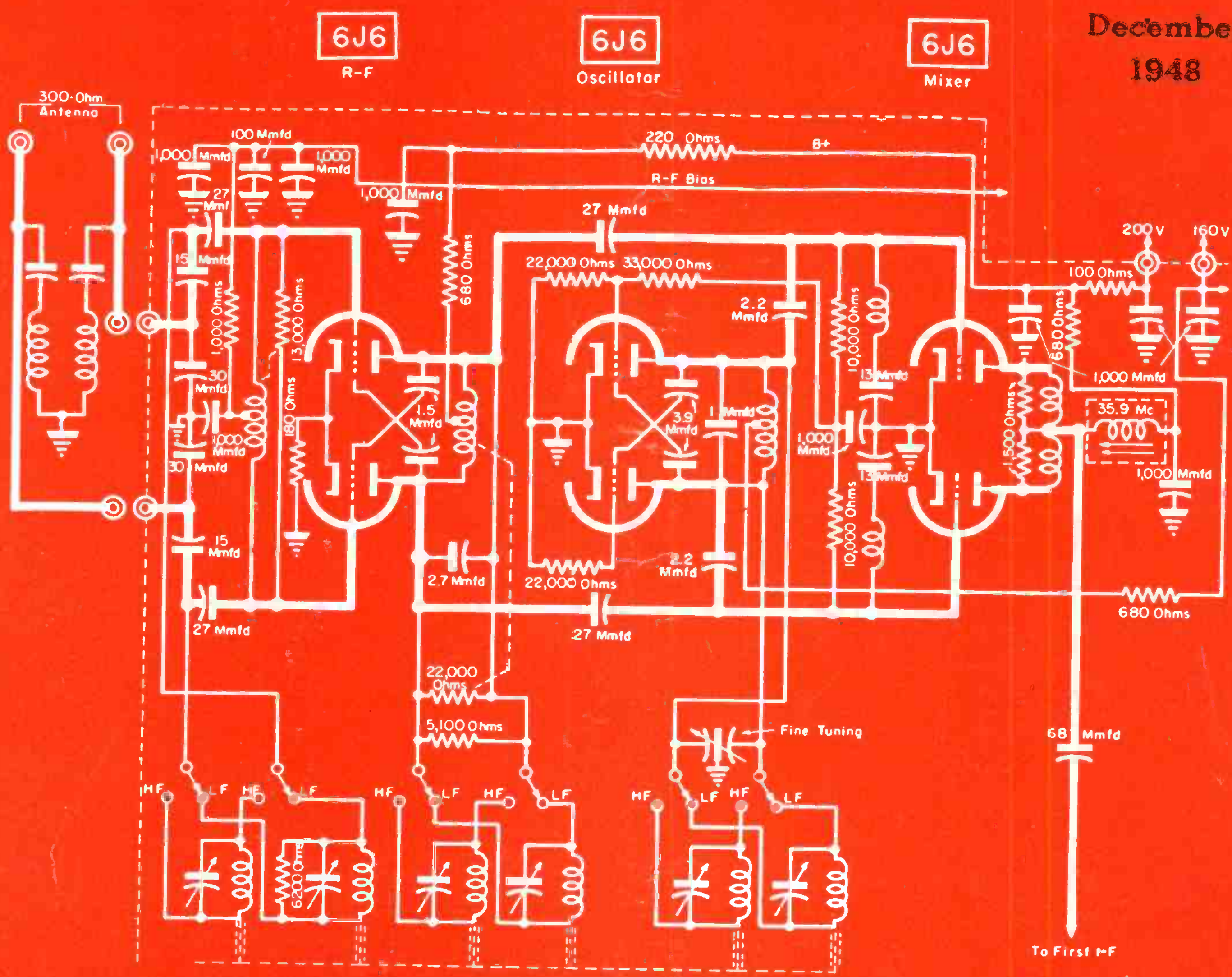
RADIO · TELEVISION · ELECTRONIC

SERVICE

December
1948



The r-f, oscillator and mixer system of a table-model push-button TV receiver using a 10-inch picture tube.

(See page 3)

THE TECHNICAL JOURNAL OF THE RADIO TRADE

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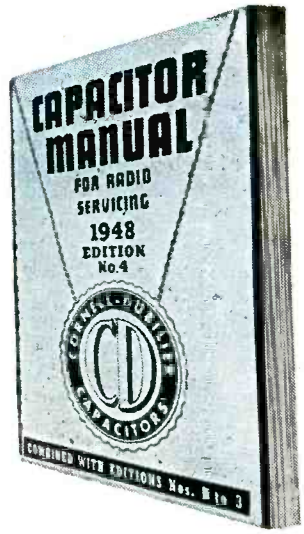
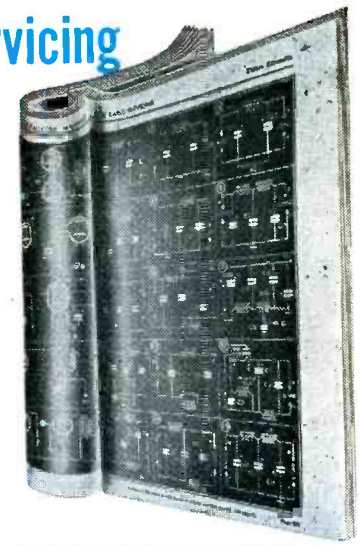


c-d capacitor manual

For Radio Servicing



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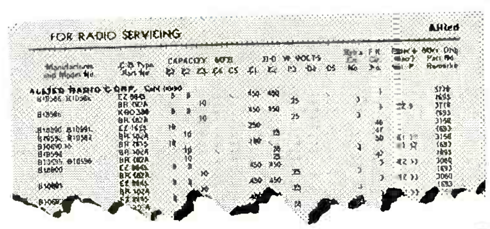

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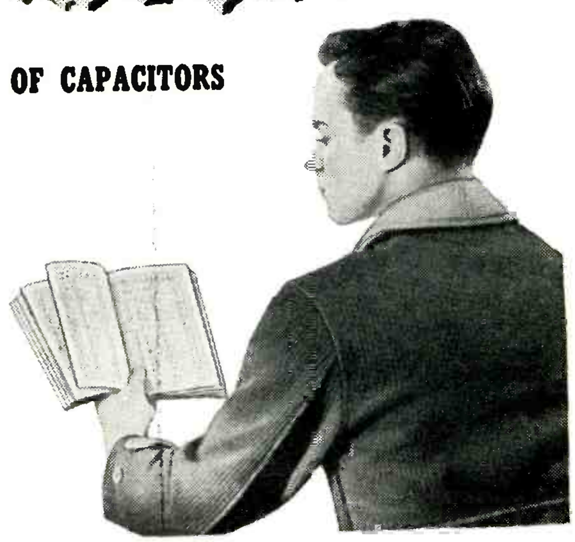

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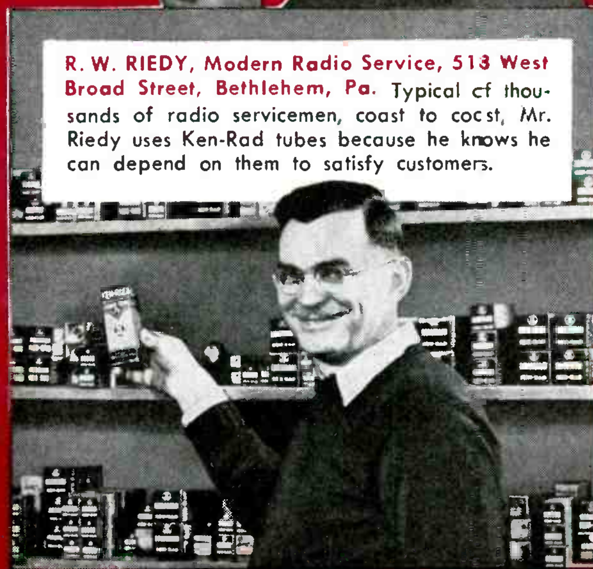

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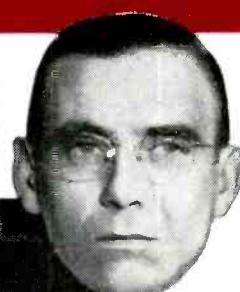
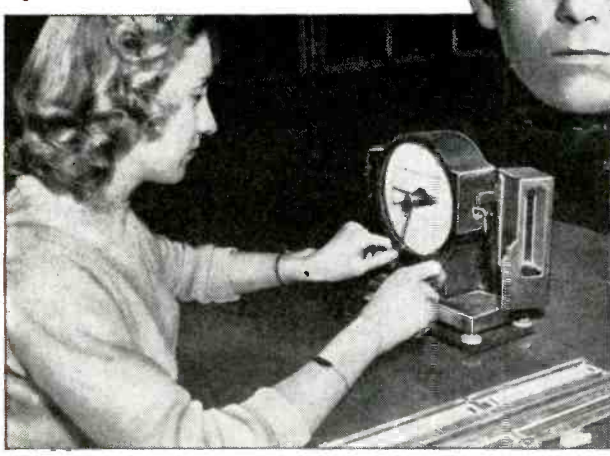
EMMETT MERCER, Foreman, is responsible for the weighing of cathode sleeves to check coating weight (shown below). Another example of the great care that is taken in making Ken-Rad tubes.





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The Serviceman's Tube

Vol. 17, No. 12

RADIO · TELEVISION · ELECTRONIC
SERVICE

December, 1948

LEWIS WINNER
Editorial Director

F. WALEN
Assistant Editor

ALFRED A. GHIRARDI
Advisory Editor

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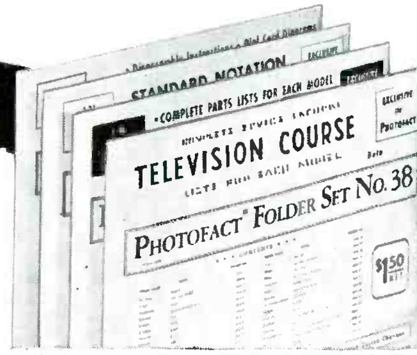

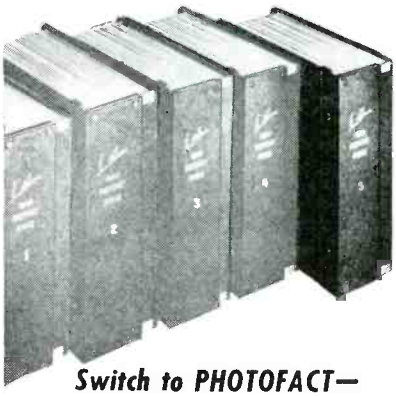

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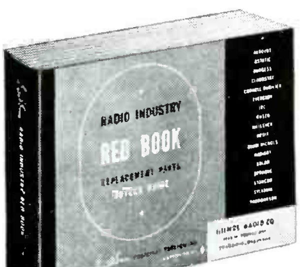

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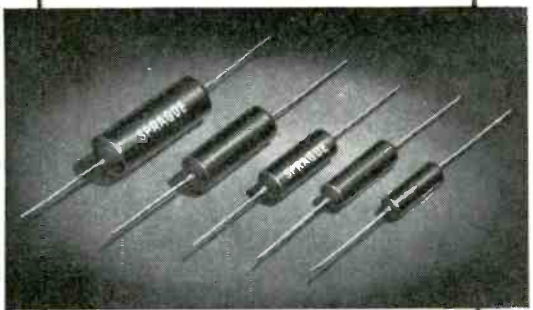

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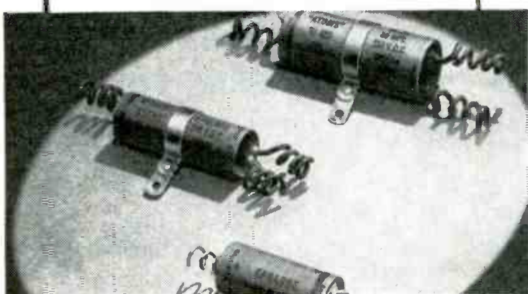

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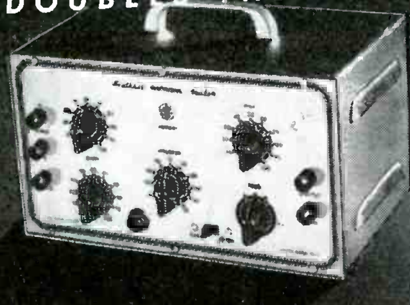

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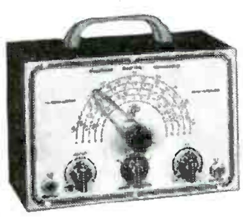

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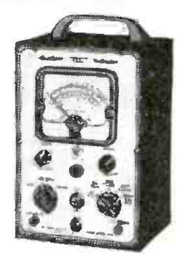

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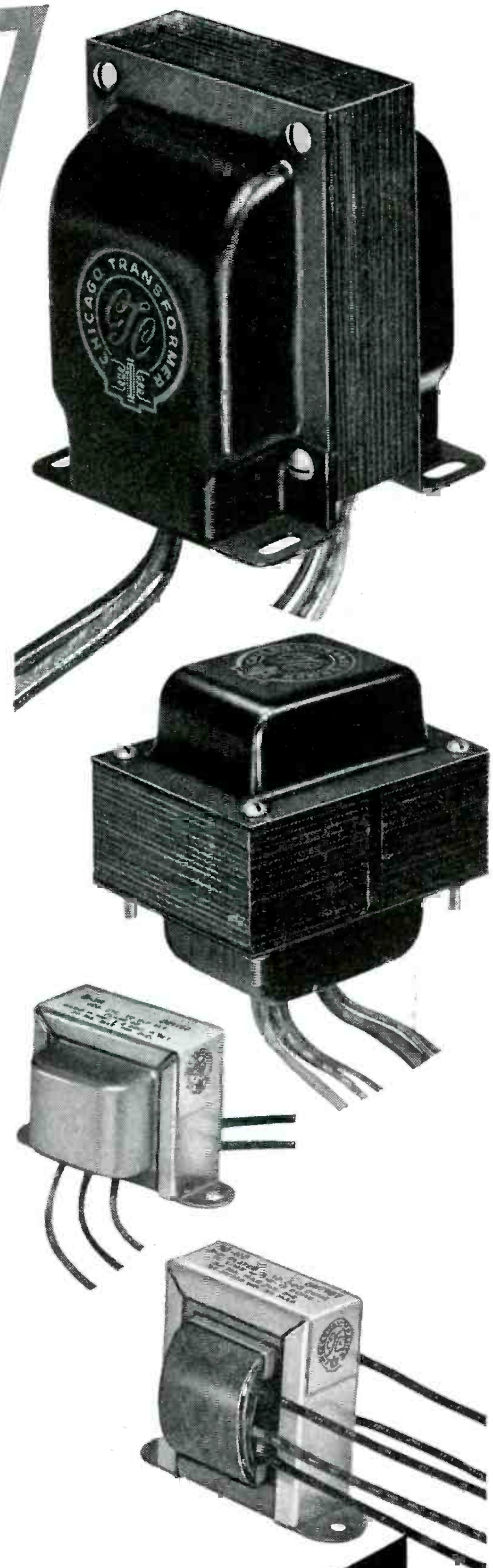

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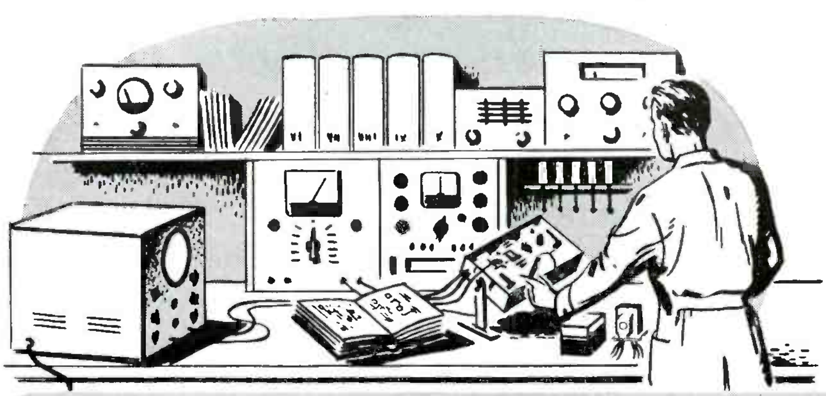

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The Service Man in 1948

FEW YEARS IN THE HISTORY of *Servicing* have been as significant . . . in economic, technical and social advancements . . . as 1948. This has been a year of dominant progress for the Service Man on all fronts . . . a year during which industry and the consumer have become more cognizant than ever before of the important role the Service Man plays in the life of Mr. and Mrs. America.

To television, the Service Man owes much of his thanks for the accented appreciation of his talents. For the first time in a score of years, the Service Man has been able to demonstrate effectively what his know-how means and how his special schooling in the knotty aspects of the art can assure the full bright enjoyment of sight and sound to every home.

The telecaster has been extremely grateful to the Service Man for keeping the picture tubes going and maintaining his much-needed audience. Without the installation of the proper antenna, matched lines, correct adjustment of sync circuits, proper positioning of the picture tube and its accessories, and the particularly important instruction to set owners, the Hooper rating of TV programs would be at a dismal low.

Town meetings and clinics have been extremely important features of '48 too, providing valuable information on all phases of servicing, from bookkeeping, sales, and credit to shop and field work in AM, FM, TV, instruments and sound.

The town meetings in Philadelphia, New York and Boston were hosts to over 6,000 Service Men who heard well-prepared and illustrated talks by such experts as John F. Rider, John A. Meagher, Ira Kamen, Edward M. Noll, Harry P. Bridge, Austin C. Lescarboura, Bill Parkinson and dozens of others. Next year Atlanta, Georgia; Los Angeles, and Chicago will play hosts to these meetings with the Atlanta meeting scheduled for January 31, February 1 and 2 in the Municipal Auditorium, and the Los Angeles gathering at the Roger Young Auditorium on February 28, March 1 and 2. The Chicago clinic is expected to be held in the early spring months.

Attendees at the town meetings were also privileged to hear RMA prexy Max Balcom, who keynoted the meetings with very illuminating talks. During one meeting Mr. Balcom said, "I know that we manufacturers often have failed to recognize the importance of the Service Man who services the sets we make. And I suspect that many of you have not always understood the problems we manufacturers have been up against when you struggle to repair a receiver of an unusual or intricate design.

"But as often happens, we are being brought closer together today by force of circumstances: primarily by television and secondarily by FM broadcasting. I believe that this closer cooperation will prove beneficial to all . . . the Service Man, distributor, dealer and the manufacturer.

"All of us in the industry are having to, in effect, go back to school to keep abreast with the rapid developments in television. While closely akin to standard receiver practice, television is different in so many respects that everyone, from the design engineer to the salesman, has had to start from scratch to produce and market this new and exciting production. Television requires new production techniques and know-how. It requires new marketing and selling methods. And TV sets require new servicing knowledge and practices.

"The servicing of home receivers, particularly the new TV sets, is rapidly becoming a big business, and it will require well-trained men who are familiar with the instrument they are servicing and the most modern techniques for detecting and correcting any trouble that may develop."

Associations held their own clinics, too, in '48 and very successfully. The New York group initiated a program on TV which began in October, '48, and will last until May, '49. Every branch of TV servicing has been scheduled: antennas, front ends and *if* systems, video amplifiers, horizontal and vertical sync circuits, low- and high-voltage power supplies, picture tubes, alignment and servicing test equipment.

The Pennsylvania State Federation group held a series of clinics at each of its chapters during '48, with John F. Rider as guest speaker, covering antennas and instruments. Service associations in the Middle West and on the Pacific Coast also heard Al Saunders deliver his popular talks on TV.

Distributors and manufacturers were also active TV clinic holders in '48, with scores of bigger and better meetings scheduled for '49. Even those areas where television is months away became TV conscious in '48 and set up clinics. In Kansas City, for instance, the Electric Association of Greater Kansas City prepared a year-long course, which was underwritten by ten major distributors in the area, each of whom contributed $125 to establish the program. The cost of the course to the student, $53, was in most cases paid for by the local association and distributors. Some of these expenses were also borne by the Missouri State Board of Education. Another excellent example of clinic work was presented by the Northern Illinois and Wisconsin distributors and associations with a crowded two-day session which began at 8:30 A.M. and ended about 5:30 P.M. Over one hundred Service Men attended these streamlined TV clinic sessions.

