Radio SERVICE DEALER

JULY, 1949

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AM-FM-TV-SOUND

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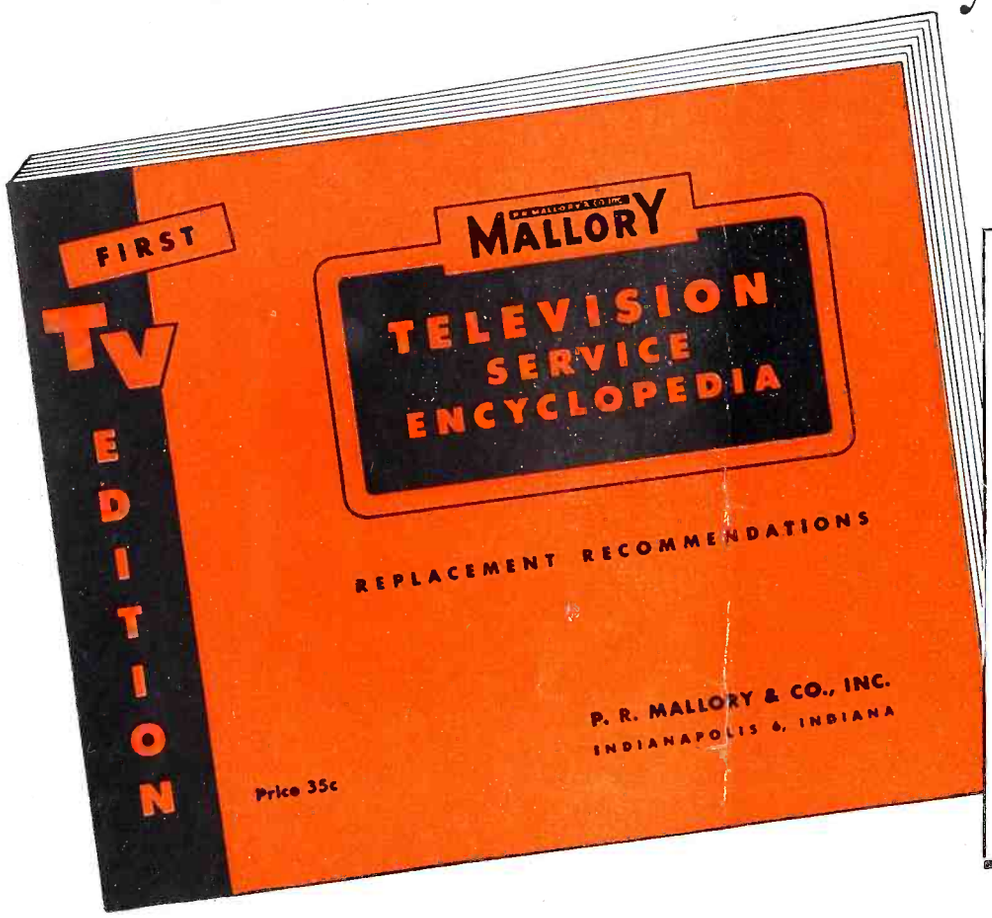

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EDITORIAL

Preventive Radio Maintenance Month

RMA heard our recommendation, given in behalf of the thousands of technicians who appointed us to represent them, that the servicing profession needs and wants an RMA-NAB co-sponsored "National Preventive Radio Maintenance Month." But RMA merely listened to the proposal and took no action whatever.

That was to be expected. RMA's basic membership is the group of radio-TV receiver manufacturers who are primarily interested in selling to the public new sets. These manufacturers don't seem to give a hoot about keeping old radios in operable condition. NAB, on the other hand, recognizes that AM audiences are falling off and that TV audiences are increasing. AM-FM Broadcasters are perturbed about the loss of listeners to the point where they will do anything about keeping old radios working if it will help their circulation (meaning, listening audiences). So, service dealers, let's work with NAB and go along with the idea of having a "Service Month."

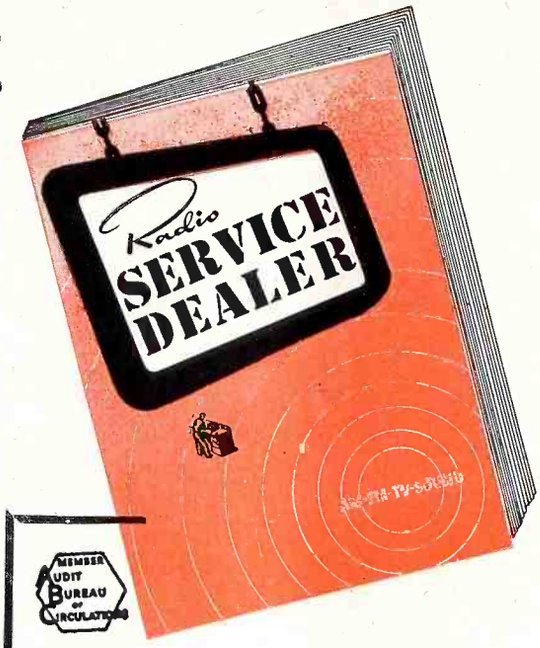
Plans are already afoot between the heads of the Federations of Radio Servicemen of the States of New York and Pennsylvania whereby it is planned that the month of October, 1949 will be declared "Fix Your Radio Month" or words to that effect. Naturally cities adjacent to N. Y. and Pa. borders will participate and it is further suggested that all progressive radio service dealers and service organizations regardless of where they are situated should try to promote the same idea for their own locality. As details about the N.Y.-Pa. "Fix Your Radio Month" progress this and contemporary publications will report in full.

Crossroads to Survival or Failure

The present moment and the dozen months ahead represent the most critical period for independent radio service dealers and servicemen since the inception of our industry. What happens these next few months truly will be the answer to the question: *Is The Servicing Industry To Survive Or Fail?*

From coast to coast, both where there is AM only and where there is AM and TV, the radio-(and TV) servicing business is far below normal and getting worse by the minute. The causes and cures of the serious depression our industry is now in are so complex we cannot cover them properly in an editorial as short as this.

For that reason the regular department called "Field Findings" is omitted from this issue and in its place I cover the subject with an article titled, "What Is Ahead"? Every independent service dealer and serviceman owes it to himself to read and digest this article to the fullest degree. You will learn whether you are committing business suicide and what precautions must be taken immediately to counteract the trend of our profession to murder itself out of existence.



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Field Findings

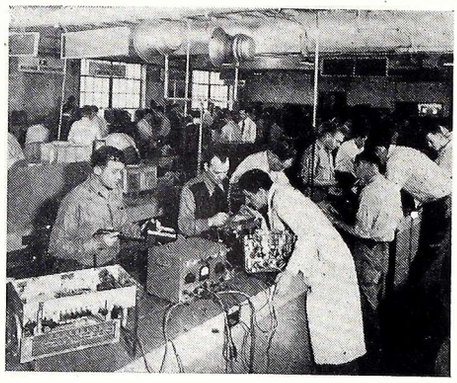
A resume of Industry happenings here, there and everywhere

NEVER before in the history of radio has the servicing profession been in such jeopardy as it is at this moment. No one has ever accused me of being a pessimist, for on the contrary, heretofore I have always managed to find a glimmer of hope upon which to lean with anticipation. But now matters are in such a chaotic state that I am forced to repeat, with all the emphasis at my command, what I stated editorially, to wit: "The present moment and the dozen months ahead represent the most critical period for independent radio service dealers and servicemen since the inception of our industry. What happens these next few months truly will answer the question, *"Is The Radio Servicing Industry To Survive Or Fail?"*

Suicidal Practices

Several branches of the radio industry, including the servicing profession, is committing business suicide; whether willfully or unwittingly is beside the point. Two years ago more men were engaged in radio servicing than ever before; most were busy, and practically all were doing well financially. Only a few months ago the outlook was so bright that I said: "Because of the tremendous potentialities of TV it is becoming apparent that soon this great country of ours will need upwards of one hundred thousand competently trained radio technicians merely to keep in operable condition the 5 million videosets that will be in use by the end of 1951, and at least 20 thousand other technicians will do well for themselves keeping in repair the many millions of AM sets which will also be in use."

What do the records show? They indicate that more men are in radio training schools learning the ramifications of radio and video; that more men finished their technical radio schooling during the past year than ever before, and entered the ranks of practicing radio-video technicians actively—and yet, the records also show that the business mortality of radio technicians has been by far greater this past year than ever before, (the mortality rate is now upwards of 90% of the graduating radio students per month), and close to 96% of the men who entered the radio servicing profession since the end of war are already out of this field. Further, the mortality rate of old, well established, radio service organizations is sky-rocketing. See pix.



Here is a TV class at the Commercial Trades Institute, one of the largest radio-TV trade schools, where the instruction is practical, the students being required to work on TV chassis, which, experience proves, is the only way a technician can learn TV's many ramifications.

The Current "Recession"

There is a serious business recession at present. The underlying causes are many; some being attributable to the return to postwar normalcy. In radio, however, a basic reason for reduced income and earning power is the stupidity or lack of farsightedness on the part of many who are engaged in selling, installing and servicing radio—TV sets.

We are in a buyers' market. The public, acutely price conscious, has come to expect to buy TV sets at retail at or slightly above the retailer's actual net cost, not allowing said dealer normal markup or profit. Naturally retailers are going into bankruptcy in droves. And a crop of unscrupulous retailers has been bred from this stupid price-cutting trend period. I refer to the many retailers who have sold videosets at cost, or below cost, and who have in addition sold the unwary videoset buyer a "service-installation contract" which they had no intention of fulfilling. Such unscrupulous retailers pocketed the "service contract" fees and after accumulating a sufficient volume simply went into bankruptcy. This new racket has given the "servicing part" of this business a black eye.

Then there were many legitimate wholesale service organizations that came into being with TV's inception. but who did not price their service fees high enough, and because of the tremendous volume of call-backs, suddenly found their operations were in the red and had to be abandoned.

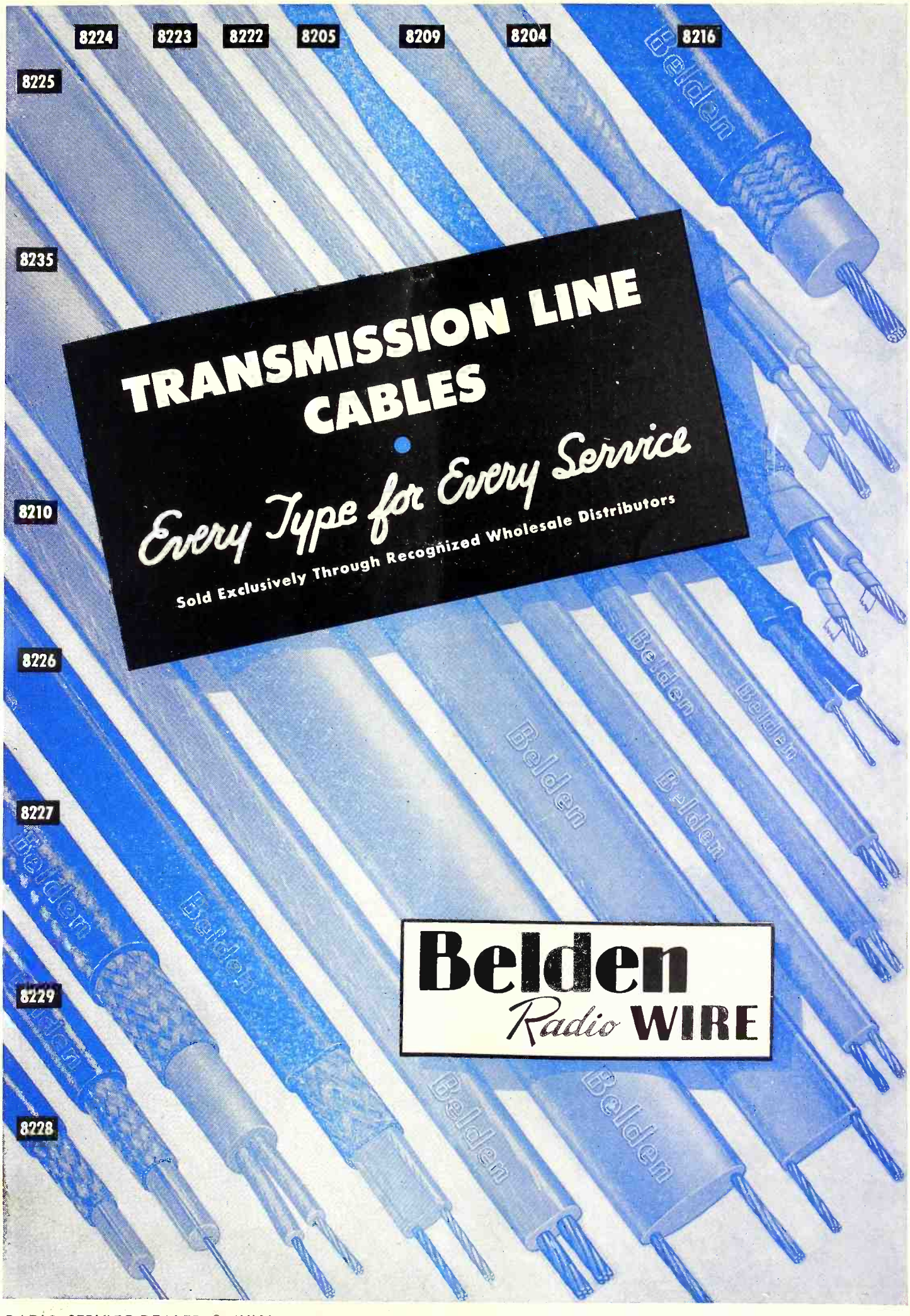
Who Is To Be Blamed?

Any business firm's management which permits its firm to operate on an unprofitable basis must be condemned. The pity of it is that most radio firms, both retailers and servicers alike, are managed by men who are excellent technicians but extremely bad businessmen. It seems that radiomen just won't pay heed to the warnings about business management methods that some of us have tried to inculcate over a period of years.

Now-a-days the radio business, (from a servicing point of view), is sharply divided into two spheres: 1) —Areas being served with TV, and 2) —Areas where there is no TV at present and where TV cannot be expected to play an important role for over a year. Yet business indices show that both types, or shall I say, *all* phases of the radio servicing profession are in a serious slump. It is incongruous!

