JULY, 1935

Radio Engineering

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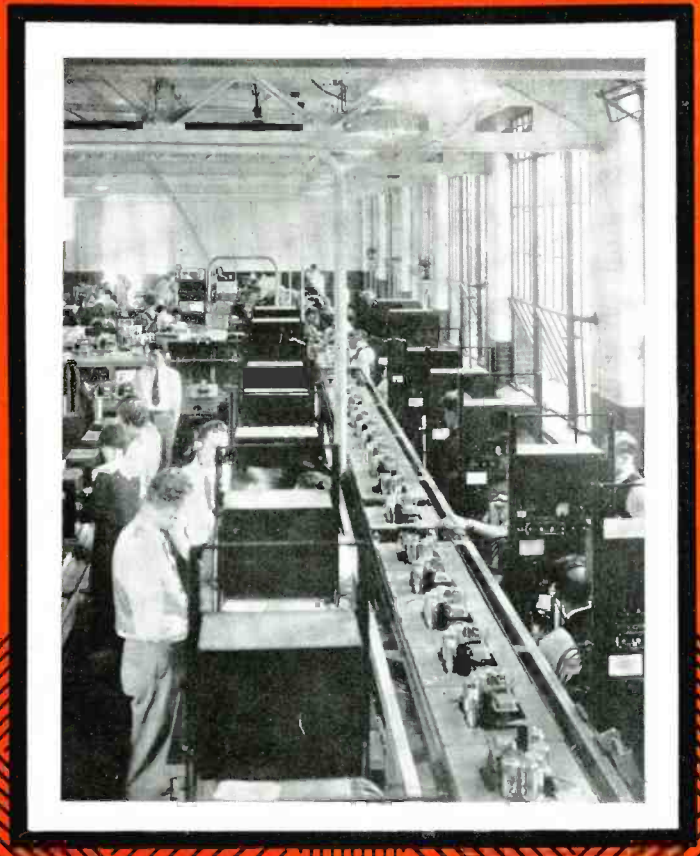

VOL. XV NO. 7

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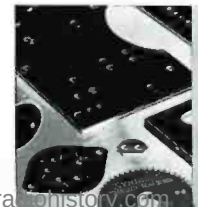

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Published Monthly by the
Bryan Davis Publishing Co., Inc.
19 East 47th Street
New York City

SANFORD R. COWAN
Advertising Manager

A. B. CARLSEN
Circulation Manager

New York Telephone: Plaza 3-0483
Chicago Office—608 S. Dearborn St.—C. O. Stimpson, Mgr.
Telephone: Wabash 1903.
Cleveland Office—10515 Wilbur Ave.—J. C. Munn, Mgr.
Telephone: Garfield 0905-J.

St. Louis Office—505 Star Bldg.—F. J. Wright, Mgr.

Wellington, New Zealand—Te Aro Book Depot.

Melbourne, Australia—McGill's Agency.

Entered as second class matter August 26, 1931, at the Post Office at New York, N. Y., under Act of March 3, 1879. Yearly subscription rate $2.00 in United States. $3.00 in Canada and foreign countries.

EDITORIAL

AUTOMATIC CONTROL

WE HAVE REPEATEDLY stressed the advisability of conditioning the home radio receiver in such manner that consistently good reception of programs may be obtained in spite of the listener. This calls for a complete elimination of auxiliary controls. leaving in the hands of the operator only the two essentials. the tuning and volume controls.

Even the tuning control is misused, the nearest approach to a guarantee of its proper setting for a given station being one of the various types of tuning indicators. As for the manual volume control, the listener either sets it at a high level, which is a blessing to no one aside from the listener, or sets it at such a low level that quality suffers.

The question is: Should the listener be permitted to misuse a radio receiver and thereby gain a poor impression of radio broadcast reception; or should the design engineer so condition a receiver that the common and habitual incorrect operation cannot affect the actual functioning of the receiver?

It is pleasing to note that considerable effort has been applied to this problem. The application of automatic bass compensation to receiver design can insure a maintenance of proper frequency response irrespective of manual volume-control setting. Natural quality of reception may be preserved, without regard to the usual dangers of low signal level and adjacent channel interference, through the combined use of an effective avc system and automatic selectivity control. The disadvantages brought about by mistuning may be obviated by the use of some form of automatic frequency-searching circuit or automatic resonating system.

Some of the new receivers employ one or more automatic fidelity control circuits, but the full advantages to be gained from automatic control systems have not yet been realized. Making a receiver foolproof against the listener's poor judgment is but one of the advantages to be gained. Other advantages to be derived are: The maintenance of consistently good reception under conditions over which the operator has no control, such as oscillator frequency drift, and the maintenance of correct receiver functioning through the provision of resonant circuits having flexible tolerances, monitored by an automatic control system of high precision. With such arrangements, frequent receiver adjustments would not be necessary. Moreover, the adjustments required could be restricted to a relatively few critical circuits.

It might be assumed that the difficulty in maintaining the adjustments of critical circuits lends an impractical flavor to the scheme—that in centralizing the precision in one or two circuits, the adjustment procedure may be simplified, but at the expense of the increased probability of drifting. Of course, a scheme of Goldbergian character would be the inclusion of a monitor monitoring the monitor . . . ad infinitum.

We believe the answer lies in what amounts to an inequitable distribution of costs: that is, instead of quite precise, and therefore costly, adjustments for each resonant circuit, use simple and inexpensive adjusters for broad circuits and high-precision adjusters for the one or two narrow monitor circuits, each of the latter being protected against alterations in temperature, moisture content of the air, and mechanical vibration. Non-resonant control circuits could be similarly treated.

It seems probable that the main objections the public has to radio may be overcome by "foolproofing" sets, and the nearest approach to foolproofing appears to be complete automatic control. The auto manufacturer has accomplished marvels in the past few years by the addition of automatic devices to the car equipment. Each of these devices, it will be noted, has been incorporated as a component of the complete auto for the express purpose of reducing failure of mechanical parts, yet each device also contributes something to the efficiency of the complete unit.

Though the conditions and problems in the radio field do not parallel those in the automotive industry, the same ends may be met.

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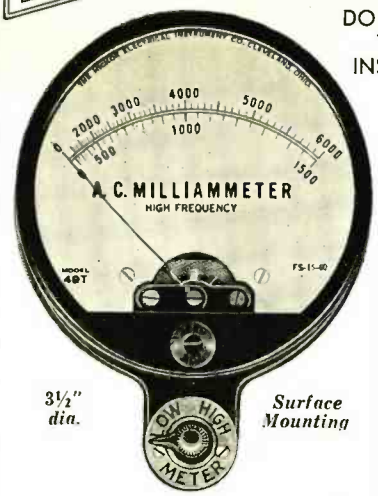

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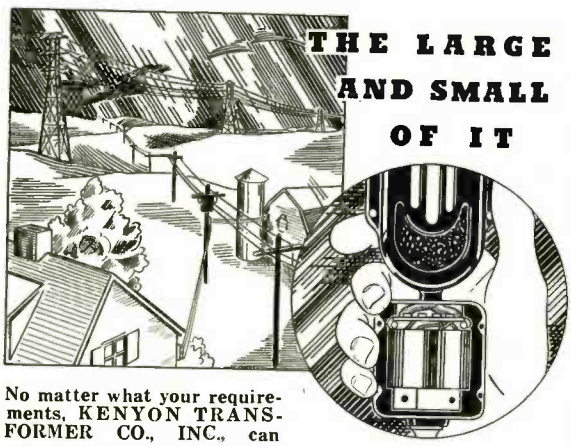

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RADIO ENGINEERING

FOR JULY, 1935

A Linear, Multi-Range ELECTRONIC VOLTMETER

By L. C. PASLAY* and M. W. HORRELL**

IN CONNECTION with the television research work being carried on at W9XAK, a constant need was felt for a voltmeter which was able to measure a-c voltages over a frequency range of from 20 cycles to several megacycles, and still retain the advantages of wide voltage range and simplicity of operation.

While the copper-oxide rectifier meter will serve below 10,000 cycles, its accuracy is poor, and at higher frequencies it becomes useless. Also, low-range voltmeters are not suited for use with high-impedance circuits.

In most work the waveform is not of great importance since most measurements are made on nearly sinusoidal voltages. When measuring voltages of complicated waveform due to speech or music, with instruments reading average values, the errors produced in calculating the peak swing are usually neglected, although in some cases they may be of considerable magnitude. When measuring television signals, however, the ordinary meter is of little value for determining peak swing, since the relationship of the peak to the average value varies over wide limits.

*In charge of television research, Department of Electrical Engineering, Kansas State College.
**Television Research Assistant, Kansas State College.

VOLTAGE-DIVIDER TYPE METER

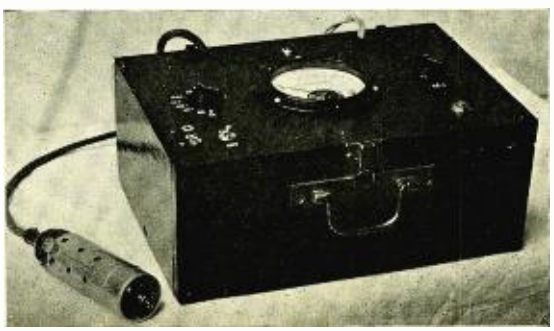
Many kinds of vacuum-tube voltmeters are available which offer high input resistance, and have low enough input capacity to be satisfactory even at radio frequencies. The voltage range of most of these instruments is very limited, however, since a voltage divider cannot be used for higher frequencies.

Fig. 1-A shows the input circuit of a vacuum-tube voltmeter with a voltage divider and operating at a frequency low enough to make the input reactance negligible. In this case,

$$E_g = E\,\frac{R_2}{R_2 + R_1} = \frac{E}{1 + \dfrac{R_1}{R_2}}$$

and the voltage division depends only on the values of R_1 and R_2. As the frequency is increased, the input reactance X_{C1} of the tube decreases and shunts R_2 as shown in Fig. 1-B, so that,

$$E_g = \frac{E}{\sqrt{\left(1 + \dfrac{R_1}{R_2}\right)^2 + \left(\dfrac{R_1}{X_{C1}}\right)^2}}.$$



The a-c operated vacuum-tube voltmeter developed for measuring television signals at W9XAK.

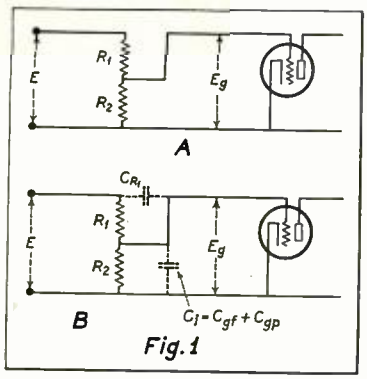


Fig. 1

Illustrative input circuit of voltage-divider type meter, showing effect of high frequencies on Eg.

Thus it can be seen that as X_{C_1} decreases at the higher frequencies E_g also decreases, and the voltage division is no longer determined simply by R_1 and R_2. This difficulty can partly be overcome by placing a small condenser C_{R_1} in parallel with R_1. Then,

$$C_{R_1} = \frac{C_1 R_2}{R_1}.$$

This condenser is difficult to construct and adjust accurately because of distributed capacity to the shielding and because of its small size.

"Slide-back" voltmeters have the advantages of wider range and direct-reading scale, but must be set for each reading and must have an additional d-c supply equal to the peak voltage being measured. This type of vacuum-tube voltmeter is commonly used to read peak voltages. If the plate current is set to cut-off, considerable error is introduced at low voltages because the cut-off point cannot be accurately determined.

This error is still worse if a reference value of plate current greater than zero is used. Fig. 2 illustrates the operation of this type of meter with a sinusoidal voltage applied. Plate current flows during the parts of the cycle shaded. The current which is brought to the no-signal value by the bucking voltage depends on the shaded area. It can be seen that the value of the bucking voltage added is not equal to the peak value of the signal, especially when the waveform is very peaked.

VOLTMETER REQUIREMENTS

The usefulness of any instrument is limited by the difficulty involved in making it ready for use and in taking the readings. So it was decided that the ideal voltmeter must meet the following requirements:

1. It must not be bulky.
2. If a power supply is needed it must operate entirely from the a-c lines.
3. The meter must cover a voltage range of from 0.1 to 200 volts.
4. The scale reading must be linear and direct, so no calibration curves or special meter scales will be needed.
5. The accuracy must be within 2 percent over the entire range, and be independent of waveform.
6. The meter must have high input resistance (at least 2 megohms) and low input capacity.

This last requirement obviously limits the voltmeter to the vacuum-tube type, since even the best rectifier meters have a resistance of less than 3000 ohms per volt. In order to iron out the difficulties which are encountered with the usual vacuum-tube voltmeter, the circuit shown in Fig. 3 was developed and has performed unusually well.

THE CIRCUIT

Condensers C_1 and C_2 both have low impedance at the operating frequency, so the a-c voltage being measured is impressed across a circuit consisting essentially of R_1 in parallel with C_{pf} and R_2. When the plate of VT_1 swings

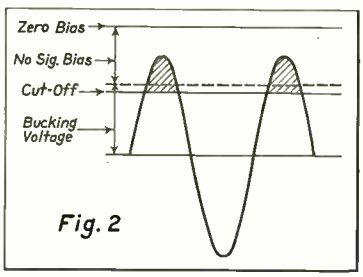


Fig. 2

Illustrating the operation of "slide-back" voltmeter with a sinusoidal voltage applied.

positive, rectified d-c will flow through R_1 and back to the cathode. This causes a voltage drop through R_1 in such a direction as to make its plate end negative with respect to the d-c circuit. Since the grid of VT_2 is connected to the plate of VT_1 through R_2, it will become more negative and reduce the plate current flowing through the milliammeter M. On the negative half of the a-c cycle, no rectified current will flow through R_1, and the grid potential of VT_2 will be held approximately constant by the charge on C_1 and C_2. Since VT_1 is a half-wave rectifier with a very light load, the drop across the load (R_1) will be very nearly equal to and always proportional to the peak voltage of the impressed signal.

The complete circuit is shown in Fig. 4. A 55 tube is used as the rectifier, with the control grid acting as the anode. All the plates in the tube are grounded to the cathode. Such an arrangement offers less capacity than can be obtained with any other standard receiving tube.

By placing the 55 at the end of a cable, its grid may be connected directly to the circuit being measured through the blocking-condenser leads, and the input capacity of the voltmeter kept very low. This is an important feature if the voltmeter is to present a negligible load at radio frequencies. The two resistors R_1 and R_2 are attached directly to the cap of the 55 tube. Thus no current of signal frequency is required to flow through the cable between the rectifier and voltmeter proper, the capacity of the wires will have no effect, and ordinary unshielded cable may be used. It is extremely necessary, however, that the insulation resistance be very high because of the high impedance of these circuits.

D-C AMPLIFIER

The second tube is a 57, used because of its high sensitivity and because its characteristics are well suited to this circuit. This tube is simply a d-c amplifier whose plate current varies directly with grid voltage. Since the 57 operates linearly with a plate swing of one milliampere, little is to be gained by the use of a more sensitive meter. R_{12} is placed in series with the 57 grid circuit to prevent rapid discharge of the condenser C_2 through the voltage-multiplier resistors.

The resistors R_7, R_8, R_9, and R_{10} act in conjunction with R_2 to form a divider for the d-c voltage rectified by the 55. In this manner it is possible to have a high a-c voltage across the input terminals and still operate the 57 over the linear portion of its characteristic. Five a-c voltage ranges were incorporated in this meter: 0-1, 0-5, 0-10, 0-50, and 0-200 volts; and four d-c ranges: 0-5, 0-20, 0-100, and 0-500 volts. A double-pole, ten-position selector switch makes it possible to rapidly select any of these ranges, and has in addition an "off" position which is very useful when setting the meter to zero, or when changing connections in the circuit being measured.

No batteries at all are used with this voltmeter, as all power comes from the 110-volt a-c lines. A rheostat is connected in the primary of the power transformer to compensate for changes in line voltage. The spare filament

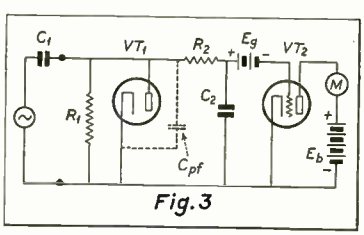


Fig. 3

Schematic of vacuum-tube voltmeter developed at W9XAK. Complete circuit shown in Fig. 4.

windings are also connected in series with the primary in such a manner as to boost the secondary voltage and help overcome the drop in the rheostat. If automatic compensation is desired, a good ballast tube may be used and a variable resistor placed in parallel with the primary.

