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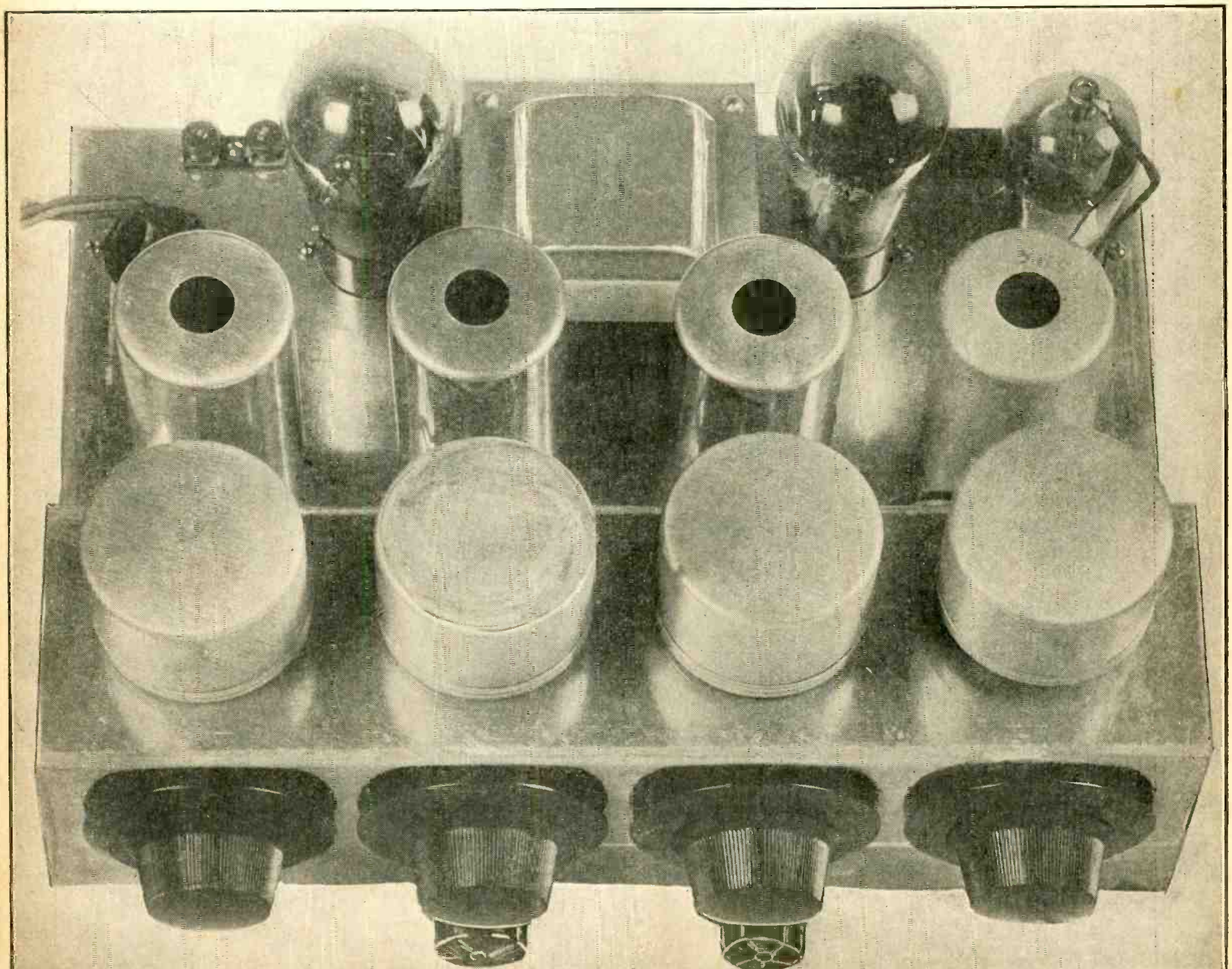
The First and Only National Radio Weekly
503rd Consecutive Issue
TENTH YEAR

Diode As Detector, Modulator and Feeder of Push-Pull

Monitor Receiver for the Broadcast Band and Other Waves



View of the All-Wave T-R-F Monitor Receiver. See Pages 12 and 13.