Leading videoset manufacturers claim that they are losing money by operating their own TV service-installation companies and that they would cease and desist from participating in such company-owned or directed subsidiaries if they could do so without impairing their investment in the video art. In contrast, several large, independent wholesale TV service companies claim they are operating on a very profitable basis. Many small service organizations who have succeeded in getting a share of TV installation-service work report they can handle the business profitably, and yet a majority of these small independents are going broke in droves simply because they don't know whether they are making money or

[*Continued on page 27*]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G. E. Pix Tube Production

Inspection of General Electric's "Daylight" television picture tube plant at Buffalo, N. Y., was made recently by Charles E. Wilson, President of the company, seen here examining one of the operations with

R. T. Pennoyer, manager of the plant. G. E. is working "round-the-clock" six days a week at the Buffalo picture tube factory and will soon supplement this production with new manufacturing facilities at Electronics Park, Syracuse, N. Y.

Rider Announces New Book

John F. Rider Publisher, Inc. announces a new "Commercial Radio Operators' Q&A Manual" by Milton Kaufman, lecturer in commercial radio operators' procedure at RCA Institutes, as an August publication.

Riders Manual Volume XIX (19), the largest volume to date is currently available at all Rider jobbers.

Announcement has been received from Mr. Rider that he has acquired all properties, copyrights, etc. of the Electronic Research Publishing Company, publishers of the Electronic Engineering Master Index, as well as the Electronic Engineering Patent Index.

The new organization known as the Electronic Research Publishing Company, Inc., of which John F. Rider is president, will expand both compilation and publishing activities of these two indices, so as to include the full gamut of foreign as well as domestic sources of electronic data.

Sylvania Receivers

Don G. Mitchell, president Sylvania Electric Products Inc., announced today that a full line of television sets bearing the Sylvania name will be placed on the market this fall.

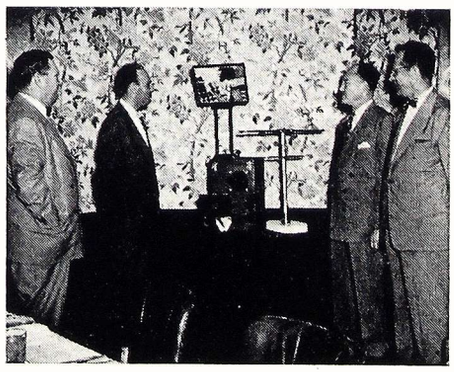
Sets are expected to be available on October 1. Initially the line will feature 10 inch and 12½ inch table models, consolettes and console combinations with three speed record changer, AM and FM radio, and also a 16 inch consolette. Also announced by H. Ward Zimmer, vice-president in charge of operations was the formation of a new division of Sylvania Electric Products Inc. to specialize in the design, engineering and production of viewing tubes for television receivers.

Radiart Announces New Units

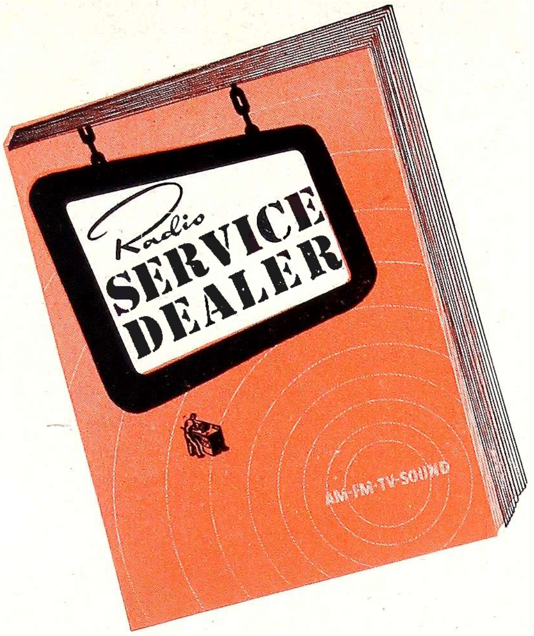
Milton S. Roth, jobber sales manager of the Radiart Corporation of Cleveland, Ohio, announces the final development of the newest product by Radiart engineers, the RADIART TELE-ROTOR. This is a new rotator for television antenna installations. Roth also announces a new VIPOWER line for DC to AC power conversion. These vibrator-powered converters are now available to furnish 110-volt 60 cycle AC current from 6, 12, 32, or 110-volt direct current sources.

Ward Produces Antenna Movie

The Ward Products Corp., Division of the Gabriel Co., 1523 E. 45th St., Cleveland 3, Ohio has produced a five minute sound movie in color which illustrates to the serviceman



the ease and speed with which he can now install Ward "Minute Man" antennas. The movie depicts Dick Moss, a Chicago installer, assembling a



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Ward Model TV-46 in 42 seconds or 6c in service time. It also shows a comparison of Ward's especially developed Perma-Tribe — a corrosion resisting steel that has withstood over 2000 hours of salt spray tests.

The photograph shows Bill Klein, Executive Vice-President, Julius Fine, Sales Manager, L. H. Finneburgh, Chief Engineer, and George McAllister, General Manager, all of Ward, watching the movie at their sales meeting at the Radio Show in Chicago recently.

Maginot Nat'l Union Sales Head

Kenneth C. Meinken, President of National Union Radio Corporation, announces the appointment of Emil J. Maginot as Sales Manager of the Distributor Division of that company.

Mr. Maginot came to National Union Radio Corporation eight years ago and has served successively as Director of Sales Engineering, and Manager of Advertising and Sales Promotion.

Meyer On Stewart-Warner Board

George L. Meyer, Jr., a vice president of Stewart-Warner Corporation since 1941 and an employee since 1907, was recently elected to the board of directors. This was announced by James S. Knowlson, president.

Tiny Personal Portable

Mr. R. D. Payne, Manager of Sales, Air King Products Co., Inc., Brooklyn, New York, manufacturers of radios television and electronic apparatus announces a new small personal portable.

This portable known as the "Pockette" has added power and range in its new design. It is encased in an ebony, polystyrene cabinet, weighs only 11 ounces and is 5-¾" high x 3-⅝" wide x 3" deep.

RMA Admits Howard W.S. Sams

Word of the election of the Howard W. Sams & Co., Indianapolis, publishers of technical manuals, to associate membership in the Radio Manufacturers Association was received by the company here recently.

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Picture Tube

HIGH VOLTAGE SYSTEMS

by ALLAN LYTEL

In this article the author discusses the theory and applications of various types of high voltage power supplies found in all types of television receivers.

PICTURE tubes of both the electro-static or the electro-magnetic type need a high voltage which is the accelerating potential supplying the electron beam. This voltage is of the order of several thousand volts d.c. but the exact amount depends upon the geometry and size of the tube. While the voltage is necessarily very high the current drain is at the same time very low, which enables circuits of this character to use simple RC networks for filtering. The highest peak current requirement that is needed is usually one milliampere or less, which accounts for the rather low value of filter condenser used. The resistance, which is used as a part of the pi filter, is chosen in order that the RC time constant be of proper value. This time constant only need be enough to keep the charge upon the condenser output until the next rectified pulse is applied.

60 Cycle H-V Supplies

There are several methods which have been used, and are at present in use in order to obtain this high voltage. The earliest high voltage system, which is rarely found in use today, is represented by RCA TRK series which is no longer in production. This circuit, and others like it, are only an extension of the regular transformer type power supply. Before explaining the action of this circuit, a note of caution must be inserted. These systems are exceedingly dangerous and are capable of causing instant death since the power supply coming from a transformer can have a larger current drain if necessary. Measurements of the high voltage in this type of power supply should never be made while the receiver is in operation. *Figure 1* is an illustration of a conventional transformer type of half-wave power supply which was first used to obtain this high accelerating potential.

The operation of a power supply of this type is familiar enough to most service technicians so that a full and complete discussion is not necessary here. The half-wave type of rectifier is used since approximately twice the voltage output is obtained with this system as compared to the same transformer winding used for full wave rectification. Thus, a higher voltage output is obtained with half wave rather than full wave for a given secondary winding. The full wave rectifier will supply more power and more current drain than a half-wave rectifier, but because of the exceedingly low current drain of the system the voltage advantage of a half-wave type can be obtained.

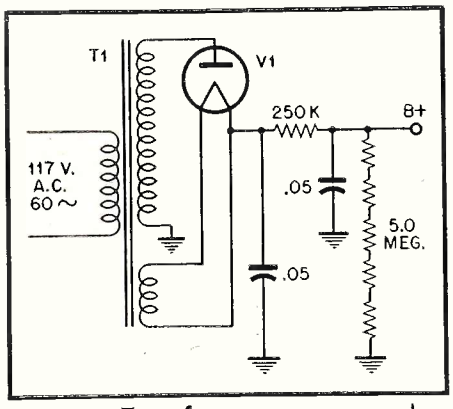


Fig. 1—Transformer power supply

With an electrostatically deflected tube, a series of bleeder resistors are connected from the d-c output to ground. Different elements of the picture tube are then tapped off from the right resistor in order to obtain their necessary high voltage. A total bleeder resistance is used which limits the current drain to one milliampere or less, and this constitutes a load upon the rectifier circuit.

In the electro-magnetically deflected and focused tube, high voltage is supplied only to the second anode and no bleeder is used. Thus, there is very little load placed upon the power supply. Electrodes of this picture tube obtain their necessary voltage from the low voltage supply, which means that there is a much smaller load upon the high voltage rectifier circuit. In both types of picture tubes, good regulation of power supply is very important in order that there be no inner action between focus and brilliance controls. Good regulation is obtained through use of a non-varying load upon the power supply.

Figure 2 is an illustration of the RCA TRK electrostatic picture tube high voltage power supply system. The high voltage rectifier is a type 879 diode which uses a directly heated cathode and plate cap. The a-c voltage applied to this tube comes from the secondary winding; the other end of this winding does not go to ground but instead to the filament of the Kinescope and then to ground through the *Brightness Control*. The cathode and heater of the Kinescope are tied together as shown. A simple RC network is used as a filter, and the accelerating potential as well as the potentials for the other electrodes are taken from a bleeder network. Vertical and horizontal centering voltages, applied to the deflection plates, are taken from controls in parallel with the portion of the bleeder. This high voltage output is 3000 volts and the focus voltage is approximately 500 volts. Transformer type voltage doublers have also been used as high voltage sources. These provide an increased voltage output with a given winding.

Today's television receivers use a high voltage system which is quite

different from the one just described. The transformer type of power supply is expensive because of the large number of turns needed on the secondary and this type of power supply has an element of danger as has been pointed out.

Other High Voltage Systems

One type of high voltage supply uses a low voltage rectifier to provide plate voltage to some type of oscillating system. This oscillator may be either the Horizontal Sweep Output tube or some type of a-c source other than the power transformers. A voltage step up is obtained through a transformer and this high voltage is then rectified by means of a separate diode. Because this high voltage diode operates on a higher frequency than 60 cycles many circuit modifications are possible. The filter network can be made much smaller and also much safer since the current drain is definitely limited to a non-fatal value. Where a separate oscillator is used to supply the high voltage rectifier, this oscillator may be of the r-f variety. In this case, tuned circuits may be used to increase voltage amplification. Where the horizontal output tube is used as the source of the oscillation, an additional winding is used to increase the voltage applied to the diode.

In a television receiver using magnetic deflection, the deflection coils are inductively coupled to the horizontal output tube. The purpose of the horizontal output tube is to produce in the horizontal sweep coils a saw-tooth sweep current. When the cathode ray beam is being moved across the tube face, a saw tooth current is built up in these deflection coils. The output tube is not conducting during the retrace or fly back time and the magnetic field built up by the deflection coil collapses. This rapid change in the magnetic field produces a very high voltage pulse across the deflection coil. A damping tube is used across the deflection coil in order to remove this voltage peak as soon as possible. It is this voltage peak caused by the collapse of the magnetic field in the deflection coil, during the retrace time, which is the source of power for the high voltage system.

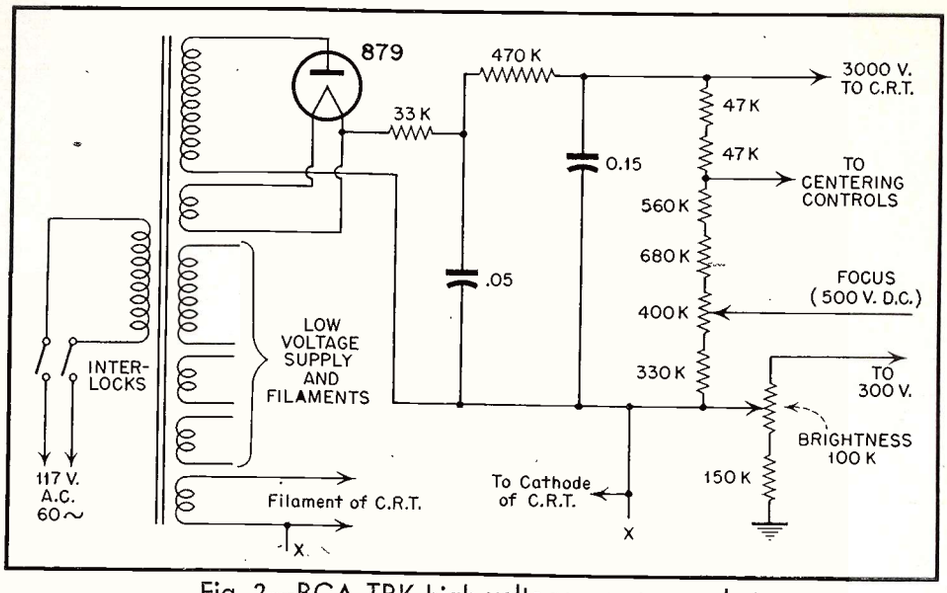


Fig. 2—RCA TRK high voltage power supply

The horizontal output transformer has a step down ratio from the primary to secondary because the relatively high impedance of the horizontal output tubes must be matched to the low impedance of the deflection coils. Thus, there is a step up in voltage, due to the turns ratio, in going from secondary to primary. An additional section of primary winding is used for the high voltage which results in a further increase from secondary to primary. This is illustrated in *Fig. 3*, showing the horizontal output tubes, the output transformer and the high voltage power supply.

