Systems

(Continued from page 54)

tuned circuits and broad bandwidth. The impedance of the triode is inherently lower than that of a pentode.

(2)—It has inherently a greater noise reduction, because again a triode is inherently a quieter tube than a pentode.

(3) The amplifier section of the stage receives its excitation from the cathode-follower section through the cathode coil which is common to both triodes. The grounded grid of the amplifier, of course, reduces the tendency to oscillate. Such a duo-triode stage can be made to have the same gain as an equivalent pentode with

fewer component and fewer critical parts.

The i-f systems of most tv receivers require no alignment or very infrequent alignment. However, should alignment be necessary, it is absolutely essential that the Service Man understands the i-f system and the function of the various components and various controls in this system. The alignment of any i-f system should not be attempted unless the system you are working with is thoroughly understood and you have precise alignment instruction necessary for the receiver. Incidentally, it is the best policy not to change any control unless you know that changing that control is absolutely necessary and unless you know absolutely what can be expected when you do change the control.

[To Be Continued]

Ser-Cuits

(Continued from page 23)

grid and cathode circuits, and taking the signal off the plate circuit. The modulation, at 400 cycles, is supplied by a 6J5 triode in a tuned-grid plate-feedback circuit, with a third winding used to inject the modulation into the suppressor grid of the 6SJ7 oscillator. The signal is then fed into a ladder type attenuator and brought out to the signal lead through a .1-mfd capacitor. A separate jack permits connection to the audio modulator for straight audio output.

Admiral 7T10, 7T14, 7T15

Admiral has just released a revision on their circuit for their models 7T10, 7T14 and 7T15. The revision is included in chassis UL5K1 as shown in

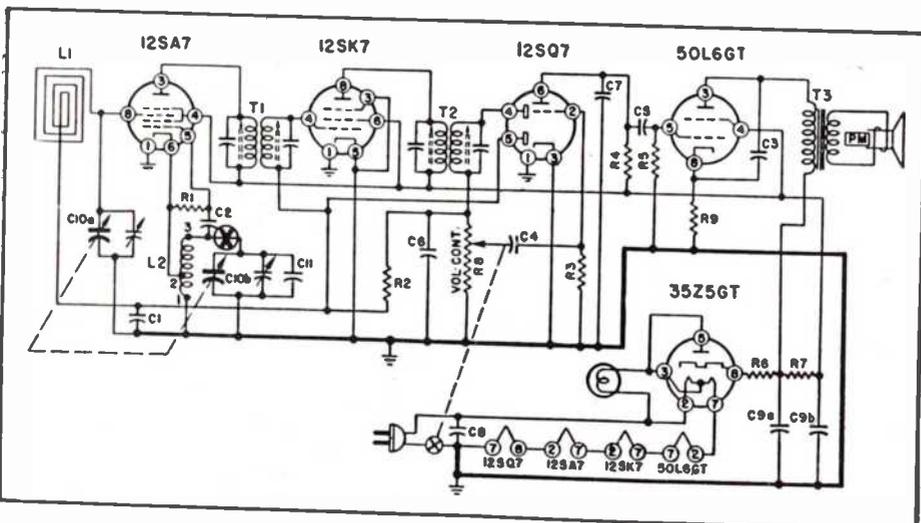
Fig. 4a. List of parts for the Admiral model.

Fig. 4. Admiral 7T10, 7T14 and 7T15, which has had its oscillator circuit revamped; point x.

Fig. 4. The oscillator circuit has been modified to include a .05-mfd capacitor at point x. The B- is now isolated from the chassis by a 150,000-ohm resistor and a 18-mfd capacitor in parallel. The gang capacitor is grounded to chassis and not connected to B- as in the original circuit.

R1.....	22,000 Ohms, 1/2 Watt
R2.....	1 Megohm, 1/2 Watt
R3.....	4.7 Megohms, 1/2 Watt
R4.....	470,000 Ohms, 1/2 Watt
R5.....	470,000 Ohms, 1/2 Watt
R6.....	33 Ohms, 1 Watt
R7.....	1000 Ohms, 1 Watt
R8.....	1 Megohm Volume Control and Switch
R9.....	150 Ohms, 1/2 Watt

C1.....	.1 mfd., 200 Volts, Paper
C2.....	50 mmfd., ±20%, Ceramic
C3.....	.02 mfd., 400 Volts, Paper
C4.....	.01 mfd., 400 Volts, Paper
C5.....	.01 mfd., 400 Volts, Paper
C6.....	250 mmfd., ±20%, Ceramic
C7.....	500 mmfd., ±20%, Ceramic
C8.....	.05 mfd., 400 Volts, Paper
C9a.....	50 mmfd., 150 Volts } Elec
C9b.....	30 mmfd., 150 Volts } Elec
C10a.....	Gang, 0 to 420 mmfd. }
C10b.....	Gang, 0 to 162 mmfd. }
	(Spot welded to drum)
C11.....	20 mmfd., ±20%, Ceramic



JOHN RIDER SAYS ...