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Tubes as Circuit Basis

Valves First Analyzed, D-C Set Design Follows

By J. E. Anderson

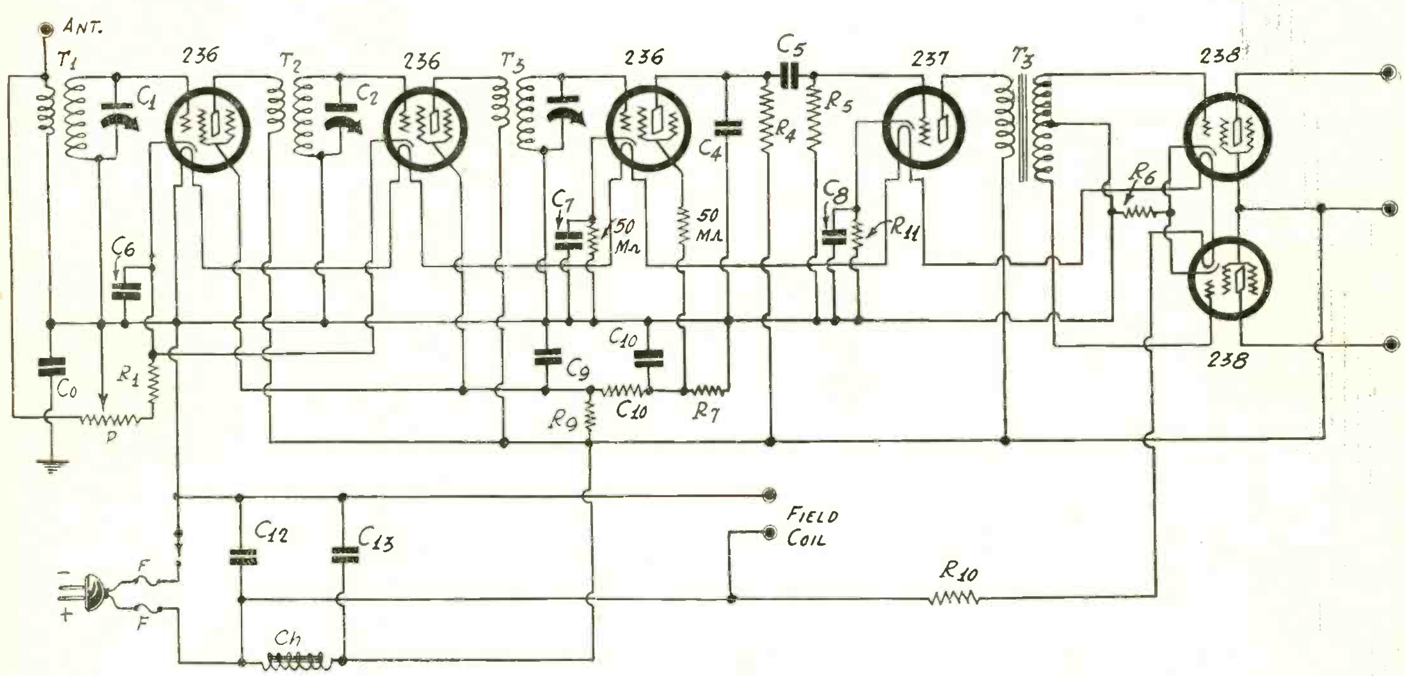


FIG. 1
The circuit diagram of a six tube direct current receiver using automotive tubes throughout.

SYSTEMATIC design work is essential if one would produce a satisfactory receiver which is somewhat different from the ordinary run of receivers. It is a simple matter to copy any receiver upon which some one has already done the preliminary laboratory work, but it is a more painstaking process to pioneer.

Assuming that we start with tuners which have been worked out by some one, the design work is largely a matter of selecting the correct voltages on the grids, screens, and the plates, and if these are obtained from resistance drops, then the work consists also of proportioning the resistance values.