When the magnetic field in the deflection coil collapses at the end of a horizontal trace, a very large voltage is built up because of this inductive decay. This voltage is of course also applied across the secondary of the horizontal output transformer. Since there are a greater number of windings on the secondary than on the primary, this voltage is stepped up by the transformer action between the secondary and primary windings. In order that this voltage increase may be even higher, the additional primary winding is used for the high voltage pulse as illustrated. During the period of the electron beam retrace, a very large voltage pulse is present across the primary of the horizontal output transformer.

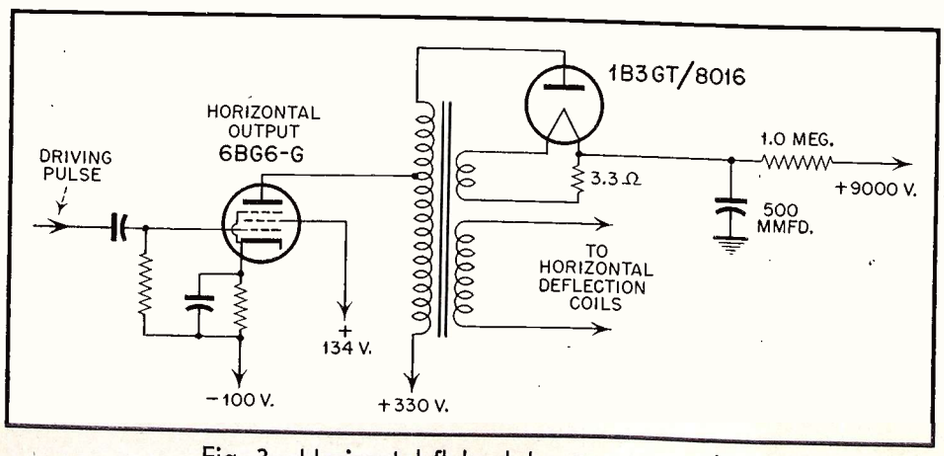


Fig. 3—Horizontal flyback h-v power supply

Projection Receiver High Voltage

The use of a special cathode ray tube of the 5TP4 type for projection television receivers, brings with it the problem of a high voltage power supply. These kinescopes need a supply of about 30,000 volts for the very bright image which they produce. A brighter screen means that there must be a higher voltage supply than is normal with the direct view tube. If a high voltage transformer of the ordinary type were to be used, it would have to have a great number of windings on the secondary. This would mean that such a supply would be very expensive and also very bulky. There are different methods which are used to produce the very high voltages needed for projection television receivers.

Because of the extremely high voltages needed for projection television picture tubes voltage triplers are in very wide use. These work on the principle of charging a string of three condensers each to nearly the peak of the applied signal. The voltage output is taken across the three con-

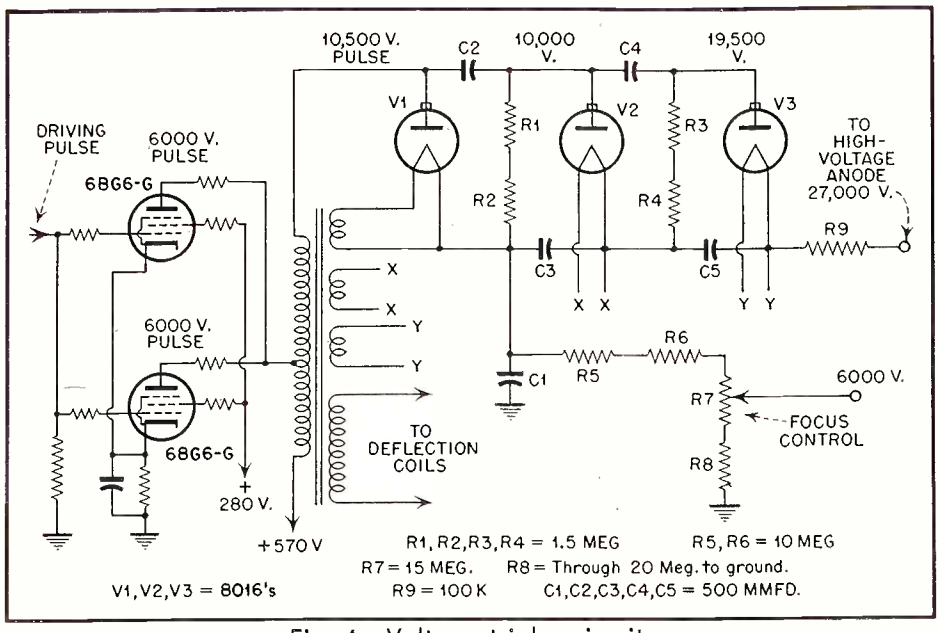


Fig. 4—Voltage tripler circuit

densers in a series which effectively triples the peak of the applied voltage.

Corona Effect

The very high voltage used in the power supply systems of projection receivers have some unique problems. Special insulation is needed to prevent a breakdown and short between two points which have a great difference of potential. Another difficulty is corona or ionization which causes the air to become a conductor. Where a great difference in voltage exists between two points there is an ionization effect; this is only noticeable where the voltage difference approaches values near 10,000 volts. Because of this voltage difference the air becomes ionized just as the gas in certain gas-filled tubes becomes ionized under the proper conditions. The air is broken down into ions and electrons which makes the air become a conductor. A blue glow may be noticed and flashes on the picture screen will give evidence of this condition.

Corona is more marked where the surfaces are small or sharp; hence sharp edges are to be avoided. Plastic covers are sometimes used over the ends of condensers and resistors to prevent corona. Parts with a large difference of potential are to be kept separated or well insulated to prevent losses of this type.

RCA - 648 PTK - (8PCS 41)

This circuit is an illustration of an inductive kickback voltage multiplier using the horizontal output transformer. This transformer has three filament windings which are used for the rectifier diodes. In operation, this circuit, *Fig. 4*, charges three different filter condensers each to the peak of the voltage applied. These three condensers in series make up the output of this high voltage system. A voltage pulse of approximately 10,000 volts is applied to the plate of the rectifier tube 1. This tube conducts, which charges *condenser 1* to almost 10,000 volts. *Condenser 1* discharges through *series resistors 1* and *2* and then charges *condenser 2*. This charge of *condenser 2* must occur when *vacuum tube 1* is not conducting. *Vacuum tube 2* conducts because of the voltage on *condenser 2*. As *tube 2* conducts, it charges *condenser 3* also to 10,000 volts. Now there is 20,000 volts between the cathode of *tube 2* and ground. This is the principle of voltage doubling through the process of charging two condensers whose outputs are in series.

Condenser 3 discharges through *series resistors 3* and *4* and charges

[*Continued on page 24*]

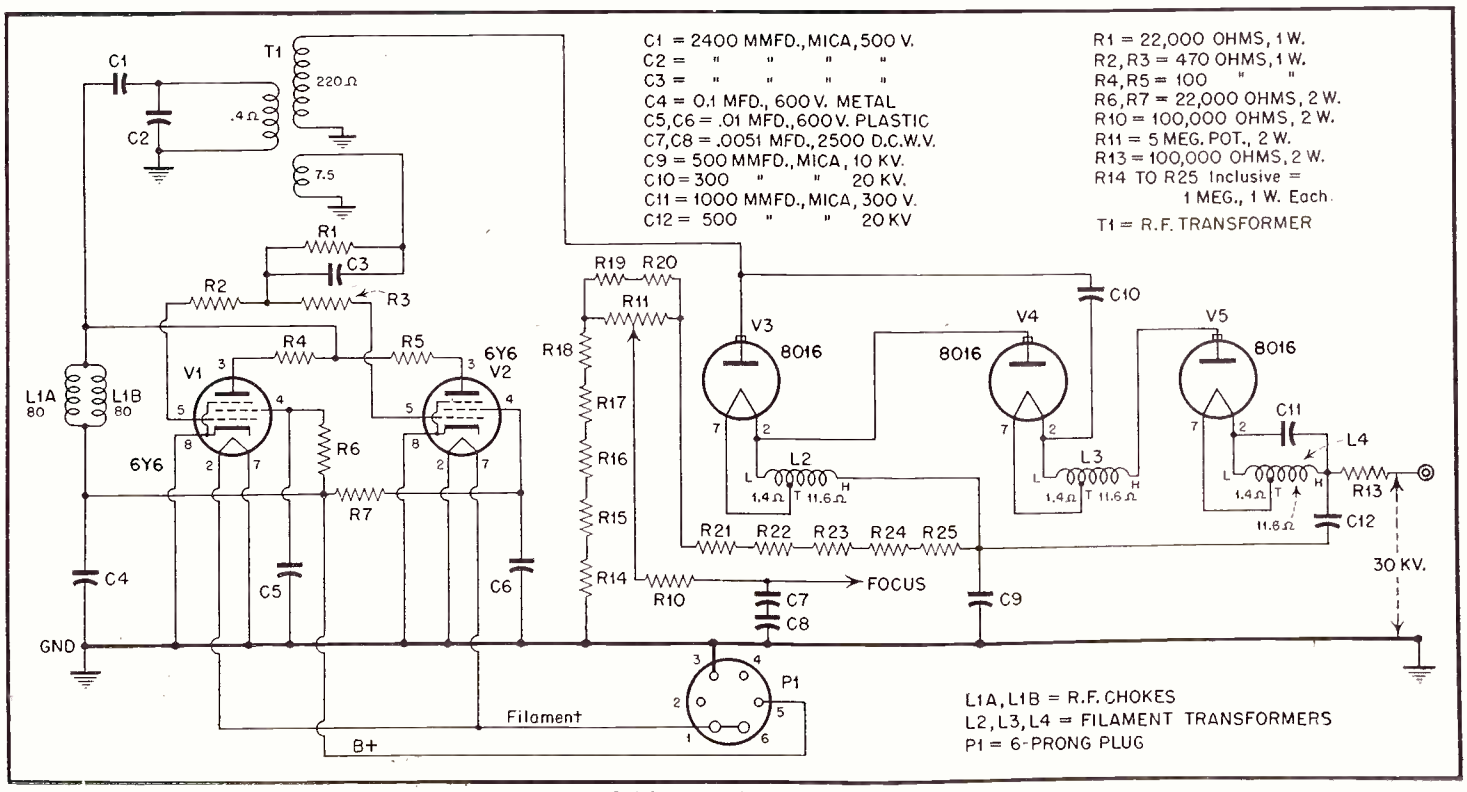
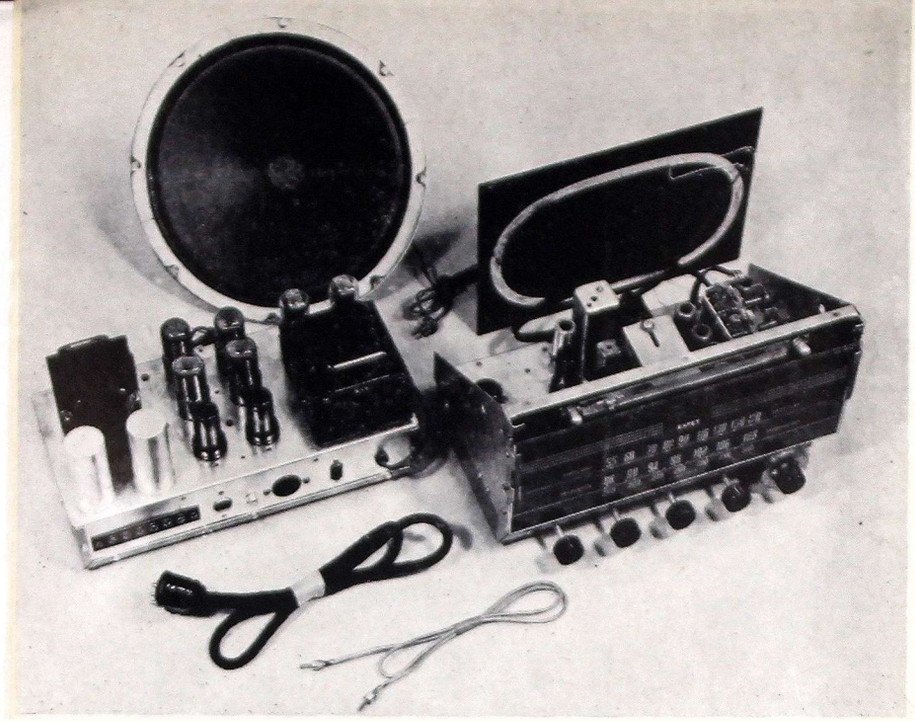


Fig. 5—UST high voltage power supply



High Quality TUNER ANALYSIS

by T. L. HARKWELL

Espey Model 513 chassis

Beginning a new series on high quality tuners

In an endeavor to aid dealers harried by discriminating customers who recognize and seek quality reception, an analysis of several high quality commercial products is in preparation. One worthy offering in each field and price class will be discussed in such a way that dealers may use the data for reference when confronted with queries. Since but a few equipments can be discussed in this limited series, apologies are extended to all worthy manufacturers whose products are not included.

This, the first in this analytical series, deals with one of the simpler AM—FM tuners in the sense of equipment involved. Excluding the tuning indicator its tube complement totals only ten. Three of these do double duty as detailed herein.

Tuner Characteristics

The most important characteristics of a modern tuner, some of which are good but some of which are still bad, fall under the following list;—Sensitivity, Selectivity, Fidelity, Noise Content, Power Capacity, Distortion and Response to Spurious Frequencies.

From all of the above the most kicked around term is "Fidelity." It's a good word but terribly abused. We therefore shall use the term "High Quality." More and more this term "Spurious" is rearing its ugly head. Respect it. It is indicative of a disease, which if conquered, results in healthy equipment.

Digging into the meat, we have at hand a combination of high quality tuner (AM & FM), and following power amplifier, up for consideration as seen in *Fig. 1* photograph. And, since the superheterodyne AM channel is familiar to all readers we will leave that till last.

FM Section

The autotransformer-coupled FM input conveys a solid signal from the dipole antenna through inductance *L-2* of *Fig. 2* , to the grid of a 6BA6. Here it is amplified at signal frequency. The tuned circuits for this initial r-f tube are independent of a similar r-f stage for the AM channel. Image and noise interference is held to a minimum. As can be seen from the sketch, mechanically ganged tuning includes the 6C4 oscillator tank circuit along with the input and output circuits of the 6BA6. Signal from this r-f output passes directly to one set of grids in the 6BA6 FM mixer tube (*V-7*).