Normally the 57 draws 3.4 milliamperes plate current. In order to prevent the entire bucking current from flowing through the meter before the 57 warms up, an 84 is used as the rectifier. This tube is of the indirectly-heated cathode type and requires nearly as much time for heating as does the 57.

THE RESISTORS

It is extremely important to use wire-wound resistors whenever appreciable current must be carried. The ideal procedure would, of course, be to use non-inductive, wire-wound resistors throughout. This is not practical, though, because of space limitations, and because of the prohibitive cost. However, ordinary carbon resistors are quite satisfactory in the input circuit and in the voltage multiplier, where the current is below 50 microamperes.

The bypass condenser C_2 should be about 0.1 mfd. A much smaller value will introduce error at low frequencies, and a condenser any larger will make the meter sluggish. The size of the input coupling condenser depends upon the frequency of the voltage being measured, but should be large enough to offer negligible impedance. For radio frequencies this condenser may best be one of the high-grade mica types. At lower frequencies the capacity must be greater and a good non-inductive, tubular paper condenser may be used.

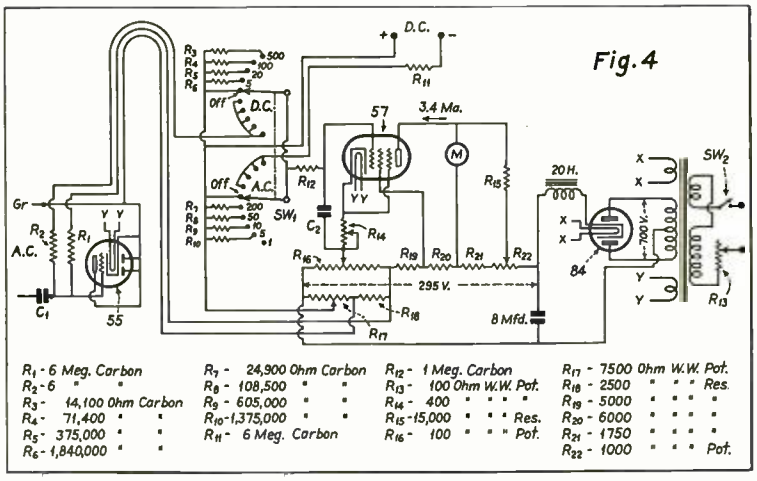
ADJUSTMENTS

In placing the meter in operation for the first time the adjustments are made as follows:

The line resistor R_{13} is adjusted until the filament voltage on the 55 and 57 is 2.5 volts. A milliammeter is placed in series with the plate of the 57 and with the switch Sw_1 set at "off" the plate current is brought to 3.4 milliamperes by changing the setting of the potentiometers R_{14}, R_{16} or R_{17}. The milliammeter M can now be adjusted to zero by means of R_{22}, and the extra meter in the 57 plate circuit removed. Short the input terminals through C_1 and set the switch Sw_1 to the one-volt tap. Turn R_{16} until M reads 0.08. Owing to the characteristics of the 55, this is the lowest potential at which rectification takes place. Sw_1 is turned to the "off" position and M returned to zero by adjusting R_{17}. The initial reading will now be 0.08 volts on each range.

Apply one volt rms through C_1, with Sw_1 on the one-volt range. If the meter M does not read full scale, reduce the resistance of R_{14} somewhat and reset R_{16} so that M reads zero when Sw_1 is at "off." If the meter reads more than full scale, R_{14} must be increased. The purpose of R_{14} is not to furnish bias to the 57, but to introduce degeneration in order to control the amount of amplification.

The remainder of the a-c ranges are set by applying known voltages to the diode and adjusting R_7, R_8, R_9 and R_{10} until the meter M reads the proper value. These resistors may be adjusted by combining large and small values of standard resistors or by choosing slightly lower values of carbon resistors and filing the body until the correct value is obtained.



The complete circuit of the a-c operated, direct-reading, vacuum-tube voltmeter designed for measuring television signals.

DIRECT-READING SCALES

Since this instrument reads according to peak values it may be equipped with scales marked to 150, 300, and 750, and adjusted to read peak values directly. The d-c ranges are set in the same manner as described above by applying d-c potential of known value at the d-c terminals.

Changing the 55 tube makes little difference. An "acorn" tube may be substituted, effecting a reduction in input capacitance and a saving in space. If for any reason it becomes necessary to change the 57 tube, the potentiometers will probably have to be readjusted.

All the variable resistors except R_{13} are provided with a screw-driver slot and are never touched except during calibration. To compensate for line-voltage changes, the meter M is set to zero with Sw_1 in the "off" position by means of R_{13}.

This instrument was equipped with a good meter and when checked against laboratory standards was found to be within 2 percent of full-scale values at all points. While the principles involved are not new, the circuit arrangement has provided an instrument which has proved to be a most valuable addition to the laboratory equipment.

PATENTS IN SWEDEN

A DECISION was rendered on April 12 in the Borough Court at Malmo which Swedish experts on patent law believe will eventuate in opening wide the Swedish market to all American makers of radio apparatus who, for a number of years, have been blocked in their efforts in this market by the radio patent situation. The case was one in which Telefunken sued an importer of American apparatus under the basic screen-grid tube patent. The decision, based on a new interpretation of Swedish patent law, held that the law provided that where a license fee was paid on a patent in another country and goods manufactured under that license were imported into Sweden that a second fee could not be collected in Sweden even though the original patent was also registered in Sweden. The American patents in Sweden have been assigned to European manufacturers, principally Phillips of Holland, who have carried on a campaign to keep American competitors out. The case will be appealed, but until a final decision is given it seems certain that American radio will have a better chance in Sweden. (Commercial Attache Osborn S. Watson, Stockholm, *Electrical Foreign Trade Notes.*)

Highlights of RMA CONVENTION

LESLIE F. MUTER,
President, RMA.

A THREE-DAY program bulging with future plans for developing the radio industry, many committee and group meetings, problems resulting from NRA code annulment, plus unusual entertainment features marked the eleventh annual RMA convention at the Stevens Hotel, Chicago, June 11-13. Over 100 manufacturers attended and the "RMA Cabaret" and membership dinner Tuesday evening was sold out at the 300 mark.

MUTER REELECTED RMA PRESIDENT

President Leslie F. Muter of Chicago, who presided, and other RMA officers were reelected. There were meetings of the set, tube, parts and amplifier divisions and of many committees, including the Service Section and a newly created export trade development committee.

Voluntary continuance of a few beneficial features of code operation were arranged for, but without any formal action or resolutions except for development of a plan to continue filing by set manufacturers of open prices. Existing wage scales will be generally continued voluntarily, according to those present.

POINTED ADDRESS BY VAN ALLEN

In the discussions of industry problems resulting from annulment of NRA, a feature of the convention was a stirring address by John W. Van Allen of Buffalo, RMA general counsel, criticizing "New Deal laws." He declared many were contrary to the American plan of government and individual freedom. He deplored "usurpation of political power," declared that the American plan was for a "government of laws, not of men," and that the latter would lead to political despotism. He also criticized the tremendous debt burden and new laws oppressing business and industry. In discussing the proposal for amendment of the Constitution to meet the NRA decision of the Supreme Court, Judge Van Allen warned that this would give the President power to make "laws" and make Congress and the President the sole judges of their own powers, resulting in "dictatorship or downright despotism."

"CHISELING" ON WAGES

The industry leaders also were warned by Arthur T. Murray of Springfield, Mass., chairman of the Set Division and former code supervisory agency, against "chiseling" on wages. Industry instead of the Government, Mr. Murray declared, now has the problem of solving the unemployment situation. He said the electrical code under which radio manufacturers operated imposing a 36-hour maximum week was manifestly unfair when every other industry had 40 hours, and took steps to continue a voluntary plan of filing set prices. The latter, he said, was a tremendous step in the right direction toward a cleaner industry.

The RMA Cabaret, an innovation in industry entertainment, in charge of Chairman A. S. Wells of the Entertainment Committee, was a marked success. During the evening the associates of President Muter on the RMA Board presented him with a beautiful silver service in appreciation of his work during the past year. The convention closed on Thursday with a golf tournament by the Radio Industries Golf Club of Chicago with nearly 100 entrants at the Olympia Fields Club.

"OLD GUARD" REUNION

Many veteran RMA officers and members made the convention a reunion. On Tuesday there was an "old guard" luncheon of former presidents, including Arthur T. Haugh, H. B. Richmond and Fred D. Williams, and former RMA directors.

There were no merchandise displays and little trade attendance at the manufacturers' Chicago meeting. "Business" was its keynote. There were two meetings of the RMA Board of Directors, separate meetings of the four Divisions of the Association, and of many committees and groups.

Further development and increased

(*Continued on page* 17)

ATTENDANCE OF OVER 100 MANUFACTURERS WITH 300 AT RMA CABARET-MEMBERSHIP DINNER.
PRESIDENT LESLIE F. MUTER AND OTHER OFFICERS AND COMMITTEE CHAIRMEN REELECTED.
MANUFACTURERS GENERALLY CONTINUING PRESENT WAGE SCALES ALTHOUGH COMPULSORY CODE PROCEDURE ENDED.
IMPORTANT ADDRESS BY JUDGE VAN ALLEN CRITICIZING MANY "NEW DEAL LAWS" AS UNAMERICAN.
SET, TUBE, PARTS AND AMPLIFIER DIVISIONS PLAN NEW PROGRAMS, INCLUDING CONTINUED FILING OF SET PRICES.
NATIONAL SALES PROMOTION PLANS AND FUNDS INCREASED.
NEW EXPORT TRADE DEVELOPMENT COMMITTEE ORGANIZED.

Shielded Coil INDUCTANCE

● GRAPHICAL DETERMINATION OF THE DECREASE IN INDUCTANCE PRODUCED BY A COIL SHIELD

IT IS COMMON practice at the present time to encase one or more of the r-f coils of a modern all-wave receiver in a suitable shield in order to minimize the undesirable effects of inter-circuit coupling. This shield reduces the inductance of the coil by an amount depending upon the geometry of the coil and the shield; the amount of this decrease must be known when designing r-f coils to cover a predetermined tuning range. Although calculation or actual measurement may be resorted to for the determination of the decrease in inductance, the RCA Radiotron Laboratory has found the following graphical solution entirely practicable.

SOLUTION

If the shield is considered as a single turn of wire around the coil, the decrease in reactance of the coil may be shown to be

$$\frac{\omega^2 M^2}{\omega L_s}$$

where M is the mutual inductance between coil and shield and L_s is the inductance of the shield. The resistance of the shield is assumed to be small compared to its reactance. The coefficient of coupling between coil and shield is

$$K = \frac{M}{\sqrt{L_a L_s}}$$

where L_a is the inductance of the coil without shield. Substituting K for M in the first equation, we have for the decrease in the reactance of L_a,

$$\text{decrease in } X_a = \omega L_a K^2$$

and

$$\text{decrease in } L_a = K^2 L_a.$$

The inductance of the coil within the shield is, therefore:

$$L = L_a (1 - K^2).$$

Values of K for various coil and shield diameters have been calculated and verified experimentally; the results are plotted as a family of curves, as shown in the accompanying illustration.

The abbreviations used are as follows:
b = the length of winding of the coil
a = the radius of the coil
A = the radius of the shield.

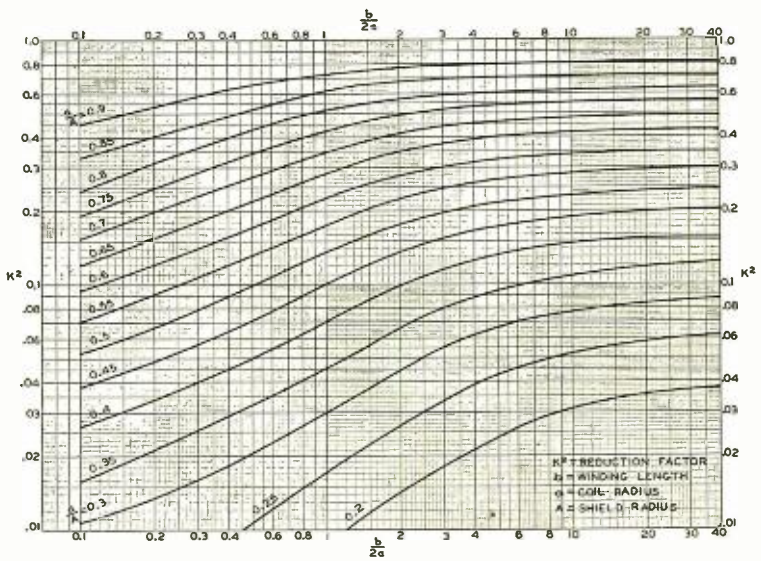
EXAMPLE

An r-f coil 1.5 inches long and 0.75 inch in diameter is to be used in a shield 1.25 inches in diameter. What is the inductance of coil in the shield?

b = 1.5
a = 0.375
A = 0.625
b/2a = 1.5/0.75 = 2
a/A = 0.375/0.625 = 0.6

From the curves, $K^2 = 0.28$; the inductance of the coil is therefore reduced 28 percent by the shield. The inductance of the shielded coil is $(1 - 0.28) \times 100$, or 72 percent of its unshielded value.

The curves are sufficiently accurate for all practical purposes throughout the range shown when the length of the shield is greater than that of the coil by at least the radius of the coil. If the shield can is square instead of circular, A may be taken as 0.6 the length of one side.



A FAMILY OF CURVES USED FOR DETERMINING THE DECREASE IN INDUCTANCE PRODUCED BY A COIL SHIELD.

The 6F7 Used as an Amplifier and Second Detector

By J. R. NELSON

RAYTHEON PRODUCTION CORP.

THE 6F7 TUBE was brought out as an oscillator and first detector combination tube in one bulb. The 6F7 has a pentode and a triode with a common cathode in one bulb. As is usual with multi-element tubes, other possible applications were later found. Among these for the 6F7 was the use of the tube as a high-frequency amplifier and C-bias detector.

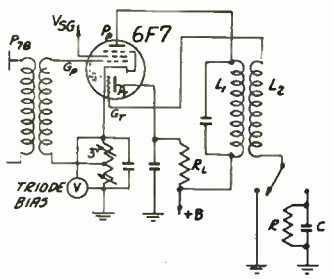


Fig. 1. Circuit used to check 6F7 performance as a high-frequency amplifier and bias second detector.

The operation as an amplifier and second detector is not quite equivalent to the use of two separate tubes, due to the common cathode and electrostatic coupling within the tube due to the proximity of the two sets of elements. The optimum bias voltages for the two sets of elements are not the same. The pentode section will have the best performance at minus 3 volts, its rated value, while the triode section will require considerably higher voltage to obtain good overload characteristics. The bias requirements may be taken care of by returning the pentode grid to some point along the cathode resistor as shown in Fig. 1.

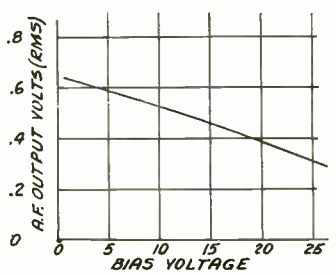


Fig. 2. 6F7 small-signal sensitivity, a-f output vs bias. Input = 11,000 μv; R_L = 0.1 megohm; M = 30 percent.

INTER-ELECTRODE CAPACITIES

There are capacities within the tube between the various elements of each section. The most serious will be that between the two grids as indicated by the dotted lines in Fig. 1. This capacity is small and is of the same order as that of the grid-plate capacity in the pentode. If a high-impedance load is used in the plate of the pentode section, oscillations may occur unless care is taken in the winding polarities. If connections are properly made the energy fed from G_T to the pentode grid will oppose the regenerative energy fed back from the pentode plate to the pentode grid, thus assuring stability. If the connections are reversed, the two sources of feedback energy will be in phase, which may result in oscillations. The correct connections are easily found, for if L_1 and L_2 are considered as one coil wound in the same direction, the start and finish of the coil should go together as either the high or low sides and two ends where the coil is tapped go together.

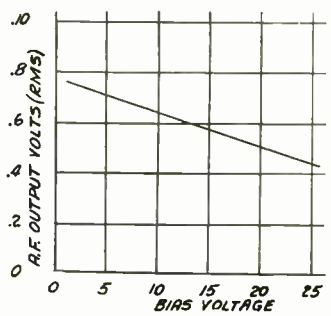


Fig. 3. 6F7 small-signal sensitivity, a-f output vs bias. Input = 11,000 μv; R_L = 0.25 megohm.