Suppose we wish to design a receiver that is supposed to work on

(*Continued on next page*)

LIST OF PARTS

Coils
- T1, T2, T3—One set of three shielded radio frequency transformers such as are used in midget receivers
- T3—One push-pull input transformer
- Ch—One 30 henry choke coil

Condensers
- Co—One 0.01 mfd. condenser
- C1, C2, C3—One gang of three 0.00035 mfd. tuning condensers for tuning coils
- C4—One fixed 0.00035 mfd. condenser
- C5, C6, C7, C10—Four fixed 0.1 mfd. by-pass condensers
- C8, C9—Two 0.5 mfd. by-pass condensers
- C12, C13—Two 16 mfd. electrolytic condensers

Resistors
- R1—One 300 ohm resistor
- R2, R3—Two 50,000 ohm resistors
- R4—One 250,000 ohm coupling resistor
- R5—One half megohm grid leak
- R6—One 600 ohm resistor
- R7—One 2,000 ohm resistor
- R8—One 7,000 ohm resistor
- R9—One 15,000 ohm resistor
- R10—One 240 ohm, 25 watt resistor
- R11—One 1,500 ohm resistor
- P—One 10,000 ohm potentiometer with line switch

Miscellaneous Parts and Accessories
- FF—Two 3-ampere fuses.
- One vernier dial with pilot light
- Five grid clips
- Six UY sockets
- A special midget chassis
- One dynamic speaker with push-pull output transformer and 1,800 ohm field
- Three tube shields

Design of a Receiver for

Careful Choice of Constants and Voltages

By Herman

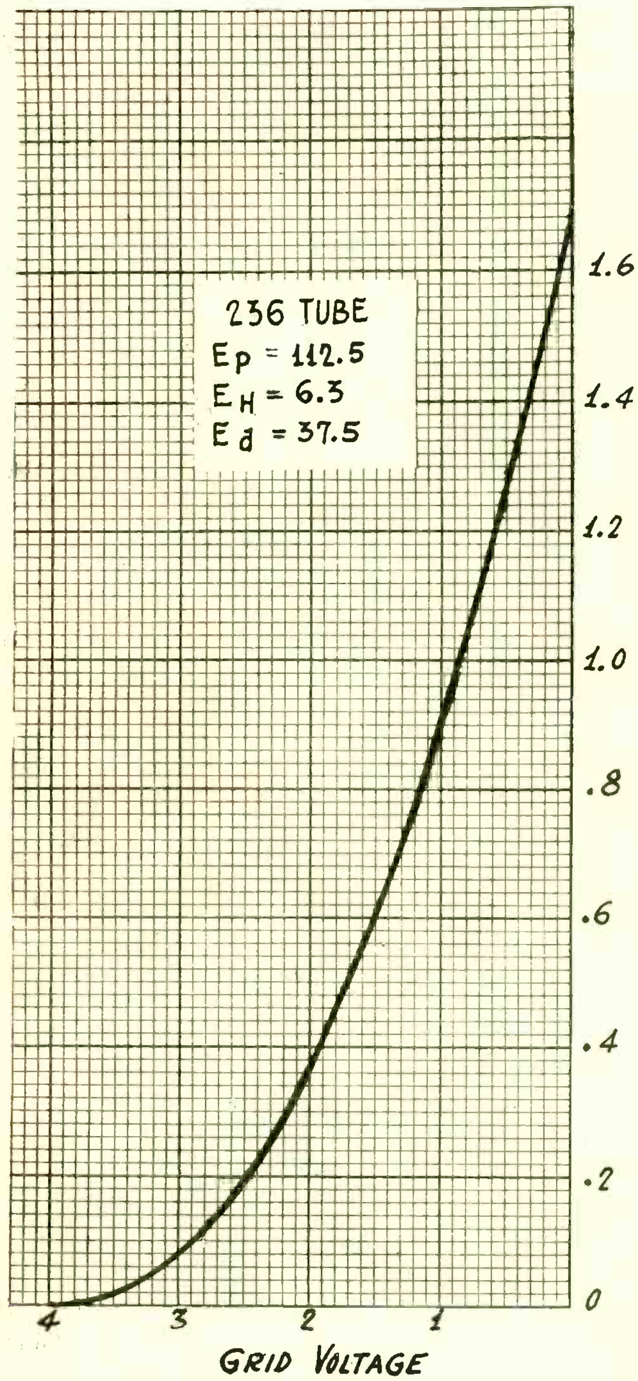


FIG. 2

A grid voltage, plate current curves of a BCF *tube with* 112.5 *volts on the plate and* 37.5 *volts on the screen.*