The use of this pentagrid mixer 6BE6 affords a means of isolation between the incoming FM signal and the oscillator output voltage from the 6C4. The latter voltage is fed via resistors R603 and R604 to a second grid input of the tube. When this method is applied in preference to the use of a triode tube as mixer, spurious interaction between FM and oscillator signals is held in check. The importance of correction here is great. When tuning of the mixer grid creates a condition called *pulling* the direct result is a change in oscillator frequency. Such *pulling* must be minimized because the stability of a high frequency tuner depends upon the stability of the associated oscillator.

When a 6BE6 pentagrid mixer is used, the oscillator output is introduced into the electron stream of the tube through the injection grid. Following this action any tuning of the signal grid circuit can have but little effect upon the oscillator frequency because of isolation and the fact that the oscillator injection grid is usually at or near ground potential.

From this point forward the translated signal from the mixer is passed through the 10.7 megacycle section of a common 6SG7 intermediate stage. Tunable core i-f transformers shunted by fixed capacitors provide for any alignment requirement in this stage. Similar coupling and tuning is used for entrance to and exit from this i-f stage. It is not uncommon today to find a common tube serving both the 10.7 megacycle and 455 kilocycle functions at this point in commercial receivers. However the indicated shielding between transformers and other components, as shown by the dotted lines, is highly important despite the common tube. Unwanted regeneration is often experienced adjacent to these tuned circuits. Proper shielding and regard for level differences where undesired coupling may occur has been considered in design. Amplification is held to a point where no cross-over can occur. Therefore when components are replaced, true duplicates should be used and wiring should not be altered.

For the FM channel only, an additional 6SH7/i-f, or 10.7 megacycle, stage is added to increase the signal strength and this *V4* tube serves as a

detector driver for the modern transformer coupled Ratio-Detector circuit. The 6AL5 which serves as the Ratio-Dectector is a miniature double diode designed especially for high frequency operation having a resonant frequency per unit or side of approximately 700 megacycles. Each diode is completely separated from the other by an internal isolation shield which is grounded.

The 6SH7 conventionally drives the 6AL5 through the primary of a triple winding transformer *T-7* used for the ratio function. The tuned secondary feeds one cathode and the unmatched anode or plate. The third winding tapped to but a ratio of the secondary voltage, and delayed in phase relation by a 250 $\mu\mu$f capacitor *C-406*, otherwise feeds the second plate matched opposite to the initial cathode previously fed by the usual secondary winding. A dividing network comprised of capacitor *C-407* and resistors *R-408* and *R-409* will be seen from the schematic to supply power to the 6AL5 elements. Also through this network a link is established between the third winding and the second or remaining cathode in the 6AL5 duodiode.

This same third transformer winding, through the rear wafer of the switching system, feeds the audio grid of the 6SQ7 where AVC is established. The resultant amplified audio output terminates in audio output jack (*X904*). However, the signal can be equalized before reaching the output jack by either the treble or bass filters shown in the schematic. Pre-emphasis in the transmitted signal and tone control compensation is thus at hand.

Within this rather tricky ratio detector circuit final demodulation of the original FM signal takes place. Compared to other detectors the sensitivity of a diode is low but in this case adequate signal is applied. The important point is that its linearity is good and its signal handling capability is high. Because of their qualities duodiodes are commonly used as video detectors.

The final FM output may be introduced into any high quality amplifier but the plug and sockets shown are intended for inclusion of the Espey Model 514 amplifier whose description follows shortly.

AM Section

The broadcast channel extending from 535 kc through 1720 kc employs a superheterodyne circuit whose input is fed by a low impedance loop antenna. Provision is of course made for an external antenna when desired. However, it is important to remember that whenever an outside antenna is used the loop should not be disconnected. It is wired in as an integral part of the r-f input.

One 6BA6 gang tuned r-f stage provides isolation from spurious interference and adequate signal voltage to the local oscillator-converter circuits which follow. For this function a 6BE6 pentagrid mixer is used as shown in *Fig. 2*. Its plate output is conventionally coupled thru a permeability-tuned 455KC transformer to the common r-f stage which employs a 6SG7. The product of this tube through transformer coupling and the rear wafer section of the switching system is fed to the 6J5 detector and the 6SQ7 for AVC control.

The final audio signal again derives benefit from treble and base equalization (as in the FM comparison) before reaching the final audio output jack whence available for further amplification. A phonograph input socket (*X703*) plus a test and alignment socket (*X903*) both appear at the rear of the tuner chassis. An external source of power supply is required for this tuner.

Associated Amplifier

Often a manufacturer's slight regard for the production of an audio amplifier whose capabilities merit the descriptive term *high quality* proves

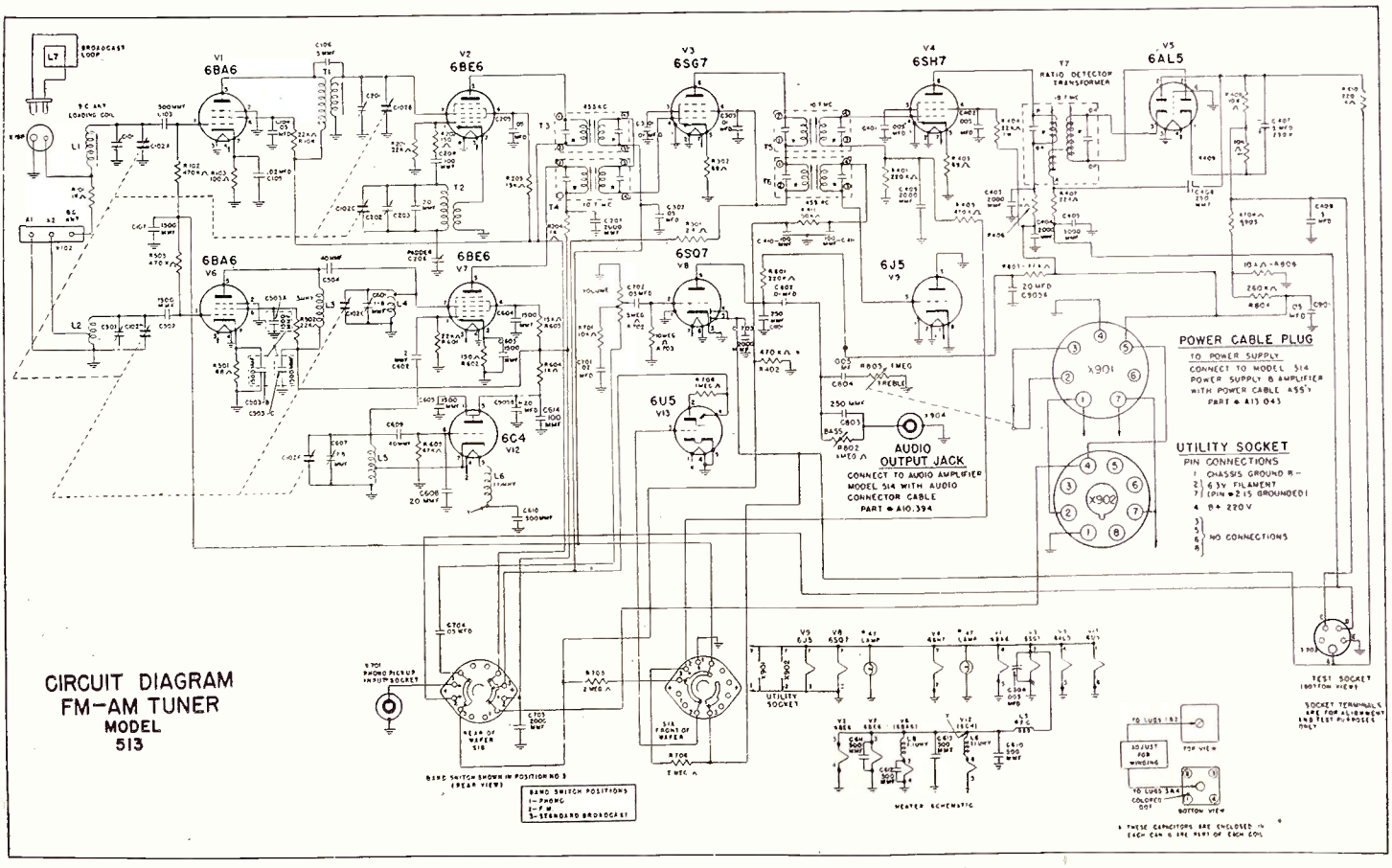


Fig. 2—Circuit diagram of Model 513 Espey chassis

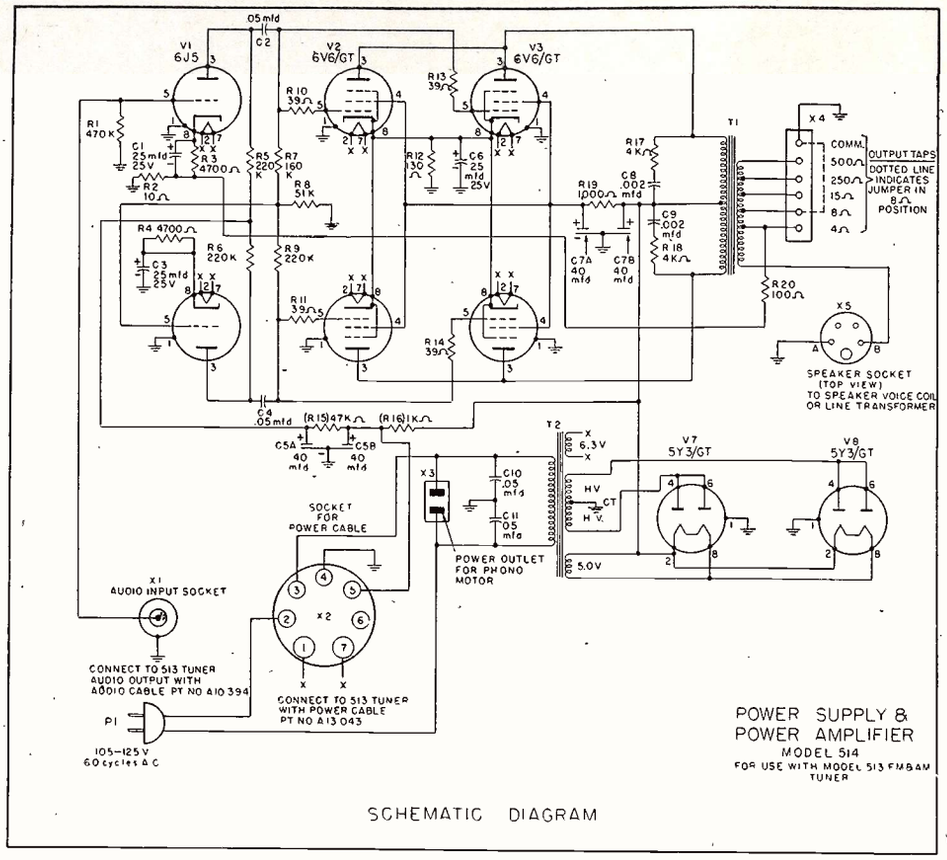


Fig. 3—Circuit diagram of power supply and amplifier

an expensive bottleneck to the trade. At best the requirements honestly placed upon truly high quality audio amplifiers are still far from great when compared to the wider spectrum requirements considered *normal* for video amplifiers. Fortunately a growing consideration for the less exacting demands of present FM Sound Channels has hammered home the fact that, *no colossal tuner, regardless of price, is any better than the audio amplifier which it feeds.*

Fully realizing the necessity for a following amplifier capable of meeting wide spectrum requirements, this firm has designed their model 514 amplifier especially for use with the 513 tuner chassis just described. The amplifier response is flat since equalization is provided in the tuner. Of course, it will serve equally well in coordination with other qualified tuners when its input connections are properly matched. As can be seen from the schematic of *Fig. 3*, its output possiblities are flexible enough to handle individual or combination outputs varying from 4 through 500 ohms. When powered from a 105/125 volt 50/60 cycle a-c supply this amplifier consumes approximately 150 watts. The power output is approximately 25 watts. The full benefit of four 6V6GT beam power tubes is achieved within this amplifier. Two well balanced pushpull stages are connected in parallel as shown to adequately drive any reasonable loudspeaker load.

The first 6J5 audio voltage stage, seen as *V-1* in the top left of the schematic, is capacity coupled through *C-2* to drive the upper 6V6GT beam power tube in the following balanced stage. In addition this first upper 6J5, through a compensating drop in resistor *R-7* also feeds the grid of the second or lower 6J5 in the input section. Here the necessary phase inversion takes place so that when the plate of this inverter is capacity coupled to the grid of the second or lower 6V6 the signals upon the grids of the companionate 6V6s have the proper out-of-phase relationship for pushpull amplification.

Prior to and beyond this first pushpull pair of 6V6s balanced values of resistors and capacitors appear very prominently. Particularly it should be noted that resistors *R-10* and *R-13* are identical in value and fed from the same point. It follows then that the signal input grids of the two upper 6V6s (*V-2* and *V-3*) are identically fed. Furthermore, since their other similar elements are strapped together, these two tubes operate in parallel.

The same holds true for the two lower 6V6s in the diagram. Their similar elements are strapped and resistors *R*-11 and *R*-14 are also identical in value. Now these two input grids are also fed from a common point but their signal, having been inverted through the second 6J5, is of proper relation for completion of parallel pushpull action by the highly efficient 6V6 beam power tubes. The constantly and carefully matched values of opposing or corresponding components throughout this amplifier set up a condition of *stability* which lends itself to further gains derived from its final feature,—inverse feedback. To augment this stability selected "matched" tubes should be employed in each of the 6V6 stages.

In the output section of the schematic (*Fig. 3*), we see a 100 ohm ¼ watt resistor (*R20*) connected to the 4 ohm transformer secondary final output. We see further that the other end of *R20* finds its way completely back to the cathode resistor *R3* of the initial 6J5 input stage. Through this circuit a chosen amount of negative feedback is applied to the entire amplifier.

The value of *R20* is calculated to to form a voltage divider with *R2* of the initial 6J5 input stage. Proper values here determine that fraction of final output voltage which will effect the most desirable quantity of feedback. To insure stability these critical resistors (*R20* and *R2*) are both of ¼ watt rating. The extended range of reproduction derived from properly controlled negative feedback amplifiers is too well known to warrant discussion here.

Whatever tuner be used to drive this amplifier, a short shielded cable should be used for connection and mated to the concentric audio input socket *X-1*. Long cable connectors will introduce a loss in high frequency reproduction. All connectors should be clean and solid for insurance against foreign pickup. A good, common ground should be solidly maintained.