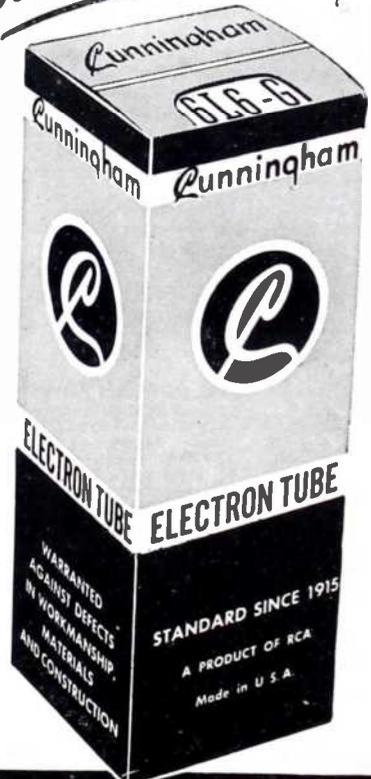
Systematize Your Servicing



● Most technical activities are planned and accomplished by means of a systematic working method. Servicing is no different. Often, system is described as "red tape," and frowned upon, but even red tape has its place, where it prevents indiscriminate starting and stopping of activities.

In the servicing field the possession of test equipment permits planned and systematic operation. Sometimes, the application of a planned method of procedure may seem roundabout, but in the long run it is the fastest and most efficient way to conduct a servicing business. As an operator becomes accustomed to systematic operation he becomes more and more rapid with his work; the various steps become almost automatic and so does his association of thoughts related to the diagnosis of a troublesome problem. Try it for a while—say, three months or so—and you'll be surprised at the good results.

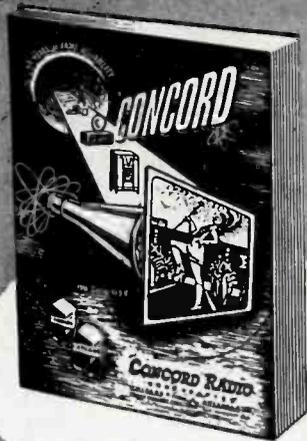
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X157M	10-10	450	47c	X162M	16	500	39c
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JOTS AND FLASHES

TELEVISION IS RAPIDLY BECOMING a daily service in the key cities of the country and manufacturers are keeping in step with this expansion with unprecedented receiver production. Last month approximately 30,000 tv receivers were made. Thus far, there are close to 100,000 receivers in the field. It is expected that there'll be twice as many around within the next few months. Most of the major manufacturers either have or soon will announce television models in their lineup of receivers. In the main, the 10" tube type is the most popular. However, projection models with 15" x 20" and 18" x 24" screens will be featured, too. The 12" type tube will be included in moderately-priced models, which will also provide f-m and a-m service, by at least two manufacturers. The tv parade is on. . . . A 4-page bulletin (201), with specifications on 12 types of crystals, has been issued by Premier Crystal Labs., Inc., 57-67 Park Row, New York 7. . . . The Southern California Radio and Electrical Association, Los Angeles, are planning an extended f-m dealer, public educational program. H. Leslie Hoffman, president of Hoffman Radio Corp., is chairman of the committee, who will conduct the program. Others on the committee include Sy Cooper, California rep. for Pilot; Loyd Sigmon, KMPC chief engineer; L. J. Perkins, G. E. radio sales manager, and C. J. Bledsoe, Westinghouse radio and appliance manager. . . . Grady Duckett, of Atlanta, Georgia, and Porter Holland, Dallas, Texas, have been appointed P. R. Mallory & Co. sales representatives to cover southern state territories. . . . Display cards featuring phonograph needles, neutralizing tools, dial pointers, test leads, etc., have been announced by the JFD Mfg. Co., Inc., 4117 Ft. Hamilton Parkway, Brooklyn 19, N. Y. . . . W. S. Harmon Co., 830 Venice Blvd., Los Angeles 15, is now a member of the Los Angeles chapter of the Representatives. Harmon covers Southern California for Electronic Rectifiers, Inc., Indianapolis, and Industrial Hardware and Mfg. Co., New York. . . . The Walter Hervey Junior College, 15 W. 63rd Street, New York City, a collegiate branch of the YMCA schools, is now offering two-year transfer and terminal diplomas for basic engineering and radio electronics. . . . The 1946 annual report of the P. R. Mallory & Co. was judged as the best in the electronics and radio industry in the *Financial World* annual report survey. The bronze "Oscar of Industry" was presented to P. R. Mallory, chairman of the board. . . . Land-C-Air Sales Inc. are now located at 1819 Broadway, New York 23. . . . Sherman M. Fairchild, chairman of the board of Fairchild Camera and Instrument Corp., is now in Europe surveying engineering developments and production techniques in the precision instrument fields. . . . Les A. Thayer, sales manager, merchandise division, Belden Mfg. Company, has been elected chairman of the Association of Electronic Parts and Equipment Manufacturers in Chicago. Charles Hansen, of Jensen Mfg. Company, was named vice chairman and Helen Staniland of Quam-Nichols Company was elected treasurer for the twelfth consecutive year.