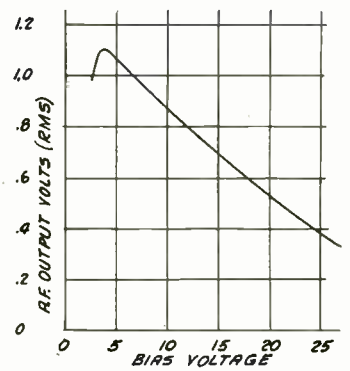


Fig. 4. 6F7 small-signal sensitivity, a-f output vs bias. Input = 11,000 μv; R_L = 0.5 megohm.

EXPERIMENTAL RESULTS

The circuit used is shown in Fig. 1. The pentode section was used as a high-frequency amplifier, which was fed from a 78 tube having a high impedance in its plate circuit and hence in the grid

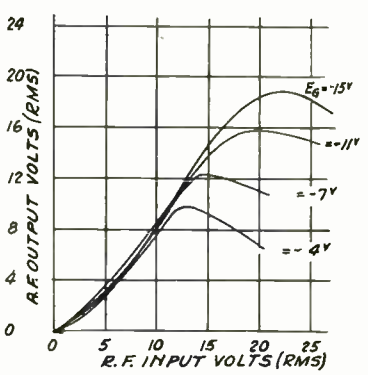


Fig. 5. 6F7 overload characteristics, a-f output vs. r-f input to triode grid, 30 percent modulation. R_L = 0.1 megohm.

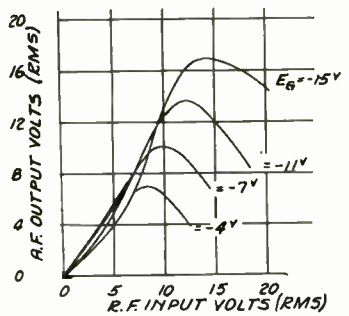


Fig. 6. Overload characteristics. R_L = 0.25 megohm.

circuit of the pentode of the 6F7 tube. Investigations were made of stability, etc. A close-fitting tube shield was found helpful if connections of L_1 and L_2 were connected so as to feed back energy from the triode grid to the pentode grid. In all cases stability could be obtained with the right connections.

The signal was placed on the grid of the 78. The bias was kept at 3 volts on the 6F7 pentode. The bias of the triode detector was varied by means of the cathode resistor. The results for a small output are shown by the three curves (Figs. 2, 3 and 4) for 0.1, 0.25 and 0.5 megohm plate resistors. The curves shown are average values. For weak signals the bias should be around 4 volts. The overload will not be so good, however, with 4 volts bias. Figs. 5, 6, 7 and 8 show the overload curves obtained for the triode bias conditions. The output is none too even for a pentode output tube, particularly for four and seven volts. The output is better for eleven and fifteen volts. The output in any case would not be enough for weak modulation to overload the power tube.

The curve of Fig. 8 shows the output using a one-megohm resistor in the triode grid return. The grid resistor was by-passed with a one-tenth microfarad condenser, so grid-circuit detection played no part. The output is several times higher than in the previous case so that considerably lower modulation percentages than 30 percent would load up the conventional pentode output system, such as the 42.

CONCLUSIONS

In concluding, we see that the use of the 6F7 is practical in this application. Using a quarter-megohm plate resistor it takes 10 volts rms, or 14.1 volts peak,

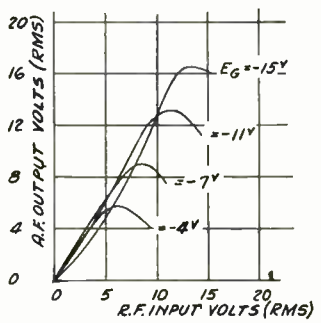


Fig. 7. Overload characteristics. R_L = 0.5 megohm.

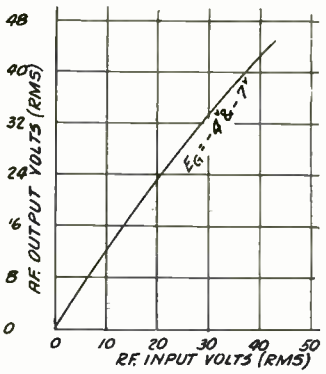


Fig. 8. Overload characteristics. R_L = 0.25 megohm with 1.0 megohm and 0.1 mfd in triode grid return.

to give 12 volts output with M equal to 30 percent. This is about equal to the output of a diode with M equal to 100 percent. We can thus say that the triode section will be about three times as sensitive as a diode. The overload characteristics will not be so good unless a high resistance well by-passed is placed in the grid return. The 6F7 triode is operated as a fixed-bias detector because the current from the pentode section remains constant and the increased current in the triode with increasing input does not affect the bias much. The high resistance in the grid return seems to be about the only method of obtaining high output voltage and still keeping the bias reasonable for small-signal sensitivity.

PARIS RADIO SHOW

THE TWELFTH PARIS International Radio Show, organized by the "Societe pour la Diffusion des Sciences et des Arts," will be held in Paris from the 5th to the 15th of September, 1935, at the Grand Palais, in the Champs Elysees. (Assistant Trade Commissioner Lestrade Brown, Paris, in *Electrical Foreign Trade Notes.*)

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CHINESE RADIO MARKET

IMPORTS OF RADIO sets and parts into China during 1934 increased 20 percent in value as compared with the previous year. (Quantity statistics are not recorded.) In terms of American currency the increase is considerably greater owing to the change in comparative values of the Gold Unit and the U. S. Dollar between 1933 and 1934. Ninety percent of the total imports entered the Port of Shanghai. (Gold Mint, 1933, $0.513 U. S., 1934, $0.670.) Sets of the a-c, d-c variety are reported as never being satisfactory under the peculiar conditions operating in this market, though some have been imported. Many Chinese dealers prefer a-c 220-volt sets, objecting to a-c. d-c sets on the basis that they burn out too quickly.

Facilities are available in Shanghai for converting a-c 110-volt sets to a-c 220-volt.

Electrical characteristics in the interior cities of China generally range between 350 and 380 volts. 50 cycles. Electric current characteristics in Shanghai area also vary greatly. (*Electrical Division, Department of Commerce.*)

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RADIO IN ALGERIA

THE FIRST CENSUS of radio-receiving sets in Algeria was taken late in 1934. The number of declared sets as of November 1, 1934, was fixed at 30,942.

Figures showing the 1934 imports of radio-receiving sets are not yet obtainable. Owing chiefly to the strict application of the quota restrictions, American sets have today almost disappeared from the market. A stock-taking of the number of American sets available for sale in the city of Algiers, the largest center of population in Algeria, revealed that there were only 28 obtainable at the beginning of the 1935 calendar year. Until quota restrictions are lifted in France and Algeria, the two countries being considered as a single territory for purposes of quota control, the sales possibilities in this country are more than ever limited and hardly warrant serious efforts by American exporters, while the restrictions remain unchanged. Algeria is a willing buyer of American merchandise and distributors are generally impatiently waiting for a removal of the restrictions. (*Electrical Division, Department of Commerce.*)

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LITHUANIA RADIO EXHIBITION

A RADIO EXHIBITION of local significance was held in Kaunas from Sept. 30 to Oct. 6, 1934. Simultaneously the firm Radio-Technikos Akcine Bendrove J (formerly Radio Sekcija) of 39 Laisves Aleja, Kaunas, which has specialized in American radio equipment for the past year, held an exhibition of its own. American equipment is increasing in popularity as a result of the activities of the above mentioned firm as well as to the lower prices prevailing on the American equipment as compared with other foreign makes sold on the market. (*Electrical Trade Notes,* No. 351, December 15, 1934. *Basil F. MacGown, V. C. Kaunas.*)

Six-Volt Receiver Design

BECAUSE MANY FARMS and rural communities have little or no power-line facilities, radio receivers intended for these unelectrified localities must depend upon battery supply for the primary source of power. It is desirable, therefore, that these specialized receivers have low power consumption and obtain their high-voltage supply from the filament-supply battery. Consideration of these requirements has directed the trend in modern battery-operated receiver design toward the use of series-parallel arrangements of 2-volt filament-type tubes, the filaments being connected so as to facilitate operation from a 6-volt storage battery. The same battery also furnishes plate power through the use of a small motor generator or a vibrator unit, similar to those commonly employed in auto-radio receivers.

Heretofore, it has been the custom to use one or more indirectly-heated tubes in certain portions of the circuit for this type of receiver in order to minimize the noise output which results from the use of B-supply units. However, the use of such tubes does not always guarantee an acceptable noise level. The current drain of the receiver is also higher than necessary because a heater type of tube requires more power than a corresponding filament type. The use of heater-type tubes in this specialized type of receiver is an especially significant disadvantage in view of the necessity for more frequent battery charging, a necessity not always compatible with local conditions. It is the purpose of this article to show how the exclusive use of 2-volt filament-type tubes in this type of receiver can provide minimum power consumption and a negligible noise level without resorting to special circuit design or the use of costly filters. The data presented arises from research conducted by the RCA Radiotron Division of RCA Manufacturing Co., Inc.

TABLE I

Noise Output With 1000-kc Input

Test Conditions	Noise Output in Milliwatts	
	Original Circuit	*Revised Circuit*
21 microvolt carrier, no modulation	10.0 mw	5.6 mw
210 microvolt carrier, no modulation	10.0 mw	0.78 mw
2100 microvolt carrier, no modulation	263.0 mw	0.5 mw
21000 microvolt carrier, no modulation	290.0 mw	0.125 mw
210000 microvolt carrier, no modulation	338.0 mw	0.125 mw

NOTE: A 21 microvolt carrier, 30% modulated, was required for 50 milliwatts output both in the original and revised circuits.

CAUSES AND ELIMINATION OF NOISE

One of the most objectionable characteristics of battery-operated receivers having mechanical B-supply units is the high noise level caused by common coupling between A and B circuits and by circulating currents in the chassis, set wiring, and cable shields. Noise arising from these causes can be minimized only by reducing common coupling and circulating currents to a mini-

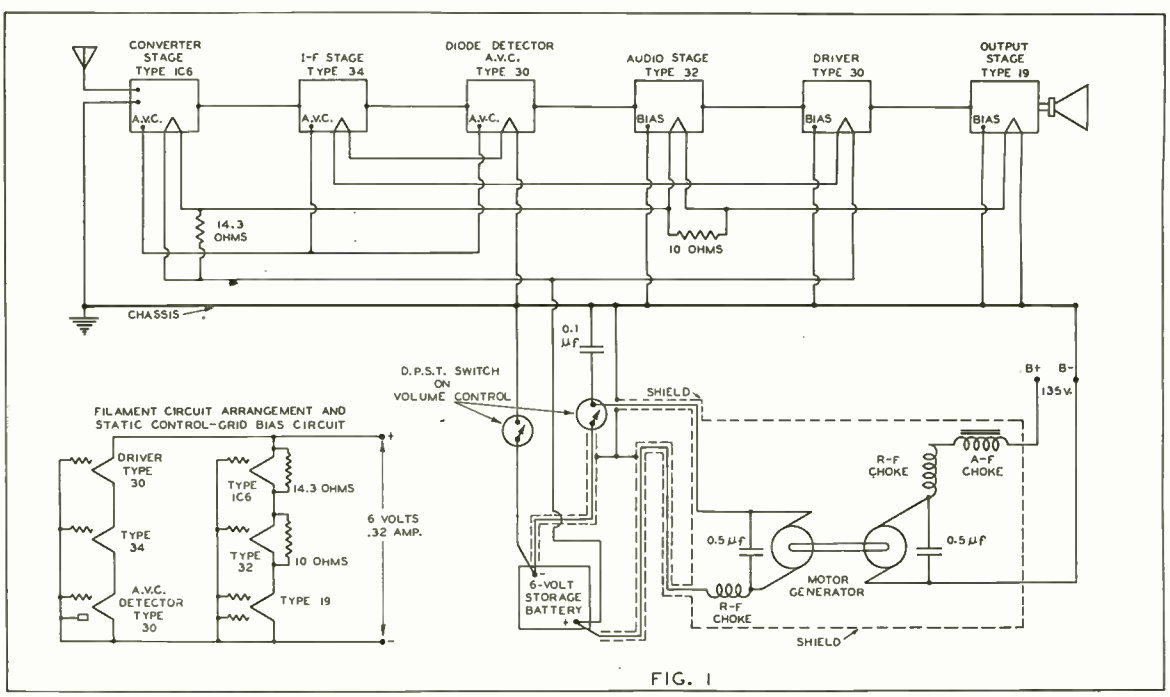


FIG. 1

Six-volt receiver circuit with motor-generator high-voltage supply.

mum. The use of indirectly-heated tubes does not in any way reduce the magnitude of the causes of the noise; their use is merely an expedient to reduce the effects.

When the motor commutator or vibrator of a B-supply unit is connected to a source of constant emf through leads having some resistance, the fluctuating current drawn by the B-unit causes variations of voltage at its input terminals; the alternating component of this pulsating voltage is the ripple, or noise, voltage. Thus, if the filaments of a receiver's tubes are connected to the same source of emf by means of the same B-unit leads, the voltage applied to the filaments will have a noise component, which will be amplified by the succeeding tubes. In other words, under these conditions, the battery leads form the common coupling element between the filament and B-unit circuits.

Elimination of noise from this cause may be effected to a large extent by running separate leads from the filaments of the tubes to the battery, since the low internal resistance of a storage battery (about 0.005 ohm for a fully-charged cell) provides nearly perfect regulation; it has, therefore, nearly zero ripple voltage across its terminals. This method will necessitate the use of separate on-off switches for the separate circuits; however, d.p.s.t. switches which are an integral part of variable resistors are now available. A further reduction of the noise level due to common coupling may be realized by eliminating common A- and B-circuit connections in the B-supply unit itself. There are types of self-rectifying vibrators that have a single, uninsulated reed common to the primary and secondary circuit; because this reed is a common coupling element between A and B circuits, it gives rise to a noise voltage across the filament terminals. The use of a split reed, one section for the A- and one for the B-circuit, will eliminate this common coupling. Similarly, any common A- and B-circuit lead in the motor-generator unit should be removed and the connection made in the receiver proper.

Noise caused by circulating currents may be minimized by adequate shielding and by-passing. Although no specific rules regarding the elimination of circulating currents can be set down, there are several general remedies which should be tried first. The leads from the storage battery to the B-supply unit should be shielded and the shield grounded to the frame of the B-unit. This unit, together with its directly associated components, should be housed in a metal container and then mounted on the chassis as far removed from other circuit elements as space permits. If at all possible, the B-unit and its associated components should be separated from the receiver, connected to the receiver by a shielded cable, and the shield grounded to the receiver chassis at a single point. Under no circumstances, should this shield act as a conductor of A- or B-current. It is also necessary to by-pass the input and the output circuit of the B-unit directly to the negative A-lead on the input side and to the negative B-lead on the output side, respectively. In any case, shields and chassis should not be used as terminals for by-pass condensers in the B-unit. The somewhat common practice of placing the vibrator of the B-unit on one corner of the chassis and the power transformer on another corner contributes largely to the generation of circulating currents; the consequent necessity for using an excessive number of large by-pass condensers increases the cost of material and labor. The judicious placement of the B-supply unit and its components, therefore, results in reduced manufacturing costs.