Power Supply

The power supply shown included within this beam powered amplifier chassis embraces two 5Y3GT rectifiers connected as shown in the schematic. These adequately serve the model 513 tuner described earlier in addition to the amplifier requirement. Individual filtering takes place in two locations. One filter comprised of capacitors, *C7A* and *C7B* plus resistor *R9* cares for final 6V6 plates through the output transformer *CT-1* primary. The drop through *R19* supplies the 4 screen grids of the 6V6 tubes.

[*Continued on page* 22]

AMATEUR TVI

by **RUFUS P. TURNER**

The nature of television interference (TVI) as caused by the amateur is discussed in this article.

A few radio service dealers also are licensed radio amateurs. These men have first-hand acquaintance with the problems arising from a ham transmitter that interferes with neighboring receivers. A great many more servicemen have had no experience with amateur stations. To them, ham interference definetely is not an old story. Heretofore, the radio service dealer has not been called upon often to eliminate ham interference. But the wide use of television has altered that situation. TV set owners are more critical, chiefly because the eye will not tolerate interference which, unless it is very severe, the ear quickly learns to ignore in ordinary radio reception

Amateur television interference (TVI) is of as serious concern to the ham station owner as to the installer and user of a television receiver. It is sufficiently important that one publisher has brought out an entire booklet explaining the nature of TVI and methods of eliminating it.[1] Also, the *Radio Amateur's Handbook* published by the American Radio Relay League, official national association of transmitting amateurs, devotes space to a discussion of TVI. Unlike some other forms of television interference, amateur TVI usually can be more effectively dealt with since it is possible to enlist the aid of the party causing it.

The purpose of the following discussion is to introduce the radio service dealer to suggested methods of handling amateur TVI cases. Undoubtedly, all servicemen will be called upon more frequently to deal with this trouble as the number of TV receivers in use continues to increase. Hundreds of amateur stations operate in each of the larger cities and each of these stations is a potential disturber of TV reception.

Nature of Amateur TVI

We have seen numerous installations where a TV receiving antenna is next door to a ham transmitting antenna. It is almost inevitable that TVI should result in such a situation. This condition is pretty much the same as living next door to a broadcast station. It is possible also for a ham station to interfere with TV receivers on the other side of town.

Amateur TVI, like other kinds of television interference, can, and does, take a number of forms ranging all the way from distorting or cross-barring the picture to completely blanking-out the screen. The stronger the interfering signal or the closer the ham station to the TV receiver, the more pronounced will be the disturbing effects. Amateur stations employ either voice or telegraph transmissions. When voice (phone) is used, the carrier is kept on during an entire transmission and any resulting TVI will be present during the entire period. When telegraphy (code) is used, the carrier is switched on and off to make the dot-and-dash signals and any TVI resulting from this sort of transmissions accordingly will start and stop, more or less rapidly.

CHART 1.

TELEVISION CHANNEL	AMATEUR BAND (S) MOST LIKELY TO CAUSE HARMONIC INTERFERENCE
2	10, 11, 20, meters
3	none
4	20 meters
5	11 meters
6	10, 11, 20 meters
7	10 meters
8	none
9	11 meters
10	11 meters
11	6, 10 meters
12	6, 10 meters
13	6 meters

Chart 1—Amateur bands most likely to cause TVI

Most amateur TVI undoubtedly reaches the receiver by way of the latter's antenna and is due to harmonics of the amateur transmitting frequency. *Chart* 1 shows which amateur bands are most likely to produce harmonic-type interference in the 12 TV channels now in use. If you know of nearby ham stations operating on the bands shown, you may expect trouble in the indicated TV channels. This chart assumes, of course, that the amateur station is not operated outside the frequency limits of the assigned amateur bands. The information given in *Chart* 1 will be helpful both to the serviceman and to the amateur operator. For example, this chart shows that a nearby ham transmitter operated in the 20-meter band may be expected to cause interference on channels 2, 4, and 6 unless effective steps are taken at the offending transmitter to suppress harmonic radiation.

A second type of amateur interference (arising especially from 80-meter ham transmitters) may enter the TV receiver through the latter's video channel or through the sound i-f channel. This type of interference, while reported in some quarters, is not common, unless a nearby high-powered transmitter is the offender, because good shielding usually is employed in the video stages. When this type of interference is present, it may be spotted by the fact that it is not tunable, showing up on all channels, usually with equal intensity.

In a third type of amateur TVI, the offending signal arrives over the a-c power lines from which it is coupled into the receiver. This type of interference, like that discussed in the preceding paragraph, undoubtedly will be amplified in the video channel of the receiver and consequently will be present on all 12 channels.

TVI arising from an amateur station located at a good distance from the TV receiver occurs most often in TV "fringe areas" where the intensity

of the received TV signal is only 500 microvolts per meter, or less. When a good, strong TV signal is received, any amateur interference usually arises from *nearby* stations.

Identifying Amateur TVI

Unquestionably, the amateur is blamed for a great deal more interference than he actually causes. In some localities, he is the innocent butt of complaints which should be directed toward medical equipment, industrial machinery, household electrical appliances, automobile ignition systems, and faulty power equipment. The serviceman consequently should establish first that a certain type of television interference really is due to amateur transmissions before assailing a particular ham.

The job of identifying amateur TVI is not always easy. When the interference is caused by code signals, this fact might be established by the rhythmic manner in which the picture appears and disappears. In some cases, the effect may be so pronounced that the serviceman (if he understands telegraphy) can read the code signals blinker-fashion" from the flickering TV screen and thus find the call letters of the interfering amateur station. When amateur TVI is due to a strong phone signal, however, the picture may be knocked completely off the screen for relatively long periods. In cases where the screen is not blanked out in this manner, a modulation bar-pattern may appear. If the interfering phone signal is sufficiently strong, with respect to the TV signal, it may be possible to listen to it with an ultra-high-frequency receiver, such as the National One-Ten, tuned to the TV picture channel involved, and in this manner to discover the call letters of the interfering station.

The serviceman's first step will be to locate nearby amateur stations if he is unable to discover the call letters, since the nearest stations are most apt to be the offenders. The addresses of local amateur stations may be found in the *Radio Amateur Call Book* obtainable at radio stores handling ham supplies and at most public libraries. If a serviceman is able to determine the call letters of an interfering amateur station but does not have a call book available, the name and address of the station owner may be obtained from the nearest office of the Federal Communications Commission. Most hams are known also to the salespeople at local radio stores, especially supply houses for ham gear.

How to Handle Amateur TVI

When TVI definitely has been traced to an amateur station, the serviceman should contact the owner of the station and enlist his aid in cleaning up the nuisance. The F. C. C. expects the amateur to offer his cooperation in such cases. And the amateur is well versed in the proper steps which he must take to eliminate interfering signals emanating from his transmitter. He will do his part gladly.

When the TVI is not the result of faulty operation of the amateur transmitter but is due mainly to the nearness of the transmitter to television receivers, it undoubtedly will be necessary to install one or more small wavetraps in the antenna lead of the TV receiver, *right at the receiver.*[2] When the installation is made properly, operation of the TV receiver will not be impaired. Each of these traps will remove only one offending signal, or at best only a very narrow band of frequencies. The installation of such wavetraps or interference filters should be made by the serviceman, but the amateur will work closely by making test transmissions for adjustment of the devices or by advising the serviceman what frequencies should be trapped and how the wavetraps should be designed (or selected from catalogue items) and installed.

Obstinate cases of amateur TVI resulting from picking off interfering signals by the TV set wiring, especially the video amplifier wiring, may require extra shielding of the TV receiver by means of grounded, close-mesh copper screen-wire tacked all around the inside of the receiver cabinet. Installation of a metal bottom plate, when the chassis does not already have one, also has been reported to help in this instance.

A high-voltage mica bypass capacitor connected from each side of the power line to a good earth ground (such as a *cold* water pipe) at the electric meter in the place where the TV set is used, and also from each side of the power line to *grounded* chassis inside the TV receiver (if line bypass capacitors are not already installed in the set) will eliminate or reduce interference coming in over the power lines. The proper capacitance of these capacitors must be determined by cut-and-try at each individual location. In most cases, however, the capacitance will not be greater than 0.05 microfarad and can be obtained by connecting several capacitors in parallel for the higher values. In stubborn cases, it may be necessary to install power-line-type r-f chokes in each leg of the power line, often in addition to the bypass capacitors. Suitable chokes of this type are manufactured by the J. W. Miller Co. and by Meissner Manufacturing Co.

Finally, the amateur is interested in maintaining good relations with his neighbors, more so than most non-radio persons think. He wants to live side-by-side on good terms with private radio receivers of all kinds, including TV. So he is willing to shift his transmitter to non-interfering frequencies or even to observe self-imposed silent hours, keeping off the air altogether from 8:00 to 10:30 P. M. local standard time and on Sunday mornings, when all efforts fail to remove his interference from a modern set of good design.

The amateur desires to cooperate with the service dealer in matters of TVI. Consequently, when you have located a case of amateur TVI, do not hesitate to get together with the ham who is causing it. TVI is a far sharper stone in the ham's shoe than ordinary broadcast interference ever was, and he is most anxious to collar this ghost, but good!

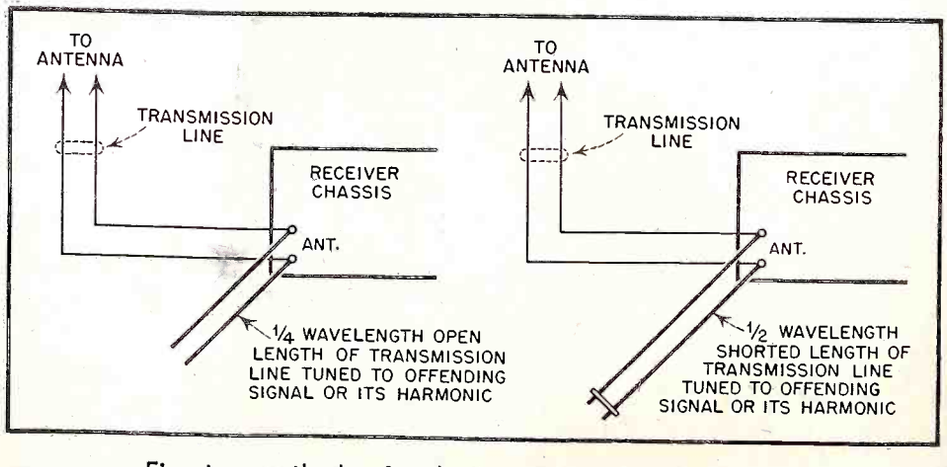


Fig. 1— methods of reducing TVI by means of traps

[1]"Television Interference. Its Causes and Cures." 50c. RADIO MAGAZINES, INC. 342 Madison Ave., New York 17, N. Y.

[2]The Editor has included two typical transmission line wave traps for this purpose. See Fig. 1.

CIRCUIT COURT

Decca Model DP-29

An unusually elaborate dual-channel audio amplifier, particularly in view of the simplicity of the instrument, is to be found in this table model record player. The circuit of the a-c operated chassis incorporates only three tubes, including rectifier.

The output tube is a 6V6, and the circuit is conventional, as is the power circuit, employing a 6X5 rectifier. A circuit is shown of the dual preamplifier stage, in which a 6SL7 dual triode tube is used.

Two paths are provided for the audio signal through the first stage. The output of the crystal pick-up is divided, the low frequencies entering *section 1* of the tube by way of the 6.8 megohm resistor. The gain of this stage is 12 at 400 cycles. Use of a large coupling capacitor insures efficient coupling of the low frequencies to the output stage.

The high frequencies in the output of the pick-up reach the grid of the second section of the tube via a small capacitor. Provision is made to shunt a selected amount of the highs off to ground with the variable tone control. A small capacitor delivers the output of the treble section to the grid of the 6V6. The gain of this section is 40 at 400 cycles.

General Electric Model 250

This five tube receiver operates from a self-contained one-cell storage battery. The tubes are the conventional 1.5 volt types. Provision is included to charge the battery, either during use or when the set is idle. Provision is also made to charge the cell from an external d-c source, such as a car battery system.

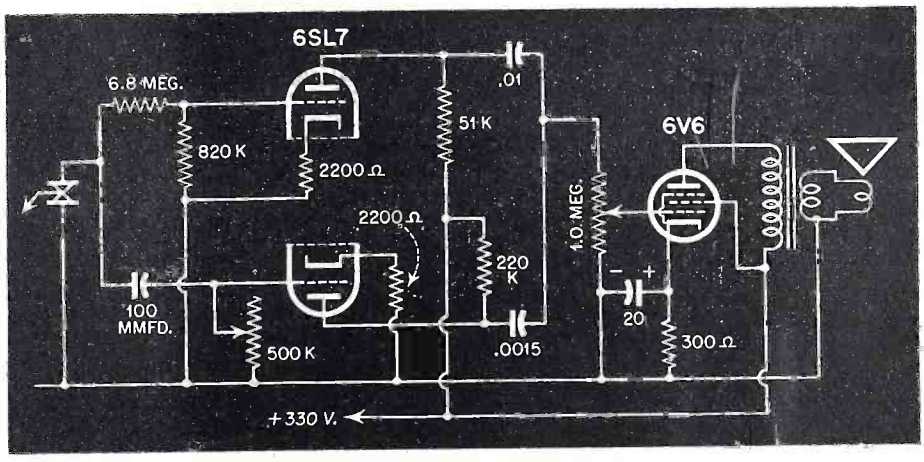
Several interesting points appear in the power circuits. A partial schematic shows details up to the primary of the high voltage transformer. The *B* voltages are developed by a synchronous vibrator rectifier.

There is a three-position, four-section switch serving to provide OFF, ON and CHARGE connections. One section, marked *S1*, closes the primary a-c circuit in the latter two positions. The charging transformer, *T1*, delivers 5.8 volts across its secondary.