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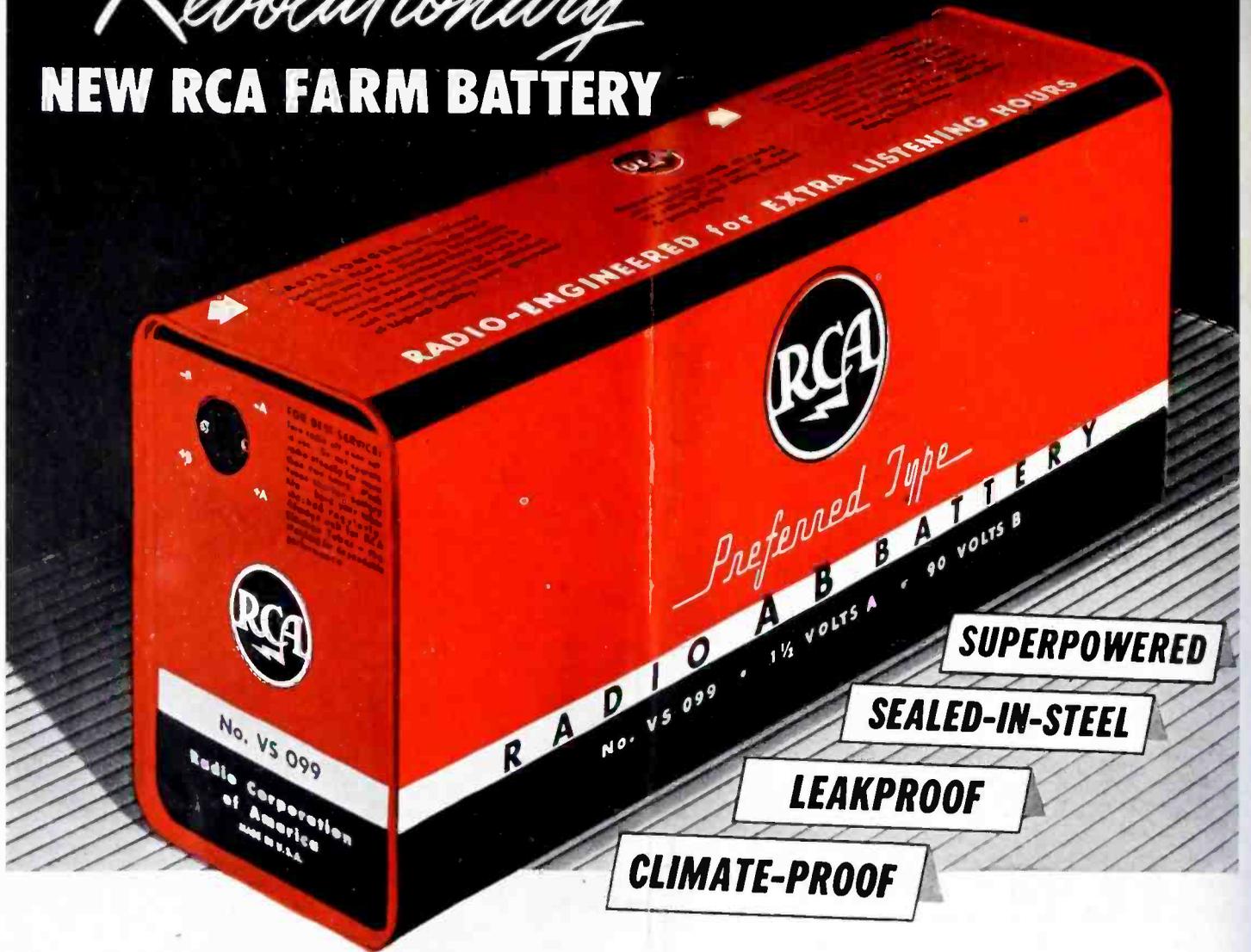
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