Associations once again became a factor in '48, contributing to the remarkable strides in consumer and industry acceptance of the Service Man. Excellent codes played quite a part in cementing this friendship. One such code adopted during the Philadelphia Town Meeting and prepared by the delegates of the Federation of Radio Service Men's Associations of Pennsylvania, set a fine example around which many codes were prepared. The code said in part: "I will at all times, without any exceptions, perform my work to the very best of my knowledge and ability. In addition, I will make a sincere effort to improve my knowledge of the technical and business requirements of my profession, thereby enabling me to render still better radio-electronic service. . . . I will engage only in fair and ethical practices recommended and approved by the radio-electronic profession as being conducive to public confidence."

Yes, the Service Man grew in '48 and today he is the perfect liaison between industry, broadcaster and consumer. In '49 we are sure that his stature will continue to grow.—L. W.

Servicing Taxicab Radio

Typical Troubles Encountered in Servicing Two-Way Systems Operating in 152-162 Mc Bands and How to Remedy Them . . . Composite Characteristics of 15 Types of Receivers and Transmitters . . . Charges Usually Made for Mobile System Servicing.

by SAMUEL FREEDMAN
New Developments Engineer
DeMornay-Budd, Inc.

IN THE PREWAR days two-way systems operated on the 30-40-mc band. Today taxicab two-way equipment is required to operate in the new postwar 152-162-mc band. There are three major differences between the low- and high-band systems:

(*1*) More tubes are employed in both the transmitter and the receiver. This is due to increased frequency multiplication of the transmitter crystal frequency. In the case of some receivers, it is due to the use of double conversion in the superhet receiver.

(*2*) The four-fold increase in frequency or four-fold reduction in wavelength begin to manifest conditions that are common on microwaves . . . increased inductive reactance, reduced capacitive reactance, appreciable distributed capacitance and inductance for the frequency involved. We also have quarter-wave problems with which to contend; conditions invert every quarter wavelength (or every 20″) for any conductor. Thus it is necessary to use very short lengths of wiring to avoid resonant line effects.

(*3*) Although more tubes are employed, they are usually of the receiving type. The 6AK5 is one of the most popular in use, where the 6AC7 was the popular low-band prewar tube.

The composite receiver based on average specifications of fifteen manufacturers comprises 14.3 tubes ranging from a minimum of 12 to a maximum of 17. The receivers may use:

(*a*) One or two stages of *rf* amplification.

(*b*) An oscillator-multiplier or an oscillator and a harmonic amplifier, the oscillator being crystal controlled.

(*c*) A first mixer at a high *if* frequency.

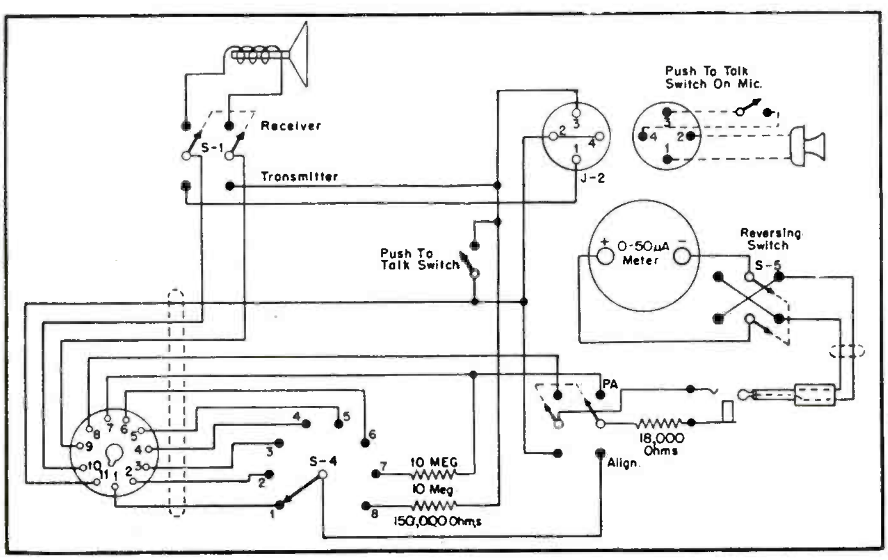
(*d*) Two or three *if* stages.

(*e*) A discriminator.

(*f*) Two stages of audio.

Some receivers also use a second mixer at a low *if* frequency. Other special features include noise amplifier, noise rectifier, squelch, and synchro-cycle control (an *afc* provision which locks the receiver to transmitter frequency), etc.

Test set plan used for the alignment of the dispatcher.



The Transmitter

The composite transmitter based on average specifications of fifteen manufacturers uses nine tubes ranging from a minimum of six to a maximum of twelve. Transmitters usually have:

(*a*) A pair of modulator tubes.

(*b*) A crystal-controlled oscillator.

(*c*) Four or five frequency multiplier stages operating as either doublers, triplers or quadruplers to raise the crystal frequency in the oscillator stage to that of the output frequency in. Out of the fifteen setups analyzed, seven use a frequency multiplication of 48, two use 36 times, two use 54 times, two use 96 times, one uses 32 times and one 64 times. Typical examples of frequency multiplication actually employed are: 32 times (one quadrupler and three doublers), 36 times (two triplers and two doublers), 48 times (one quadrupler, one tripler and two doublers), 54 times (three triplers and one doubler), 64 times (two quadruplers and two doublers), 96 times (one quadrupler, one tripler and three doublers).

The transmitter output tubes and the rated power outputs are:

Manufacturer	*RF Output Tube*	*Rated Output*
Motorola Dispatcher . .	2E26	7 to 10 watts
Raytheon	832A	15 watts
Link	829B	15 watts
Comco	3D23	15 watts
Wilcox	832A	15 watts
General Electric	(2) 2E24	15 watts
Kaar	(2) 5515	20 watts
Western Electric . . .	(2) 2E24	20 watts
RCA	(2) 2E24	20-25 watts
Federal	(2) 5516	25 watts
Mobile Communications .	632A	25 watts
Harvey	(2) 5516	30 watts

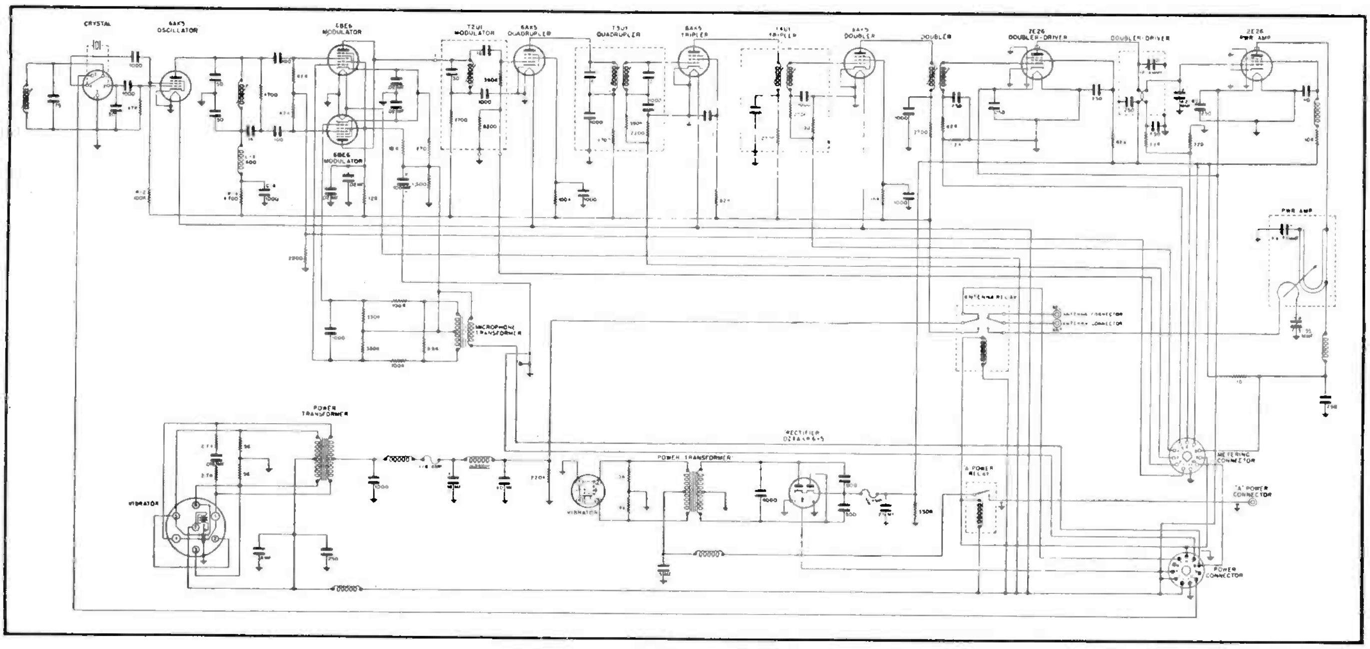


Fig. 1. **Circuit of the Motorola dispatcher transmitter.**

Temco	829B	30 watts
Doolittle	(2) 2E24	30 watts
Motorola Standard ..	(2) 2E24	30 watts

General Mobile Radio Troubles

The troubles likely to be encountered with any type of mobile two-way radio equipment are:

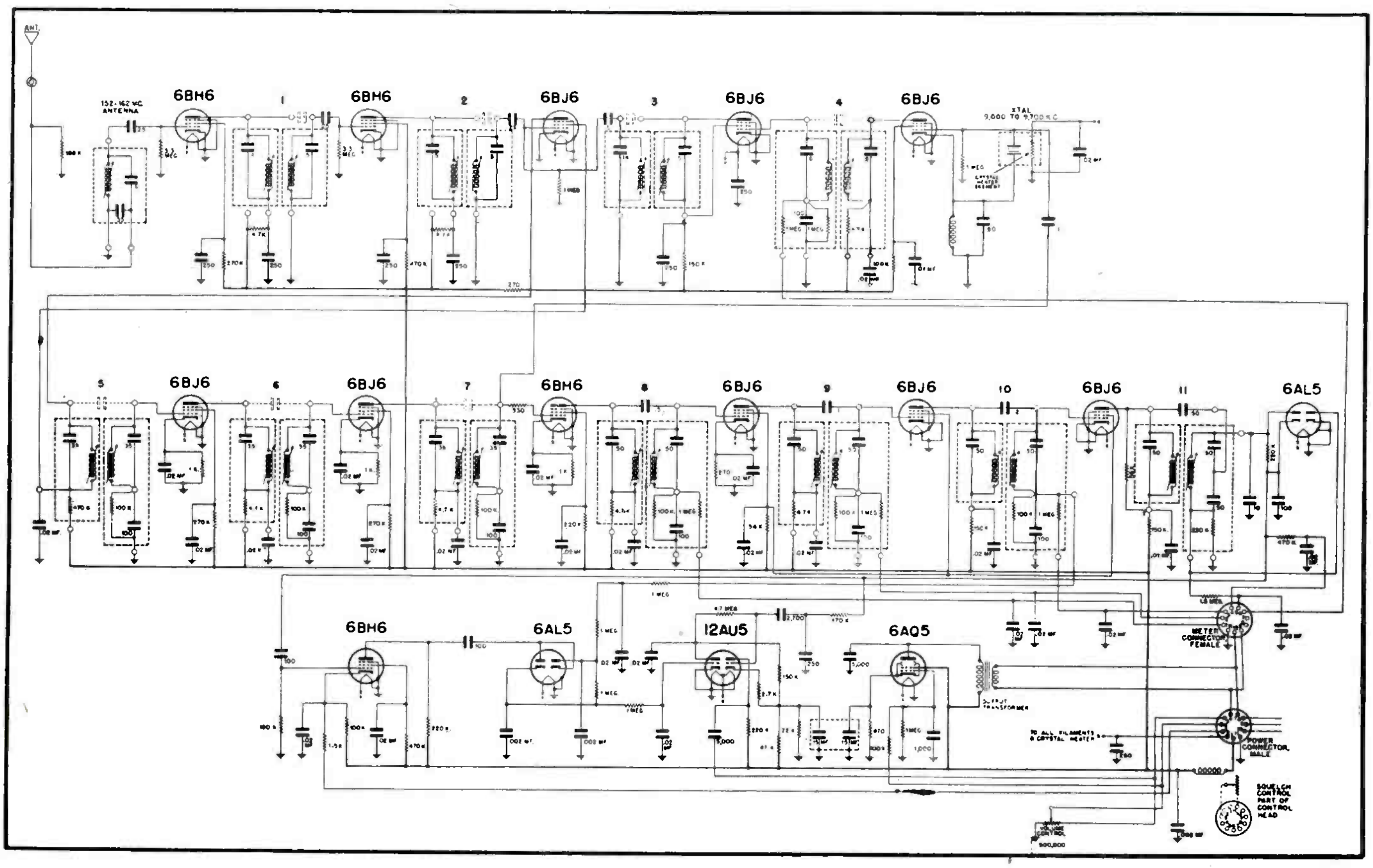
(*1*) Worn rotating or switching parts. Eventually any part that moves, turns or slides to make contact will require replacement. Usually these problems can be detected by three symptoms:

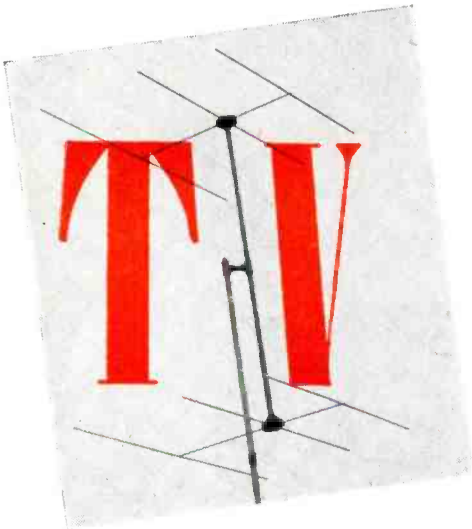
(*a*) Loud scratching or intermittent signal as volume control is moved. It may also reveal itself at the volume control by getting weaker instead of louder as the setting is advanced.

(*b*) Failure of circuit to close when

(*Continued on page* 40)

Fig. 2. The Motorola dispatcher receiver circuit. 6VH6s are used for first and second *rf*; 6BJ6, first mixer; 6BJ6, second quadrupler; 6BJ6, first quadrupler and oscillator; two 6BJ6s in dual *if* stages, a 6BH6 as a second mixer; another 6BJ6 in the second *if* stage; two 6BJ6s in the first and second limiter stages; a 6AL5 as a discriminator; 6BH6, noise amplifier; 6AL5, noise rectifier; 12AU5, first audio and squelch and 6AQ5, power amplifier. The first and second *rf* stages cover the 152-162 mc bands, points *1* and *2*. At *3* is the second quadrupler covering 144-157 mc; point *4* is the first quadrupler for 36 to 39 mc. At *5*, *6* and *7* are the 7.3-8 mc *if* stages. The 1.7-mc limiter is at *9* and at *10* and *11* are the 1.7-mc limiter and discriminator tubes, respectively.





Installations In FRINGE AREAS

by IRA KAMEN

Manager, Television Antenna Dept.
Commercial Radio Sound Corp.
New York City

Television reception in fringe areas (over 45 miles from the TV transmitters) is dependent on three fundamentals:

(*1*) Signal-to-noise ratio in the area.

(*2*) Gain and directivity of the television antenna.

(*3*) Sensitivity of the television receiver.

The signal-to-noise ratio in any fringe area can usually be improved by increasing the height of the TV antenna and by selecting antennas with a narrow horizontal and vertical pick-up pattern.

The gain and directivity of any antenna array depends upon the number of dipole and parasitic elements assembled within the array.

The simplest stacked array used for bi-directional high gain pick-up is the double dipole which narrows the vertical angle of the antenna's pick-up pattern; Fig. *1*a. Narrowing the vertical pick-up angle improves signal-to-noise ratio because:

(*1*) The TV signal from the station develops in-phase voltages on the dipole elements which *add up*, in phase, at the input to the transmission line.

(*2*) Aperiodic noise fields from sources above or below the dipoles develop voltages are out of phase at the transmission line input and therefore tend to cancel.

The signal-to-noise ratio of this antenna is further improved when reflectors are added behind each dipole (common *Lazy H*, Fig. 1*b*) as the horizontal television signal pick-up angle is concentrated in one direction and therefore noise fields from the direction are rejected. In addition, the gain of the antenna is increased. The reflectors are usually placed one-quarter wavelength behind the dipole elements. This one-quarter wavelength spacing is adjusted for the mean frequency to which the dipole elements are cut. When the elements are cut and adjusted for channel *4*, the antenna is usually satisfactory for channels *2* to *6*, and when they are adjusted for channel *10*, the antenna may be used for channels *7* to *13*.

Folded dipoles may also be stacked, with or without reflectors, for high gain and directivity in one TV band (channels *2* to *6* or *7* to *13*); Fig. 2. This antenna is best matched to 300-ohm line.

Perfect matching of coax or 300 ohm-twin lead transmission lines to a TV antenna over the entire band is not practical and relatively unimportant, providing the mismatch is not severe. A mismatch between the antenna and the transmission line of 3:1 produces a loss of only a few db in power. The mismatch in impedance at the antenna *does not affect the quality of the picture when the receiver input matches the impedance of the transmission line.*

Another method of increasing the signal-to-noise ratio of a TV antenna is to place a director in front of a folded dipole or straight dipole and

Fig. 4 (above). Double stacked array of dipole, director and reflector. (*Courtesy Workshop Associates*)

Fig. 2. Stacked folded dipoles and reflectors. Impedance at the mean frequency (channels *4* or *10*) is approximately 150 ohms.

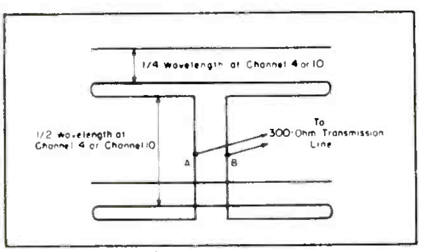


Fig 1. In *a* appears a setup for a stacked dipole for the *2* to *6* channels adjusted for the mean frequency (channel *4* or *10*). Impedance at points *A* and *B* is approximately 36.5 ohms at channel *4* or *10*. In the layout, the rods are ¼ wavelength at channel *4*. In *b* is a *lazy H stacked* dipole with reflectors.

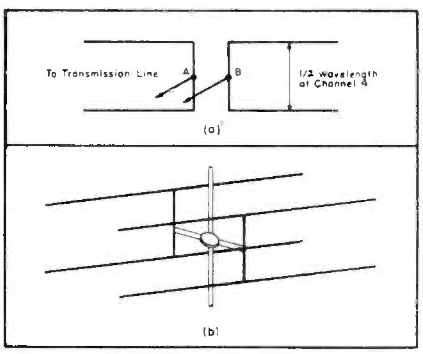
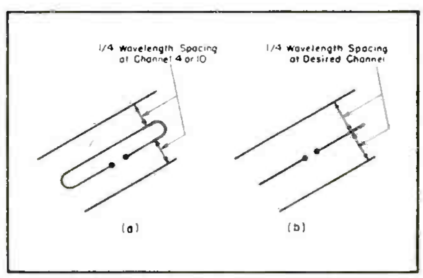


Fig. 3. At *a*, a folded dipole (with director and reflector) adjusted for broadband and directivity at channels *2* to *6*. At *b* we have dipole director and reflector assembly adjusted for single channel high gain and directivity.



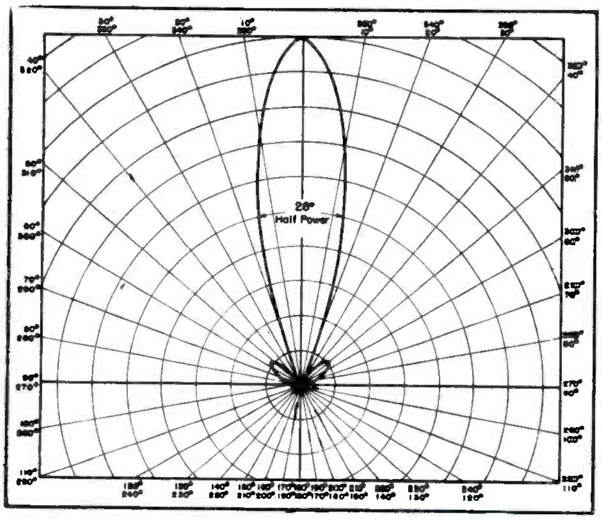


Fig. 6 (above). Horizontal pattern of antenna shown in Fig. 5.