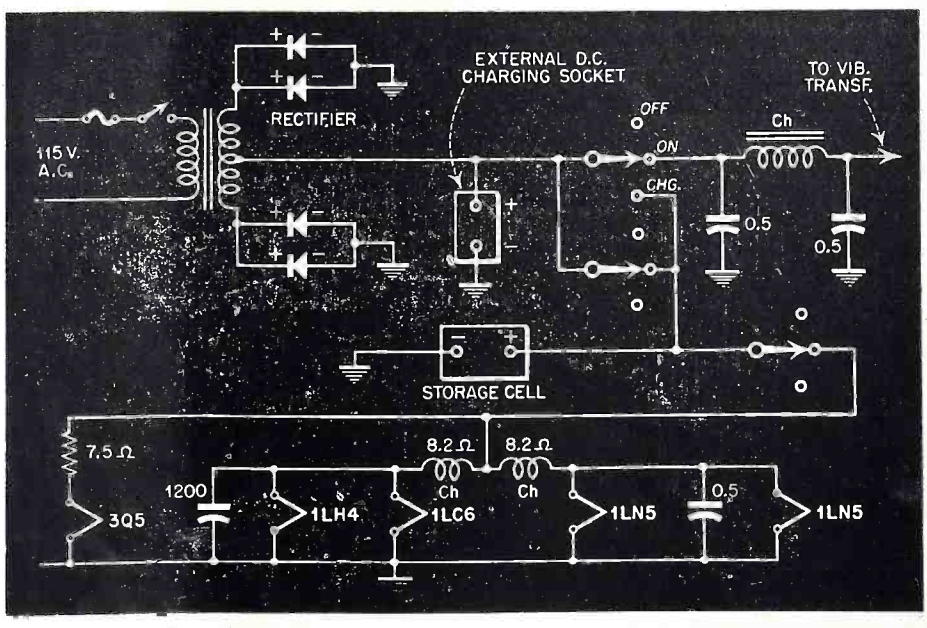
Two copper-oxide rectifiers are used in a full wave circuit to provide 2 volts. This potential is applied to *S2* and *S3* sections. In the ON position both the cell and the set are connected to the rectified voltage. In the CHARGE position only the cell is connected. The charging rate is such that a small amount of current flows into the cell when the set is operating, a larger amount when on CHARGE.

In the ON position, *S2* passes power to the primary of the vibrator transformer via a filter consisting of an r-f choke and two .5 μf capacitors. In the same position, *S4* is found to connect the filament network to the 2 volt source.

The 3Q5 output tube is supplied through a dropping resistor of 7.5 ohms. Being more subject to hum and vibrator hash interference, the other tube filaments are provided with additional filtering. A dual r-f choke serves to drop the voltage to the proper value and suppress the hash. Capacitors of appropriate value after the choke sections complete the filtering action.



Partial Schematic of Decca Model DP-29 receiver



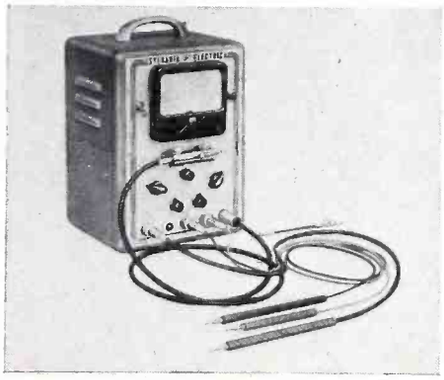
Power circuit of G. E. Model 250 receiver

[*Continued on page 22*]

NEW PRODUCTS

HYTRON TUBE LIFTER

Hytron Radio & Electronics Corp., Salem, Mass., announces a new shop tool for the service technician, a tube lifter. It lifts tubes the easy way from the meanest sockets, GT, G, standard, metal, and lock-in.



NEW VTVM

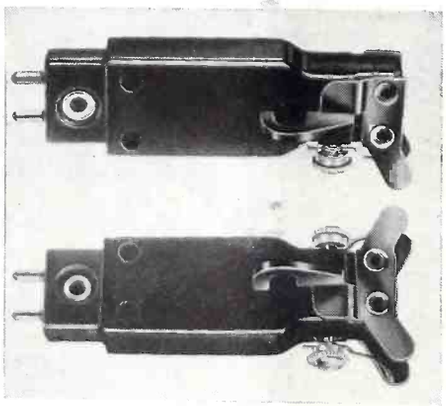
An improved VTVM, the Polymeter Type 221, with range and accuracy particularly appropriate for servicing television and high fidelity audio circuits as well as measurement of a wide range of voltage, current and resistance values in standard broadcast receivers and many types of industrial electronic equipments has been announced by the Radio Division of Sylvania Electric Products Inc., 500 Fifth Avenue, New York, 18, New York.

NEW "BREAK-IN" DESK STAND

A new type Touch-to-Talk Desk Stand that fits any microphone with standard ⅝"-27 stand coupler is announced by Electro-Voice, Inc., Buchanan, Michigan. Provides versatile, effortless Touch-to-Talk operation in communications, paging, dispatching and public address.

MICROVOLT SIGNAL GENERATOR

This new Model 292X, Signal Generator, just announced, covers both upper channel TV and mobile band frequencies on fundamentals. The manufacturer states that its major use will be in the coverage of mobile band frequencies for taxicabs, police departments, railways, ships, etc.

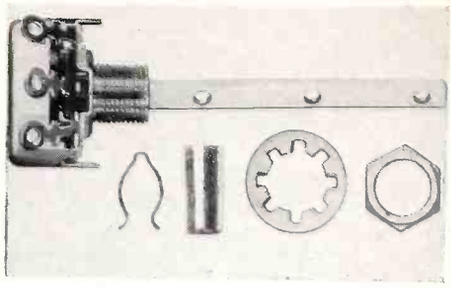


NEW CARTRIDGES

Shure Brothers, Inc., Chicago, Illinois, announced the new exclusive "Vertical Drive" series Crystal Phonograph Cartridges. They were developed to meet the strict requirements of high compliance and fidelity needed for the new fine-groove records.

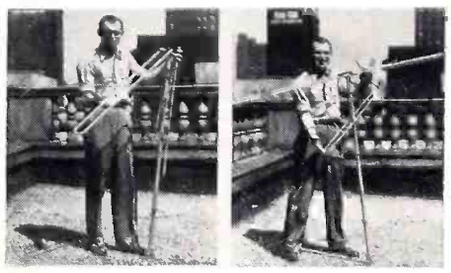
NEW 5" SPEAKER

A new five-inch PM speaker and universal chassis mounting brackets for all 4, 5, and 5¼-inch G-E speakers are now available from the Receiver Division of the General Electric Company at Electronics Park, Syracuse, N. Y.



MIDGET VOLUME CONTROL

The 15/16th In. size volume control makes it possible for the service man to use the Mallory Midgetrol on portables, automobile radios and small AC-DC receivers.



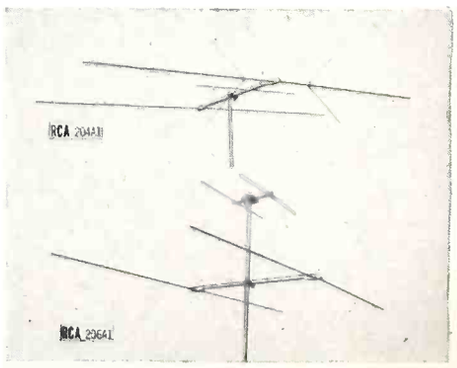
NEW ANTENNA FOR TV

Dick Moss, television engineer, flicks up dipole in assembly operation of Ward Minute Man antennas. (Model TV-46) (Left)

A few seconds later and Dick snaps the high frequency dipole into position. It costs only 6c in labor to assemble this Ward Minute Man antenna. (Right)

NEW TV-FM SWEEP GENERATOR

The Triplett Electrical Instrument Co., Bluffton, Ohio, announces a new TV-FM Sweep Generator with large Marker dial mirrored for easy reading and greater reset accuracy providing a complete service laboratory for TV & FM servicing and other electronic requirements.



NEW TV INDOOR ANTENNA

Technical Appliance Corporation, Sherburne, N. Y., pioneer manufacturer of TV antennas, has announced the first Taco indoor TV antenna known as Catalog Number 975.

Test Pointers

ON AC VOLTAGE MEASUREMENTS

In television servicing, the importance of distinguishing between RMS, peak, and peak-to-peak electrical values is not always realized.

RMS values, long in use by the electrical industry, provide a method of measuring ac current and voltage values so that the values obtained represent the same power in a pure resistive load as would be obtained with the same values of dc voltage and current.

Experienced technicians know that peak and peak-to-peak values are frequently more important in television circuits than are RMS values. Peak voltages operate to trigger discharge tubes, to control local-oscillator frequencies, to intensity-modulate the kinescope, and to perform other important functions. Peak-to-peak values are used to measure gain or loss in deflection, synchronizing, and video circuits.

The distinction between RMS, peak, and peak-to-peak values is illustrated in Fig. 1 for a sine wave. Fig. 2 illustrates one kind of a complex wave and shows how peaks above and below the reference line add up to give the peak-to-peak voltage. No RMS value is shown because the RMS value of a complex wave has little significance in service work.

Most service voltmeters are calibrated to indicate the RMS values of *sine* waves. From such values, the peak and peak-to-peak values of *sine waves* can be easily determined from the conversion factors given at the end of this article.

An oscilloscope provides the maximum amount of information because it displays the instantaneous voltage values at any point on the trace. Peak values above and below the reference line, and the peak-to-peak value, can be read directly from the trace.

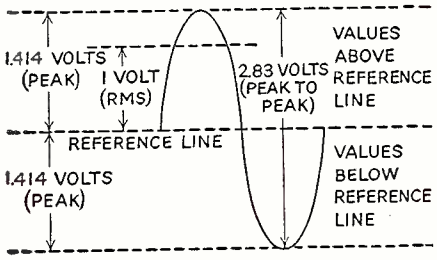


FIG. 1 PURE SINE WAVE

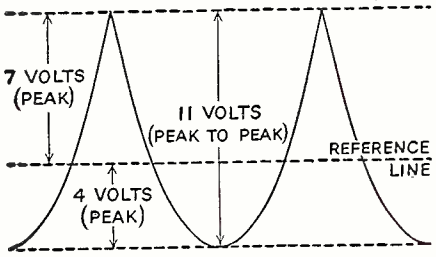


FIG. 2 COMPLEX WAVE

If the oscilloscope has been calibrated with a sine wave of known peak-to-peak voltage value, it is evident that a transparent graph screen can be used to determine the individual peak, peak-to-peak, or instantaneous voltage values of a complex waveform.

The factors given below show the relationships between RMS, peak, and peak-to-peak values of *sine waves:*

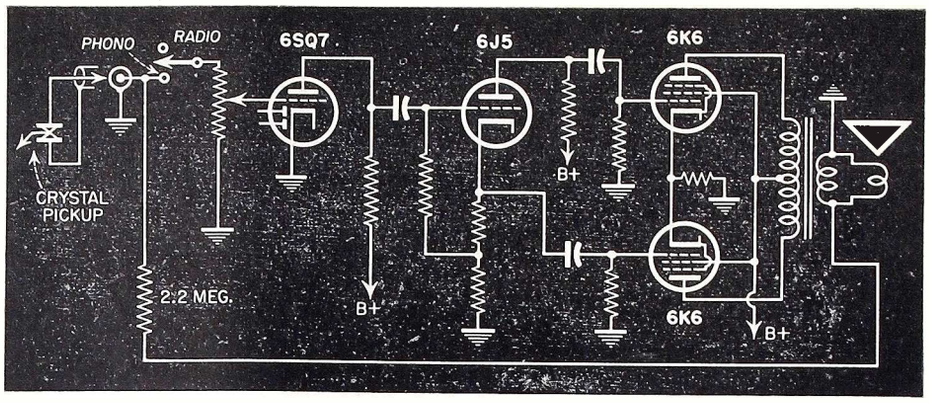
Given Values	Multiply Given Values by Factor to Obtain:		
	RMS Value	Peak Value	Peak-to-Peak Value
RMS	—	1.41	2.83
Peak	0.71	—	2
Peak-to-Peak	0.35	0.5	—

CIRCUIT COURT

[*from page* 19]

Three of the filter capacitors shown have two leads from one plate. This type of construction is used to minimize the lead inductance which causes trouble in conventional construction in this type of service.

For charging from a 6 volt d-c source a cable with proper dropping resistor is supplied to plug in the terminals shown.



Audio Circuit of Majestic Model 8JL885 receiver

Majestic Model 8JL885

Many versions of the use of audio feedback have been seen recently. Generally, they function during operation of the instrument on all ranges and uses. An exception to this rule is found in the Majestic 8JL885.

This 8 tube, a-c operated combination employs feedback over three stages, only when the phonograph reproduction is in use. A simplified schematic of the audio system is shown to illustrate the details.

One of the diode plates of the 6SQ7 rectifies the i-f signal and the resultant audio appears at the RADIO position on the function switch. The output of the crystal pick-up appears at the PHONO position of the switch.

The audio amplification takes place in the triode section of the 6SQ7, a 6J5 phase invertor and push-pull 6K6 output tubes. An electromagnetic speaker is used, one side of the secondary being connected to ground. The other side of the voice coil and secondary are connected via a 2.2 megohm resistor to the PHONO terminal of the function switch. The result is to apply feedback over the entire audio system on PHONO operation only. It is likely that the compensation obtained is too great for use on RADIO.

TUNERS

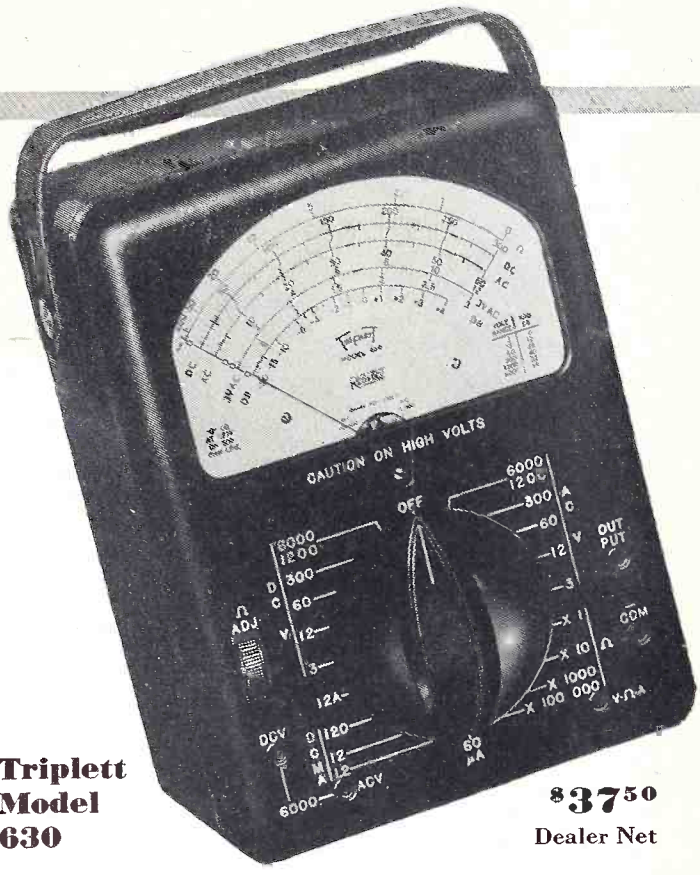
[*from page* 16]

A second filter comprised of capacitors *C5A* and *C5B* across resistor *R15* supplies the plates of the two 6J5 tubes through the *R5* and *R6* voltage divider. In case another tuner is employed, the 513 required 6.3 volt a.c. at 3.5 amperes and 220 volts d.c. at 60 milliamperes. A power line receptacle (*X-3*) is supplied at the rear of the chassis for the drive of a phonograph motor or similar equipment.