TEST VERIFICATION OF SUGGESTED METHODS

The effectiveness of these precautionary measures was verified by two separate tests. In the first, a receiver which obtains its plate power from a small motor generator mounted on the chassis was connected to a storage battery in the more prevalent manner; common battery leads were used for the A- and B-circuits; a single, shielded

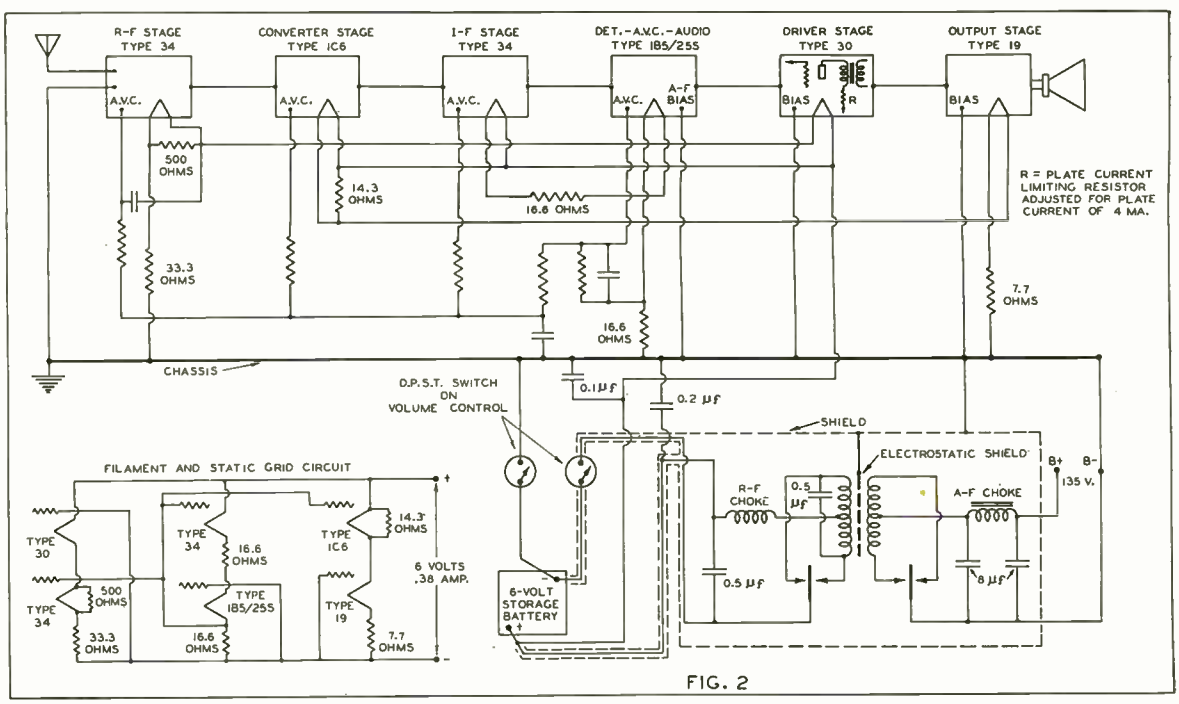


FIG. 2

Six-volt receiver circuit with vibrator high-voltage supply.

TABLE II

Noise Output With 1000-kc Input

Test Conditions	Noise Output in Milliwatts	
	Original Circuit	*Revised Circuit*
5.5 microvolt carrier, no modulation	5.25 mw	1.0 mw
55 microvolt carrier, no modulation	4.5 mw	1.53 mw
550 microvolt carrier, no modulation	13.8 mw	0.03 mw
5500 microvolt carrier, no modulation	5.25 mw	0.03 mw
55000 microvolt carrier, no modulation	8.00 mw	0.03 mw

NOTE: A 5.5 microvolt carrier, 30% modulated, was required for 50 milliwatts output both in the original and revised circuits.

cable was run from the battery to the receiver; and the shield was grounded at the most convenient point. No precautions regarding the proper terminal points for B-unit by-pass condensers were observed. The sensitivity and noise output of the receiver were measured. Then, separate A- and B-circuit leads were run, the B-circuit leads were shielded and grounded to the shield can of the B-unit, separate A- and B-circuit switches were installed, and B-unit input and output by-pass condensers were terminated at the negative A-wire and the negative B-wire, respectively. The sensitivity of the receiver was again measured and found to be the same as that previously obtained. Noise measurements were then repeated. Fig. 1 shows the revised circuit and tube complement, and Table I the measurement data.

It is apparent that a very material decrease in noise levels resulted from the changes and that the noise levels of the revised receiver are far below any generally accepted value. Of particular significance is the decreasing noise level with increasing carrier strength in the revised circuit; this should be compared with the opposite effect that existed in the original circuit. This phenomenon of increasing noise with carrier is caused by modulation of the carrier by the noise; this modulation did not exist in the revised receiver.

In order to segregate as much as possible noise originating in the receiver itself from that due to the use of the motor-generator, a series of oscillograms were taken of the noise voltages existing in certain sections of the revised receiver with the i-f portion short-circuited. These oscillograms showed that the peak ripple voltage across the motor commutator was about 20 millivolts, across the filament of the 32 about 0.5 millivolt, and across the output about 100 millivolts. The noise frequency was approximately 400 to 500 cycles. The storage-battery voltage was 5.8 volts at the time the oscillograms were taken, so that the internal resistance of the battery was somewhat high, though representative of average operating conditions.

TESTS WITH VIBRATOR B-UNIT

The second series of tests was conducted on a receiver using a synchronous-vibrator type of B-unit. Sensitivity and noise measurements were made with conventional shielding, common coupling, and by-pass condenser terminals. The circuit was then changed to that shown in Fig. 2 and the sensitivity and noise measurements repeated. Of special importance is the use of the split-reed vibrator in the B-unit to avoid A- and B-circuit coupling; the original unit employed a single, uninsulated reed. Table II shows the results of these measurements.

It is seen that here, too, a very substantial reduction in noise level and carrier modulation resulted from the improvements. A comparison of Tables I and II should not be attempted because of the different sensitivities of the individual stages and the wide differences in mechanical layout and wiring.

One of the most important advantages of the exclusive use of filament-type tubes is the low power consumption. The filament circuits of Figs. 1 and 2 draw 0.32 and 0.38 ampere, respectively; this should be compared with other circuits using one or more indirectly-heated tubes. Each of these circuits shows the method of obtaining proper bias for each tube, and the inserts show, respectively, the biases on all tubes with no signal. The avc circuit for each receiver is also given.

CONCLUSION

The circuits in this article are merely suggested as possible arrangements for the tube complements used. In this respect, it should be remembered that in any series arrangement of filaments the total filament current is the sum of the normal current due to the storage battery and the plate currents returning to negative B terminal through tube filaments. The addition of shunt resistors across certain filaments to maintain the filament voltage of each tube at its rated value of 2.0 volts will insure normal life performance.

From these test results, it may be concluded that the exclusive use of filament-type tubes with proper circuit precautions can provide minimum filament power consumption and negligible noise level to meet the special requirements of receivers employing mechanical B-supply units.

ICELAND CREATES STATE MONOPOLY

AN ICELANDIC LAW of Nov. 28, 1934, provided for the organization and operation by the State of all radio broadcasting in Iceland, and reserved to the State the sole right to sell radio-receiving sets, according to Norges Utenrikshandel of Feb. 15, 1935. (*Foreign Tariffs and Trade Regulations.*)

RADIO RECEIVING SETS IN MEXICO

A MARKED INCREASE in the purchasing power of the country, together with improved programs and more continuous service rendered by domestic broadcasting stations, has been reflected in a sharply expanded market for radio-receiving sets in Mexico. In 1933 imports of radio-receiving sets totaled 2,521,322 pesos and reached 3,696,701 pesos in 1934, which represents an increase of more than 46 percent. The estimated number of radio-receiving sets in use in Mexico is now placed at 130,000, and with a continuance of prevailing favorable business conditions the demand for radios should increase at a rapid rate.

The last two years have witnessed an increasingly larger sale for all-wave receiving sets, it being estimated that at present from 50 to 60 percent of the total demand is for this type of instrument. The accelerated trend in the demand for sets capable of receiving distant programs confirms other indications that Mexican listeners are manifesting greater interest in distant reception. Reception of short-wave programs originating in the eastern part of the United States is characterized as satisfactory during the rainy season and good during the winter months.

Five- and six-tube alternating-current sets find the largest demand and while an increasingly large number of automobiles are being equipped with radios, as yet the sale for this type of radio is comparatively small. In so far as is known, no trains, airplanes, or motor buses in this country are equipped to receive broadcasts, but receiving sets have been installed in a limited number of taxi cabs. (*Electrical Division, Department of Commerce.*)

BOOK REVIEW

THEORY OF ALTERNATING CURRENT WAVE FORMS, by Philip Kemp, published by Instruments Publishing Co., Pittsburgh, Pa., 218 pages, cloth cover.

While this book is intended primarily for the student of power engineering, there is much of value in it for the communication engineer. The study of the properties of transients and non-sinusoidal waves generally is not new to the communication engineer, indeed a large part of communication technique is built around it. Nevertheless there is much to be gained from a fresh point of view, and from waveform analysis that can be applied directly to oscillographic patterns.

Chapters I and II are entitled, "Properties of Complex Waves" and deal with wave shapes of complex waves of few or many harmonics which are plotted with phase as a parameter. Harmonic vector diagrams are introduced and several ways in which they may be used effectively pointed out. An original graphical method of determining the root-mean-square value of a complex wave is explained and the subject of harmonic impedance treated in some detail. The apparent increase in reactance due to harmonics is given at considerable length. Circuits excited by rectangular and triangular waves are given considerable space and the resulting induced voltages derived. Wave filters of the simpler types are analyzed from a point of view that should be decidedly new to most radio engineers. Of particular interest is the author's method of plotting both sinusoidal and complex waves in polar coordinates instead of rectangular coordinates to facilitate vector analysis. A unique graphical method of arriving at the rms value of a complex wave from its polar coordinates is given. All in all, there is a great deal of interest in these two chapters for engineers dealing with oscillograms.

Chapter III deals with the effect of iron on complex waves. Saturation, apparent inductance, hysteresis, harmonic generation, iron losses, etc., are treated in some detail and in a very readable manner.

Chapter IV has to do with the effect of varying circuit conditions. One interesting point discussed in this chapter deals with the change in power factor in a purely resistive circuit brought about by a cyclically-variable resistance. The effect of pulsating inductance and capacity in complex waves is also treated in some detail.

Chapter V deals with harmonics in polyphase systems and is of somewhat less interest to the communication engineer. However, there is some nourishment even in this chapter for the engineer concerned with wired radio on power systems.

The last chapter is probably the most interesting of all. It deals entirely with harmonic analysis. It naturally starts with Fourier's Series, which is discussed at some length. Other methods of analysis, which will be new to many of the engineering fraternity who have been accustomed to the Fischer-Hinnen method, are Perry's method, Thompson-Runge method, Kemp's method, Clayton's method, Wedmore's graphical method, and Russell's method. The value, accuracy, and general practicability of the various methods are analyzed and compared.

A very complete bibliography adds considerably to the value of this work and permits the reader to glean more detail on most of the subjects discussed. All in all, *Theory of Alternating Current Wave Forms* is to be recommended for those engineers interested in analysis of complex waves.

RMA CONVENTION

(*Continued from page* 10)

funds for national sales promotion were voted by the RMA directors. Chairman Powel Crosley of the Sales Promotion Committee reported substantial success and need for enlargement of the RMA promotion projects.

OFFICERS AND DIRECTORS

The present RMA organization was continued for the coming year. In addition to President Muter, other officers and directors were reelected including Fred D. Williams of Philadelphia as treasurer; Bond Geddes of Washington, D. C., executive vice president-general manager and secretary, and John W. Van Allen of Buffalo, as general counsel.

Arthur T. Murray of Springfield, Mass., was reelected vice-president and chairman of the Set Division, and Arthur Moss of New York vice-president and chairman of the Parts, Cabinet and Accessory Division. Two new RMA directors are Roy Burlew of Owensboro, Ky., succeeding S. W. Muldowny of New York, and Henry C. Forster of Chicago who succeeds Richard A. O'Connor of Fort Wayne, Indiana. Ben G. Erskine of New York was named a vice-president and chairman of the Tube Division. Director Forster also was elected a vice-president and chairman of the Amplifier and Sound Equipment Division.

Directors George A. Scoville of Rochester, N.Y.; A. H. Gardner of Buffalo; W. R. G. Baker of Camden, N. J., and A. S. Wells of Chicago were reelected for three-year terms from the Set Division. Also Directors Arthur Moss of New York and N. P. Bloom of Louisville, Ky., were reelected the directors from the Parts, Cabinet and Accessory Division.

President Muter continued all RMA committee chairmen, as follows:

Credit Committee — Arthur Moss, chairman; Engineering Committee—W. R. G. Baker, chairman; Legislative Committee—Paul B. Klugh, chairman; Membership Committee—Ben Abrams, chairman; Trade Promotion Committee —Powel Crosley, chairman; Traffic Committee—J. C. Warner, chairman.

NEW EXPORT COMMITTEE

To further develop radio export trade, a new export committee was authorized by the Set Division and Board of Directors. Under Chairman Murray of the Division, the export committee will be headed actively by Vice Chairman E. G. Hefter of Chicago. An initial meeting of a large group of export managers was held June 13.

Another largely attended meeting during the convention was of the RMA Service Section. Chairman F. B. Ostman of Camden. N. J., and associates planned many new features for improving radio service.

Metal-Tube Characteristics

The characteristics, typical operating conditions, and detail drawings of the ten types of metal tubes released by RCA Radiotron. The data on the 6L7 pentagrid mixer amplifier, and the 6H6 diode, is of particular significance. Both these types offer improved operating characteristics

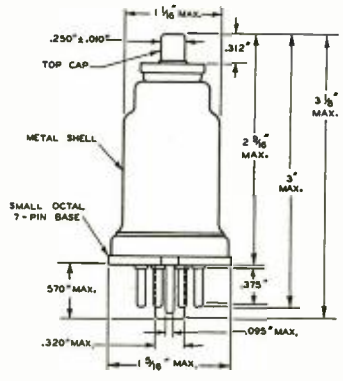
RCA-6L7

PENTAGRID MIXER AMPLIFIER

Heater Voltage (A-C or D-C)..6.3 Volts
Heater Current ..... 0.3 Ampere
Maximum Overall Length .....3⅛"
Maximum Diameter.....1-5/16"
Cap ..... Miniature
Base ..... Small Octal 7-Pin

Mixer Operation

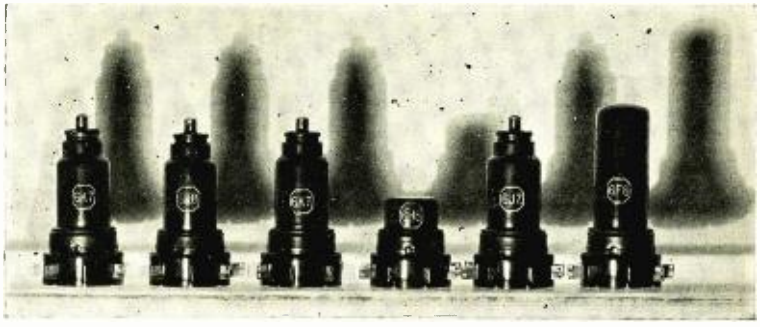
Plate Voltage ..... 250 max. Volts
Screen (Grids No. 2 and 4) Voltage—
150 max. Volts
Typical Operation:
Heater Voltage ..... 6.3 Volts
Plate Voltage ..... 250 Volts
Screen Voltage ..... 150 Volts
Control Grid (Grid No. 1) Voltage—
—6 min. Volts
Control Grid (Grid No. 3) Voltage—
—20 approx. Volts
Peak Oscillator Voltage applied to Grid No. 3.....25 approx. Volts
Plate Current ..... 3.5 Milliamperes
Screen Current .....8.0 Milliamperes
Plate Resistance—
Greater than 2 Megohms
Conversion Conductance...325 Micromhos
Conversion Conductance at —45 volts bias on Grid No. 3.....2 Micromhos



Mechanical details of the 6L7.

Amplifier Operation

Heater Voltage ..... 6.3 Volts
Plate Voltage ..... 250 max. Volts
Screen (Grids No. 2 and 4) Voltage—
100 max. Volts
Control Grid (Grid No. 1) Voltage—
—3 min. Volts
Control Grid (Grid No. 3) Voltage—
—3 Volts
Plate Current ..... 5.3 Milliamperes
Screen Current ..... 5.5 Milliamperes
Plate Resistance ..... 0.8 Megohm



Typical metal tube line-up . . . this is the tube complement for the new Remler auto-radio receiver.

Mutual Conductance .... 1100 Micromhos
Mutual Conductance at—
—21 volts bias on Grid No. 1
—12 volts bias on Grid No. 3
10 Micromhos

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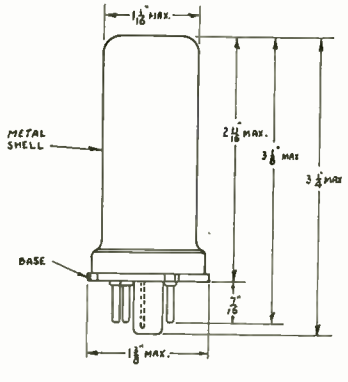
RCA-6D5

POWER AMPLIFIER TRIODE

Heater Voltage (A-C or D-C)..6.3 Volts
Heater Current .....0.7 Ampere
Maximum Overall Length.....3-1/4"
Maximum Diameter.....1-3/8"
Base .....Small Octal 6-Pin

As Single-Tube Class A Amplifier

Heater Voltage .....6.3 Volts
Plate Voltage.....275 max. Volts
Grid Voltage ..... —40 Volts
Plate Current.....31 Milliamperes
Plate Resistance.....2250 Ohms
Amplification Factor.....4.7
Mutual Conductance.....2100 Micromhos
Load Resistance .....7200 Ohms
Undistorted Power Output.....1.4 Watts



Outline drawing of the 6D5.