(Courtesy Workshop Associates)

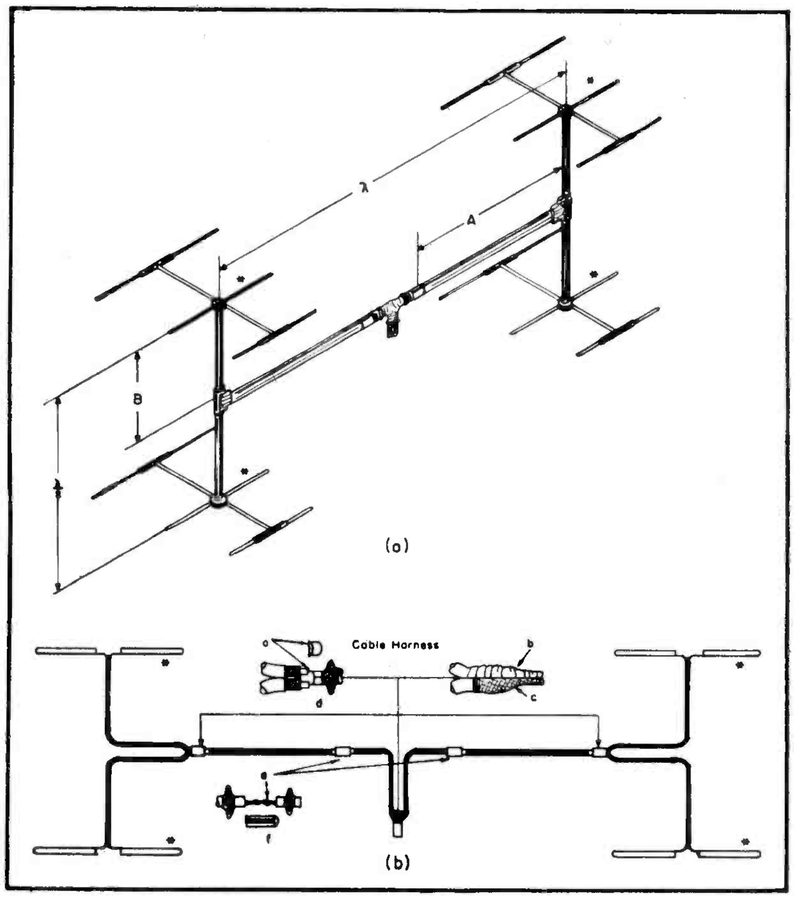


Fig. 5 (right). Dual-double stacked array of dipoles, directors and reflectors. To secure maximum efficiency with this system the element must be spaced very carefully: Channel *3* (63 mc) distances between λ are 187 19/64"; *A*, 89 17/32" and *B*, 45 43/64"; channel *4* (69 mc) distances between λ are 171 1/64"; *A*, 81⅛" and *B*, 41 19/32"; channel *5* (79 mc) distances between λ are 149 23/64"; *A*, 70 9/16" and *B*, 36 3/16"; Channel *6* (85 mc) distances between λ are 138 53/64"; *A*, 65 9/32" and *B*, 44 35/64"; for FM (97 mc) distances between λ are 121 41/64"; *A*, 56 45/64" and *B*, 29¼"; channel *8* (183 mc) distances between λ are 64 31/64"; *A*, 28 7/64" and *B*, 14 31/32"; channel *10* (195 mc) distances between λ are 60 33/64"; *A*, 26⅛" and *B*, 13 31/32"; channel *12* (207 mc) distances between λ are 57"; *A*, 24⅜" and *B*, 13 3/32". The RG-58/U or RG-59/U cables running to the elements are also cut to exact lengths for the eight frequencies. In (*b*) at *a, b, c* and *d*, appears cable harness makeup information: *a*, cover with split sections of insulation; *b*, tape; *c*, wire binding and solder *d*, solder. At *e*, appear details of the junction connection, which is soldered and covered with split sections of insulation. The joint is then wire bound, soldered and taped as shown at *f*. All dipoles* connected to the inner conductor of the coax cable are to be pointed in the same direction.

reflector assembly; Figs. 3*a* and b. The addition of the director element to these antennas beam their pick-up pattern so that the area in which noise can induce energy into the antenna is reduced. This type of antenna usually has a gain of 5 to 6 db. The folded-dipole antenna array is preferred where complete TV (*2* to *6* or *7* to *13*) coverage is required. The straight dipole is preferred for single and adjacent channel operation.

The reflector element is usually 5% longer than the dipole element. The director element is approximately 5% shorter than the dipole. These parasitic elements do not normally reduce the antenna's impedance by more than 25%. The folded dipole array should be connected to a 300-ohm transmission line and the straight dipole array to a 52 or 73-ohm coax cable. The forward gain of this type of antenna can be increased to 7.5 db and the vertical pick-up pattern reduced to 64° by stacking two dipole-director-reflectors arrays; Fig. 4.

The maximum practical gain (11 db) and the narrowest pick-up angle (28°) which can be realized with this antenna principle is available with a dual-double stack array; Figs. 5 and 6.

This array should be used for single channel reception only. Several of these complex arrays may be circuited to a single TV receiver through a coax switch. When a TV receiver with a 300-ohm input is used, a 50/300 matching transformer can be circuited between the coax cable and the television receiver for proper matching.

Another type of fringe area antenna combines a low-channel stacked array and a high-channel three-element directional beamed antenna; Fig. 7. These two antennas may be circuited together if there is no interaction between the high and low-channel antenna units; Fig. 8. The technique of determining interaction between antenna units has been described in an

(*Continued on page* 42)

Selecting the Best Antenna System For Installations Which Are Over 45 Miles From the TV Station . . . Determining What Type Booster To Use . . . Choosing the Proper Low-Loss Leadin Cable.

TV Variable-

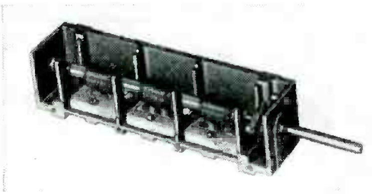


Fig. 1. View of Inductuner.

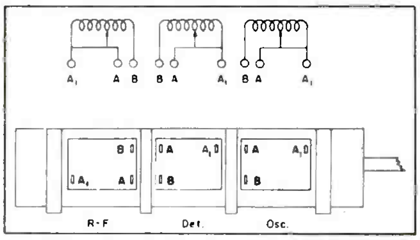


Fig. 2. How the coils are connected in tuner for *rf*, detector and oscillator circuits.

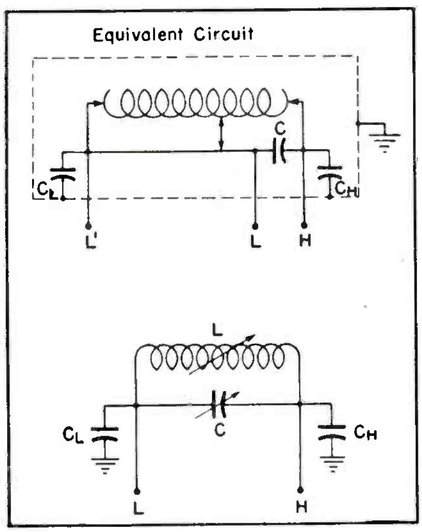
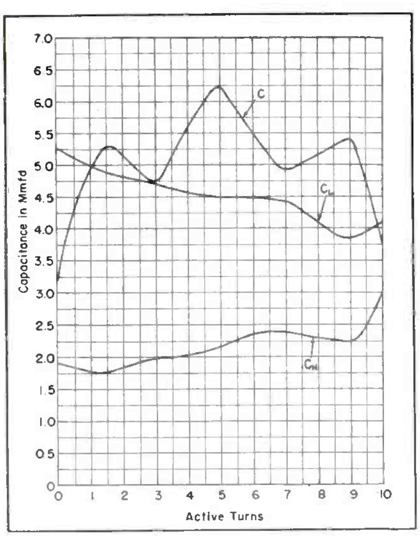


Fig. 3. Circuit analysis of the tuner. The two-terminal network appears as a variable-inductance element which includes stray capacities (C_H and C_L from terminals *H* and *L*, respectively, to ground).



ONE OF THE MAJOR problems in vhf tuning systems has been the rather limited band of frequencies which could be covered in one continuous tuning range, these limits in ordinary capacity-tuned circuits being governed by distributed and lumped capacity effects and a loss of efficiency at the higher frequencies. To satisfy quasi-optimum performance, a different tuning capacity must be used for each band of frequencies. Since this could lead to rather impractical ends in a receiver designed to cover a number of distinct frequency bands, either a compromise in tuning capacity must be made with the attendent sacrifice in efficiency, or another means of tuning must be sought. In most commercial communications receivers covering broadcast, amateur and government frequencies, this problem is satisfactorily solved by utilizing split-section tuning capacitors in conjunction with a rotary band switch, the proper amount of capacity for one or more bands being switched into the circuit. Although this method is the most practical in ordinary communications-type receivers where frequency ranges of 550 kc to 30 or 40 mc are encountered, distributed capacity and circuit losses in the tuning system and bandswitch begin to assume relative proportions as the tuning range is extended into the higher frequencies. At TV and FM frequencies, especially, where overall gain, bandwidth, signal-to-noise ratio, image rejection and circuit stability must approach optimum values for each of the individual channels, the usual variable-capacitor system of tuning leaves much to be desired.

Variable-Inductance Tuning for High Frequencies

In tuning systems employing variable inductances instead of the usual variable capacitances, several distinct advantages are realized. First, a high order of overall circuit stability and efficiency can be maintained since the lumped capacities associated with tuning capacitors are non-existent. Second, it is possible to maintain, or increase, the Q as the frequency is increased by the use of a fixed series inductor of low loss construction. By careful design and apportioning of circuit constants, it is possible to reduce the circuit losses at a rate faster than the increase in circuit frequency. This allows a rise in gain at the higher frequencies which may be used to advantage in compensating for high-frequency losses in other parts of the receiver tuning system. Another main advantage is the ability of an inductance to tune over a much wider range of frequencies than is possible with a variable capacitance, due to the smaller minimum capacity of the inductance.

The Inductuner*

Extensive development work has resulted in production of the *Inductuner*, an infinitely variable inductance unit capable of tuning an extremely wide range of frequencies (44-216 mc) in one continuous range.

In Fig. 1 appears a view of the *Inductuner*. Essentially, the unit consists of three separate variable inductance units ganged on a rotatable ceramic and brass shaft. Each coil is equipped with a sliding shorting mechanism which varies its inductance in proportion to rotation of the shaft. Rotation allows the inductance to vary from approximately .02 to 1.0 micro-

*Registered trademark of P. R. Mallory & Co., Inc., for variable inductance tuning devices, manufactured under Paul Ware Mallory patents.

Fig. 4 (left). Inter-terminal capacitance of a 10-turn Inductuner; measurements made at 1,000 kc. C = capacitance between terminals; C_H = capacitance between high side terminal and frame of tuner; and C_L = capacitance between low side terminal and frame of the tuner.

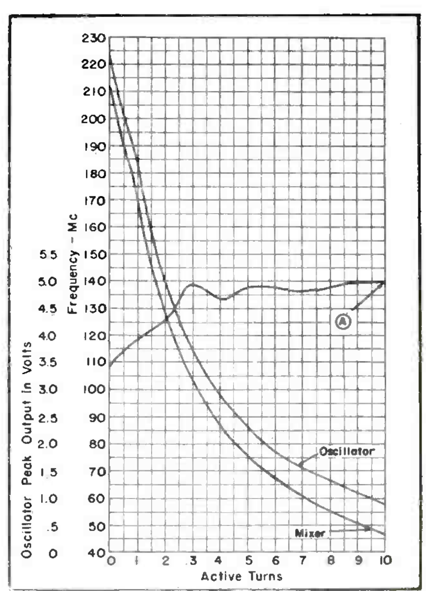


Fig. 5 (right). Oscillator and mixer frequency curves using the 10-turn Inductuner with an *if* frequency of 11 mc. Output voltage (*A*) was measured with Measurments Corp. model 62 *vtvm* with a *vhf* diode.

Inductance Tuning

Design and Application of VHF Tuning System Used in TV Receivers (Du Mont) Which Permits Wide-Band Tuning and Rising Gain in Higher Frequencies.

by JOHN B. LEDBETTER

Engineer, WKRC-TV, WCTS-FM

henry, which provides an inductance ratio of 1:50. Maximum to minimum inductive tuning is obtained by rotating the shaft through 10 turns or 3,600°.

To raise the natural frequency of the unused turns above the operating range of the tuner, the unused turns are progressively shorted on each unit. This permits a reduction in inductance and in distributed capacity effects. In the minimum inductance position the turns are completely shorted and the total inductance of the unit consists essentially only of the current path in and out of the unit.

In Fig. 2, terminals A_1 and B are connected directly to the ends of their coil, while terminal A is connected to the slider shorting bar which in turn is connected internally to the A_1 end of the coil. In circuits where an absolute minimum of inductance is required, connections are made to terminals A and B and no connection made to A_1. Terminal A_1 may be used instead of terminal A in circuits where convenience of wiring is more important than a reduction in circuit inductance.

The tuner is mounted on a rigid, aluminum die-cast base to eliminate errors due to frame torsion. The front bearing consists of a number of balls rolling in a cone bearing race, while the rear bearing is a single ball between the shaft end and an adjusting screw stud. Complete shielding is provided by a cover of sheet aluminum. Ceramic terminal block insulators are provided in order to reduce possibility of leakage losses from this source. Coil forms are molded mica-filled phenolic, held to close tolerances to maintain good tracking between coils.

Equivalent Circuit

Generally, the *Inductuner* may be thought of as a two-terminal network. Although three terminals appear, terminals L and L^1 (Fig. 3) are merely opposite ends of the bar along which the shorting slider runs. Operation of the unit is essentially the same whether terminals H and L (high-side and low-side terminals) or H and L^1 are used, except that in the latter case the minimum inductance will be higher due to the extra length of current path.

The two-terminal network appears as a main variable-inductance element which includes stray capacities (CH and CL) from terminals H and L, respectively, to ground. In shunt with the inductance, across terminals H and L, is a third capacitance (C) which consists of, first, a fixed portion representing inter-element stray capacitance and, second, a *variable* portion which in reality is the distributed capacity of the inductance itself. As turns are progressively shorted out, the distributed capacity is changed and ultimately reduces C to a minimum value; Fig. 4. This plot also indicates the variation of capacitances CH and CL as the total tuning range is covered.

In Fig. 5 may be seen the relationship of *true inductance* versus *active turns* of the tuner. The values presented have been corrected for lead and capacitance C and are those seen when looking *into* terminals H and L.

Due to its ability to maintain a constant and accurate setting over extreme periods of time, the *Inductuner* may be precisely calibrated. The maximum reset error at 100 mc is 50 kc, and 100 kc at 200 mc.

Credits

Material, photos and diagrams are reproduced through courtesy of P. R. Mallory & Co. and especially through the personal cooperation of Myron F. Melvin.

Fig. 6. Typical circuit for 44 to 216-mc continuous tuning with a 10-turn Inductuner. At *A* are two turns of ¼" diameter No. 18 wire, ¾" apart, coupled opposed. At *B* is the end inductor and at *C* are the shunt inductors.

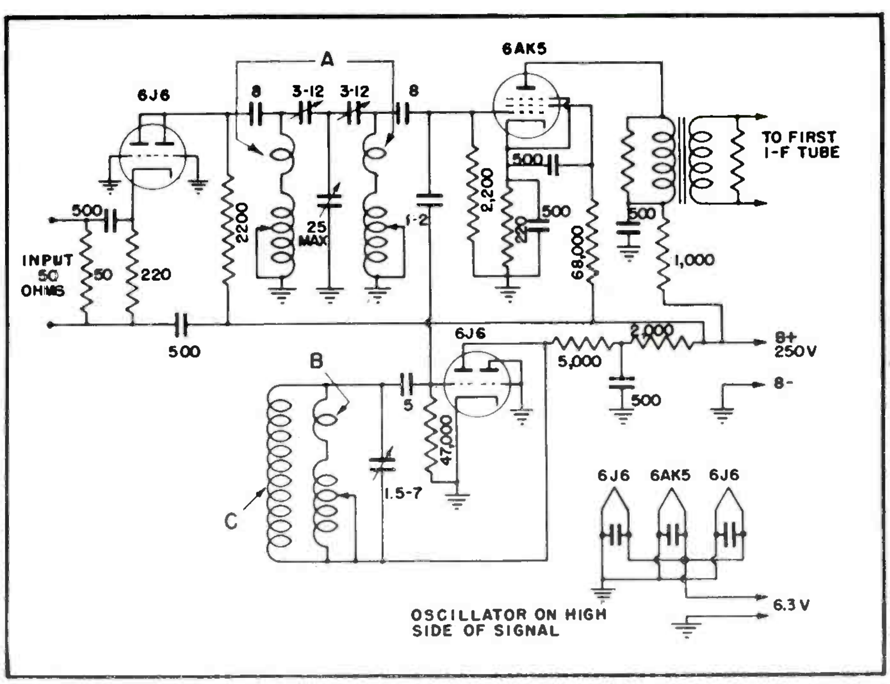


Fig. 1. How to connect a double-pole double-throw switch in the audio circuit to provide application of an *lp* pickup. Shield is connected to point *B* in circuit.

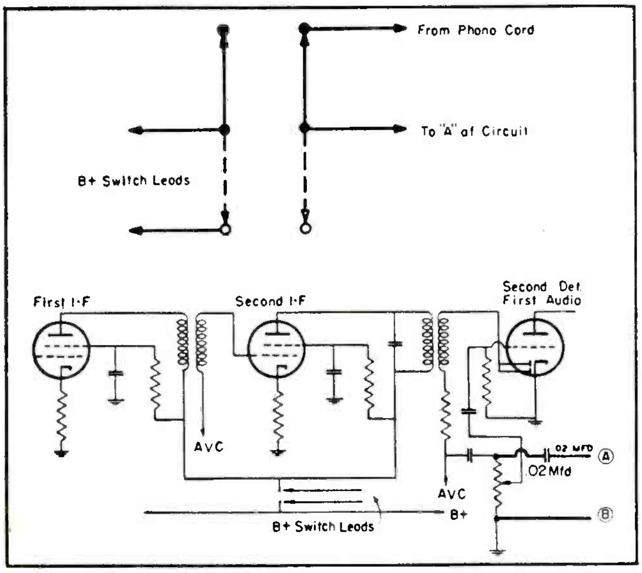
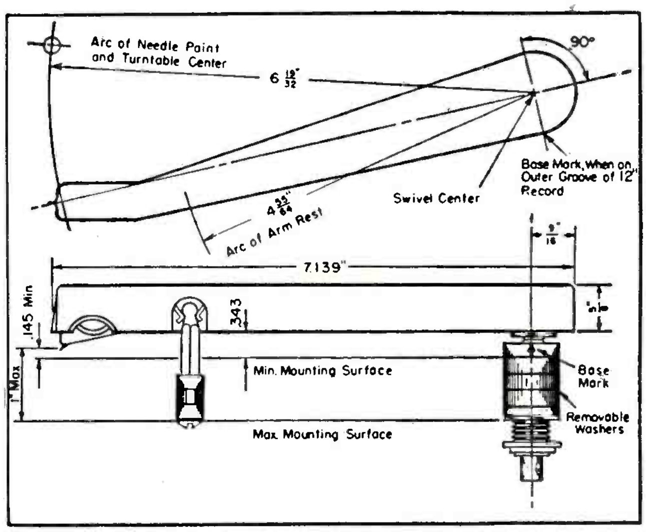


Fig. 2. How pickup height (*Astatic FL33*) can be adjusted by space washers so that bottom of arm is parallel with top of record when needle rests on record.



The LP Microgroove

Part II . . . How To Install and Operate Automatic Record Changers, Pickup and Motor Assemblies Designed for the New Long-Playing Microgroove Records.

by RALPH M. BARUCH

THERE ARE two general types of automatic *lp* record changers that Service Men can sell and install in existing setups, one which will supplement and another which will provide new record playing facilities. One type which can be used to supplement the existing operations is an automatic record changer for microgroove records only.[1] This player attachment is automatic and several installation precautions must be noted. If the radio-phono to which the player is to be attached has its phono connection already in use, a single-pole double-throw switch must be connected to the player, thereby allowing for easy switching from the two types of record players. When radio-phonos have no phono provision a double-pole, double-throw switch is required, connecting the shield to point B as in Fig. 2.

Another model[2] available is a dual-speed automatic record changer for both standard and microgroove records, as well as standard 33⅓ recordings. The changer is supplied with a counterbalance control which allows for two kinds of pressures (one for each type of record) and two different needle points, .001″ for *lp* and .003″ for standards. Little servicing is required for both types of players. However, after approximately 1 year or 1,000 hours of operation a few drops of high-grade oil should be applied to the top bearing, bottom motor bearing, turntable bearing, and idler wheel. Incidentally, the drive on this changer is a rubber pulley which disengages when player is on *off* position, thereby eliminating the possibility of the idler flattening out by remaining too long pressured against the turntable.