The combined amplifier (model 514) and power supply is mounted within

BUY THE BEST • THE V.O.M.A. THAT DOES MORE

MORE FOR YOUR MONEY



Triplett Model 630

$37.50 Dealer Net

NOTE THESE SENSATIONAL IMPROVEMENTS:

- ★ Individual Scales with separated spacing are easy to read.
- ★ Large 5½ Inch Meter In Special Molded Case Under Panel.
- ★ Resistance Scale Markings from .2 Ohms to 100 Megohms—Zero Ohms Control Flush With Panel.
- ★ Only One Switch—Has Extra Large Knob 2½" Long—Easy To Turn—Flush With Panel Surface.
- ★ Enclosed New Molded Selector Switch and insulated resistor housing in unit construction.
- ★ All Resistors Are Precision Film or Wire Wound Types For Permanent Accuracy.
- ★ Batteries Easily Replaced—Balanced Double-Contact Grip. Spiral Spring—Battery for Ohms test due to low drain insures shelf-life usage.

In the relatively short time since Model 630 was introduced to the trade it has steadily risen to the top in sales. The reason is obvious. Here is a Volt-Ohm-Mil-Ammeter that does more . . . has proven components . . . and will give a lifetime of satisfaction. All the engineering skill and facilities of the industries' largest manufacturer of Volt-Ohm-Mil-Ammeters joined forces to make it outstanding in every way. Look over all the features and you too will buy Model 630.

TECH DATA

D.C. VOLTS: 0-3-12-60-300-1200-6000 at 20,000 Ohms/Volt
A.C. VOLTS: 0-3-12-60-300-1200-6000 at 5,000 Ohms/Volt
D.C. MICROAMPERES 0-60 at 250 Millivolts
D.C. AMPERES 0-12 at 250 Millivolts
D.C. MILLIAMPERES 0-1.2-12-120, at 250 Millivolts
OHMS: 0-1000-10,000; (44 Ohms and 44 Ohms center scale)
MEGOHMS: 0-1-100 (4400-440,000 at center scale)
DECIBELS: —30 to +4, +16, +30, +44, +56, +70
OUTPUT: Condenser in series with A.C. Volt ranges
High voltage Probes available, extra; also plug-in shunts for other current measurements to suit special needs.

Laboratory Standard Model 630-A—All scales on this model are hand drawn and hand stepped, used with mirror for extreme accuracies, beyond the average servicing needs of the model 630.

Triplett Model 630-A **Dealer Net $47.50**

VOMA JR.—A NEW VOLT-OHM-MIL-AMMETER

Handy "POCKET-SIZE LABORATORY" By Triplett

VOMA Jr. MODEL 666-R has many of the design features of the popular Model 630:

1. Switch and controls flush with panel.
2. Enclosed molded selector switch.
3. Exclusive Unit construction-resistor housing integral with switch.
4. Resistors Precision wire wound and permanent film type.
5. Resistance Measurements to 3 Megohms.
6. Batteries with spiral spring contacts, easily replaced.

VOMA Jr. MODEL 666-R . . . $24.50
U.S.A. Dealer Net Price

Note: *Model 666-HH The Original Pocket-Size Lab—still a favorite with many. U.S.A. Dealer Net $22.00.*

TECH DATA

D.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt
A.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt
D.C. MILLIAMPERES: 0-10-100, at 250 Millivolts
D.C. AMPERES: 0-1, at 250 Millivolts
OHMS: 0-3000-300,000 . . . . (20-2000 at center scale)
MEGOHMS: 0-3 . . . . . (20,000 ohms center scale)

Precision first . . . to Last

TRIPLETT

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO, U.S.A.

In Canada: Triplett Instruments of Canada, Georgetown, Ontario

a chassis measuring 13½" wide x 7½" high by 7" deep and weighing 18 pounds. The power consumption of the unit is approximately 150 watts.

HIGH VOLTAGE

[*from page* 13]

denser 4. causes *tube 3* to conduct which charges *condenser 5*. There are three condensers in series each with a 10,000 volt charge upon them. These are *condensers 1, 3, and 5* so that the voltage output from this circuit is 3 times 10,000 volts or 30,000 volts. Because of a slight phase shift the actual voltage output is somewhat less than 30,000 volts. This high voltage is applied to the high voltage anode of the projection cathode ray tube. Series resistors may be used across *C1* in order to obtain a focusing voltage. There is no high voltage bleeder used or needed in this circuit.

The frequency of the applied pulse to this tube is 15,750 cps, which is the frequency of the horizontal sweep. Because of this relatively high value of frequency, as compared to 60 cps, very small condensers may be used of approximately 500 $\mu\mu$f. In most cases the cathode ray tube itself acts as a final high voltage filter. There is an aquadag coating inside the tube which acts as a high voltage anode. Another aquadag coating is used on the outside of the tube and these two coatings act as a condenser with a capacity of approximately 500 $\mu\mu$f. The glass wall of the tube acts as a dielectric for this condenser.

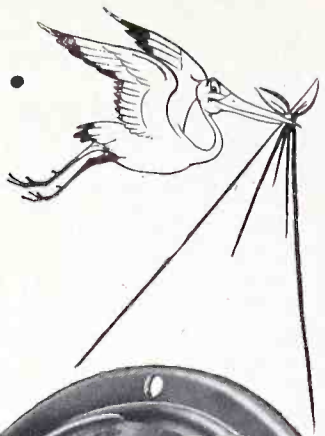
United States Television

U.S.T. uses a different type of high voltage source which has a separate oscillator for this purpose. This is shown in *Fig. 5*. Operating at a frequency between 50 and 200 kc, this oscillator uses two pentodes in parallel; the tuned place circuit is the 0.4 ohms section of *T1*, the 7.5 ohm section is the grid winding used for feedback. This oscillator produces a strong r-f signal which is coupled to the secondary. This winding is a step up and resonates with its own distributed capacity at the resonant frequency. A large voltage is obtained in the secondary winding due to the turns ratio and the high L to C ratio. By these means the oscillator can deliver about 10,000 volts to the rectifier diodes.

These three tubes are designed to triple the applied voltage to give this circuit an output of 30,000 volts. As the sine wave is applied, *V3* conducts as its plate is made positive and *condenser C9* is charged to 10,000 volts.

New baby in a proud family . . .

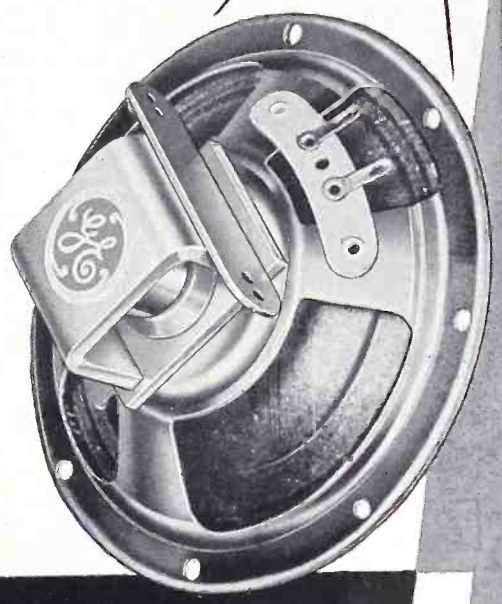
5" ROUND PM LOUDSPEAKER

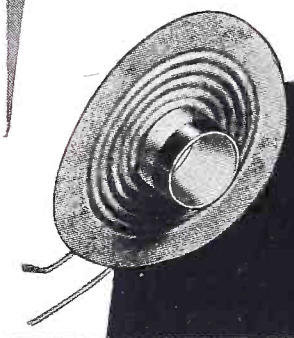


THERE'S always something new and better in the G-E Speaker Line—Now it's the G-E 5" Round *—specifically designed for service replacement!*

• • •

Naturally it has the quality you expect of a General Electric Speaker — sturdy all-weld construction, rock-steady G-E Alnico 5 magnet—plenty of power, sensitivity, fidelity! Give your customers the best—that G.E. gives you! See your G-E parts distributor and stock up today.

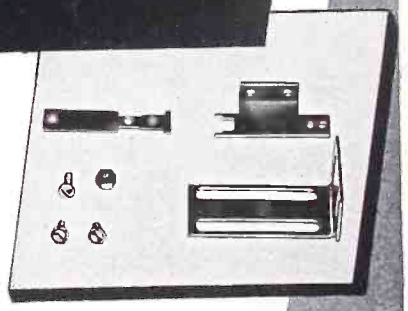




Of course it has the famous G-E Aluminum Foil Base Coil! Not subject to warping resulting from high humidity. Provides much higher power handling capacity. P. S. All G-E Speakers have this Metal Base Voice Coil—don't forget that!

FREE—with all 4", 5" and 5¼" G-E Speakers!

Chassis Mounting Brackets



Save time, money and materials for the hard-working serviceman!

Well, now, here's the story. With the serviceman in mind, G. E. has cooked up these neat little mounting kits to save your temper and please your customers. They're adjustable—up, down or sideways, for simplified mounting of speakers in small working areas. Less work for you—and a cleaner job for that important fellow—your customer. The brackets are FREE with every 4", 5" and 5¼" G-E speaker you get from your G-E distributor or jobber. *General Electric Company, Parts Section, Electronics Park, Syracuse, New York.*

You can put your confidence in—

GENERAL ELECTRIC

This voltage source has a bleeder to ground and the 10,000 volts is used for the focus voltage. The actual voltage is about 6,000 volts applied to the focus electrode due to the series of resistors and the placement of the control.

The high voltage is obtained through the continuation of the rectifier action. *C9* has a 10,000 volt charge due to the conduction of *V-3*. The tube *V-4* conducts of the next alternation of the sine wave as its cathode is driven 10,000 volts negative. At the same time the plate of *V-4* has a 10,000 volt positive potential due to the charge on *C9*. Thus, there is 20,000 volts across this diode which conducts charging the condenser *C10* to 20,000 volts. *V3* conducts on one alternation, charging *C9* to 10,000 volts. *V4* charges on the next alternation charging *C10* to 20,000 volts. This extra voltage applied to *V4* comes from the charge on *C9*.

On the next alternation *V-5* conducts and charges *C12* to 20,000 volts. *V-5* has three applied voltages; 20,000 volts is applied from *C10*, this is positive and applied to the plate. There is 10,000 volts, also positive, and applied to the plate coming from the transformer secondary. The third voltage is the applied charge from *C9* which is 10,000 volts, also positive, and applied to the cathode. The net result is 30,000 volts positive applied to the plate of *V5* and 10,000 volts, also positive, applied to the cathode. This means that there is an effective voltage of 20,000 volts positive across this tube since a positive voltage on the cathode prevents the tube from conducting. The 10,000 volts on the cathode therefore subtracts from the 30,000 total and leaves 20,000 volts across this tube. When this tube conducts, it charges *C12* to 20,000 volts.

This circuit has its output from *C9* in series with *C12* for a total of 30,000 volts. *C9* has 10,000 and *C12* has 20,000 volts to make this total high voltage output. A voltage tripler arrangement such as this will deliver a high voltage at a small current drain.

Heater power is also obtained from the output of the oscillator through use of absorption type heater tuned circuits. These coils, *L2*, *L3* and *L4* are resonant to the oscillator frequency and are tapped to apply the proper voltage to the heaters. If 60 cps were to be used for this power there would be a great difficulty in keeping the r.f. from these heaters. This system uses the r.f. for power in the heater circuit and is easy to design since there are no r-f chokes needed.

FIELD FINDINGS

[from page 4]

not—for most have been guilty of wishful thinking. And still further, when many other small independent operators are asked how they are doing report, they "won't touch TV with a yardstick," because they feel that unless they can have their share of original installation and first-year warranty business they would be suckers to take on second year maintenance work where the element of risk is ever-so much greater.

The Mortality Rate

Getting down to fundamentals, I decided to find out why the radio servicing business mortality rate is so high, with this result:

1)—Most students who enroll in video training schools never finish their courses and the small percentage who do, when they go to get their first job, are accepted as apprentice helpers suitable for antenna and basic installation work only. Quickly becoming discouraged at the low pay and small chance for advancement they drop off payrolls and go into the TV servicing business for themselves. Then, being inadequately financed, they fail in short time.

2)—Established service organizations are confronted with a greater amount of incompetent and unethical competition than ever before, which hurts them financially, even though only for an indefinite period of time. And, as the set-owning public is having less AM radio repair work done than ever before, (in areas where there is TV), the amount of radio servicing has fallen off sharply. So has servicemen's income.

3)—Where there is no TV at present, service organizations are suffering from a drop in repair work as the public is anticipating having TV soon, and thus is neglecting to fix old sets which they hope to soon be able to discard entirely.

Common sense gives us an immediate answer to the problem. But it seems to me the servicing profession is not applying it. When volume falls off and a certain income is required the normal and proper way to increase income is by increasing prices. Are servicers doing it? No, they are not! Why? Because of that hackneyed excuse: "If I increase prices my competitor will get the business". Now I ask you: Is it better to insist on maintaining too-low, inadequate prices, thereby getting insufficient income, which automatically bankrupts you in a short while? Or would it not be better to work harder trying to increase your volume, charge higher but justifiable prices, and make a success?

Too many radio service organizations just go along in a static way, depending upon recommendation and transient business. Too many service dealers are going broke waiting for business to come to them. *Go out—create and get business!* It is your duty to yourself to enjoy a high enough volume of work to support yourself and family. Re-examine your operating costs, your price scales, your potential business and judge honestly whether or not you are merely drifting along in lackadaisical manner toward oblivion—or, can you make changes in your business setup and consequently increase your income.