As Push-Pull Class AB Amplifier (Two Tubes)

Heater Voltage.....6.3 Volts
Plate Voltage.....300 max. Volts
Grid Voltage (Fixed Bias)... —50 Volts
Plate Current (Per Tube)
23 Milliamperes
Load Resistance (Plate to Plate)
5300 Ohms
Power Output .....5 Watts

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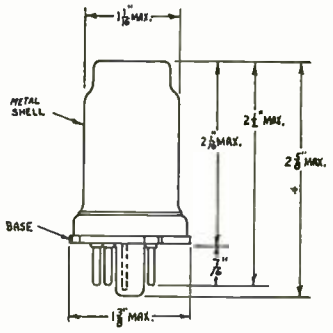
RCA-6C5

DETECTOR AMPLIFIER TRIODE

Heater Voltage (A-C or D-C) .....6.3 Volts
Heater Current.....0.3 Ampere
Plate Voltage .....250 max. Volts
Grid Voltage ..... —8 Volts



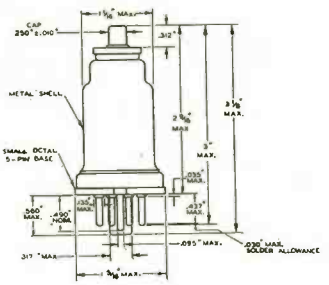
Details of the 6C5.

Plate Current.....8 Milliamperes
Plate Resistance.....10,000 Ohms
Amplification Factor 20
Mutual Conductance.....2000 Micromhos
Maximum Overall Length.....2-5/8"
Maximum Diameter .....1-3/8"
Base .....Small Octal 6-Pin

RCA-6F5

HIGH-MU TRIODE

Heater Voltage (A-C or D-C)..6.3 Volts
Heater Current .....0.3 Ampere
Plate Voltage.....250 max. Volts
Grid Voltage .....—2 Volts
Plate Current .....0.9 Milliampere



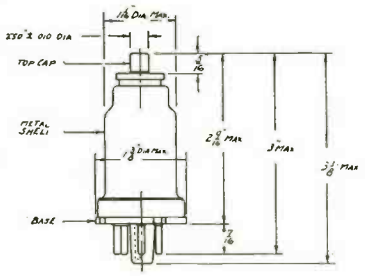
Dimensions for the 6F5.

Plate Resistance .....66,000 Ohms
Amplification Factor 100
Mutual Conductance .....1500 Micromhos
Maximum Overall Length.....3⅛"
Maximum Diameter .....1-5/16"
Cap ..... Miniature
Base .....Small Octal 5-Pin

RCA-6K7

TRIPLE-GRID SUPER-CONTROL AMPLIFIER

Heater Voltage (A-C or D-C)..6.3 Volts
Heater Current ..... 0.3 Ampere
Plate Voltage ..... 250 max. Volts



Details of 6J7 and 6K7.

Screen Voltage (Grid No. 2)..100° Volts
Grid Voltage (Grid No. 1). —3 min. Volts
Suppressor (Grid No. 3)—
Connected to cathode at socket
Plate Current ..... 7.0 Milliamperes
Screen Current ..... 1.7 Milliamperes
Plate Resistance ..... 0.8 Megohm
Amplification Factor 1160
Mutual Conductance .... 1450 Micromhos
Grid Voltage* ..... —35 Volts
Grid Voltage** ..... —42.5 Volts
Maximum Overall Length.....3⅛"
Maximum Diameter ..... 1⅜"
Cap ..... Miniature
Base ..... Small Octal 7-Pin

* For mutual conductance of 10 micromhos.
** For mutual conductance of 2 micromhos.
° Maximum Screen Volts = 125.

RCA-6J7

TRIPLE-GRID DETECTOR AMPLIFIER

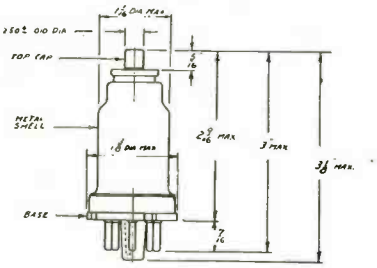
Heater Voltage ..... 6.3 Volts
Heater Current ..... 0.3 Ampere
Plate Voltage ..... 250 max. Volts
Screen Voltage (Grid No. 2)..100* Volts
Grid Voltage (Grid No. 1)..... —3 Volts
Suppressor (Grid No. 3)—
Connected to cathode at socket
Plate Current ..... 2 Milliamperes
Screen Current ..... 0.5 Milliampere
Plate Resistance—
Greater than 1.5 Megohms
Amplification Factor .. Greater than 1500
Mutual Conductance .... 1225 Micromhos
Maximum Overall Length.....3⅛"
Maximum Diameter ..... 1⅜"
Cap ..... Miniature
Base ..... Small Octal 7-Pin

*Maximum Screen Volts = 125.

RCA-6A8

PENTAGRID CONVERTER

Heater Voltage (A-C or D-C)..6.3 Volts
Heater Current .....0.3 Ampere
Plate Voltage.....250 max. Volts
Screen Voltage (Grids No. 3 and No. 5).....100 max. Volts
Anode-Grid Voltage (Grid No. 2).....200 max. Volts



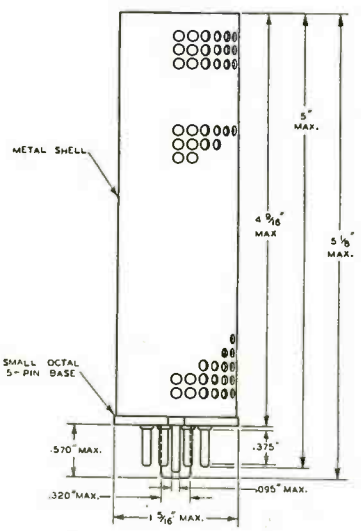
Details of 6A8 pentagrid converter.

Control-Grid Voltage (Grid No. 4)..... —3 min. Volts
Total Cathode Current
14 max. Milliamperes
Maximum Overall Length.....3-1/8"
Maximum Diameter.....1-3/8"
Cap ..... Miniature
Base .....Small Octal 8-Pin

RCA-5Z4

FULL-WAVE HIGH-VACUUM RECTIFIER

Heater Voltage.....5.0 Volts
Heater Current.....2.0 Amperes



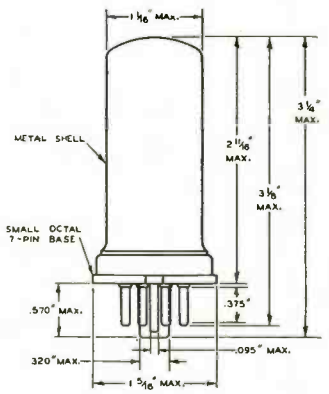
Outline drawing of 5Z4 rectifier

A-C Plate Voltage Per Plate (RMS) .....400 max. Volts
Peak Inverse Voltage....1100 max. Volts
D-C Output Current
125 max. Milliamperes
Maximum Overall Length.....5-1/8"
Maximum Diameter.....1-5/16"
Base .....Small Octal 5-Pin

RCA-6F6

POWER AMPLIFIER PENTODE

Heater Voltage (A-C or D-C)..6.3 Volts
Heater Current.....0.7 Ampere
Maximum Overall Length.....3¼"
Maximum Diameter .....1-5/16"
Base ..... Small Octal 7-Pin



Details of 6F6 power pentode.

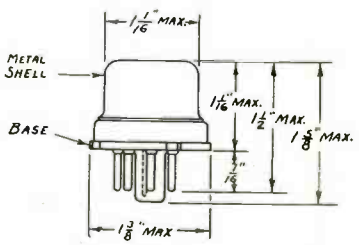
Class A Amplifier

Heater Voltage .....6.3 Volts
Plate Voltage .....250 max. Volts
Screen Voltage.....250 max. Volts
Grid Voltage .....—16.5 Volts
Plate Current .....34 Milliamperes
Screen Current ..... 6.5 Milliamperes
Plate Resistance ....100,000 approx. Ohms
Amplification Factor ..... 220 approx.
Mutual Conductance ....2200 Micromhos
Load Resistance ..... 7000 Ohms
Total Harmonic Distortion.....7 Percent
Power Output ..... 3 Watts

RCA-6H6

TWIN DIODE

Heater Voltage ..... 6.3 Volts
Heater Current ..... 0.3 Ampere
A-C Voltage per Plate (RMS)—
100 max. Volts



The 6H6 twin diode.

D-C Output Current, 2 max. Milliamperes
Maximum Overall Length.....1⅝"
Maximum Diameter ..... 1⅜"
Base .....Small Octal 7-Pin

Notes on Foreign Radio Practice

Recent Reports Relative to Markets, Administration and Design

RADIO IN PARIS TAXIS

TAXIS EQUIPPED with small radio sets which appeared recently in Paris have met with great success. At present there are 5000 of these taxis running, and many others are being equipped. One hundred francs per year is paid by the taxi companies to the government for each one of these radio sets installed in their taxis. (*Assistant Trade Commissioner Lestrade Brown, May 10, 1935*).

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PROPOSED CHANGE IN FRENCH RADIO LICENSING

SOME TIME AGO, the Ministry of Commerce proposed doing away with the existing Radio Licensing Committee, the president of which, Mr. A. M. Brace, was designated by the American Chamber of Commerce, and to assign its functions to a regular Interprofessional Committee, but that, as a result of representations made by certain French importers, assurances were given that the present Committee would continue without change. Such being the case, no further developments were expected, but a letter from the Minister of Commerce pointed out that his Department had received various complaints with regard to the methods now employed in the allocation of licenses and suggesting certain specific changes in these methods. These are as follows:

1. The setting aside of 15 percent of the quota for new importers.

2. A reduction in the percentage reserved for American manufacturers and a proportional increase in the percentage allotted to importers. At present, each group receives an equal share of the total quota; namely, 43 percent.

3. Representation of the importers of French nationality on the Committee.

4. The granting of benefits to importers of French nationality, such as forbidding American exporters to transfer their agencies from their present representatives, except to firms which can be proved to be effectively French and, as a corollary, forbidding American firms to appoint co-agents or sub-agents for a portion of their exports, except to firms likewise effectively French.

Mr. Brace has revealed that on October 17 his Committee agreed:

1. To raise the reserve set aside for new importers from 10 to 15 percent.

2. Instead of the present equal share in the allotments to importers and American manufacturers, to accord the importers 60 percent and American manufacturers 40 percent of the reserved amount.

3. To revamp the Committee as follows:

PRESENT COMPOSITION

One member delegated by the Chamber of Commerce.
Two French manufacturers.
Two importers-distributors:
(*a*) *President of the Importers' Syndicate (American).*
(*b*) *A second member of the Importers' Syndicate (Spanish).*

PROPOSED COMPOSITION

One member delegated by the Chamber of Commerce.
Two French manufacturers.
Two importers-distributors:
(*a*) *President of the Importers' Syndicate (whatever nationality).*
(*b*) *A French representative of the Syndicate.*

In regard to the fourth request of the Ministry of Commerce, it was stated that the Director of Industrial and Commercial Affairs at the Ministry had intimated that this demand of this Department is exaggerated, and upon the expressed opposition of the Licensing Committee would be withdrawn. Accordingly, the Licensing Committee presented a letter to the Ministry of Commerce objecting to request No. 4 and offering an adjustment of the three other points. (*Electrical Division, Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce*)

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INDIAN RADIO MARKET IMPROVES

AN APPRECIABLE IMPROVEMENT in the sale of radios in India has been reported, according to the Electrical Division, Department of Commerce. This was particularly true of American receivers. The improvement, though to some extent seasonal, is also the result of a wide advertising drive.

A discount and bargaining process permeates the market in Bombay, despite the agitation carried on in the press. One American firm reduced prices of their most expensive sets during the trial period in sympathy with the "net price" policy, but later on switched back to their original prices, as, in their opinion, this move was not effective. Calcutta dealers continue to sell at list prices, and the discount evil is not prevalent in that market.

Total imports of wireless apparatus during the first two months of the December quarter more than doubled in value, amounting to Rs. 276,977 as compared with Rs. 125,609 during the same period of 1933. The United States' share of imports of wireless apparatus into India continues to improve month by month. During the first two months of the December quarter imports from the United States amounted to Rs. 121,-208, or 42 percent of total imports.

Imports from the United Kingdom, which has received a severe setback during the last two years, showed a substantial increase in November, the value amounting to Rs. 84,568 as compared to Rs. 22,675 in October and Rs. 45,323 in November, 1933. However, the United Kingdom continues to hold second place in imports of radio sets into India and market reports indicate that British sets are gradually becoming more popular.

Some distributors of American sets complain that owing to their principals being prone to change their models frequently and without sufficient notice they are faced with the difficulty of clearing the stock on hand.

The demand for combined short- and long-wave receivers is increasing, for many users formerly satisfied with obtaining local programs have evinced increased interest in endeavoring to obtain foreign broadcasters. A small increase in the inquiry for a-c, d-c sets is also reported.

Considerable difficulty is encountered due to the growing tendency of prospective buyers writing direct to the manufacturers in the United States and elsewhere, and sending their orders direct.

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LIST OF CZECHOSLOVAKIAN IMPORTERS AND DEALERS

A LIST of importers and dealers of radios and radio equipment in Czechoslovakia has been compiled by the Commercial Intelligence Division from data prepared and submitted by American consular officers abroad under the direction of the Secretary of State. Copies of this circular may be obtained from the Bureau of Foreign and Domestic Commerce or from its district and cooperative offices. Price 50 cents each. (*Electrical Division, Department of Commerce.*)

NO BAN ON ENGLISH AUTO RADIO

LESLIE HORE-BELISHA, the Minister of Transport, has written a letter to the Society of Motor Manufacturers and Traders to the effect that no evidence has been brought before him to indicate the necessity on grounds of public safety of prohibiting radio sets in cars. He has been for the past few months investigating claims for and against the use of radio sets in automobiles. No accidents have as yet been attributed to the fact that a radio was installed in a car. (*Assistant Trade Commissioner Henry E. Stebbins, London, May* 9, 1935).

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FRENCH RECEIVER DESIGN

AT PRESENT, there is a general feeling in France that the technical development of the radio broadcasting system has progressed to a point where, so far as the average public taste is concerned, the reception is good enough. This is due to the fact, according to French radio engineers, that broadcast stations are approximately two years ahead of radio receivers. The attitude in general of the French manufacturer is not to expend any unnecessary funds in order to improve the present radio, as this would entail an increase in overhead which would, of course, have to be carried on to the set, and the prices at the present time are at the lowest possible level in order to meet an increase in competition, not only from the home-manufactured set, but also from imported sets.

It would seem that there has been very little progress made as regards technical improvement in broadcasting in the past 4 or 5 years. The principal improvements made from the time of the earphone and crystal detectors were the superheterodyne, which has been adopted in France, radio-frequency amplifiers. alternating-current tubes, tone controls, automatic volume controls. automatic intercarrier noise suppression. dual tubes, variable-mu tubes and improvements in selectivity; the latter, which is most important in France, due to the fact that there are numerous stations and the interval between two stations is only 9 kilocycles. Regardless of these improvements, which have been giving better electrical performance. radio receivers still sound about the same as they did 4 or 5 years ago, and in some cases, not as good.

Radio manufacturers in France have concentrated more on making sets easier to operate and at the same time have endeavored to reduce the cost. At the present time, although French radio engineers are well acquainted with high fidelity, it is practically unknown and unused in the trade.

Radio receivers in France are built to handle 150 to 3,000 cycles; these are usually the cheaper sets, while the better sets accommodate from 60 up to 5,500 or 6,000 cycles, which in this case is considered quite good. On the other hand, transmitting equipment meets required standards for 50 to 9,000 cycles.

On the basis of the 50 to 8,000 cycle high-fidelity range, it would seem that at present American receivers will not find this characteristic of great sales value. (*Assistant Trade Commissioner Lestrade Brown, Paris, May* 8, 1935).

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PHILIPS RADIO PATENT ACTIVITIES

Consul Walter A. Foote, Batavia

THERE HAVE BEEN three patent decisions by Netherland Indian courts against American radio manufacturing concerns and in favor of the N. V. Philips Gloeilampenfabrieken.

The first one of these decisions is that in the case of Philips versus two different defendants: (1) an American mail order radio house, and (2) a Batavia firm. The decision was rendered by the President of the Court of Justice in Batavia during the second week of April, 1934. The President found the American company guilty of patent infringement since it had brought radios embodying principles covered by patents held by Philips into the trade of Netherland India, and prohibited further shipments by this company to this country on pain of damages. With regard to the second defendant, the President found insufficient evidence to establish that the Patent Law had been violated.