Pickups

Several types of pickups have been designed with the necessary light pressure required for the *lp* records. Various kinds of points are being used in the arms, some of them to play 16″ records and the 10″ and 12″ microgroove record, also. However, arms that are too long cannot be installed on existing regular phonograph installations and therefore a new turntable assembly must be provided with these pickups.

One recently developed *lp* pickup[3] has a pressure of 5 grams, ideal for the new discs. The pickup can also accommodate a cartridge for regular 78 *rpm* records. To install this pickup, a ½″ hole is drilled 6 9/32″ from

[1]Webster-Chicago Model 133.
[2]Webster-Chicago Model 256.

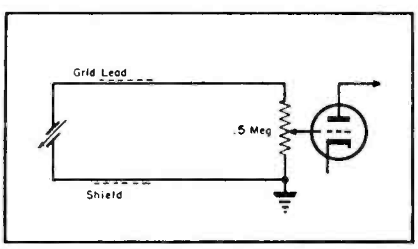
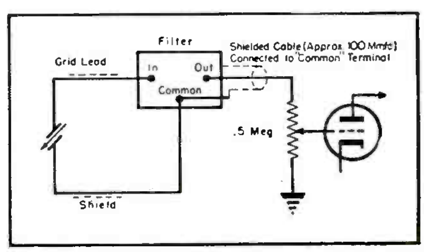


Fig. 3 (left). Connecting the Astatic pickup into grid of first amplifier with a 500,000-ohm volume control in the circuit.

Fig. 4. How a filter can be connected in the pickup circuit to attenuate highs.



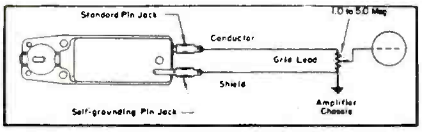
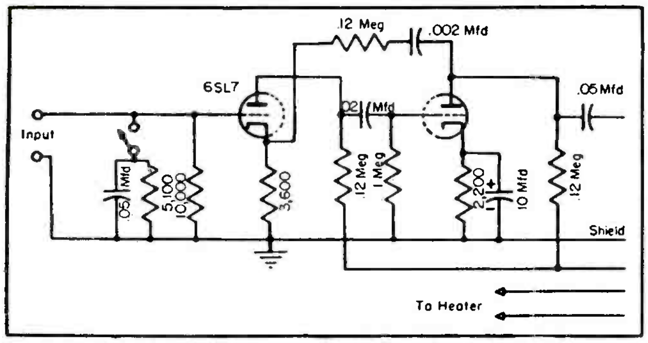
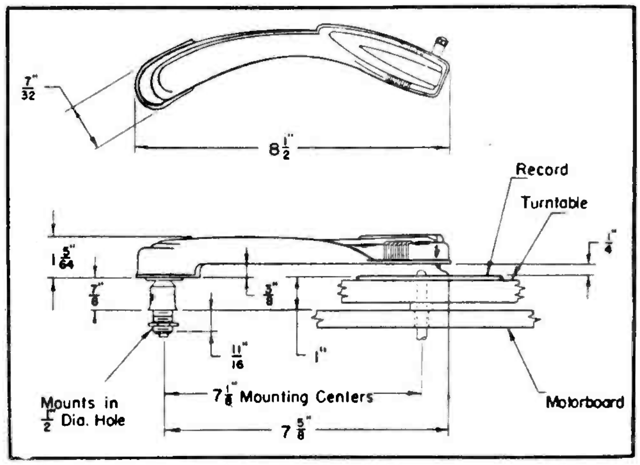


Fig. 6 (below). Mounting layout for the Shure 900 MG *lp* pickup.

Fig. 7 (left). Shure *lp* pickup in an amplifier using a single grid input.

Fig. 5. Equalizer circuit used with *lp* cartridge.





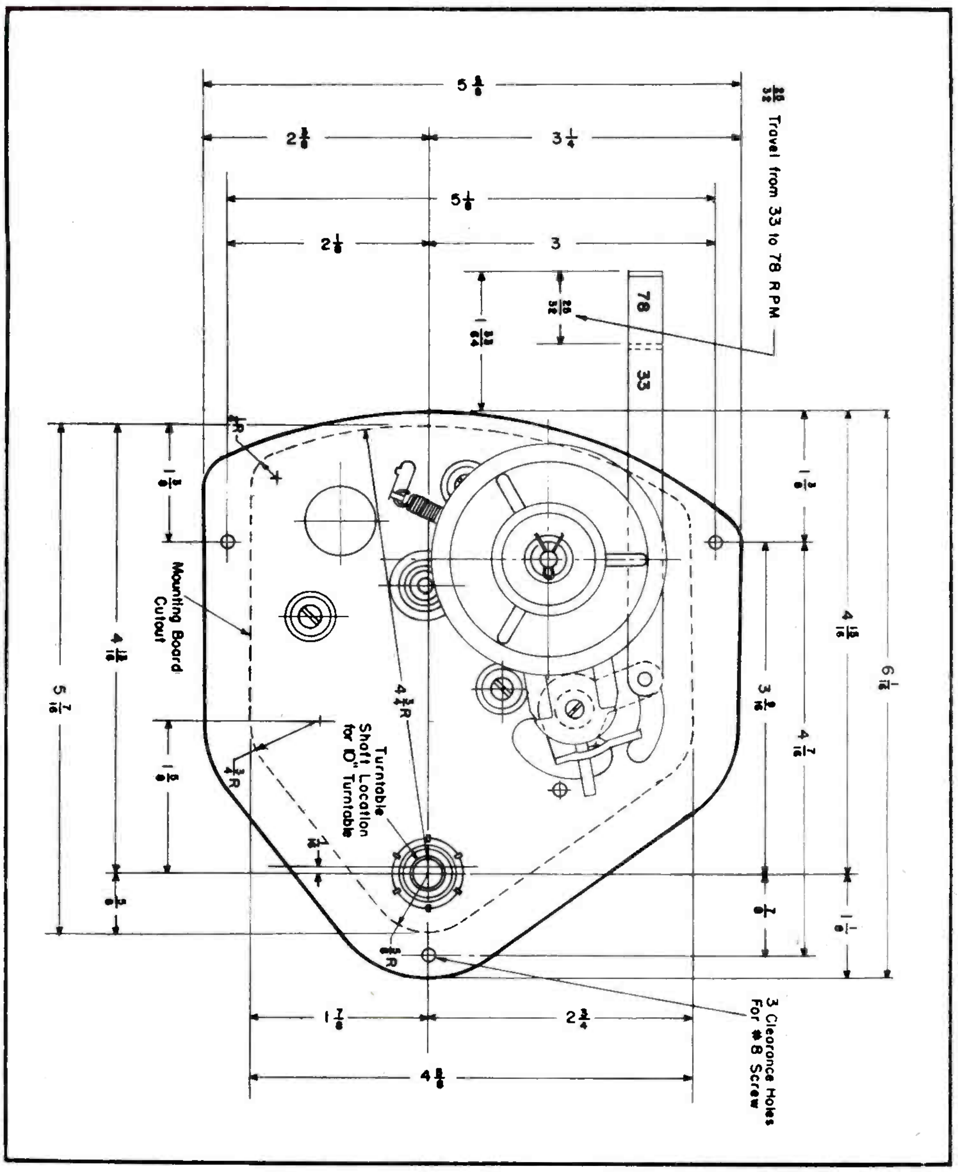
Record System

center of turntable spindle; stylus should reach center of this spindle. Pickup is mounted in a ½" hole, and height adjusted by space washers until bottom of the arm is parallel with top of record when the needle rests on disc; Fig. 2. The arm-rest hole should be located 4 55/64" from center of ½" mounting hole, and the height should be approximately same on arm rest as on top of disc. In Fig. 3 we have a basic circuit for this *lp* pickup connected to grid of first amplifier tube using a 500,000-ohm volume control. If highs are too prominent a .05-mfd capacitor can be placed across primary of output transformer of amplifier. A filter[4] might prove necessary with good amplifiers to attenuate highs; Fig. 4. When inserting, keep the filter away from sources of hum.

Cartridges for *lp* records to fit nearly all pickups using crystal cartridges have also been developed.[5] They are equipped with a 1-mil diamond tip. The cartridge is complemented by a 125-henry equalizer using one 6SL7; Fig. 5.

Another lightweight *lp* pickup[6] recently announced comes equipped with a jewel tip and a 14" shielded lead to simplify installation. To install this pickup is mounted so that the offset needle in the cartridge passes in an

(*Continued on page* 44)



[3]Astatic FL-33.
[4]Astatic FL filter.
[5]Pickering D140S.
[6]Shure 900MG.

Fig. 9. Motorboard layout for a dual-speed rim-drive motor; *G. I. model DR.*

Servicing Helps

by P. M. RANDOLPH

MANY SERVICE readers have written in requesting that we continue our discussion of typical TV parts[1] and accordingly data on several more pertinent components have been compiled.

A particularly interesting TV receiver part is the ion-trap magnet, such as the p-m type.[2] This ion-trap magnet designed for use with pictures tubes like the 10BP4, which incorporate ion-trap guns, has a neck diameter of 1⅜" to 1½" and operates with anode potentials of 7 to 14 kilovolts.

The magnet consists of two ring-shaped permanent magnets mounted on a fiber sleeve which fit snugly on the picture-tube neck. Metal-leaf springs inside the sleeve contact the tube neck and maintain the magnet's position. This arrangement centers the magnet on the tube neck without placing a strain on the tube neck.

Installation and Adjustment

Preliminary orientation of the magnet is obtained by placing it on the picture-tube neck so that the white arrow points toward the tube screen. The larger magnet will then be at the base end of the tube and should be positioned approximately over the ion-trap flags which protrude at right angles from the gun structure within the tube neck just above the base.

With the picture-tube operating, final orientation of the ion-trap is begun. Starting from the magnet position specified above, the magnet is moved forward or backward, and at the same time rotated to obtain the brightest raster. The brightness control is reduced, setting it until the raster is slightly above average brilliance. Then, the picture-tube focus is adjusted until the line structure of the raster is clearly visible. The ion-trap is again adjusted for maximum raster brilliance. A final adjustment may be made with the brightness control at the maximum position with which good line focus can be maintained.

Another important TV part is the vertical blocking oscillator transformer which is used in typical blocking-oscillator circuits which generate pulses for driving the grids of the vertical-discharge tubes. One type[3] employs a potted type of construction which is said to provide resistance to moisture absorption.

This transformer has a turns ratio of primary to secondary of 1:42± 5%. The primary inductance (with 3-volt, 1000 cps signal and no *dc* current) is 1.15 ± 20% henries.

The vertical deflection output transformer for direct-viewing picture tubes with magnetic-deflection circuits is another interesting TV part. This is an output transformer designed for use with deflecting yoke[4] and directly viewed tubes such as 10BP4, and 16AP4.

Turns ratio of primary to secondary of one type[5] is 10:1.

The primary will stand 2500 volts, secondary 1000 volts.

In typical applications, the transformer is used with a triode-connected 6K6GT operating with a plate-supply voltage of approximately 350 volts.

For horizontal oscillator and synchronizing control a center-tapped oscillator coil[6] has been produced. This is a permeability-tuned unit for use in TV receivers employing a 6SN7GT as a combination horizontal blocking oscillator and synchronizing control tube. In such circuits the synchronizing pulse is combined with the horizontal oscillator voltage to produce a combination voltage which is applied to the grid of the control-tube section of the 6SN7GT. When these voltages do not have the correct frequency and phase relationship, the oscillator tube is biased automatically to reestablish synchronization.

(*Data based on copyrighted material prepared by RCA.*)

[1]Servicing Helps, SERVICE; October, 1948.
[2]RCA-20303.
[3]RCA-208T9.
[4]Such as the RCA-201D1.
[5]RCA-204T9.
[6]RCA-203R1.

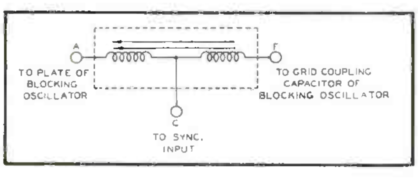


Fig. 1. Terminal connections for center-tapped oscillator coil. (*Courtesy RCA.*)

Picture Tubes[7]

TV RECEIVERS today use two types of picture tubes, the electrostatic and electromagnetic, in several types of circuits.

Regardless of size or type, all picture tubes are fundamentally the same and every tube consists of seven basic elements:

(*1*) A source of electrons in the form of a cathode.

(*2*) A filament to heat the cathode so that it will emit electrons.

(*3*) A control grid for varying the number of electrons passing it.

(*4*) A means of focusing or concentrating the electrons emitted from the cathode into a beam.

(*5*) A high-voltage anode to accelerate the electrons emitted from the cathode.

(*6*) A means of deflecting the beam of electrons in any desired direction.

(*7*) A screen coated with a fluorescent material which glows upon impact of the electron beam.

Electrostatic Tube Voltage Circuit

The electrostatic type is so called because the electron beam is focused and deflected by an electrostatic field.

In electrostatic deflection, two pairs of plates are placed around the beam at the end of the electron gun. For vertical deflection, a plate is placed above the beam and one an equal distance below the beam. Likewise, for horizontal deflection a plate is placed on one side of the beam and one an

[7]From TV lecture data prepared by F. Fowler and H. Lippert of the G. E. technical service section.

Design and Application of TV Components: Ion Trap Magnets, Vertical Blocking Oscillator Transformers, Vertical Deflection Output Transformers, Horizontal Oscillator and Sync Control Coils. Features of Electrostatic and Electromagnetic Type Picture Tubes; Typical Picture Tube Voltage Circuits.

equal distance of the opposite side of the beam.

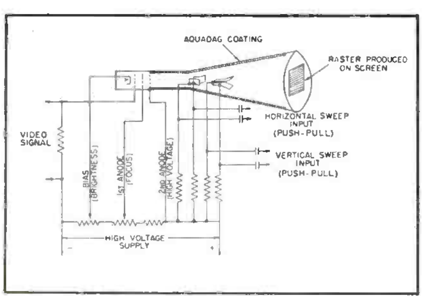
If a difference of potential is made to appear between the vertical plates, the electron beam will be deflected up or down toward the plate that is more positive, the amount of deflection on the screen being proportional to the voltage applied between the two plates. If zero potential exists between the two vertical plates, then there will be no vertical deflection of the beam.

With the horizontal plates introduced physically at 90° to the vertical plates, the application of a more positive potential on one of these plates in respect to the other will cause the beam to move sideways instead of up and down.

It is thus apparent that if a voltage is applied to the horizontal deflecting plates and if another voltage is simultaneously applied to the vertical deflecting plates, then the position of the spot at any instant is due to the resultant force of the two voltages acting at right angles at that instant. In television, the voltage applied between the vertical deflecting plates is referred to as a vertical sweep voltage since it deflects or sweeps the electron beam in a vertical direction. The voltage applied between the horizontal deflecting plates is referred to as a horizontal sweep since it deflects the electron beam in a horizontal direction.

In TV receivers, a rapidly changing voltage or sweep is applied between the horizontal deflecting plates, which moves the beam rapidly from left to right and traces a horizontal line. At the same time that the beam is rapidly being moved horizontally, another voltage or sweep is applied to the vertical deflecting plates which changes much slower than the horizontal sweep voltage, and the beam traces horizontal lines across the face of the tube at the same time that it is gradually being moved from top to bottom by the much slower vertical sweep voltage. The result is a number of horizontal lines across the face of the tube extending from top to bottom referred to as a *raster*.

Fig. 2. Basic voltage circuit for an electrostatic picture tube.



Electrostatic Tube Voltage Circuit

A basic voltage circuit for a typical electrostatic picture tube is shown in Fig. 2. As indicated, electrode voltages for forming focusing and controlling the intensity of the beam are obtained from a bleeder connected across a high-voltage supply. A variable voltage for the focusing anode is obtained from a potentiometer in the bleeder circuit. The potential on the second or high-voltage anode is usually five or six times that of the first or focusing anode and ranges from approximately 1500 to over 10,000 volts, depending upon the tube type. The higher anode voltages result in a smaller spot size and also produce a brighter picture.

The intensity of the beam or brightness of the picture is controlled by means of a potentiometer in the bleeder circuit which varies the bias between control grid and cathode. Making the cathode more positive with respect to the grid decreases brightness, while making it less positive increases brightness. This is the equivalent of biasing the grid more-or-less negatively in respect to the cathode.

The video or picture signals are introduced in the grid-cathode circuit of the picture tube, which causes the intensity of the electron beam to vary in exact accordance with the picture signal as the electron beam is deflected across the screen by the application of suitable sweep voltages to the horizontal and vertical deflection plates.

To prevent the application of the sweep voltages on the deflection plates from defocusing the electron beam, the mean potential of the deflecting plates is kept at the same potential as the last or accelerating anode. It is advisable from this standpoint to use push-pull deflection circuits; that is, both sets of plates are made to vary in potential about a fixed positive potential (the last anode potential) as an operating point. This method of operation is accomplished by connecting each deflection plate to a high resistance, the center point of which is connected to the last anode, and then coupling each pair of deflection plates to a push-pull amplifier.

Some provision is usually made to place a variable *dc* potential on each set of plates for proper centering of the beam. This small variable voltage is required to compensate for any misalignment of the electron gun and for any stray electrostatic or electromagnetic fields which would tend to move the beam off center.

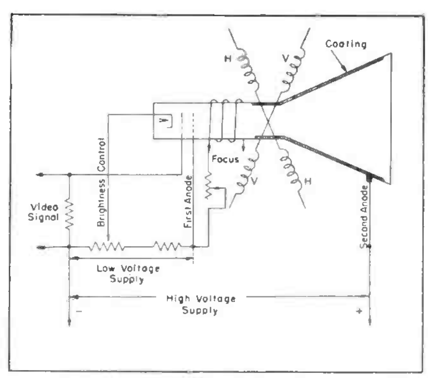
Fig. 3. The basic voltage circuit for an electromagnetic picture tube.

Electromagnetic Types

The electromagnetic picture tube is fundamentally the same as the electrostatic type except that the electron beam is focused and deflected by an electromagnetic field instead of by an electrostatic field.

In the electromagnetic type of tube the electron gun structure is similar to that in the electrostatic tube consisting of: a heater, cathode, control grid, and two anodes. However, the first and second anodes do not perform any of the focusing action. The first anode attracts electrons from the cathode and the second or accelerating anode, which is the high voltage anode, accelerates them toward the screen.

[To Be Continued]



Push-Button TV Receiver

(See Front Cover)

THE INPUT SYSTEM of a push-button type TV receiver, the Bendix model 235M1 and 235B1 chassis,[1] on the front cover this month, features an *rf* stage consisting of one 6J6 in a balanced input *rf* amplifier. Series tuned wave-traps are tuneable over the 30 to 40-*mc* band in order to reject any signal that might be picked up by the antenna and interfere with the *if* signal. (The sound *if* is 31.625 *mc* and the picture *if* is 36.125 *mc*.) The input circuit consisting of a pair of 15 mmfd, two 30-mmfd, and a 1000-mmfd capacitor plus a center-tapped inductance forms a tuned circuit on either the low or high TV band, when connected by the switch pushbutton arrangement to the tuneable elements for the high and low-frequency bands. This circuit is actually series tuned and therefore, provides a voltage gain at the grid of the 6J6 over the voltage that is applied at the antenna input terminal. When one of the channel control pushbuttons is pressed, a mechanical linkage automatically positions all of the iron core slugs in the antenna, oscillator, and mixer coils, as well as operates the low to high frequency switching.

The tuned circuit tapped coil is wound over a 13,000-ohm composition resistor which is a damping resistor for the tuned circuit. A 1,000-mmfd capacitor used for *dc* isolating actually connects the center of the tapped coil to the chassis ground as far as the *rf* signal voltage is concerned. The bias applied to this tube is a combination of cathode bias produced by a 180-ohm resistor, the variable bias from the *agc* circuit, and the fixed bias set by the contrast control. The resultant voltage from these three sources is applied through the 1,000-ohm resistor connecting the center tap of the center-tapped coil back to the *agc* circuit. Since triode type tubes must be neutralized to prevent regeneration, 1.5-mmfd capacitors are alternately connected from one plate to the opposite grid as neutralizing capacitors.