Specialty TV Technical Training Is Absolutely Necessary for Oldtimers

Let me repeat that sub-caption: Experience has definitely proven that specialty TV technical traning is an absolute necessity even for old-time, established radio service organizations. Let's look at the record! Are AM radio receivers like TV sets? *Absolutely NO!* In a few respects they resemble one another but in the main, and particularly when it comes to trouble-shooting, an AM receiver circuit is so unlike a TV circuit that the two cannot possibly be considered alike in most every respect. Or, stated another way, no radio technician, regardless of the number of years of actual experience behind him working on AM receivers, and regardless of his skill in the use of all modern radio test equipment (and that's taking in an awful lot of territory), is even slightly qualified to consider himself able to service a television receiver. True, some basic radio theory and knowledge regarding AM circuits might be applied to TV work, but in the main, the new and different stages of a videoset which are unknown in old AM practice leave TV entirely out of comparison with the other field, AM. It takes study, and more important, it takes actual work and application and physical contact with video circuits before an old experienced radio technican can possibly cope with the inherent problems of TV. If you don't believe it, try answering some of the TV Quiz questions which have appeared in this publication regularly. But I can prove the point more emphatically by citing the thousands of experienced old-time AM technicians who, having "read up a lot on TV", suddenly tried to put their newly acquired knowledge to work and found that they were ab-

solutely lost in a maze of mystery and mistaken ideas.

How To Get TV Training

The best, and proper way to learn all there is to know about TV, of course, is to take a complete training course in the subject in some school which qualified to train men in every phase of the art, from theory down to practical application. This is true whether you are a novice just trying to break into radio-TV servicing, or even if you are an old-time radio technician with upwards of twenty years of practical servicing experience behind you.

The novices can, in many cases, get their TV training under GI programs while most old-timers are not eligible for such benefits. Thus in this competitive world the old-timers are under a severe handicap because TV training courses are not cheap. Besides, a good TV course requires many hours of resident schooling, and this in itself is a hardship, for most established servicemen are reluctant to close down their businesses entirely, cutting off their income, just to obtain the needed education that TV requires. In like manner these old time technicians feel that after having put in a hard day working at their bench they are entitled to some relaxation at night, and so they prefer not to take night school courses which are long, drawn out and expensive.

Let Others Pay For Your TV Training

Leading TV manufacturers have held TV training clinics for their dealers' and distributors' personnel. These clinics have not helped independent servicemen or service organizations for most were not eligible to participate. On the other hand, most of these clinics were only stop-gaps for they were not comprehensive enough. Now-a-days the average TV manufacturer agrees that a TV training course for a man having several years of practical radio servicing experience must run from 7 weeks to 3 months, 5 to 8 hours daily. Ha! How many manufacturers are giving that sort of technical training? None! On the other hand, some smart, old time radio technicians have worked out a "system" to beat the manufacturer at his game of trying to operate factory-controlled service organizations. It's a great system if you want to apply it. I'll let you in on the secret. If you are an experienced technician, simply apply to the factory-owned radio service organization for a job as a full-time TV employee. If you get the job, of course you will have to close up your own shop, at least to all outward appearances.

Assuming you are accepted by the service organization you will have to take an intensive training course. You'll get paid a nominal sum. Then, having graduated, you will have to take on the duties of a faithful employee for a period of time. I would say that at least three months of practical work should be the minimum for it will take you that long to obtain the practical experience needed to qualify you to then go out on your own, or back to your own business. But, fellows, by following this system, you will have gotten quite a fair TV education at minimum expense. It is not the best and fastest way to learn about TV, but it is a way in which to get further technical training at (what will soon be) your competitor's expense.

I bitterly condemn the many thousands of radio technicians who for many years have been of the opinion that "they know it all". When TV came into being they continued that attitude with the result that they and the entire TV servicing profession have suffered irreparable damage.

As publisher of "RADIO SERVICE DEALER", which as you know is a technical monthly journal with national distribution, two years ago I was confronted with a difficult decision. I recognized that all radio technicians had to learn about this coming development, TV. I also realized from 19 years of experience working with radiomen that many considered themselves know-it-alls who didn't need further technical training. I further realized that were I to publish a lot of technical data about TV in "RSD", while it would be helpful to radiomen located where TV was soon to make its appearance, such new and hard to digest material might not appeal to radiomen located where TV was not expected to become a fact for some time to come. But, I took what I believed was the proper course for an educator, (for that is what a publisher is supposed to be), and established the policy that "RSD" would publish as much TV material as possible and I suggested to all our subscribers that they should be good soldiers and read our articles regardless of whether or not they were in areas where TV would soon become a fact. I have gotten gray these past two years for you have no idea how much vituperation has been heaped upon my head from subscribers in non-TV sections who insisted they didn't want any "RSD" space wasted on TV until TV was more practical and about to become a reality in their part of the country. And, I had my share of grief with technicians located

the heart of TV sections who decided they didn't need to read magazines covering the subject because they were so busy handling both AM and TV business at the time that they did not have additional time left over to devote to reading trade journals. All this is stated without ego or desire to be an "I told you so-er" but the record now shows that most of the radio-TV servicing profession's difficulty may be ascribed to the simple fact that the radiomen did not choose to heed our pleas that they should learn—yes, learn all there is to know about TV.

Perhaps many of our readers are not aware of the fact that frequently an article in our journal can be worth its weight in gold. Take the articles, "Checking Video & Synch Waveforms By CRO", which Sam Marshall ghosted for me, and which I used as a technical lecture from Coast-to-Coast last Fall, and which we subsequently published in "RSD". That article, covering our advocated method of signal tracing troubles in a TV chassis by diagnosing what wave forms disclosed to a CRO user, opened a new vista to all who read it. Leading tube and test equipment manufacturers have issued over 300,000 reprints of it. The system we advocated has become the industry's standard trouble-shooting method for TV. And now, we have learned that our next biggest job is to try to teach radio technicians how to use oscilloscopes.

Thousands of words and dozens of books have been published on 'scopes, and how to use them. Lectures by the score have been delivered on the subject. Yet, in the main, radio technicians still do not know one iota of what they should know about cathode ray 'scopes, even though many radiomen have owned such instruments for years. It is a pity that the radio servicing profession seems to take so much for granted. As a consequence, radio technicians have fallen behind in this fast-moving industry and unless they immediately take the necessary steps to come abreast of developments they will be eliminated, first by the newly formed independent service organizations that have taken the trouble to obtain the needed technical training; second by the factory-owned service companies that have come into being with the avowed purpose of keeping TV sets in operable condition for manufacturers who cannot rely upon independents to handle the work themselves; and third by the new crop of TV training-school graduates who will have the necessary know-how regarding TV, and who will quickly win recognition from the TV set-owning public when they go into business for themselves.

Old-time radiomen—continue along on your complacent way and neglect to learn all there is to know about television if you wish to be forced out of the servicing business quickly. The choice as to whether or not you want to stay in this business rests solely with you.

The Brighter Side

The future for radio-TV servicemen can be brighter and more profitable than ever before *if* those of us in the profession apply ourselves to accomplishing that goal. We do not want or need licensing or unions. We must have better technicians, who can do their work more efficiently, in less time and consequently at greater profit. We must have better businessmen and business managers. It is to no avail to be the best technician in the world if at the same time one

does not know how to obtain the proper prices for his services and thus works at a loss. Knowledge of cost-accounting is as vital as technical knowledge now-a-days when every TV installation and repair job, for sake of discussion, requires so much more non-productive or waste labor than did conventional AM work. There being but 8 working hours a day, it is still necessary for a technician to earn as much while doing 2 TV jobs a day as he formerly earned while doing 15 AM jobs.

Because of TV's complexities, technicians must lay out much more for working tools and test equipment and inventory than heretofore. Thus, in figuring customers' charges, these new items must be taken into account and sufficient added income must be gotten to provide against contingencies and the purchase of new, modern instruments.

Where heretofore there were upwards of 60 million AM sets in homes and 7 million more in autos, all subject to maintenance work, now there are over 70 million home radios and 10 million auto radios in use plus well over a million and a half TV sets, which in comparable number of tubes and components would be equivalent to approximately 10 million additional sets.

The old days of "free estimates" and "50c service charges" should be forgotten. Today, as far as TV men are concerned, once a teleset has passed its service policy period, the mere fact that a technician has to go to a home only to inspect a troublesome videoset requires a customer charge of at least $3.00. Labor charges should run closer to $10 an hour compared to AM where the average serviceman got less than $2.50 an hour. So, the basic minimum "estimate fee of $3.00" for an inspection that can be gotten to and handled in less than 10 minutes is absolutely justified as a basic minimum in low-pay areas, and the fee should run $5.00 for estimates, and $12 to $15 per hour for labor in higher income sections of the country. BUT, by the same token, where heretofor many technicians worked at low scales and gave their customers sloppy or only partial service for their fees, in TV it must be remembered that a thorough and absolutely fine job must be done in every case. TV can't stand for inferior servicing. Rendering partial service is a sure way to commit business suicide. A good TV technician can get more recommendation business today than he can possibly handle. A sloppy technician is shunned like a parasite. TV set owners are having so much service work done now that

they, if satisfied or dissatisfied, can make or break a service organization.

To the servicemen in areas where TV has not yet made an impact, or where TV cannot be hoped for in the immediate future, the vast number of AM sets in use, and because many of them are of ancient vintage, offers a money- making potential that offsets the benefits which seemingly accrue to those of us who are in TV areas. Where there is no TV and where a radio firm is not engaged in selling radios but confines itself to servicing only, now is the time to get to work advertising your services, stimulating business in every possible manner. Statistics show that AM sets are not discarded when TV comes in but instead these same reliable statistics show that homes having several AM sets, even where there is no TV, seem to neglect old sets that go bad. These sets go into disuse because the technicians are not on their toes and let business slip right through their fingers. Let's making the servicing profession an aggressive business again! Let's get sales conscious for a change. Let's try to make money come into our cash registers rather than merely wait for customers to come to us to suggest that we do business with them.

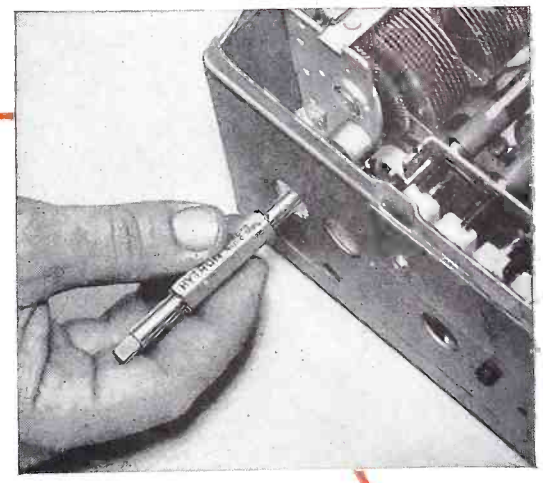
AD INDEX

YOU DON'T NEED THESE TUBES ...Yet!

As a serviceman, you don't need the brand new Hytron 1X2, 6BQ6GT, and 25BQ6GT immediately. But you will soon. They are first of a new line of Hytron originals for lower-cost TV sets. Designed for the mass market in collaboration with leading TV set manufacturers.

Two new GT firsts by the originator of the Bantam GT. A brand new 9-pin miniature by the pioneer of smaller tubes. Three more Hytron contributions to the growth of TV.

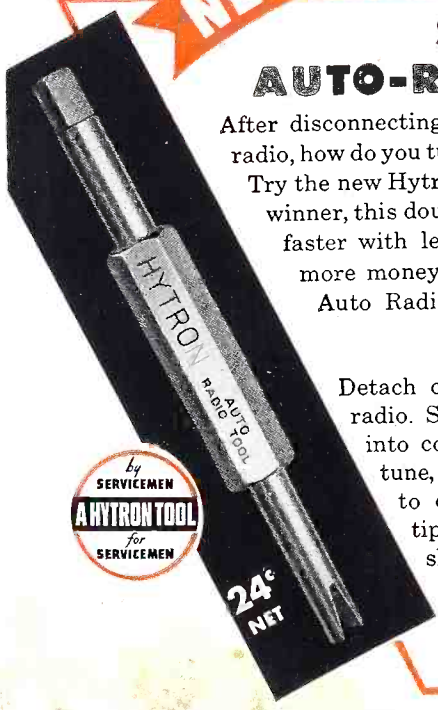
The 6BQ6GT and 25BQ6GT are horizontal deflection amplifiers; the 1X2, a high-voltage TV rectifier. All three do equally well the job of older, much more expensive tubes—in a-c or a-c/d-c TV sets. Watch for them. And for many other Hytron originals in low-cost TV tubes.



NEW

SPEED UP AUTO-RADIO SERVICING

After disconnecting control cables from a universal auto radio, how do you tune it? Screw driver? Here's a better way. Try the new Hytron Auto Radio Tool. A contest first-prize winner, this double-ender fits most sets. Helps you work faster with less effort, yet more precisely . . . to make more money. Only 24c. One job pays for it. Get your Auto Radio Tool from your Hytron jobber today.



IT'S EASY

Detach cables from universal auto radio. Slip Hytron Auto Radio Tool into control fittings. Turn set on/off, tune, adjust volume and tone, realign to dial . . . smoothly, exactly. Square tip also fits splines. Slotted tip is V-shaped for different thicknesses of spade and similar key fittings. Tool fits over 90% of universal sets with minimum backlash.

Durable one-piece construction. Precision machined steel, bright-zinc plated. Compact size for working under dash. Comfortable handle is large diameter for vernier-like adjustments, hexagon to prevent rolling off bench. Imprint on handle counts dial revolutions. New Hytron Auto Radio Tool is unique. A bargain tool by and for servicemen.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

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RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

RCA has pioneered the development of miniature tubes

One high quality—for TV-FM-AM —at no extra cost

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This *single standard* quality benefits all users. This extra quality cuts down costly service call-backs . . . builds customer confidence . . . brings you *more business.*

When you push RCA tubes you're selling the brand that holds top customer acceptance. So—*push RCA tubes and watch your business grow!*

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Now RCA miniatures come neatly packaged, five of a type, in attractive, expendable cartons. They're easier to handle, easier to stock, and a great aid in keeping track of your inventory. No extra cost . . . but plenty of extra convenience!

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