The second decision consists of the temporary court order granted by the President of the Court of Justice in Batavia at the request of the legal representative of Philips prohibiting another American mail order radio firm from introducing its radio apparatus into Netherland India on pain of damages, the ground being that this apparatus embodies principles covered by patents held by Philips and that the company has already violated the Patent Law by delivering such apparatus to various persons in Netherland India. This decision is still standing but has not yet been made permanent since the legal representative in Batavia of the American company has not yet made his plea for its cancellation.

The third decision is one very similar to the foregoing one, but issued by the President of the Court of Justice in Semarang. In spite of the plea of the legal representative of the American company for cancellation, this restraining order was made permanent on November 30, 1934. In arriving at his decision, the President of the Court of Justice relied upon the testimony of an expert to the effect that the apparatus did in fact include a device covered by a patent held by Philips, and did not admit as evidence the testimony of an expert submitted by the defense to the effect that the device involved was not actually covered by the patent in question.

In all three decisions, there seems to have been no doubt in the minds of the judges that the importation by amateurs for their own use of the apparatus in question did not prevent the application of the Patent Law to that apparatus. Likewise, it is notable that the arguments for the defense seem never to have touched upon the question as to the right of a Netherland Indian court to accept suits against a foreign company *in absentis* for alleged wrongful acts committed in another country.

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RADIO MARKET IN GREECE

DURING THE opening months of 1935 radio sales in Greece were very satisfactory, but the revolutionary outbreak in March brought them to a standstill. It was not until several weeks after the revolt had been suppressed that interest in radio receiving sets was revived, although sales have since remained at a low level, owing to seasonal influences. The active season for radio sales in Greece is from October through April. During the hot summer months reception deteriorates and there is a tendency on the part of the public to defer buying until the fall, when new models incorporating the latest improvements are usually brought out.

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CANADIAN RADIO SALES DATA

CANADIAN RADIO SALES data as compiled by the Radio Manufacturers Association of Canada, reveals that highly satisfactory demand for battery sets and continued expansion of the market for automobile-radio sets almost counterbalance the seasonal decline for a-c models. Total sales to dealers in April numbered 8,877 valued at list prices at $762,412 as compared with 8,966 units and $791,718 in the preceding month. Automobile sets, sales of which numbered 2,010 units, represent an increase of 365, a gain of approximately 25 percent. A generally lower trend in prices of automobile sets is indicated by the fact that in March average list value of sales was $70.40, in April the average was slightly less than $62.

Sales of battery sets in April numbered 1,224 as compared with 778 the previous month and prices appear to have been maintained. Alternating-current set sales were 900 smaller than in March.

Projected production May 1 to June 30, as reported by members of the Radio Manufacturers Association totalled 24,314 sets. Manufacturers will concentrate on dual-wave chassis, a-c chassis but in battery sets more than half a production will be Standard-Band sets. *Electrical Division, Department of Commerce.*

Design .. NOTES AND

THE RADIO ENGINEER'S PLACE IN INDUSTRY

TO USE THE WORDS of Mr. Bassett Jones, "an engineer is a man trained to base intelligent guesses on insufficient data." He is a seeker of facts and of truths based on natural laws and their applications.

Since the engineer bases his judgment on experiences and on events which can be reproduced, his deductions must naturally be founded on detailed analysis of events which have come under his observation or which have been observed and recorded by others in the same or allied professions. Events, of course, do not lie, but they are often misinterpreted. It is the engineer's business to avoid misinterpretations. As Leonardo da Vinci so aptly put it, "experience is never at fault, it is only our judgment that is fallacious, promising effects which are not indicated by experience."

It is obvious that an engineer cannot know all of the laws of nature and their immediate consequences. As a result his training must include a knowledge of where to find the facts pertaining to the particular problem with which he is confronted. An engineer can no more be expected to remember all of the necessary facts with which he is likely to deal than can a composer be expected to have in mind all previous musical scores. However, it is not to be inferred that the engineer's knowledge is simply a neatly arranged card file of timely references and a few hard facts, but rather that his immediate store of knowledge must necessarily be extremely small in comparison with the facts which he must use.

It is interesting to examine records of engineering graduates over a period of years prior to 1930. One survey, covering a period of fifty years, indicates that on the average over 60 percent of all engineering graduates remain in their chosen field and that only 15 percent enter non-engineering activities. Probably in no other profession, including medicine, is the percentage of graduates who continue in their field greater than this.

It is, of course, inevitable that as an engineer gains in experience the probability of his assuming executive duties is greater. However, this does not mean that he withdraws from the field of engineering endeavor, but rather that he is called upon to supervise the efforts of younger men. At first this may only mean a greater output, but eventually it leads to isolation from the actual practice of his profession. Engineers can and do become managers, business men, promoters, statesmen, etc., and in many instances give extremely good accounts of themselves. Such men as Herbert Hoover make us realize that men who once have been involved in the actual practice of engineering have been able to use their training to excellent advantage in fields considerably removed from their professional activities.

Since the engineer's scientific training teaches him to deal with the laws of nature, the question naturally arises as to whether he should also have business training to teach him to deal with men, money and the legal rules relating thereto. In other words, would a business training develop in the engineer a broad view of his relations to other professional men and place him in a position to engage their services rather than to act as their agent?

It is often contended that managerial positions of importance should be properly held by the engineer who has designed the plant, keeping clearly in mind the financial side of construction, operation and maintenance, rather than by some other person who has had business or legal training alone. Indeed, Mr. Onward Bates has said: "The engineer is frequently the tool of those whose aim it is to control men and to profit by their knowledge, a servant where he should be a master. He should be a manager. It should not be considered unprofessional for an engineer to be a capitalist and take his proper place as promoter and organizer and share in the profits of engineering enterprises. He has not reached his proper rank until he manages as well as designs and supervises engineering works. A better position will be secured whenever an engineer makes it his business to study men as well as materials, and to use men as he does machinery."

Instances in which radio engineers have entered the manufacturing field and became owner-managers of sizable corporations are sufficiently numerous to need no mention here. Their number, however, is a relatively small percentage of the total who were engaged in similar activities at the same time. It should not be inferred, though, that because a mere handful of engineers have been successful as business managers that the same holds true for the majority of the profession. The engineer is trained in logical deduction and reasoning, is thoroughly grounded in rigid scientific principles and taught to think consecutively. It might appear that he should obtain results commensurate with those of business men if he applies his logically-trained mind to business and economic problems with the same diligence that he exercises in his purely engineering functions. Indeed, many so-called business men have had no systematic instruction in business methods but have absorbed their knowledge from business contacts and from the atmosphere in which they move. As a result, many business men know less of the laws of business than of their usages and customs.

The question of why the majority of engineers remain in their profession naturally arises. It would appear that we need not go very far for the answer. Before the student enters the study of engineering he has made the decision of whether he will dedicate his life to the service of humanity or whether he will apply his talent in building up a fortune of his own. Had he chosen the latter course he might, of course, have studied engineering and, after graduation, embarked upon a business career. No doubt this actually occurs in some instances. On the other hand, the engineer who studies and practices engineering because it is at once his vocation and his avocation has already dedicated his life to searching for facts and applying them for the betterment of humanity. Consequently his interest lies in the fruits of his endeavors rather than in their commercial success. Most radio engineers point to the performance of their product with pride rather than to the number of units consumed by the public. This obviously is not the point of view of the business man or the manager whose interest lies in commercial exploitation. Obviously these two ideas are not entirely compatible, since excellence of performance alone by no means spells commercial success. It might, of course, be argued that a compromise between performance and costs would and does in many cases provide for commercial success. Unhappily this is too often not the case.

We live in an age of specialization in which the jack-of-all-trades is largely a man of the past. If this be the case it would seem that we need technically-trained engineers to do the engineering, and business executives trained in the laws and customs of business practice to fill managerial positions.

Few men are so versatile that they can be successful in more than one line of endeavor. It would hardly appear

COMMENT . . *Production*

then that the majority of technically-trained engineers can be expected to assume managerial positions for which they have had no training, except that of orderly and organized analysis of the problem in hand.

Surely business demands more than this. No doubt a small percentage of engineers will continue to enter the business field. It is contended here, however, that a man who spends the better years of his life in the study and active practice of the engineering profession is better fitted to carry on in the technical field than to enter an entirely new field in which he has had no previous experience. Undoubtedly business executives could benefit if part of their training had to do with the study of engineering. It would seem, though, that a man should choose his career early in life and, if he succeeds at his calling, stick with it to the bitter end. Only in this way can we expect better organized business and greater technical achievement.

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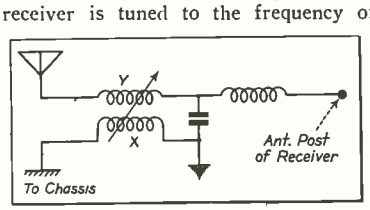
NOISE SUPPRESSION IN AUTO RADIOS

DURING THE PAST year there has been a tendency among the manufacturers of automobile-radio receivers toward the elimination of spark-plug suppressors. Among the circuits employed to reduce interference have been band-pass filters, with a pass band covering the broadcast frequencies, inserted between the antenna and the radio receiver. This circuit arrangement which is used in RCA and General Electric models reduces materially all noise components outside the broadcast band. This tends to reduce the effect of shock excitation by limiting the frequency band. In effect this type of circuit tends to knock the corners off the high peaks of the interference which finds its way into the radio receiver by the way of the antenna circuit.

Another arrangement which has been extensively used by Motorola is called the Magic Eliminode. This arrangement, shown, consists of a phase-balancing circuit. In general the procedure lies in applying the usual methods of reducing car interference. After these measures have been applied, the receiver is tuned to the frequency of maximum interference and the coupling between coils X and Y adjusted until the interference is a minimum. Voltage for coil X is picked up on the car chassis at some suitable point which will provide a sufficient amount of noise for balancing purposes. Of course this has a negligible effect on the signal, since no signal can be picked up by the noise antenna.



Another factor of considerable importance in quiet automobile-radio reception lies in the care in which the radio receivers are shielded and isolated by filters. For example, it is now quite customary to insulate the flexible shafts used for controls to prevent interference finding its way into the set via the shafting. Each of the leads leaving the receiver, whether they be volume-control or battery leads, are also carefully filtered with chokes and condensers.

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R-F DISTRIBUTION FOR PRODUCTION TESTING

LARGE-SCALE PRODUCTION of all-wave receivers would ordinarily require a large number of all-wave signal generators and expensive attenuators. It is readily seen that the production of many units per day might require an unwarranted expenditure for test equipment. Moreover, since the modern all-wave receivers must have reasonably accurate calibration, it is essential that the frequency calibration of all signal generators not only be accurate but also be alike. Otherwise the calibration tolerance of the receivers might vary considerably. This, of course, implies considerable maintenance.

To reduce the expenditure for equipment and maintenance it is now becoming customary in large plants to install a central generating station connected to each test position through one or more radio-frequency transmission lines. This permits the use of one carefully stabilized signal generator for each frequency. In some cases the generators are crystal controlled to insure accuracy of calibration. Ordinarily each signal generator is connected to the transmission line through a narrow band-pass filter to prevent modulation difficulties. In general each signal generator is modulated with an audio-frequency tone. Sometimes a separate transmission line is used for each frequency, thus eliminating the necessity of band-pass filters. Each test position is provided with an attenuator and a series of switches for connecting to the separate transmission lines if more than one is used. Such attenuators must of course be very carefully constructed and shielded. In addition careful maintenance of the attenuators is required.

Recent interest in all-wave antenna systems has greatly facilitated the development of radio-frequency distribution systems. This applies not only to the transmission lines themselves, but also to the coupling and attenuating networks.

A distribution system of this sort has been in use for some time in the plant of the Emerson Radio & Phonograph Corporation in New York City. In this system six signal generators centrally located feed a single shielded and balanced transmission line. A doublet antenna feeds a second shielded and balanced transmission line. Each test position is connected by means of a switch to either transmission line at will through a coupling tube and attenuator. The use of a coupling tube permits each test position to operate independently of the other and prevents the possibility of impedance irregularities or large losses being introduced into the line through accidental adjustments or otherwise.

It seems highly probable that the standards of accuracy that have been set up will make it necessary for manufacturers of all-wave receivers, regardless of size or economy, to invest in plants of this sort.

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IRON-CORE I-F TRANSFORMERS

A GREAT DEAL OF effort and some expense has been incurred in the past in the development of high Q i-f coils by the process of using more cross-overs per turn as well as multi-winding coils. With the development of iron-core i-f transformers even higher Q's are attainable without resorting to time-consuming and expensive methods. It is understood that the gain per stage for a given type of coil and shield can be nearly doubled by the use of iron cores. While this is, of course, an important feature, it is probably of lesser importance than the gain in selectivity which may be had by their use. Close-up selectivity can sometimes be increased from two to five times by the use of iron-core transformers. This is a matter of great importance in all-wave receivers.

Another feature of iron-core transformers lies in the high impedance, i. e.,

$$L/CR$$

which may be obtained over that of the conventional air-core coil. This is of especial value for coupling to the modulator plate circuit in which the gain is proportional to the impedance of the tuned circuit.

· RMA NEWS ·

FEDERAL EXCISE TAXES CONTINUE TWO YEARS

WITHOUT INCREASE in present rates, federal excise taxes including the 5 percent radio, 2 percent automotive, and 5 percent tax on electrical refrigerators will be continued for another two years. All were due to expire on June 30 but now are continued until June 30, 1937. Since the 5 percent radio tax became effective, June 20, 1932, radio manufacturers have paid up to May 30, 1935, total excise taxes of $8,788,559.71.

Revenue necessities of the government prompted the administration to continue the excise or "nuisance" taxes. President Roosevelt in his address opening Congress last January recommended their continuance. The administration resolution was passed by the House of Representatives without hearings by the Ways and Means Committee and under the "gag" rule, on June 17. The Senate passed the resolution June 26. There was no possibility of securing any reduction or change in the existing radio tax, but the RMA strongly opposed any increase of the 5 percent rate.

Expectations of the Treasury Department of continued good business for the radio industry, also sales of mechanical refrigerators and, in fact, of most business subject to the excise taxes were disclosed in the congressional proceedings. Citing revenue of $3,150,000 secured from the radio tax during the fiscal year ending June 30, 1934, the Treasury estimated receipts of $3,583,000 from radio taxes for the fiscal year ending June 30 next, and $3,700,000 from radio excise taxes for the fiscal year ending June 30, 1936. The latter is an estimated increase of 3.3 percent over the present fiscal year. The Treasury estimated that an increase of only 2 percent of automobile sales might be expected for the fiscal year 1936, and 4 percent increase from sales of electrical refrigerators.

MAY, 1935, EXCISE TAXES

U. S. Treasury collections of the 5 percent excise taxes from radio and phonograph manufacturers during May 1935, according to the official report of the Internal Revenue Bureau, were $291,536.71, as compared with $234,010.60 during May 1934.

APRIL EXPORTS

Radio exports during April 1935, according to the last report of the Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce, reported foreign sales of 47,980 receiving sets, valued at $1,250,530; 551,280 tubes, valued at $236,020; 8,595 speakers, valued at $20,134; parts and accessories, valued at $331,275; and transmitting apparatus, valued at $100,739.

Mexico, Brazil, Cuba and Colombia continued the largest purchasers in Latin America during April, while Great Britain, Spain, France and Portugal continued as the largest European customers.

RADIO EMPLOYMENT INDICES

The April report of the U. S. Department of Labor, Bureau of Labor Statistics, on radio factory employment, showed a continual slight seasonal decrease in employment and payrolls, but with increased employee earnings.

For the month ending April 15, 1935, forty-eight radio and phonograph establishments reported employment of 30,499 employees, compared with 32,387 employees by the same number of companies during the preceding month of March. No wage increases were reported during April.

The employment decrease during April was 3.5 percent compared with the preceding month, but 182.4 percent over the official comparative three-year average of 1923-25.

Radio payrolls during April 1935 decreased 3.3 percent as compared with the previous month and were 1.7 percent less than those of April 1934.

Per capita weekly earnings in radio factories reported during April 1935 were $18.63, an increase of .2 percent, compared with the weekly earnings of $18.50 during March 1935, but were 7.9 percent above those of April 1934.

Average hours worked per week during April 1935 were 32.9, a decrease of .9 percent as compared with the previous month.

Average hourly earnings of radio factory employees during April 1935 were 56.7 cents, compared with 55.7 cents in March 1935, an increase of 1.3 percent, and also an increase of 6.8 percent over average hourly earnings during April 1934.