The plate voltage for this *rf* tube is applied to the center tap of another tapped inductance through one of the B+ filter resistors having a value of 680 ohms. The tuned plate circuit for the high and low bands are connected in parallel across the coil in this circuit similarly to that employed in the grid circuit of the same tube. A tank circuit tunes the plate circuit of the 6J6 to any frequency within the high frequency TV band (174 through 216 mc), while another tank circuit tunes the plate circuit over the low TV band (54-88 mc). The plate coil in this circuit is also wound over a 22,000-ohm composition resistor which loads the circuit sufficiently to prevent oscillation. Since there is considerable length of line between the coil in this part of the circuit and the pushbutton assembly, a separate 5,100-ohm dampening resistor is connected directly across the switch contact on the pushbutton assembly.

A separate local oscillator tube is used in preference to a single multi-element converter tube because of the low conversion transconductance and low signal-to-noise ratio converter tubes have at high frequencies. This tube is also a 6J6 type connected in a push-pull type of oscillator circuit. A *fine tuning* adjustment in the plate circuits is used for sharp tuning in the sound or audio channel on both bands. Negative grid bias developed by the oscillator is also applied to the grids of the 6J6 mixer tubes.

The balanced output from the *rf* amplifier is connected through a pair of 27-mmfd capacitors to the grids of the 6J6 mixer tube. The output from the oscillator is also connected to these same grids by a pair of 2.2-mmfd capacitors. Thus we have two separate frequencies appearing on the grids of the mixer tube. These two frequencies are, of course, the selected *rf* carrier frequency from the TV transmitter and the output frequency of the local oscillator which is always equal to the *rf* carrier *plus* the *if* frequency.

The grid bias for this tube is determined by the negative grid voltage developed by the oscillator tube. This voltage is applied to the mixer grids through a 33,000-ohm resistor to the junction of a pair of 10,000-ohm resistors, which are individual grid resistors for the two grids of the mixer tube. This means that the gain of the mixer tube will vary in direct relationship to the activity of the oscillator tube. If the *rf* output of the oscillator tube is especially strong, a high negative voltage will be developed at its grids and this high negative voltage will be applied to the grids of the mixer tube reducing its gain. This arrangement assures that the mixer tube will operate at the point of optimum transconductance and a maximum signal-to-noise ratio will be obtained at its output.

The manner by which the *if* is obtained from the center junction of the inductance in the 6J6 mixer plate circuit may be puzzling in view of the fact that both the incoming *rf* signal and the signal from the local oscillator is push-pull connected to the grids. Since the input is push-pull connected, the two plates of the mixer are 180° out of phase with each other as far as either *one of the two* applied signals are concerned and therefore neither one of these signals are present at the center tap of the plate coil. In other words this center tap does not vary in potential with reference to either *one* of these two signals. This therefore eliminates any possibility of the *rf* or oscillator frequency from entering the *if* channel.

Since the desired frequency at the output of the mixer is the *difference* between the *rf* and local oscillator frequencies, the *phase* relationship between these two, as they appear on the mixer grids, is the only factor that must be considered. These two frequencies are either in phase or out of phase *on both grids* of the mixer tube *at exactly the same instant*. When they are in phase they are additive and the resulting current in each plate circuit varies accordingly. When they are out of phase they cancel each other and no change in the current of either plate is produced. The important point to notice in regard to any change produced in the plate circuits by this phase relationship, is that the change on the two plates is *in phase*, instead of 180° out of phase, as is the case when only one signal is applied in push-pull to the two grids. In effect, then, the two halves of this mixer tube are in parallel as far as the *if* is concerned, and therefore this *if* will be present at the junction of the mixer plate coil, appearing across the 35.9-mc iron-cored inductance as a common load impedance.

The heavy lines on the schematic diagram, show the path for all signals of varying amplitude.

[1]In part III of the Les Libby series of alignment articles, which will appear in the January, 1949, issue of SERVICE, the complete circuit of the Bendix TV receiver will be presented, together with an analysis of other pertinent sections of the model.

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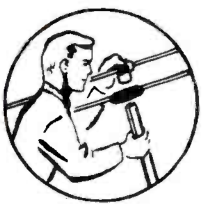

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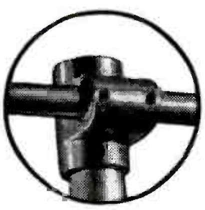

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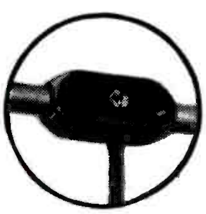

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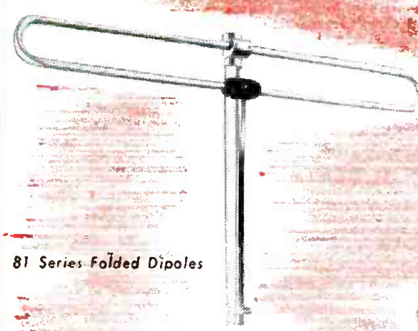

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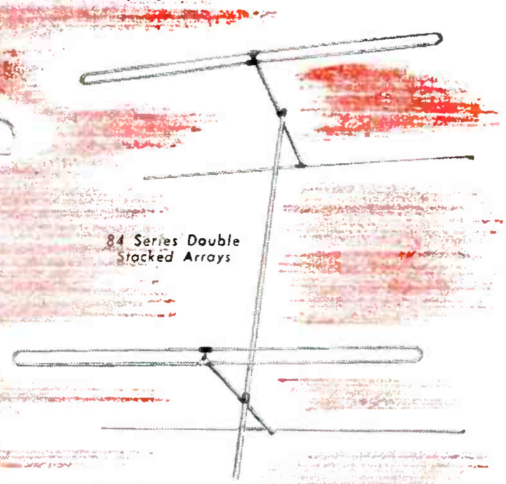

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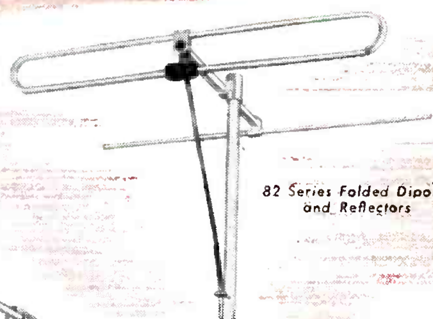

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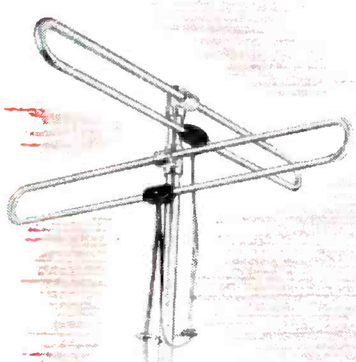

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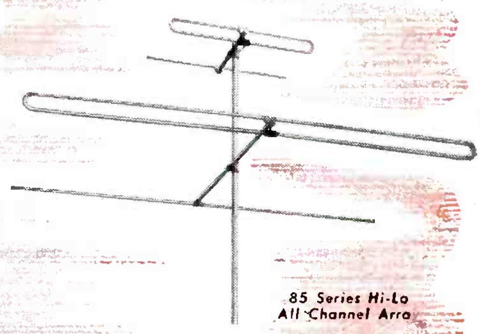

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TV Sync And Inter-Sync Systems

Part III . . . Characteristics of Horizontal and Vertical Equalizing Pulses and How They Control Picture Presentation.

by EDWARD M. NOLL*

Instructor in Television
Temple University

In our analysis of the differentiating and integrating circuits in the TV receiver, it was indicated that the integrating circuit is a long time-constant *rc* combination, with the integrated vertical sync taken off an integrating capacitor. In a typical receiver, the differentiating time-constant may be at some value between less than one and ten microseconds; the integrating circuit time-constant may be from 500 to thousands of microseconds.

A simple inter-sync separating system along with the action of the differentiating and integrating circuit on both the horizontal and vertical sync pulses is demonstrated in Fig. 1. In this drawing waveform *1* represents the short duration horizontal sync pulses which produce, across the differentiating resistor, a series of spiked voltages as shown in waveform *2*. Likewise, the leading and trailing edges of the vertical sync pulses, waveform *4*, although they are of longer duration, also produce equal amplitude spikes across the differentiating resistor as shown in waveform *5*. These pulses, however, occur at a double rate which will be discussed subsequently. Thus the spikes generated during the vertical sync pulse block prevent loss of horizontal synchronization during the vertical retrace intervals.

When the horizontal sync pulse is applied to the integrating circuit, it is of such a short duration that only a very, very tiny charge appears on the capacitor and is of no consequence; waveform *3*. During the vertical sync block, however, the pulses are of longer duration and place an appreciable charge on the capacitor. Furthermore, the charge of one pulse is not permitted to leak off the capacitor before it is again reinforced by the second pulse and so on for the entire six pulses of the vertical sync block. Thus, each pulse adds a charge to the capacitor and a cumulative effect of each charge produces an ample voltage across the integrating capacitor; waveform *6*. This integrated or step voltage is used to synchronize the vertical oscillator. Inasmuch as the six vertical sync pulses only occur once every 1/60th of a second the vertical oscillator is fired at a repetition rate of 60 per second. The horizontal leading edges, however, occur once for each line of the picture and, therefore, the horizontal is locked at a rate of 15,750.

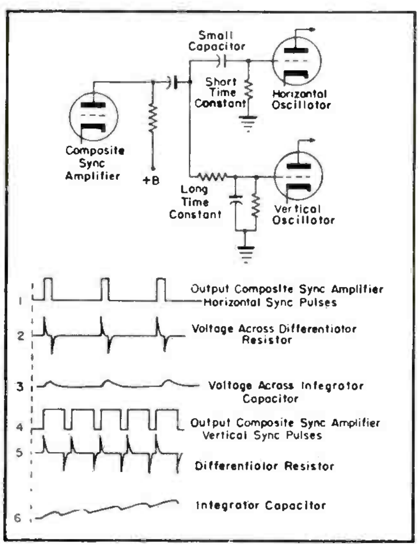
Horizontal Synchronization

The horizontal sweep is synchronized by leading edges of the sync pulses which occur at intervals of 63.5 microseconds. These leading edges occur not only during the scanning of the active horizontal lines but also occur during the vertical retrace interval because it is necessary to maintain tight synchronism of the horizontal sweep even during the time that the vertical is retracing. This rigid requirement is needed to preserve the rigidity of the interlace system because it is necessary that the even-numbered lines fit precisely at the mid-point between the odd-numbered lines to have an interlaced high resolution system. If we were for an instant to lose horizontal synchronization and then reestablish it at the end of each field, the discontinuities present would cause pairing of lines or the actual lines of the scanning raster, instead of being spaced equi-distantly, would be grouped in pairs all the way down the screen. Thus it is necessary even during the vertical retrace interval to generate leading edges to maintain synchronism of the horizontal. Accordingly, instead of using a long continuous vertical sync pulse which would serve just as well so far as vertical integration and synchronization is concerned, the vertical sync block is broken up into a series of pulses (called serrated vertical sync pulses) which form the leading edges for maintenance of horizontal lock-in. Spacing between *alternate leading edges* of the vertical sync pulse and equalizing sync pulses is also 63.5 microseconds.

Horizontal sync during active line intervals and during vertical retrace period between fields and frame is shown in Fig. 2 (page 44). If the top drawing represents the vertical retrace between fields and the lower one, retrace between frames, it is evident that the end of a field occurs at bottom right and the leading edge of the first equalizing pulse is one full line away from the last horizontal sync pulses. Thus between fields the horizontal locks-in on the odd-numbered equalizing and

(*Continued on page 44*)

Fig. 1. Analysis of inter-sync separation.



*From a forthcoming book, *Television for Radiomen*, to be published by Macmillan.

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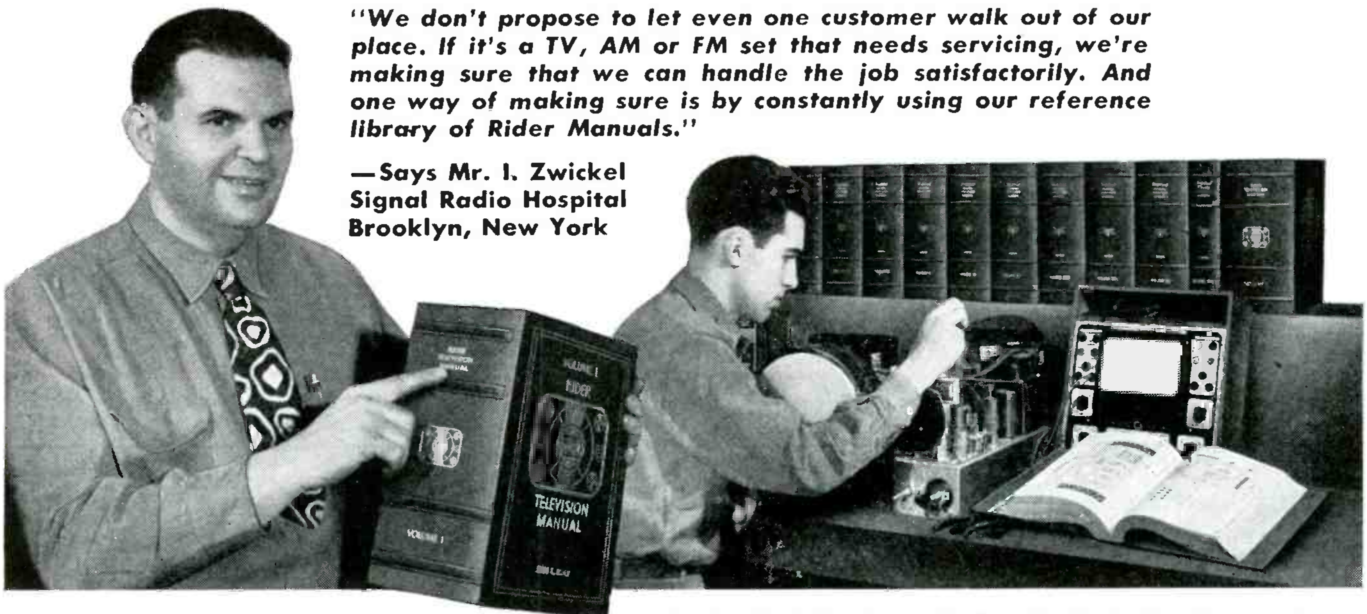

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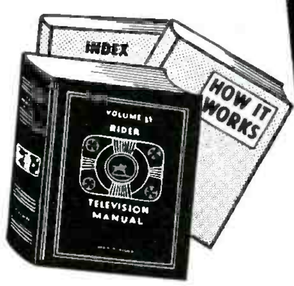

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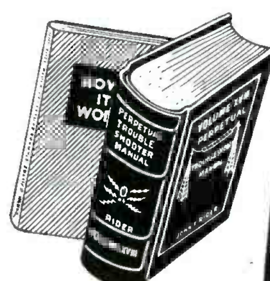

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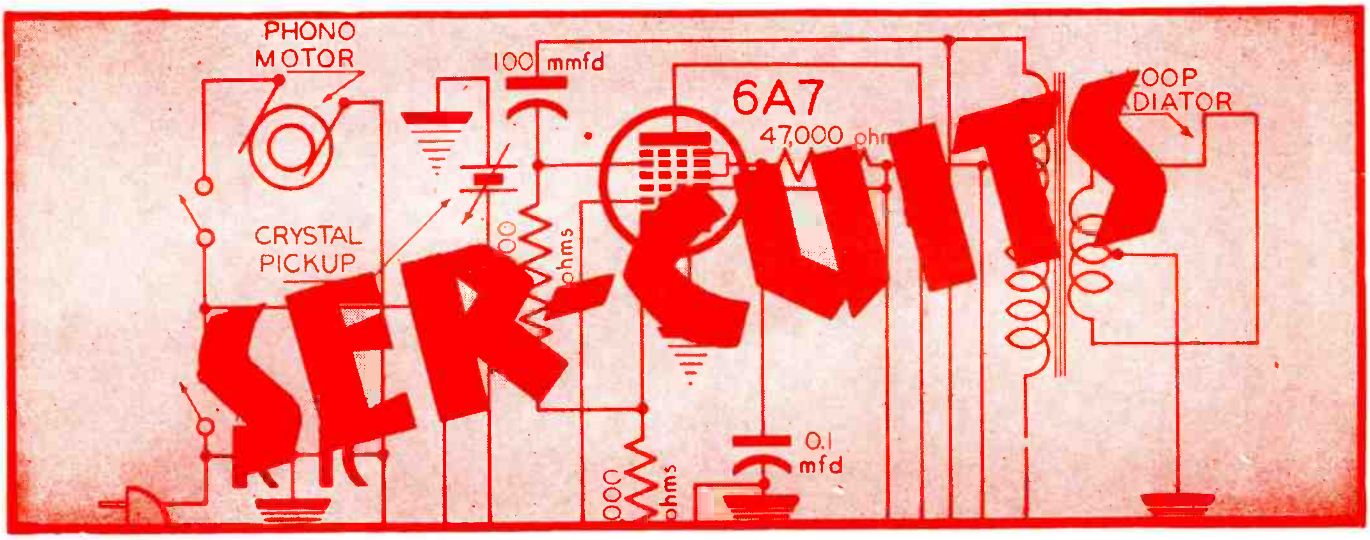
NOTE: The Mallory Radio Service Encyclopedia, 6th edition, makes reference to only one source of radio receiver schematics—Rider Manuals.
ANOTHER NOTE: The C-D Capacitor Manual for Radio Servicing, 1948 edition No. 4. makes reference to only one source of receiver schematics—Rider Manuals.



Circuit Features of the Motorola TS-5 and TS-7 TV Chassis, G. E. 810 and Farnsworth GV-260 TV Models.

Combination TV/FM/AM/Phono receivers now coming off the production line include many unusual circuit features particularly in the TV section.

An interesting example is the Motorola VF102 and VK101 series, chassis TS-5 and TS-7, shown in Fig. 2; page 26.

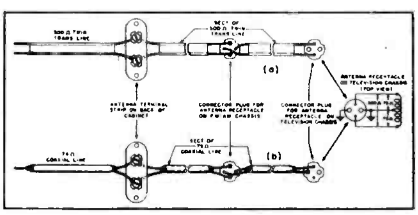
In the TV part of the chassis are a 6AG5 *rf* amplifier, 6J6 mixer and *hf* oscillator, one 6AG5 *if* amplifier, three 6AG5 video *if* amplifiers, a 6AL5 video detector, *dc* restorer and sync sep., 6AU6 first video amplifier, 6AC7 second video amplifier, 6BA6 second sound *if* amplifier, 6BA6 third sound *if* amplifier, 6AU6 fourth sound *if* amplifier, 6S8GT discriminator and first *af* amplifier, 6V6GT second *af* amplifier (power output), 6SK7 sync stabilizing amplifier, 6SH7 sync pulse stripper, 6J5M sync pulse limiter, 6SN7GT vertical blocking oscillator and discharge, 6V6GT vertical deflection output, 6H6M horizontal deflection discriminator, 6AC7 horizontal deflection reactance, 6V6GT horizontal oscillator, 6J5M horizontal discharge, 6BG6G horizontal deflection output, 8016/1B3GT *hv* rectifier, 5V4G horizontal damping, 10BP4 picture tube, and two 5U4G *lv* rectifiers.

By means of a four-connection antenna receptacle, either a 300-ohm balanced or a 75-ohm unbalanced input is available. The receivers are normally wired at the factory to match a 300-ohm balanced line. If the receiver is to be used with a 75-ohm line, the input circuit can be rewired as shown in Fig. 1. When a 75-ohm interconnector cable is used in place of the 300-ohm interconnector cable, which is furnished by the factory, FM and broadcast reception can sometimes be improved by reversing the leadin interconnector plug that fits into the *FM-BC* tuner chassis.

Under conditions of rough shipment, it is possible for the ion trap, focus coil and deflection yoke parts to become misaligned.

Ion Trap Adjustment: Shifting of the ion trap will result in poor brilliancy or shadowing of the corners. The ion trap should be mounted on the neck of the picture tube so that the pole pieces of the large coil magnet are over the flags on the tube's gun structure. The large coil must be installed toward the socket end of the tube. (If a *pm* type of ion trap is used, it should be placed on the neck of the tube with the black end toward the socket). While observing the raster on the screen, the coil should be moved slightly backward or forward, simultaneously turning it slightly to and fro until the brightest raster is obtained, and one in which none of the four corners are cut off or shadowed. These adjustments should be made with the brightest picture obtainable consistent with good line focus and a square raster. When adjustment is completed, screws must be tightened to hold trap in position.

Fig. 1. How to connect 300 or 75-ohm lines to TV antennas used with the Motorola TV TS-5 or TS-7 chassis. At *a* are the input connections for a 300-ohm transmission line and at *b* we have the revised input connections if a 75-ohm coax line is used.



Focus Coil Adjustment: Shifting of the focus coil will result in corners of the picture being cut off or shadowed, or it will be impossible to bring the beam to a focus with the focus control. To correct, the wing nuts which hold the focus coil in place should be loosened. These two nuts are found on the sides of the focus coil bracket. The horizontal and vertical centering controls should be set approximately at the center of their range of rotation. While observing the raster on the screen, the focus coil should be moved back and forth until a position is found where the raster is about centered on the screen and none of the four corners is cut off or shadowed. The wing nuts, holding the coil in this position, should then be *carefully* tightened.

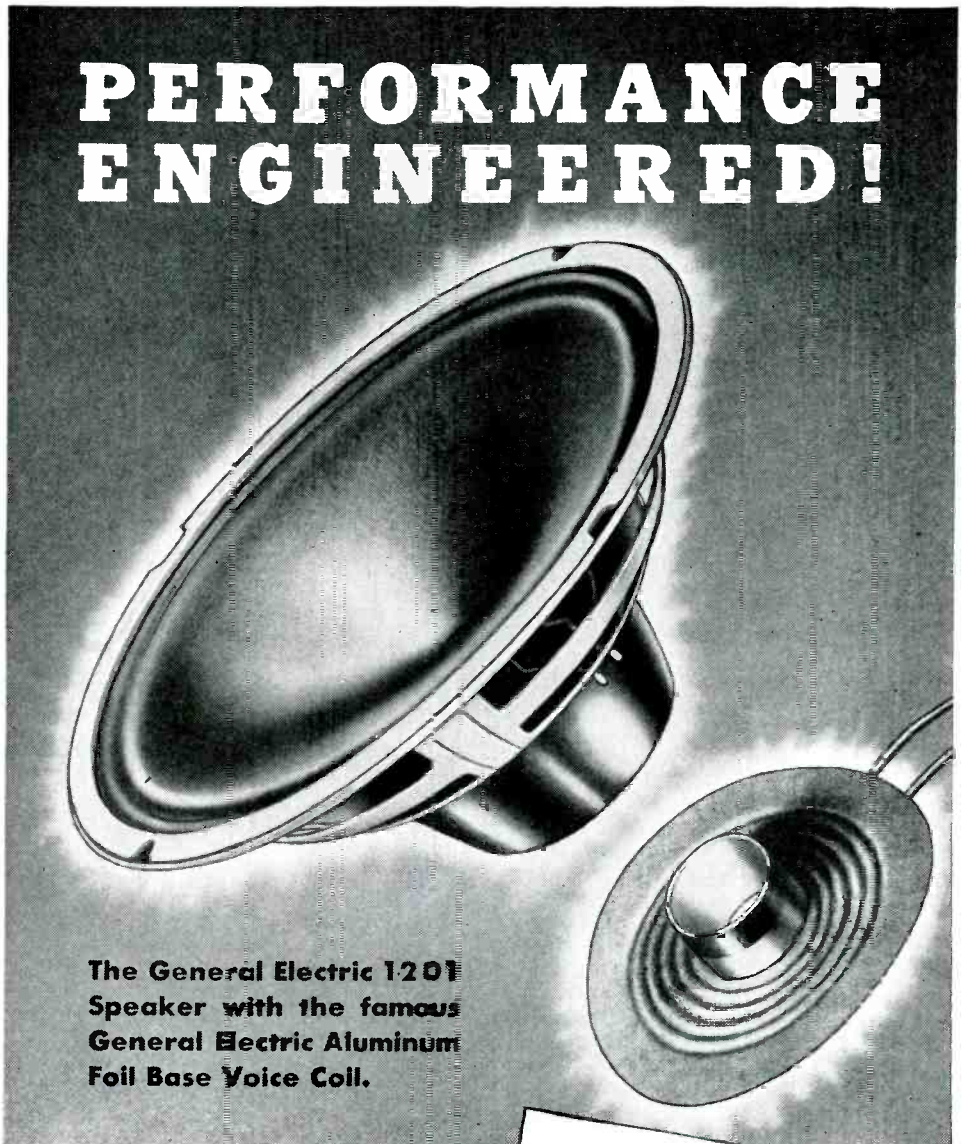
Deflection Yoke Adjustment: If the deflection yoke shifts, the picture will be tilted. To correct, the wing nut on top of the deflection yoke should be loosened and yoke rotated till picture is straight.

G. E. 810

In Fig. 3, page 28, is another interesting TV receiver, the G. E. 810 table model.

Features of the receiver include a constant input impedance *rf* amplifier

(Data continued on page 29; Circuits on pages 26, 28)



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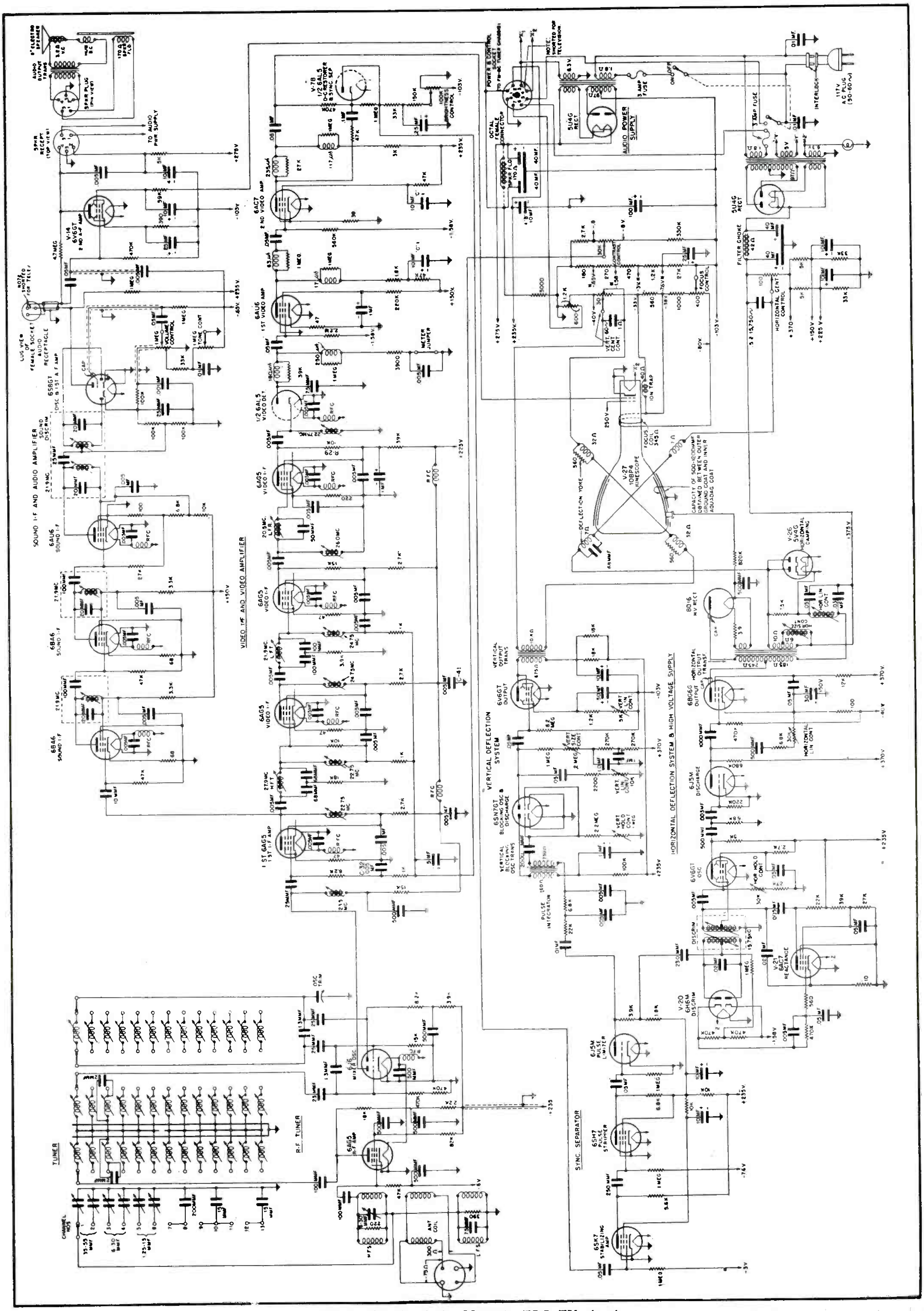


Fig. 1. Circuit of the Motorola TS-5 TV chassis.

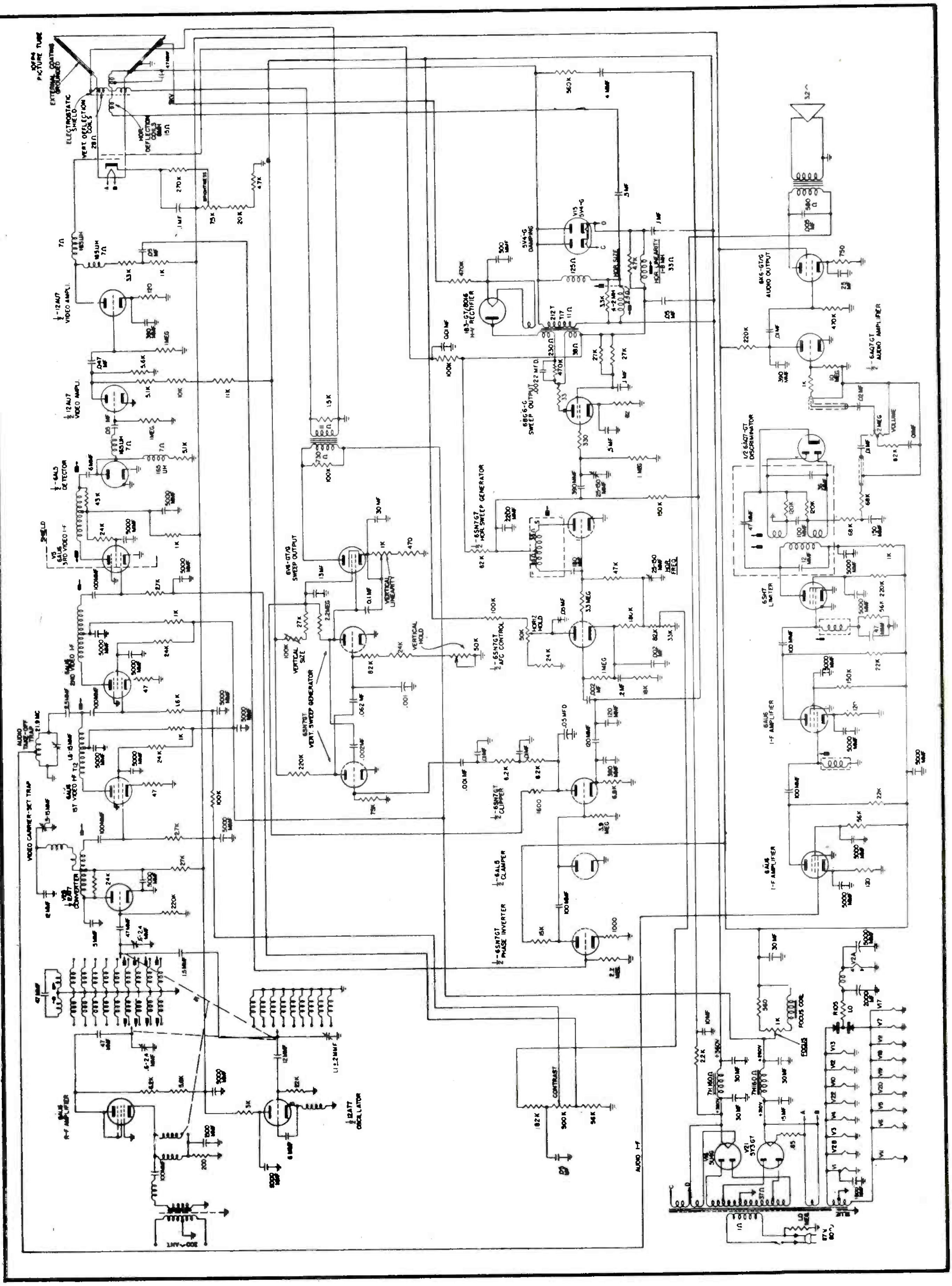


Fig. 3. Circuit of the General Electric 810 TV receiver.

Ser-Cuits

(*Continued from page 24*)

with a balanced input, automatic frequency control for horizontal synchronization, and a ten-inch picture tube with aluminumized screen.

In this model, the horizontal sawtooth generator makes use of one section of a 6SN7GT, connected in a blocking oscillator circuit. Instead of its frequency being controlled directly by the horizontal sync pulses, it is controlled by a *dc* voltage on its grid, which is the resultant of the phase difference between the incoming sync signal and a voltage wave derived from the output of the sweep generator. The resultant *dc* voltage produced by the other section of the tube is called an *afc* voltage.

The *afc* portion of the tube obtains its operating bias through its connection to the grid circuit of the blocking oscillator tube, through a 3.3-megohm resistor. The blocking oscillator produces a large negative bias in its grid circuit during its normal operating cycle. When the horizontal sync pulses or the combined output voltage are impressed separately on the grid of tube, they do not have sufficient positive amplitude to cause appreciable plate current flow. However, if they are combined and phased properly, their composite amplitude is sufficient to cause plate current to flow. During the time that conduction takes place, a .2-mfd and a .002-mfd capacitor in the cathode and grid circuits become charged positive in respect to ground, the magnitude of the charge and the resultant voltage thereon, being dependent upon the duration of the flow of plate current in the *afc* part of the tube.

Since an 82,000-ohm resistor is in the bleeder circuit across the filter and also forms a part of the grid return circuit for the sweep generator tube, any change in voltage across this resistor will thus result in a change of frequency in the sweep generator. Thus if the contributing voltage of the resistor makes the grid less negative, the frequency will be raised; likewise, if the contributing voltages make the grid more negative, the frequency will be lowered. Thus, it will be seen that the longer the conduction period of the *afc* part of the 6SN7GT, the higher will be the frequency of the blocking oscillator and its sawtooth output.

A *horizontal frequency control,* in the form of a 25-150-mmfd variable,

(*Continued on page 30*)

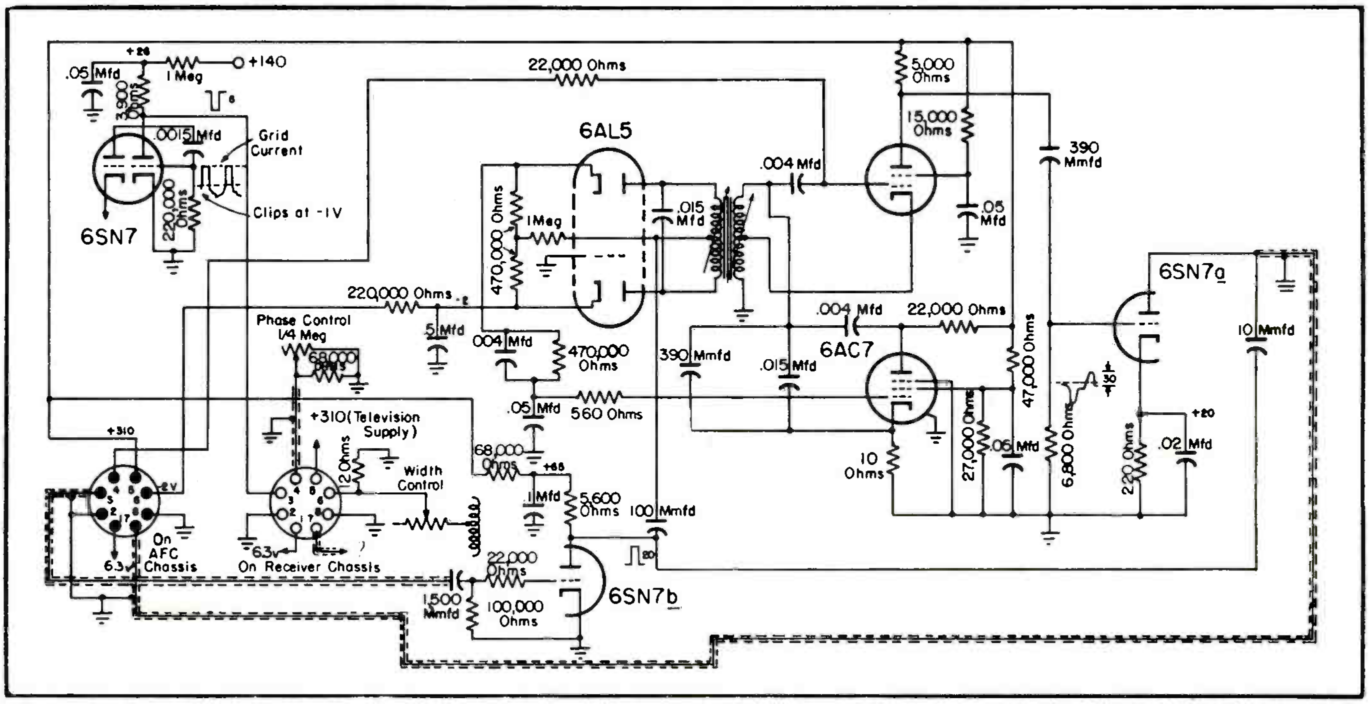


Fig. 4. The horizontal *afc* circuit used in the Farnsworth GV-260 TV receiver.

forms a part of the discharge circuit in the grid of the blocking oscillator. By varying its value, the free running speed of this oscillator can be adjusted to supplement and act as a course control for the *horizontal hold* control. The free running speed of the blocking oscillator is also adjusted by the inductance variation of a blocking oscillator coil.

The horizontal sawtooth voltage generated by the blocking oscillator is shaped and then amplified by a 6BG6G. The output of this tube is coupled to horizontal deflection coils through an impedance matching transformer. A 5V4G damping tube diode is used principally to remove a transient oscillation created by the rapid retrace of the current in the high inductance of the horizontal sweep and high voltage transformer and still retain the positive overshoot in the primary winding for use in the high-voltage supply. It also is used to provide a linear trace and to recover some of the energy from the inductive kick-back and to help supply the B+ requirements of the output tube.

A 25-150-mmfd horizontal drive control forms a capacity voltage divider in conjunction with a 390-mmfd capacitor so as to control the amount of sawtooth voltage supplied to the grid of the 6BG6G sweep output tube. This permits adjustment of the grid sawtooth voltage to compensate for variations in output tubes.

A *horizontal width control* forms a series-parallel circuit in respect to the output to the yoke. The inductance is variable in both coils of this control; the inductance of the series choke is maximum when the parallel choke is minimum and vice versa. The parallel circuit shunts the current around the deflection coil, depending upon its inductance, and the series coil attenuates the current by changing the impedance of the series circuit. This type of control provides a uniform impedance to the output transformer over a wide range of adjustment.

A vertical sawtooth voltage is generated by a 6SN7GT connected as a multivibrator. This voltage is coupled directly to a 6V6G vertical sweep output amplifier tube and then to the vertical sweep yoke through the impedance matching transformer. Vertical speed is controlled by changing the time constant of the multivibrator grid circuit by a 50,000-ohm potentiometer. Sweep size or height of picture is changed by 100,000-ohm potentiometer, which changes the B+ voltage applied to a charging network of the 6SN7GT simultaneously with the screen voltage on 6V6G. Vertical linearity is controlled by feeding back correcting voltage developed in the cathode circuit of the 6V6G through a .1-mfd capacitor into the grid circuit of the output tube. The cathode voltage which is fed back through the .1-mmfd capacitor has an opposite curvature corresponding to the nonlinear portion of the generated sawtooth output so that by combining these voltages in the grid of 6V6G correction may be effected. The amount of the correction voltage is controlled by a vertical linearity potentiometer.

The high voltage for the second anode of the picture tube is derived by making use of the inductive *kick* voltage produced during retrace in the horizontal output transformer. This kick voltage has a magnitude of several thousand volts and is positive-going, appearing between the plate of the 6BG6G sweep output and ground. Since this voltage in itself is not sufficient to produce the required anode potential, an additional winding connected electrically and magnetically with the primary is added to provide further step-up of this voltage. The top of this autotransformer is connected to the plate of a rectifier tube, a 1B3GT/8016, which derives its filament voltage from the horizontal sweep transformer by a single turn around the core. Since the frequency supplied the rectifier tube is high (15,750 cps), a 500-mmfd filter capacitor is more than adequate to give a smooth *dc* output. Due to the small capacity of the filter, this supply is relatively safe to handle.