RMA ORGANIZATION AND WORK CONTINUES

With few changes in personnel of the RMA organization and without lapse or lost motion in any RMA activity, following the annual Association convention in Chicago, June 11-13, and reelection of President Leslie F. Muter, all work of the Association is going forward. Its four divisions, of set, tube, parts and sound equipment manufacturers, have been completely organized since the convention and all activities continued.

In the RMA engineering branch, one of its most important functions, Dr. W. R. G. Baker, committee chairman, has reappointed Virgil M. Graham of Rochester as chairman of the Standards Section; L. F. Curtis of Springfield, Mass., as chairman of the Safety Section; and F. B. Ostman of Camden, N. J., as chairman of the Service Section. Committee chairmen and personnel of the Standards Section also are generally being continued so that the many engineering matters may continue without interruption.

RMA traffic service also is being continued under Chairman J. C. Warner who has reappointed O. J. Davies of Camden, N. J., as vice chairman and in active charge of numerous pending traffic and rate reduction matters.

Meetings of the Eastern and Western Credit Committees were held June 25, respectively, at New York and Chicago in cooperation with the National Credit Office and under the continued direction of Vice Chairman Ed Metzger of the Eastern Committee, and Vice Chairman P. C. Lenz of the Western Committee who have been reappointed by Arthur Moss of New York, general chairman of the Association's credit and collection services for members.

ANOTHER "LUXURY" TAX DEFEATED

A bill in California which proposed a special "luxury" tax of 10 percent on radio sets and parts has been defeated, according to reports to RMA which opposed this and similar bills in a number of state legislatures. Defeat of the California bill made a clear record for the RMA legislative committee, of which Paul B. Klugh of Chicago is chairman, for the year in successful opposition to anti-radio legislation. Although forty-four state legislatures have held sessions during the past year, every bill opposed by the RMA was defeated, including a number of measures which proposed special taxation of radio and a bill in Connecticut which sought to prohibit automotive radio.

CANADIAN RMA REORGANIZED

Canadian radio manufacturers at their annual meeting May 30 in Toronto reorganized their trade association and followed substantial features of the American RMA. President A. S. Edgar was reelected to head the Canadian RMA and R. A. Hackbusch was reelected director of engineering. The RMA division organization was followed by the Canadian manufacturers. Their new organization comprises a Set Division and a Parts, Cabinet and Accessory Division, like that of the American association. Canadian importers, however, are eligible to membership of the latter division and the Canadian dues are on a higher basis than those of RMA.

APRIL SALES IN CANADA

The RMA is advised, through cooperation with the Canadian RMA, that Canadian sales of receiving sets for the month ending April 30, 1935, totaled 8,877 with a list value of $762,411. Of these 5,643 sets, valued at $532,506 were a-c sets; 1,224, valued at $105,312 were battery sets; and 2,010 automobile sets, valued at $124.-593, a decrease in a-c sets as compared with the previous month and a considerable increase in sales of battery and automotive sets.

Canadian manufacture inventories reported on April 30, 1935, were 28,077 a-c sets, 4,971 battery sets, and 3,243 automobile sets.

News Of The Industry

RCA TELEVISION RESEARCH

Plans for RCA's field test of high definition television to begin some time next year are being developed under the direction of an inter-company committee named recently by David Sarnoff, President of Radio Corporation of America.

The committee, headed by Dr. W. R. G. Baker, vice-president and general manager of the RCA-Victor division of RCA Manufacturing Company, Inc., will draw on the broadcasting, communication and manufacturing experience and resources of RCA in formulating the details of the field test. Five other leading authorities on radio and electronics who will serve with Dr. Baker in constituting RCA's Television Committee, are R. R. Beal, RCA research supervisor; C. W. Horn, director of research and development, and O. B. Hanson, chief engineer for the National Broadcasting Company; C. H. Taylor, vice-president in charge of engineering for RCA Communications, Inc.; and J. C. Warner, vice-president and general manager of the Radiotron division of RCA Manufacturing Company, Inc.

In a statement May 7 announcing RCA's plan to conduct a field test on high definition television, Mr. Sarnoff pointed out that from 12 to 15 months would be required for the construction of a transmitter and experimental receiving sets, and that then RCA would be in a position to test television possibilities under actual operating conditions.

"Nobody knows how long it will take to iron out some of the deep wrinkles in television as we know it today," Dr. Baker said following a meeting of the RCA committee. "We have made a great deal of progress in our research laboratories during the past three years, and we hope that the experience gained in the field test will enable us to determine more definitely the possibilities of television service with standards that will be acceptable to the American public. In the meantime there are innumerable problems both technical and non-technical that can only be solved through the operation of a controlled field test. We must study transmission and reception factors, we must design and redesign, build and rebuild apparatus, and we must evolve an entirely new broadcasting technique. While the difficulties are many, we are confident of the ultimate results."

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METALS AND PLASTICS EXHIBIT

On September 1, a permanent exhibit of metals and plastics will be opened at Rockefeller Center, New York, by Metal Products Exhibits, Inc.

The exhibition will be devoted wholly to the interests of those who specify and purchase materials and parts for industrial purposes. It will feature alloys, ferrous and non-ferrous metals, plastics, finished and semi-finished parts made from these materials, finishes for metals and plastics, manufacturing processes, designs, styling, etc. It will occupy the third floor of the International Building, the latest addition to the Rockefeller Center building program.

"SMALL PANEL INSTRUMENTS"

A new 8-page bulletin describing panel-type electrical measuring instruments has just been issued by the Weston Electrical Instrument Corporation, Newark, N. J. The bulletin includes specifications, dimensional drawings, illustrations and prices for the 2, 3 and 4-inch line of instruments in both the round and rectangular types.

Specifications are given for the following instruments: D-C: voltmeters, ammeters, milliammeters, microammeters, ohmmeters, volt-ohmmeters, high sensitivity microammeters. A-C: voltmeters, ammeters, milliammeters; A-C (rectifier type): voltmeters, milliammeters, microammeters; wattmeters; thermo-instruments.

Information concerning the new line of 3-inch rectangular panel instruments recently announced by the Weston organization is a feature of the bulletin.

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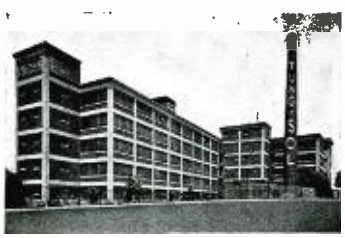
TUNG-SOL EXPANDS OPERATIONS

Tung-Sol Radio Tubes, Inc., and Tung-Sol Lamp Works, Inc., have more than tripled their usable manufacturing floor space through the purchase of a five-story factory building.

The new building is located at 370-386 Orange Street, Newark, N. J., on the new



subway as well as the cross-town bus and trolley route. Tung-Sol's new headquarters is of modern concrete and steel fireproof construction. Fenestra type windows provide excellent light for all manufacturing operations.

New machinery and equipment transferred from the Eighth Avenue factory will be put into operation as rapidly as possible without interrupting production or delaying orders. Both plants will continue to be occupied and the new space will serve to meet future demands for some time to come.

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CLEMENT APPOINTED VICE-PRESIDENT RCA VICTOR ENGINEERING, RESEARCH

Mr. E. T. Cunningham, President of the RCA Manufacturing Company, announced the appointment of Lewis M. Clement as Vice-President in charge of research and engineering for the RCA Victor Division of the Company.

Mr. Clement is one of the most widely known engineering executives in the radio art. He held his first important radio position in 1914, as Assistant Chief Engineer of the Bolinas, California, and Kahuku, Hawaii, transoceanic radio communications stations for the Marconi Wireless Telegraph Company, predecessor of the Radio Corporation of America. Two years later he joined the Bell Telephone Laboratories for whom he supervised the establishment of the first radio-telephone link, between Catalina Island and Los Angeles. During the war he was in charge of the design and development of all electrical-radio apparatus for use by the U. S. Government services.

In 1925, Mr. Clement became Chief Engineer of the Fada Radio Company, and three years later Vice-President and Chief Engineer of the Kolster Radio Company. Following this, he was for a year Assistant Manager of the Radio Department of the Westinghouse Electric and Manufacturing Company; then he became Chief Engineer for radio receivers, for the International Standard Electric Company, the manufacturing organization of the International Telegraph and Telephone Company. His duties in this capacity, which he maintained until his new RCA Victor appointment, consisted of engineering the radio receivers for eight foreign factories located in South America, Australia, Budapest, Vienna, Antwerp, London, Paris and Berlin.

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DR. IRVING LANGMUIR HONORED

The Holley Medal for 1934 was awarded on June 20, at the semi-annual meeting of the American Society of Mechanical Engineers at Cincinnati, Ohio, to Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, for his contributions to science and engineering, especially in the development of the gas-filled incandescent lamp, of the thoriated filament for thermionic emission, of atomic-hydrogen welding, of phase-control operation of the Thyratron tube, and in fundamental research in oil films.

The Holley Medal was instituted and endowed in 1924 by George I. Rockwood, past vice-president of the A. S. M. E., to be bestowed for some great and unique act of genius of engineering nature that has accomplished a great and timely public benefit. It was awarded to Hjalmar Gotfried Carlson in 1924; to Elmer Ambrose Sperry in 1928; and to Baron Chuzaburo Shiba in 1929.

Dr. Langmuir presented a paper at the meeting, entitled "The Mechanical Properties of Matter," in which he discussed the opportunities for men trained in physics to make vital contributions to industrial progress.

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CONSOLIDATED WIRE INCREASES SPACE

The Consolidated Wire & Associated Corporations, 512 South Peoria Street, Chicago, Illinois, have added a considerable amount of space to their present quarters, to take care of the increasing business they have enjoyed since the first of the year. Operations are now at full capacity, and with the seasonal increase in volume that will take place within the next few months, the additional space promises to be none too much.

With the new radio, electrical and wire items recently introduced, Consolidated claims to have the most complete variety in the field, enabling the jobber and distributor to purchase from a single source, with material savings in freight and handling.

AUSTRIAN APPOINTED SPECIAL PHOTOPHONE REPRESENTATIVE

Ralph B. Austrian, widely known radio and motion picture executive, has been appointed Special Representative for RCA Photophone, with headquarters at the company's 411 Fifth Avenue studios, according to an announcement by Edwin M. Hartley, RCA Photophone Manager of the RCA Manufacturing Company. In his new capacity, Mr. Austrian will maintain close contact with motion picture producers and theatre circuit operators in the East in connection with the marketing of the RCA high-fidelity systems of sound recording and reproduction.

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STEWART-WARNER EARNINGS

Preliminary estimates are that earnings of the Stewart-Warner Corporation for the three months ended June 30, 1935, will be slightly larger than the $496,063 net profit reported for the first quarter of the year. This will bring earnings for the half year to around $1,000,000, or approximately 80 cents a share on the common stock. In the six months to June 30, 1934, net profits were $540,260.

Sales for the first half of 1935, it is indicated by preliminary reports, were approximately 20 percent higher than in the first half of 1934.

While improvement in earnings has been registered by every division of the company during the first six months of 1935, officials indicated that a particularly encouraging showing had been registered by radio and refrigeration divisions. While no exact figures are available as to results from these two divisions, it is understood that substantial out-of-pocket losses for these two items in the first half of 1934 have been translated into modest cash gains in the first six months in 1935.

The June 30th balance sheet of the Stewart-Warner Corporation and subsidiaries is expected to show substantial improvement over the already strong position reported at December 31, 1934. Cash on hand at the close of June exceeded $1,500,000 with a working capital ratio approaching 6 to 1. There are no bank loans.

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J. G. BARRY, G. E. VICE-PRESIDENT, RETIRED

The retirement of John G. Barry, senior vice-president of the General Electric Company, after more than 45 years of service, and his election to an honorary vice-presidency, was announced by President Gerard Swope following the meeting of the board of directors held in New York on June 28. Mr. Barry, as active head of the apparatus sales organization, has for many years formulated and executed the company's policy and sales program in the apparatus field. He will maintain an office in Schenectady and will be available for consultation. The retirement is effective as of July 1.

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EASTERN MIKE-STAND CATALOGUE

The Eastern Mike-Stand Company (formerly the Eastern Coil Co.) of 56 Christopher Ave., Brooklyn, N. Y., have issued their new 1935-1936 catalogue, copies of which may be had on request from public-address and allied companies.

The new catalogue lists three methods of microphone stand adjustment; namely, thumb-screw, chuck, and air cushion. Descriptions are provided for numerous types of microphone stands and microphone mountings.

NEW EXECUTIVE APPOINTED FOR RCA MANUFACTURING CO.

Mr. E. T. Cunningham, President of the RCA Manufacturing Company, announced a number of new executive appointments and promotions. Effective at once, Mr. E. C. Grimley, formerly Manager of the International Department, becomes President of RCA Victor Company, Ltd., Montreal, Canada, replacing Mr. Ben Gardner, resigned.

Mr. Frank R. Deakins becomes Manager of the International Department which handles the export business of the RCA Victor Division. Mr. Deakins also continues his duties as Manager of Engineering Products Department.

Mr. Cunningham announced that at the last meeting of the Board of Directors Mr. F. H. Corregan, Secretary of the RCA Manufacturing Company, was elected vice-president in charge of budget control, taxes, insurance, and other matters as delegated to him, in addition to his present duties.

The appointment of Mr. Eugene Deacon as General Sales Manager of the RCA Radiotron Division of the Company was also made public. Mr. Deacon has had a wealth of merchandising and promotion experience in many fields. He was formerly General Manager in charge of plant control for the Interwoven Stocking Company, and prior to that was engaged in merchandising and promotion activities for the Curtis Publishing Company and the S. D. Warren Paper Company.

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P-A AND RECORDING EQUIPMENT WANTED

We have been informed that Louis A. Fishoff, Film-Radio, 5 Rue Denis-Poisson, Paris 17, France, is interested in public-address and recording equipment of American manufacture.

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DR. LANGMUIR ELECTED TO FOREIGN MEMBERSHIP IN ROYAL SOCIETY

Dr. Irving Langmuir, associate director of the General Electric Research Laboratory at Schenectady, has been elected to foreign membership in the Royal Society, England. Foreign membership, considered one of the highest honors that can be bestowed by British scientists on fellow workers in other countries, is limited to fifty persons throughout the world.

Dr. Langmuir, Nobel prize winner, is one of eight Americans now foreign members of the Royal Society, and is the only American industrial scientist so honored.

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NEW FEDERAL AMPLIFIER CATALOGUE

The Federal Engineering Company, 721 Broadway, New York, N. Y., have issued their Catalogue No. 66 covering sound amplifiers and accessories. Contained in this catalogue is data on the new Federal Class A and Class AB amplifiers, ranging in power output from 1 to 30 watts. The catalogue also contains data on field exciters, oscillators, microphones, mixers and pre-amplifiers.

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NEW TUBE COMPANY

The United Electronics Company, 42 Spring Street, Newark, N. J., is a new organization that intends manufacturing radio-transmitting tubes, industrial control and power tubes. According to a statement made by this new company, its personnel is made up of "key men of the original De Forest group which built up the Sylvania transmitting-tube line. Our designer is the man who laid out all of this construction. Our head chemical engineer was chief chemist for Sylvania electronics division and co-inventor of the graphite anode processing method. Our production superintendent was factory engineer and assistant production superintendent at Sylvania. Our chief engineer was the head electrical engineer in this work."

This company is said to be headed in a financial and general management way by men of substantial experience. Their plant is equipped with advanced facilities and tubes of first production are expected to embody certain changes in design.

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RADIO CHASSIS ASSEMBLY

Platon Texido, Diputacion No. 175, Barcelona, Spain, important manufacturer and radio distributor, in preparation of important changes taking place in Spain, is interested in receiving propositions for assembly of radio chassis in Barcelona. Quotations and offers should be sent either direct or through Mr. Texido's New York representative, F. Del Carpio, 505 Fifth Avenue, New York.

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NEW GENERAL ELECTRIC PUBLICATION

As a companion book to GEA-1731, "How to Make Cable Joints," issued last year, the General Electric Company now has available a new publication, GEA-1839, "Cable Accessories." The two books should be of interest and assistance to everyone who is engaged in work that involves the jointing and terminating of insulated cable.

"How to Make Cable Joints" gives clear and concise instructions for splicing, jointing, and terminating all types of insulated cable. Its forty-four pages are illustrated with drawings and construction men can easily follow the instructions while on the job.

"Cable Accessories" lists and describes all the materials required for this work —joints, connectors, terminals, reservoirs, and other materials. It has eighty pages and is complete in every respect—including prices. It should prove useful in making up jointing standards and as a general reference book.

Copies of these publications can be obtained from the nearest General Electric sales office or from General Electric Company, Dept. 6N-201, Schenectady, N. Y.