Farnsworth GV-260

Continuing our analysis[1] of the Farnsworth GV-260 TV chassis, which began last month, let us now study the *dc* reinsertion system of the set.

Even as a photographic exposure meter determines the iris setting of a camera and involuntary muscular action sets the proper iris opening of the eye, the *dc* inserter circuit establishes an average value of the intensity of the received signal which con-

[1]From a series of TV servicing lectures prepared by Farnsworth.

trols the grid-bias upon a viewing tube. The reinserter is the *exposure meter* and the bias voltage which it produces is the "iris."

Initial bias to the grid of the picture tube in the set is fed to the tube through a 1,000-ohm resistor. Through this resistor also flows the rectified portion of the video signal which, of course, is direct current. This *dc* establishes a potential across the resistor which subtracts from the initial grid bias. Therefore, a strong signal produces a relatively high potential across the resistor which, being positive, subtracts from the initial tube bias whereas a weak signal, or none at all, contributes little or no potential, increasing (opening the iris) the bias potential.

Even as an *avc* circuit should have correct time constant, the effect of *dc* reinsertion must be properly timed. Too short a time required for it to *take hold* would produce surges of light upon the screen, whereas too long a time would cause the background illumination from one scene to carry over into the next. This proper timing of the effect of the reinserter is accomplished by a 10,000- and 220,000-ohms resistor and .02-mfd capacitor. The 220,000-ohm resistor also serves to provide direct potential continuity to the grid.

Differentiation and Horizontal Control Circuits

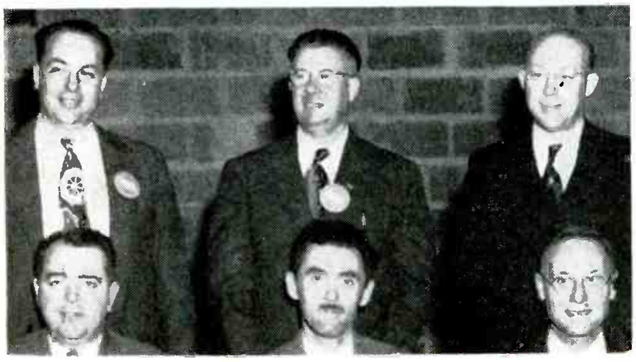
The Farnsworth receiver incorporates an *afc* circuit which maintains horizontal deflection rate constant in the presence of normal bursts of interference. Sync pulses appearing in the output of a 6SN7 are transmitted to one-half of a 6SN7. There, they are amplified to appear as positive pulses then injected into the *afc* circuit.

A 6K6 is used in the familiar Hartley oscillator in which sustained oscillation is had. The natural period of this oscillator is nominally near 15,750 cps; that of the incoming sync pulses.

Connected into the inductive circuit of this oscillator is a reactance tube, 6AC7, which operates in the familiar manner of reactance tubes in the *afc* circuits of electronic sweep circuits, broadcast receivers, etc. Signals are presented to the grid of the reactance tube by injection into the cathode circuit over a 10-ohm resistor. The reactance of the cathode coupling capacitor is considerably higher than the 10-ohm cathode resistor through which the oscillator currents flow.

[To Be Concluded in January]

Board of directors of the recently organized American Radio Technicians Guild. Front row, left to right: Ray Mattraw, Lewis Sharrard and Bertram Lewis. Rear row, left to right: Ed Fisk, William Brewerton and Hyman Levy.



At a recent service meeting in Medford, Oregon, sponsored by Verl G. Walker Co., in cooperation with Howard W. Sams and Co., Inc., who presented Al Saunders offering his popular TV talk. Left to right: Dave M. Lee, Northern Pacific rep for Howard W. Sams; Verl G. Walker and A. C. W. Saunders.

ASSOCIATIONS

ARSCP, Williamsport, Pa.

JOHN BARSOPHY, chairman of the publicity committee of the Associated Radio Servicemen of Central Pennsylvania, has forwarded an interesting report on their recent activities. He states that TV was the keynote of the October meeting, held in the Brown Library in Williamsport, where members were told that Mostoller Hill was chosen as the site of the association's TV lab. It was announced that preliminary tests on the hill with several TV sets were satisfactory, picture signals being received from New York, Philadelphia, Washington, and Baltimore.

President Robert Stout, who presided at the meeting, told the boys that it was planned to have full facilities available at the lab—power, a forty-foot tower with platform, at least two types of antennas, suitable test equipment, etc. Thus any member desiring to build a TV kit and seeing what *gives* need simply drive out to the hill, use his pass key to get into the lab, and see what does give, if anything!

In this way, members feel, reports Barsophy, and *only* in this way, by actually working with TV gear, can one become really familiar with the *works*. It is planned to supplement the lab activities with talks, a class or two (the tentative stage as yet), and private study.

ARSCP delegates to the Scranton meeting of the Federation of Radio Servicemen's Association of Pennsylvania, Carl Smith and Phil Marchioni, told the members about TV servicing problems covered, such as new set servicing. As a result, the association went on record condemning the practice of forcing purchasers of TV sets to buy servicing with the set.

At the November meeting, Barsophy reports that TV was featured, too, with a talk on antennas by John F. Rider. Rider, who was concluding a lecture tour through Eastern and Central Pennsylvania cities, addressed a capacity crowd at the Brown Library. He expressed approval of the TV lab idea, and said it was the first such cooperative effort of its kind, as far as he knew.

Three committees have been ap-

At a recent RMA meeting of service managers at the Hotel Roosevelt in New York City during which television servicing was a featured topic of discussion: A. J. Alexander (*Motorola*), H. A. Newell (*Crosley*), H. Patten (*DuMont Labs*), W. J. Zaun (RCA Service Company), A. H. Kuttruff (*Westinghouse*), Edward A. Pool (*Wells-Gardner*), B. R. Lafferty (*Hallicrafters,*) M. L. Jones (*Delco Radio-General Motors*), W. L. Parkinson (*General Electric*), F. Leo Granger (*Stromberg-Carlson*), B. J. Hickman (*Sparks-Withington*), M. R. Weiss (*Kings Electronics*), Thomas H. Ellis (*Western Auto Supply*) and Bond Geddes and James Secrest of RMA.

TEN YEARS AGO

From the Association News Page of SERVICE, December, 1938

The Greater Bridgeport Radio Service Men's Association, Bridgeport, Conn., became affiliated with the RSA. Officers were: L. F. Gravlin, chairman; A. H. Stendahl, secretary and Herbert C. Eiseman, treasurer. . . The Abilene, Texas, Chapter discussed a rate book for receiver repairs. . . . The Buffalo, N. Y., Chapter nominated officers for '39. Clarence Redstone, instructor at the Buffalo Technical Institute presented a talk before the group on *Radio Service and Theory* . . . The Danville, Ill., Chapter held a weenie roast and picnic. Russ Lund of Clough Brengle talked on *Dynamic Testing*. . . .The Flint, Mich., Chapter reported that it had almost 100% membership among the Flint Service Men. . . . The first annual banquet of the Green Bay, Wis., Chapter was held at White Lawe, Wis. . . . The Southern New Hampshire Chapter devoted the first meeting of the month to business of the chapter. . . . George Connor of Sylvania presented a talk on tone quality improvement before the New York chapter. . . . The Peoria, Ill., Chapter began a cooperative advertising campaign in the local newspapers. Editorial cooperation, in the form of articles commenting on the work and stability of RSA members, was promised by the papers. . . . The Pontiac, Mich., Chapter held its first meeting at the Board of Commerce building. . . . The Radio Service Association of California elected officers for '39. . . . Servicing groups in Fort Wayne, Ind., and Springfield, Jacksonville and DeKalb, Ill., indicated that they'll join the RSA soon.

pointed by President Stout: *program* . . . John Voelkler (chairman), A. L. Altemose, Sr., George L. Bailey, Chas. E. West, all of Williamsport, and John Stine, of Jersey Shore, Pa.; *membership* . . . Art Guild (chairman) and Phil Marchioni of Williamsport, and Frank Grinnell, West Milton, Pa.; *publicity* . . . John Barsophy (chairman) and Luther E. Reitmeyer of Williamsport, and Don Koch of Hughesville.

ESFETA

In a report on the recently formed Empire State Federation of Electronic

(*Continued on page* 45)

JANUARY, 1948 — DECEMBER, 1948

ANTENNAS

AUTO RECEIVERS

CIRCUITS

COVER DIAGRAMS

EDITORIALS

FM

FEATURES

(*Continued on page 36*)

Index

(*Continued from page 35*)

MANAGEMENT

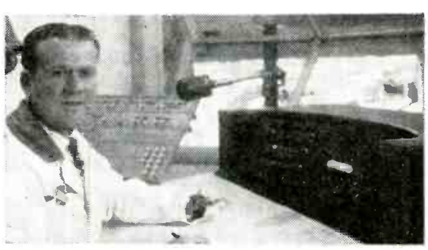
SERVICING HELPS

SOUND

TELEVISION

(*Continued on page* 38)

SOUND DISPATCHING SYSTEM



Dispatcher console receiver developed by Corbett, Veek and Co., Portland, Oregon, for garage service. Console-type switchboard employs a combination speaker-microphone with a system of lights and push buttons providing two-way contact to all parts of the garage and shop affording an accurate record of the location of cars and services being rendered to them.

PUSH-BUTTON SOUND DEMONSTRATOR

Push-button panel system in use at Sun Radio and Electronics Co., Inc., 122-124 Duane St., N. Y., which provides contact to a host of tuners, amplifiers, changers and speakers for effective demonstrations. Panel setup was developed by Irving Greene, manager of the sound and TV department.

Index

(Continued from page 37)

TEST EQUIPMENT

TUBE NEWS

VALPARAISO TECH. INSTITUTE FM/TV CLINIC

An FM/TV clinic sponsored by Valparaiso Technical Institute, Valparaiso, Indiana will be conducted on Monday, January 24, for the benefit of Northern Indiana Service Men, dealers and distributors.

Dr. Joseph B. Hershman, president of Valparaiso Technical Institute, will serve as chairman of the clinic and the heads of the school's television and radio servicing laboratories will also take part in the clinic. Technical field representatives from the instrument and model manufacturers will then present solutions to various technical problems inherent to their specific models.

ATLAS SOUND COST-PROPOSAL FOLDER

An *Estimate and Proposal Folder* to assist sound specialists in presenting a businesslike proposal which will create confidence in the prospect, has been prepared by Atlas Sound Corporation, 1449 39th St., Brooklyn 18, N. Y.

Folder is available at no charge from Atlas.

* * *

BIGELOW JOINS MAGNAVOX

John F. Bigelow has been appointed director of service training for the radio division of The Magnavox Company. Bigelow was formerly manager of the publications and training section of the Farnsworth service department.

Taxicab Radio

(*Continued from page* 11)

a toggle switch is closed due to poor, intermittent or no contact.

(c) Relay contacts failing to close because the spring tension is too tight, or failing to open because the spring tension is inadequate. It may also be due to dirty, pitted or glazed relay contacts, or poor alignment of relay contacts.

(*2*) Loose connections or hardware. This is due to vehicular vibration. It may also be due, without regard to quality of equipment, to mechanical resonant frequencies developed when vehicle is moving or engine is running. Such resonant vibrations should be avoided, when found to exist, by set placement or shock mounting so as to respond to frequencies other than developed in the vehicle. Every form of matter or material has a resonant frequency of a destructive nature. Every part also has a resonant frequency of mechanical vibration depending on its size, shape, composition, weight, placement and behavior with variations in temperature. Trouble can develop where there has been no or inadequate provision for expansion or contraction of parts due to temperature or vibration. This has been particularly true in the case of early postwar mobile designs where the manufacturer's past experience has been confined to equipment used at fixed stations.

(*3*) Poor electrical continuity. This may take a variety of forms such as:

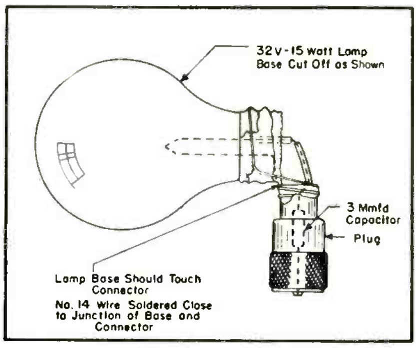
(*a*) Broken wire under the insulation. Stranded wire with considerable flexibility will minimize this possibility both in breaking and in providing continuity even if one or more of the many strands break.

(*b*) Faulty lug connections where the wire terminates.

(*c*) Poor solder connection. Each connection should hold by virtue of the solder and also by virtue of being securely wrapped to a prong or terminal wherever possible.

(*d*) Loose or bad connection to the many pins of the plugs and jacks used for cable interconnections. The cable jack and plug in each case should be positively joined and secured.

Figure 4. Details of the dummy antenna used for adjusting the dispatcher transmitter.



(*e*) Broken wire in the microphone cable. The microphone or handset is lifted off its receptacle or hook constantly during transmission. It sometimes falls on the floor, gets caught in the door, stepped upon or otherwise abused. When the wiring is defective, it is usually a very short distance from where the microphone cable enters the microphone unit and can be repaired by cutting back about six inches on the cable. Flexing of the cable is greatest a few inches from where the cable terminates in the microphone. Since the press-to-talk button is on the microphone, a defective microphone cable can put the whole system out of commission, particularly if the right wire or wires break in the cable.

(*4*) Defective or poorly seated vacuum tubes. The life of vacuum tubes depend on manufacturing quality, proper adjustment and alignment of circuits, how hard they are energized and utilized in a circuit, correctness of heater voltages, efficiency of the storage battery voltage regulator, ability and opportunity to dissipate heat, number of times turned on and off, length of operating service, etc. The net result has been that tubes have an average life varying from 1,000 to over 10,000 operating hours.

Other troubles encountered by the author in the installation and servicing of over fifty two-way systems have been wrong grounds, particularly when swapping radio units between cars having the storage battery grounded on the positive instead of negative side or vice versa, wrong tube in a particular socket, broken tube key so that tube prongs were in wrong tube socket holes, reversed receiver vibrator so that it received wrong current polarity, inadvertent omission of part equipment or a tube in the equipment when it is returned to the vehicle, antenna cable not plugged into the set, certain tubes unable to operate at the required very high frequency even though others of the same type can do so due to a certain run of tubes or changes in manufacturer, poor tube-socket prong connections, poor antenna circuit continuity between roof-top antenna and the set, floating shield or sheath on the coaxial cable between antenna and set, excessive resilience or throw in the shock mounts, inadequate shock mounting for the vehicle and the terrain it travels over, grid caps off tubes, bad quartz crystal due to dirt, chip or improper tension with respect to its contact plates, faulty modulation due to a voice too loud for a sensitive microphone or too weak for an insensitive microphone, defective parts which have changed in their electrical value, loose or poor grounding or bonding of cabinet or parts on the chassis, defective loudspeaker cone or voice coil, wet equipment due to leaky rear trunk door seams, dirty antenna insulator, etc.

While it is true that some equipments have been giving less trouble than others, the fact remains that no equipment can function without a competent Service Man indefinitely. A competent Service Man, in the case of mobile radio, is one who can understand the instruction book and who can supplement it with common sense and good judgment.

While all mobile equipment, regardless of manufacturer, has approximately the same makeup, the instruction book is different in every case.

Since a Service Man usually serves a fleet of vehicles having identical equipment, the work becomes simple or routine after a short time if case histories are recorded or remembered. Manufacturers normally reserve the right to make improvements in subsequent equipments based on the experiences obtained in the field. It therefore is very likely that the troubles encountered in earlier models will not exist in later models. Conversely, troubles developed in later models may not be found to exist in earlier models.

[*To Be Continued*]

TV Antennas

(*Continued from page* 13)

earlier article in this series.[1] This antenna is preferred in fringe areas when the desired high-frequency channel is being transmitted from a different direction than the low frequency channels.

In another type of 12-channel high-gain TV antenna design, there appears an effective compromise on directivity gain and bandwidth; Fig. 9. This antenna combines the added signal on two stacked broadband dipoles and reflectors for a single transmission line. A unique design feature is that the larger low-frequency folded dipoles act as reflectors for the smaller high-frequency folded dipoles on the 174 to 216-megacycle band.

This antenna, however, attenuates the FM band. This feature has both advantages and disadvantages. When a television receiver is connected to this antenna and the receiver has poor image-frequency rejection, the antenna's characteristic of attenuating the FM band is helpful. In commercial installations, where the TV receiver has an inductive type tuning device for the FM band (88 to 108 mc), reception of FM programs may not be satisfactory. This antenna should be used in fringe areas where all the stations are in a single direction as there are no separate adjustable directional elements on the array.

Another widely used uni-directional stacked antenna[2] is a *four bay* stacked array (Fig. 11) which develops a high forward gain and has a beamed horizontal pick-up pattern. A feature of this antenna is its tunable *Q* sections. These sections enable the installer to adjust the impedance of the antenna so that it matches the transmission line for the most desirable television channel. The best field method for adjusting *Q* sections on this or any other antenna is:

(*1*) The contrast control of the receiver is adjusted so that the pattern on the desired station is barely discernible.

(*2*) The *Q* section is adjusted along the line to the point where the contrast of the pattern is improved (made clearer and darker); this adjustment is like resonance tuning and therefore care must be exercised in adjusting back and forth for peak gain.

The adjustment is somewhat critical and is a job for two men with a 'phone connection. A properly adjusted *Q* section enables the realization of every db available from the antenna.

[1]SERVICE; August 1948.

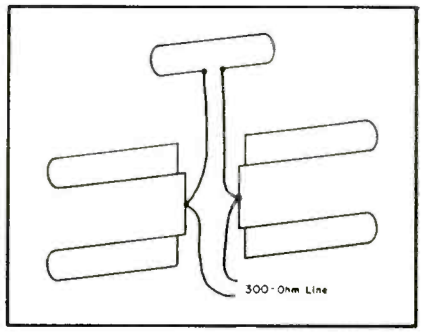


Fig. 8. Circuit for connecting a beamed high-frequency attachment to low-frequency arrangement.

The direct view type TV receivers should be selected for fringe area installation because:

(*1*) Projection receivers require greater signal drive.

(*2*) Definition is better on the smaller tubes.

(*3*) A polaroid screen over the face of a direct view tube further improves the picture contrast and tends to mask the noise spots.

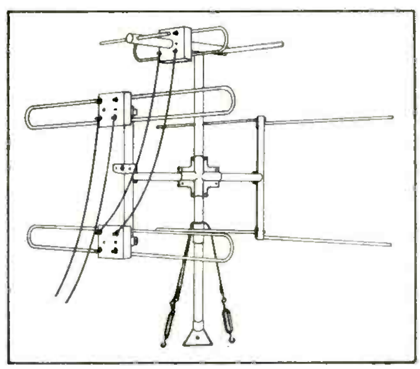
The sensitivity of the receiver unit may be improved further by the installation of a preamplifier or booster. There are two important factors in selecting a booster amplifier.

(*1*) The input impedance of the booster amplifier should match the transmission line over the complete television band, 54 to 216 megacycles.

(*2*) The booster amplifier should have sufficient bandwidth on all channels so that they pass both video and audio signals.

In fringe-area installations only low-loss cable should be employed between the antenna and the television receiver. RG17/U, RG11/U, RG8/U are preferred for coax installations. Low-loss 300-ohm twin lead (there are seven grades of twin-lead) should be selected for receivers with balanced input. Where 300-ohm line must be run over a long distance (more than 200') a weather-proof low-loss 300-

Fig. 7. Combined array of low-channel (*2* to *6*) *lazy H* and beamed high-frequency attachment. The leads from the *hf* and upper *lf* elements are actually connected to the bridging plate, as shown in Fig. 8. For clarification purposes they were not connected in this illustration. (*Courtesy Vertrod*)



ohm line,[3] which has a loss of approximately 1 db at 100 mc, is recommended. All cable used should be specified as non-contaminatable by the manufacturers if aging is not to produce subsequent losses in the cables. No old war surplus cable should be used in fringe installations.

Keeping Fringe Installations Sold

To be certain that fringe-area installations stay sold, the television installer should know his terrain (from contour map) and be certain that his signal pick-up is fringe signal and not *summer refractions* caused by sun spots. Much money has been lost from installations where the signals vanish in winter. Installations in mountain areas are also subject to intermittent operation because of continuous lightning discharges in the mountain regions during certain periods of the year.

The technique of pre-determining tower heights and installing long-wire television antennas in fringe areas will be the subject of a subsequent article in this series.

[2]VEE-D-X.

[3]Similar to VEE-D-X X200A.

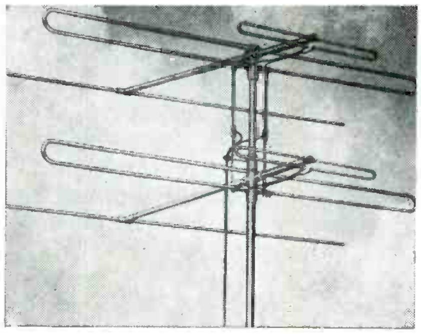


Fig. 9. Unidirectional 12-channel high-gain stacked array.

(*Courtesy Amphenol*)

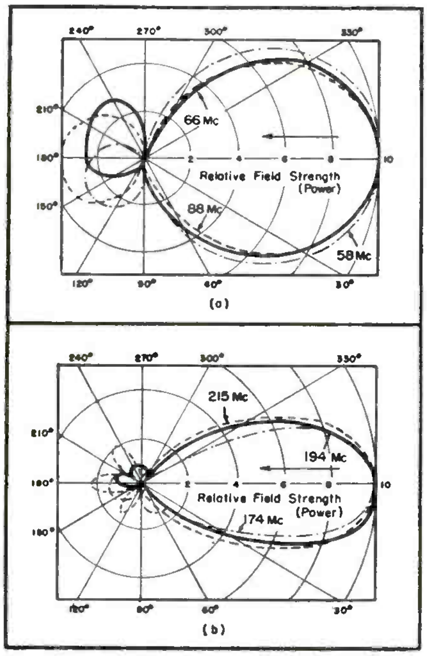
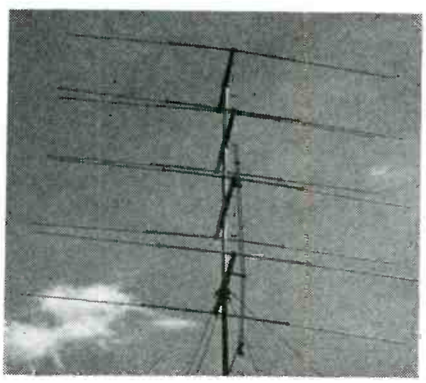


Fig. 10. Horizontal pattern of 12-channel unidirectional stacked array shown in Fig. 9.

Fig. 11. Super-stacked array.

(*Courtesy VEE-D-X*)



LP System

(*Continued from page* 17)

arc approximately ½" beyond the center of the turntable spindle. The motorboard should be mounted carefully to isolate vibrations originating in the motor. After mounting, one hex nut is placed on the ½" long needle protective screw and the screw is inserted into the hole provided in the swivel. Then the bracket is assembled with the head of the screw toward the inside of the arm. Another hex nut is then placed on that portion of the screw showing through the bracket. Needle point should and can be adjusted to be about 1/32" above turntable surface; Fig. 6.

The pickup can be connected directly to a single grid-input-circuit amplifier. The center connector should be connected to the grid or *hot* lead, and the shield be connected to ground; Fig. 7.

Motor Assemblies

On many installations it will be necessary to install not only a new pickup but also a completely new motor assembly due to the 33⅓ rpm speed of the *lp* records.

Two motor and single motor assemblies are available. One type[7] has a 78- and a 33⅓-rpm motor. For 33⅓ rpm a speed change lever extending on the outside of the turntable rim is shifted and this in turn moves a rubber-belt-driven step pulley against the idler wheel. At 78 rpm the speed change lever moves the step pulley away and the idler contacts the motor shaft directly.

Another model[8] has a 4-pole motor with a two-diameter shaft. By raising and lowering the entire idler assembly according to the speed wanted the idler engages the small diameter of the shaft for 33⅓ rpm and the larger diameter for 78 rpm.

In another model[9] which provides both 33⅓- and 78-rpm speeds, two motors are mounted below a standard 10" or 12" turntable. A single lever control changes the turntable speed.

When the control lever is operated, the desired motor is electrically switched into the circuit. The lever disengages the idler tire from the turntable rim and the motor pulley through linkage which is completely apart from the idler system when the motor is in play position. Neutral position switches off both motors when not in service.

[7]General Industries DM.
[8]General Industries DR.
[9]Alliance Dual-Speed.

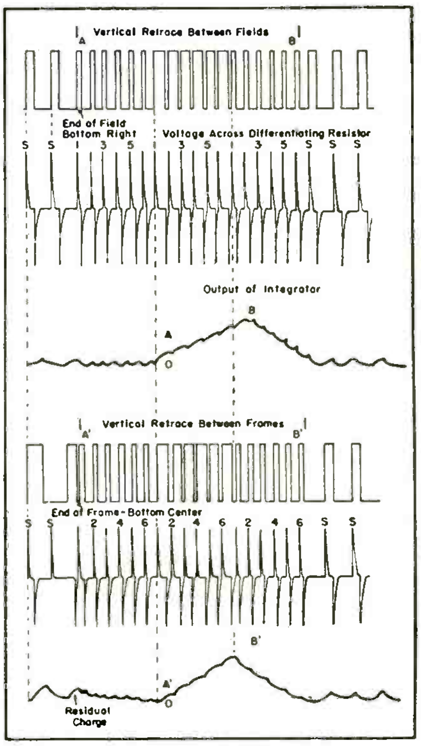
TV Sync

(*Continued from page* 22)

vertical sync pulses; top drawing Fig. 2. The horizontal synchronizes between frames on the even-numbered equalizing and vertical sync pulses. We also know that with the interlace scanning system at the end of a frame the beam is retraced from the bottom center of the scanning raster and therefore the time interval between the last horizontal pulse at the end of the frame and the first equalizing is 31.75 or one-half of the line interval. Therefore, if it were necessary to synchronize on the odd-numbered equalizing and vertical sync pulses, as before, the horizontal oscillator would naturally shift phase for an instant. It is necessary to insert equalizing and vertical sync pulses half-way between the odd-numbered pulses discussed previously. Consequently, the second equalizing pulse leading edge is one line interval away from the last horizontal sync pulse at the end of a frame and therefore during the retrace interval between frames, the horizontal is synchronized on the even-numbered equalizing and vertical sync pulses. Therefore the double-line rate equalizing and vertical sync pulses are necessary to maintain horizontal synchronism between fields and between frames.

[To Be Concluded in January]

Fig. 2. How horizontal and vertical sync appears between fields and frames.



Association News

(*Continued from page* 33)

Technicians Associations, Wayne Shaw, secretary, says that thirty-five representatives and delegates from Rochester, Ithaca, New York City, Poughkeepsie and Binghamton attended the meeting, which was held at the Hotel Arlington.

The Federation was created to further the welfare of the radio technician in New York State, to work toward raising his technical standards, and to promote among the public a better understanding of the problems of the radio Service Man.

The Federation expects to include all active radio service groups within the State, and has limited its membership to established associations which have regular local activity. Each member association is represented in the Federation by two delegates, one of whom serves on the board of directors.

ESFETA will give any required assistance to technicians or groups of technicians within the State, who are interested in forming their own local associations. The Federation will also assist in activating associations which are not now operating, and will maintain liaison with Federations in other States.

T. Lawrence Raymo, president RTG, Rochester, is prexy; Max Leibowitz, president ARSNY, New York City, vice president; Wayne Shaw, president, RSA, Binghamton, secretary; Ben De Young, president RTG, of Central New York, treasurer; and Evart M. Howland, president Hudson Valley RSA, sergeant-at-arms.

Term of office ends April, 1949.

The next meeting, which will cover constitutional questions and incorporation, will be held in about one month. Further details about the Federation may be obtained from W. Shaw, 392 Chenango St., Binghamton, N. Y.

ARTG

Delegates from nine RTG units in New York State and the New England States, who met recently at a meeting in Rochester, N. Y., voted to effect a national organization and approved a constitution for the organization which is to be known as the American Radio Technicians Guild, incorporated under the laws of the State of New York.

The delegates to the convention, acting under the authority of their local guilds, elected six directors to serve until the first annual meeting of ARTG, to be held in June, 1949.

NEWS

AUGUST-SEPT. HYTRON CONTEST WINNERS

First prize in the August Hytron Service Men's contest was awarded to Douglas T. Sweeny, 310 West Union Avenue, Bound Brook, New Jersey.

First prize in the September Hytron contest was won by Casimir F. Woods, 54 North 7th St., Newark, New Jersey.

The Sept. presentation was made at Variety Electric Company, 601 Broad Street, Newark, New Jersey, Woods receiving a Jackson 641 Universal signal generator.

Everett B. Boise, Hytron representative; D. T. Sweeny, Aug. prize winner, and Mrs. Fannie Bennett of Bennett's Radio Supplies, where the prize presentation was made.

Below: C. F. Woods, September prize winner; Stanley Dudek, Variety Electric Company, and Herbert H. Friedman, Hytron rep., who made presentation.

* * *

MUTER BUYS JENSEN

The Muter Company has acquired all of the common stock of the Jensen Manufacturing Company. No consolidation of operations is currently anticipated and no changes in management are contemplated. T. A. White, president of Jensen, Hugh S. Knowles, vice president and Ralph T. Sullivan, Jensen district sales manager, have acquired a substantial block of stock in The Muter Company.

* * *

NATIONAL UNION BUYS NEW VIDEO TUBE PLANT

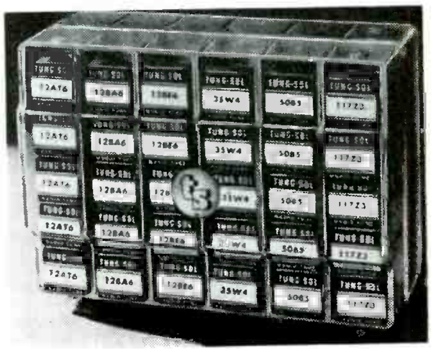
National Union Radio Corp., Orange, N. J., has purchased a plant in Hatboro, Pa., for the production of all types of picture tubes up to and including 20″ in diameter.

Based on an indicated production of 800,000 TV sets in 1948 and an estimate of more than two million sets next year, the company expects to turn out approximately 200,000 tubes in '49 and upwards of 500,000 tubes the following year.

TUNG-SOL TUBE MERCHANDISER

A tube merchandiser (TM-30) made of polystyrene has been developed by the Tung-Sol Lamp Works Inc., Electron Tube Division, 95 Eighth Ave., Newark 4, N. J.

Each merchandiser has room for six stacks of tubes, five tubes in each stack. As tubes are withdrawn through the opening at the bottom of each stack, the others automatically fall in position. The merchandiser is easily refilled through openings in the face of the cabinet at the top. Two or more may be stacked and locked in vertical position by means of self-locking washers. The merchandiser is sold already packed with an assortment of 30 tubes.



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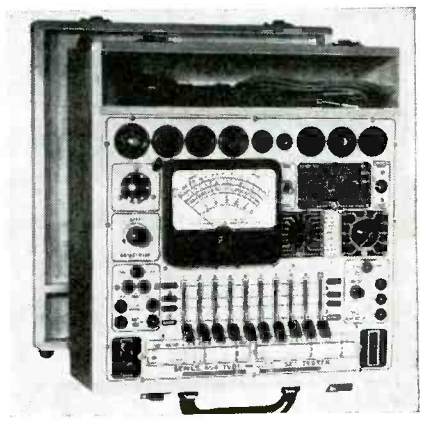
PRECISION APPARATUS COMBINATION TESTER

A combination *cathode conductance tube tester, dynamic* (under-load) *battery tester* and *high sensitivity ac* and *dc* circuit tester (20,000 ohms-per-volt D.C.), (series 654) has been developed by Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.

Features include filament voltages from ¾ to 117 v., free-point 10 element lever selection, individual tests of multi-section tubes, built-in roll chart, and fuse extractor post.



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UTAH INTERCOMM SPEAKERS

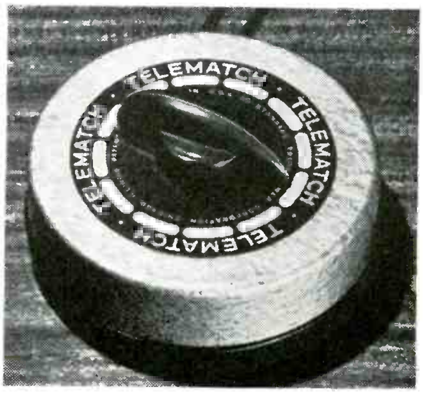
Intercomm speakers, in the four-inch SP4A1 and the five-inch SP5A1, have been announced by the Utah Radio Products Division of International Detrola, 1123 East Franklin Street, Huntington, Indiana.

Both sizes are built with 44-ohm voice coils and a .68 oz Alnico V magnet.

New TV Parts . . . Accessories

STANCOR TELEMATCH

Telematch, which is said to correct mismatch between TV antenna and receiver has been announced by Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill. Unit may be mounted behind receiver or used on top of cabinet. Literature and display material are supplied with shipments or will be mailed upon request.



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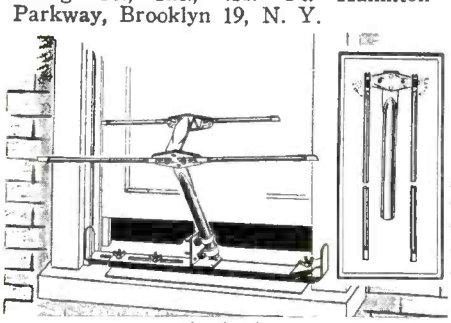
JFD WINDOW TV ANTENNA

A *Quik-Rig* TV window Antenna has been annnounced by the JFD Manufacturing Co., Inc., 4117 Ft. Hamilton Parkway, Brooklyn 19, N. Y.



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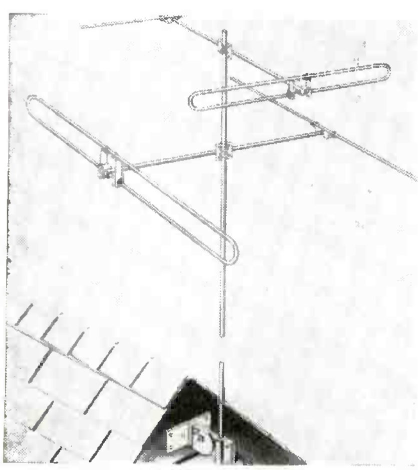
BRACH TV/FM ANTENNA LINE

A line of FM and TV antenna kits (*Flexi-Kits*) has been announced by the L. S. Brach Mfg. Corp., Newark 4, N. J.

Feature of the kits is their universal construction.

Complete individual antenna kits include a *Hi-Lo rotatable TV Antenna.* Complete data appears in catalog 1304.



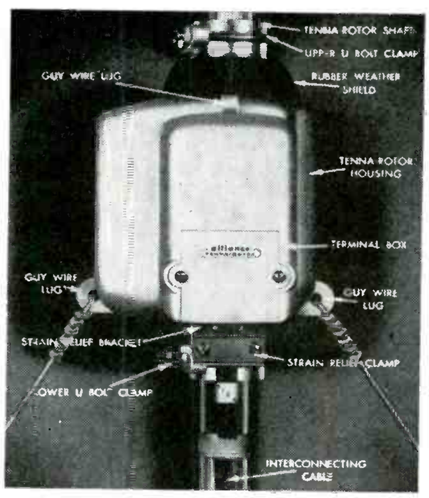
ALLIANCE TV AND FM ANTENNA ROTATOR

An electric antenna rotator (*Tenna-Rotor*) designed to rotate FM and TV antennas has been announced by the Alliance Manufacturing Company, Alliance, Ohio. The rotator unit is connected to a plastic control box, located adjacent to the receiver. A three-position switch starts rotating the antenna clockwise or counter-clockwise, through 360°. When the switch is turned to the center or neutral position, rotation is stopped. When the limit of travel is reached in either direction, a small screen on the control panel is illuminated.

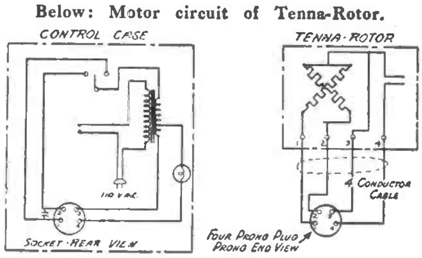
The rotator mechanism is an electrically driven rotating hollow shaft into which the antenna center post is clamped. The gear train driving this shaft is motivated by an intermittent duty, reversible, capacitor type motor. Gear reduction is so designed that the antenna rotates at approximately 1 rpm. Both the stop and reversing arrangements are said to be practically instantaneous. The control box plugs into a regular 110-volt 60-cycle house line and is connected by a four-conductor cable to the rotator.

The motor in the rotator unit operates on 24 volts at 60 cycles supplied through a step down transformer in the control box. Components in the rotator are cadmium plated and the rotor is moisture sealed.

Rotator and control box weighs approximately 12 pounds. Overall dimensions of the rotator unit are 7¾" x 5¼ x 8"; control box measures 5" x 5" x 4".



Below: Motor circuit of Tenna-Rotor.



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JERROLD BOOSTER

An FM-TV signal booster which is said to offer a gain of 20 to 30, has been announced by Jerrold Electronics Corporation, 121 N. Broad Street, Philadelphia 7, Penna.

JOTS AND FLASHES

THE NEED OF TRAINED TV Service Men to service the increasing number of television receivers was the keynote of an address by Max F. Balcom, RMA prexy and vice president and treasurer of Sylvania, before the third Town Meeting of Technicians held in Boston, recently. Balcom stated that TV set production this year will probably exceed 750,000 and next year would top 1,500,000. He also cited the increasing field for Service Men's activities in FM, privately-owned communications systems, mobile setups, citizen's radio service, etc. . . . James F. Skinner, Philco vice president in charge of the service and parts division, stated recently that 43 of its distributors in TV cities have provided training courses in TV installation, maintenance and repair to more than 5,000 Service Men. . . . William S. Hedges, NBC vice president, predicted recently that TV "may well prove to be a two-billion-dollar-a-year industry," based on an annual set production of 4,000,000 at an average retail price of $350, for a total of $1,400,000,000, plus $600,000,000 for the sale of time and talent. Hedges also foresaw TV within five years in at least 150 markets of the nation, with a total of 500 stations serving an audience of sixteen million TV families. . . . The first issue of the *REPresentor* was published recently by the Industry Relations Committee of the Representatives. It is edited by Jane Drucker and devoted to news of the forthcoming Parts Show, import and export licensing, foreign markets, FCC news, Fall business reports, new developments, etc. . . . The fifth volume of the *Photofact Folders* with sets 49 and 50 was recently published by Howard Sams and Company, Inc. . . . A volunteer firemen's home receiver operating on 152-162 mc has been developed by Motorola, Inc. . . . Technical Advertising Associates, Cheltenham, Pa., have published a *Radio Components Handbook* by A. C. Matthews and Staff, covering a variety of very handy design and application information. Book sells for $2.50. . . . Bob Gunderson is now writing a technical column for the Newark Electric Co., 242 West 55th Street, New York City. . . . Samuel J. Spector, president of the Insuline Corporation of America, Long Island City 1, N. Y., has just returned from a trip to the middle west and west coast, surveying the TV parts markets. . . . The RCA Victor Company of Montreal is now the sole Canadian distributor for Camburn products, which includes AM and TV antennas . . . Sales reps of the Simpson Electric Company, Chicago, recently attended a series of sales conference sessions at the home of Ray Simpson, prexy, at Lac Du Flambeau in the Wisconsin north woods. . . . The Herlec Corporation of Milwaukee, Wis., manufacturers of ceramic capacitors and *Bulbplate* printed circuits, has been acquired by the Sprague Electric Company, North Adams, Mass. Milwaukee operations will be under the continued direction of Herlec execs including Milton Ehlers, president; Harry Rubenstein, vice president and chief engineer, and Thomas Hunter, vice president in charge of sales. . . . Leonard C. Taggart is now director of purchasing for Sylvania Electric. . . . Frank E. Smolek, service manager of Zenith, recently completed directing a forty-hour TV course for Zenith's thirty distributors. . . . William H. Resch has joined the staff of Technical Appliance Corp., Sherburne, N. Y., as assistant treasurer.

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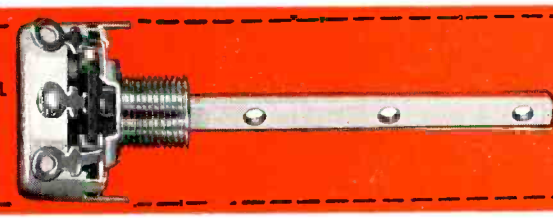
SERVICE INDEX—DECEMBER, 1948

Get Acquainted with the Little Fellow with the BIG Advantages

The All New
Mallory Midgetrol



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