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KENYON LITERATURE

The Kenyon Transformer Company, Inc., 840 Barry Street, New York, N. Y., now have available their Catalog R-1 and Bulletin C-1. Both will be furnished to those interested.

Catalog R-1 gives a great deal of information concerning their replacement transformer products. This catalog features some 70 new components and 20 power units.

Bulletin C-1 describes a line of low-priced high-performance transformers and reactor group for public-address amplifiers, amateur radio and service applications.

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VOLTAGE-DIVIDER BULLETIN

Ward Leonard Electric Co., Mount Vernon, N. Y., announces a new Bulletin 507-D listing 155 Voltage-Divider Replacement Units for radio sets.

This bulletin lists voltage dividers for some of the newer models as well as some of those no longer manufactured.

NEW PRODUCTS

NEW TOTAL TIME METER

For totalizing running or idle time on electrically operated machinery including machine tools, welders, electric signs, refrigerators, radio transmitters or any individual a-c powered unit, Westinghouse announces the Total Time Meter. The meter registers hours and it is suitable for any application where it is desirable to know the total number of hours during which a circuit is energized or apparatus is in operation. The registering mechanism has four dials and will register 9,999 hours before repeating, approximately 400 days. If desired, the meter can be mounted in the Superintendent's or Foreman's office connecting it to the machine by a single pair of wires.

The Total Time Meter including the self-starting, 120-volt, a-c, 60-cycle, synchronous motor is contained in a two-piece Moldarta case having a flange diameter of 3½" and overall length of about 3¼". The motor is of the slow-speed, sub-synchronous type, with jeweled bearings. All parts, such as the register, motor, etc., are readily removable for inspection, repairs or replacement.

The 11-volt and 120-volt styles require approximately 1.5 watts for operation. The 240-volt style requires approximately 3 watts. The synchronous motor will stay in step with voltages 12 percent above or below normal values.

The Total Time Meter can also be furnished with a special register providing one revolution per hour of the sweep hand. The sweep hand dial is then marked in 10 main divisions each of which represents 1/10th of an hour. This register reads up to 9999.9 hours before repeating. The above register is particularly useful for production checks where it is desirable to obtain data in fractions of an hour.

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ELECTRICAL CONTACTS

Electric-furnace graphite affords a very convenient means of making a contact on large numbers of sample insulating materials, as for example, ebonite, soft rubber, slate, fiber, and other similar substances, according to Mr. B. H. Porter, of the Technical Department of Acheson Colloids Corp.

While determining the volume and surface resistivities, dielectric losses and constants for such materials it is imperative that the mode of contact in no way alters the physical properties of the substance in question or interferes with the treatment of the specimen between tests. The more common methods that employ conducting paints, amalgam pastes, mercury tinfoil, and similar substances either violate such conditions or do not give a perfectly intimate surface contact, it is stated.

A deposited coating of colloidal graphite in water (such as Acheson's "Aquadag") appears, on the other hand, to be ideal for the purpose. Special advantages of this material include permanency of a very intimately formed contact, its ease of application either by spraying or brushing, and the sharp definition of the film boundary. Experimenters,* who have used contacts made from colloidal graphite during direct-current insulation tests, have further observed in this connection that "Graphite is inert to air exposure, to the specimen, and to acidic surface films. Practically no limit is imposed on the size, shape, or orientation of the test pieces by such electrodes."

Electrical contact can be made by cementing the lead wire to the graphite deposit employing for this purpose a spot of concentrated colloidal-graphited water which, incidentally, is of paste-like consistency.

*Church and Daynes. Rubber Industry Transactions. Vol. 6, No. 1. 1930.

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NEW ARCTURUS TUBE LINE

The Arcturus Radio Tube Company, Newark, N. J., has developed and marketed a new line of tubes, designated as the "G" series, which is identical in electrical characteristics and pin connections to the all-metal tubes. It is stated that several of the larger set manufacturers and many smaller ones have already developed circuits employing these new "G" tubes. Early announcement of some of these radio receivers is expected.

Carrying the same type numbers as do the all-metal tubes, the letter "G" is suffixed to denote the glass envelope type.

As announced to date, the Arcturus "G" line comprises the following types:

6A8G	Pentagrid Converter
6C5G	Detector-Amplifier Triode
6D5G	Power Output Triode
6F5G	High-Mu Triode
6F6G	Power Output Pentode
6H6G	Double Diode
6J7F	Detector-Amplifier Triple Grid
6K7G	Super Control-Amplifier Grid
6L7G	Pentagrid-Mixer-Amplifier
5Y3	Full-Wave Rectifier (Interchangeable with 5Z4)

These tubes are directly interchangeable with corresponding type numbers of all-metal tubes. The photograph illustrates a type 6K7G tube and shows the general appearance of the "G" line with the all-metal tube base connections and guide pin.

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"TEMP-URD WOOD"

The Pyratone Products Corporation of Chicago has produced a process, using a synthetic resin of the phenol and formaldehyde condensation type, known as Temp-Urd Wood. This product, when introduced or impregnated into wood, improves in a major way several of the characteristics of wood, it is stated.

In the Temp-Urd Wood process the wood is maintained in a vacuum and then submerged in the liquid resin. Pressure of several atmospheres is then introduced. The impregnated wood is thereupon subjected to a cure at 200° Fahrenheit for about one hundred hours. The new process secures absolute uniformity of resin distribution throughout the treated wood.

Processes have been developed for treating practically every article made of wood, the process depending on its ultimate use. For example, golf-club heads are treated so as to give maximum hardness, resiliency and resistance to abrasion; baseball bats to give them a high resistance to chipping and splitting; members for airplanes to give hardness, abrasion and bending strengths, and resistance to moisture to the already present lightness and flexibility of the natural wood. The impregnation serves to harden the surface, thus affording a substantial backing and eliminating the operation of filling the pores, or a primer coat. Lacquer and varnishes may be readily applied to the surface of the impregnated wood.

The impregnated wood exhibits its moisture resistance, not by complete impervity, but by the fact that it does not swell or warp, or in any way become distorted when subjected to moderate moisture changes. However, when the second (coating) process is applied, the moisture content is reduced to a negligible quantity, and the resistance to water is said to be so great that six weeks are required for the doubly-processed wood to assume a normal moisture content (8 percent) when completely submerged in water. It, therefore, becomes evident that if wood so treated is subjected to alternate humid and dry conditions, the mechanical resistance of the wood is greatly increased by a low moisture content.

The Temp-Urd Wood process is now being used commercially. Other manufacturers are testing the process. Material treated is not limited to wood, but paper, paper pulp and plaster of paris may be similarly treated.

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THE NEW HYFLUX

Wright-DeCoster, Inc., are bringing out a magnetic type speaker which has many new features. The fact that it has fewer parts, no solder used in the mechanical linkages, and extremely rugged construction, should make it operate with no attention whatever almost indefinitely, it is said. It has an exceptional frequency range for a magnetic type unit with a tone quality very similar to a dynamic type speaker.

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DEJUR-AMSCO REMOTE CONTROL

The DeJur-Amsco Corp., 95 Morton St., New York, N. Y., have issued a bulletin covering their new line of remote control heads for auto-radio receivers.

Copies of the Bulletin (No. 37) are available upon request.

SOLAR "LITTLE GIANT" DRY ELECTROLYTICS

According to a statement from the Solar Manufacturing Corp., it is a well-known fact that the capacity of dry electrolytic condensers is directly proportionate to the foil area used in making the condenser winding. To roughen the surface of aluminum foil by mechanical or chemical means thereby increasing its area is an art which has been practiced for many years in various industries. It is obvious that in taking advantage of such increased area in electrolytic condenser manufacture greater compactness may be achieved.

The great difficulty in employing this theoretical advantage in a practical way always existed in finding ways and means to make electrolytic condensers with such roughened anode plates without sacrificing all the other minute details which must be observed in the manufacture of such a condenser to achieve best power factor and leakage characteristics.

Solar engineers, after a long period of concentrated study of this art, now offer to the radio service trade condensers utilizing this principle, without sacrificing any of the electrical qualities, it is stated. Condensers made according to these processes have not only been tested for many thousands of hours under the most exacting conditions in laboratories but have also been used in radio sets for thousands of hours with excellent field results.

The new Solar series of dry electrolytics are about half the size of previous "midget" types. Two voltage ranges are available, 450 volts and 200 volts working, in all usual capacities. Thickness has been kept to a minimum, so that these condensers will fit anywhere, for rapid repairs.

The manufacturer is Solar Manufacturing Corporation, 599-601 Broadway, New York City.

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NEW EBY PHOTOELECTRIC CELL

A 32-page booklet "The Electric Eye in Theory and Practice" containing a complete treatise on this important industrial development and illustrated with thirty diagrams has been published by Hugh H. Eby, Inc., 2066 Hunting Park Ave., Philadelphia, Pa. This booklet contains a great deal of new material on all types of electric cells and gives many helpful hints both as to present and future adaptations of the "electric eye" in a wide variety of work. It is sent free to electrical and industrial executives requesting it on company stationery. To all others the booklet is priced at 50 cents.

It was prepared by the Eby engineering staff concurrent with the production of the Eby Electric Eye which has just been announced. This photoelectric cell of the electronic type is said to incorporate many important new features. It is available either singly, in complete assemblies containing cell, relay, tube, resistances, socket, etc., or in handy kits for home or laboratory experimentation.

The Eby cell covers an unusually wide range; operates on either a-c or d-c; has low internal capacity; and has the distinct advantage of being sensitive in both the generative and emissive classes, it is stated.

It consists essentially of two metal electrodes hermetically sealed in bakelite between which a light-sensitive material is exposed to incident light rays behind a special glass or quartz window. Unaffected by continuous exposure to light, it reacts to both the intensity and frequency of the incident light rays. Entirely electronic in action, its operation depends upon the light sensitive surface to emit electrons which are proportional in number to the incident light flux.

A descriptive catalog covering details of construction and adaptation of the Eby Electric Eye will be sent on request to Hugh H. Eby, Inc., 2066 Hunting Park Ave., Philadelphia, Pa.

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DEJUR-AMSCO VARIABLE CONDENSERS

DeJur-Amsco's "Bar Type" Variable condensers are said to be characterized by an unusually rigid frame constructed of heavy end plates and shields and tied together with over-size round steel tie bars. The open construction exposes the rotor and stator plates, and because of the distribution of parts permits of lower minimum capacities, it is stated.

Three sizes, designated as 50, 60 and 70 series, respectively, permit universal use in all types of receiving sets, including all-wave, short-wave and long-wave, t-r-f and superheterodyne types of circuit arrangement. All three series have the same size end plates and shields and the essential mechanical layout of rotor shaft as the DeJur-Amsco 2000 and 2100 series. These series differ among themselves in spacing between shields.

Complete information on these condensers may be obtained by writing to the DeJur-Amsco Corporation, 95 Morton Street, New York, N. Y., for Bulletin No. 36.

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OHIOHM "LV" RESISTORS

When speaking of carbon compounds as conductors and in terms of resistivity, their characteristics of both relatively low and relatively high resistance have been well known for many years. Perhaps they were first and best known for their resistance characteristics of the order of .002 or .003 ohm with perhaps the highest resistance of that type of carbon compound being from .06 to .08 ohm.

A later, but no less well known development, was the carbon resistor which has been commonly manufactured in values anywhere from 100 to 10,000,000 ohms. The gap between these two conditions has been carefully studied because of the realization that carbon has certain characteristics which make it desirable in many types of electronic applications requiring resistance values within this gap. The Ohio Carbon Company has announced a newly developed carbon resistance material permitting the production of carbon resistors in values ranging essentially between .04 and 100 ohms. These new relatively low value resistors are known as the Ohiohm "LV" series.

An important characteristic claimed of a carbon resistor is the closeness of its approach to pure non-inductivity, because of its straight-line structure as compared to the coil structure common to some types of resistances.

Another important feature of carbon as a conductor is its negative temperature coefficient. This characteristic considered in the light of carbon as a resistance unit is another feature of unusual importance to designers of electronic apparatus. Graphic charts showing the temperature coefficient of Ohiohm resistors are available upon request.

It is said the life characteristics of the regular line of Ohiohm resistors will be maintained by the new "LV" series.

Charts showing the action of Ohiohm carbon resistors under excessive humidity and heat conditions are also available.

There are limitations which a designer must bear in mind when considering the use of carbon resistors in low values, that is, relatively low for carbon resistors. One of these limitations is the fact that below 25 ohms only capped units can be supplied. Above 25 ohms, either capped or "pig-tailed" units can be supplied. Commercial tolerances (plus or minus 10%) are observed.

"LV" resistors can be supplied in any value requested between .04 and 100 ohms plus or minus 10% of the resistance value.

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CURTIS "RADIO" SPARK PLUGS

The J. D. Curtis Corporation, 404 Linden Street, Camden, N. J., have announced their custom-built "Radio" Type Spark Plugs. These units have been designed to eliminate the use of external suppressors. One of these plugs is shown in the accompanying illustration.

The new Curtis "Radio" Spark Plug is said to overcome the inefficiencies resulting from external suppressors becoming loose and dirty by having the resistance unit built inside the plug where it is protected. Compensation is also made for the resistance through the use of a patented "High-Frequency" device. The effect of this latter device is to increase the voltage of the spark plug and to decrease the current. In

regard to the resulting effect of the voltage increase and current decrease the manufacturer states:

"The layman may regard this as a disadvantage. However, the current is not the useful part, but only results in burning the electrodes. The voltage of the spark is what fires the mixture."

The J. D. Curtis Corporation also have a "High-Frequency" plug which incorporates all of the features of the "Radio" plug with the exception of the built-in resistance unit. The slight additional cost of these spark plugs will be more than offset by the saving in gasoline and oil which their use effects, it is stated.

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TRIADYNE TYPE 6B5

The Triadyne Type 6B5 tube is a new triode designed and employed for Class A operation. It requires no grid-bias voltage and hence makes the use of grid-bias resistors and bypass condensers unnecessary. This tube is a product of the Triad Manufacturing Company, Inc., Pawtucket, R. I.

INDEX TO ADVERTISERS

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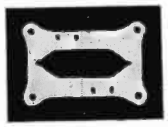
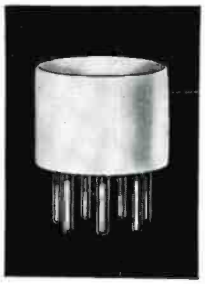


THE development from the original Fleming valve to these modern vacuum tube devices is a long story. It is a story of unceasing effort to improve manufacturing methods and to find new and better materials.

For years the leading tube manufacturers have been using ISOLANTITE insulation—a tribute to the quality and dependability of a product which has contributed much to the production of better vacuum tubes.

Your tubes also can be improved by the use of ISOLANTITE insulation. ***Isolantite, Inc., factory at Belleville, N. J.; Sales Office at 233 Broadway, New York City.***



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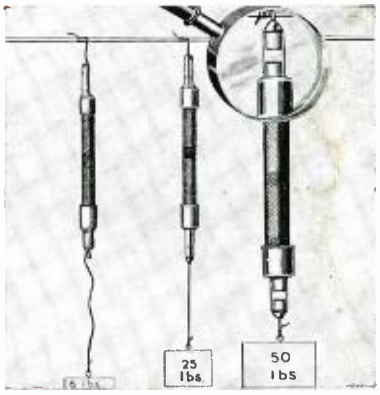
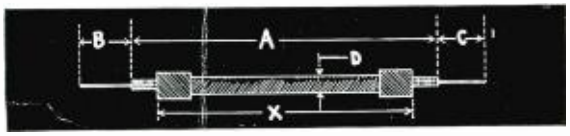


Left, above — Competitive make flexible resistor.
Center, above—Old type Clarostat flexible resistor.
Right, above—New "Clinch-Grip" flexible resistor.

Clarostat "Clinch-Grip" flexible resistors are a new series of units made and sold exclusively by us . . . superior in quality . . . yet priced competitively with carbon resistors. The R.M.A. color code for resistance values is used throughout, the color code being woven right into the braid to insure permanency.



"X" Directly proportional to watt dissipation.
Type "FX"—Watts per inch = one-half. "D" = ⅛ inch.
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"A" = "X" + ½ inch.
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All linear dimensions ± ⅛ inch.

RESISTANCE TOLERANCE: ± 10% and not more than 1% change of original value when entire resistor is wound upon a ⅜ inch diameter arbor.

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In design "Clinch-Grip" flexible resistors are trim. In accuracy, the commercial tolerance is maintained at ±10%. In ruggedness and tensile strength, their new design permits them to exceed manufacturers requirements from 250% to 500%. Production facilities permit unlimited quantities on short notice.

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