a 110 volt d-c line. What kind of circuit should be used? What type of tubes is most suitable and how should they be connected?

We can use any type of tube we desire just so we are consistent throughout. We might use the automotive tubes in every stage. These have the advantage of small size and economy of operation. They also have the advantage that they are all of the heater type and that they take the same filament current. We can also use the 3.3 volt tubes, or the 2 volt tubes. They are the most economical but suffer from the disadvantage that they are all filament type tubes. Hence thorough filtering becomes necessary when they are used. Moreover, they are not so flexible as the heater tubes in respect to grid voltages. They require grid batteries, which cannot be varied in fine steps.

Full Size Tubes

We could also use the 2.5 volt tubes, all of which are heaters with the exception of the power tubes. They suffer from the disadvantage that they take a great deal of power from the line, much of which is dissipated in the set and turns it into a furnace.

Considering the advantages and disadvantages of the various tubes available, it appears that the automotive tubes are the most suitable. The lack of output volume can be compensated for by making the last stage push-pull. Hence we have selected a six tube receiver containing three 236 tubes, one 237, and two 238 tubes, as shown in Fig. 2. The output from the last stage, which is push-pull, is of half watt, which is quite sufficient if a good speaker is used. The output would be more if a higher plate voltage were available, but our object is to design a set for a 110 volt d-c line without the use of a single battery.

There are three tuners in the circuit, and this is typical of most tuners in modern midgets, so we shall say very little about them. We also have two 236 radio frequency amplifiers. These we shall put in a setting where they will do their best. Likewise we have a 236 grid bias detector, and this, too, we shall put in a circuit where it will perform the best with the least possible distortion. The same applies to the three audio tubes, although these are not nearly so critical as the radio frequency tubes and the detector.

Curves on the Radio Frequency Tubes

In order to make the best adjustment of the voltages for the radio frequency tubes it was necessary to take a grid voltage, plate current curve on a 236 tube on the voltage that would be used. The nearest voltage obtainable with a dry cell battery is 112.5 volts, and for this reason the curve was taken with this. This is very nearly the net voltage obtainable from a so-called 110 volt line, even when some voltage has been allowed for drop in the filter choke. The screen voltage for the curve is 37.5 volts, which bears the same relationship to 112.5 volts as 45 volts to 135 volts. The curve is given in Fig. 2.

The curve tells how much plate current flows at any grid bias and it also indicates at what bias the amplification is good. The bias may be any value between about 0.5 and 1.5 volts. We selected a voltage of approximately 0.8 volts. At this point the plate current is about 1.02 milliamperes. It was found by measurement that the screen current was one-third the value of the plate current. Hence at the operating point the total current was 1.36 milliamperes. This was checked by measurement. We shall keep the plate and screen currents in mind for use when we design the voltage divider.

Right now let us determine the required bias resistance to give us 0.8 volt bias. The total current, we found, was 1.36 milliamperes. The required bias resistance is therefore 800/1.36, or nearly 600 ohms. There are two equal tubes on the same bias resistance and therefore it should be 300 ohms. This is R1 in Fig. 1. One reason for selecting a bias of 0.8 volt was that the required bias resistance was 300 ohms, which is a common and easily obtainable value. Of course, it would not have been selected had it not put the operating point at the correct place.

Detector Design

Let us keep in mind that the screen current in the two first tubes is 0.68 milliampere. We shall need it in designing the voltage divider.

Now let us pass to the detector.

This is also a 236 tube, but it has 250,000 ohms in the plate circuit in series with the 112.5 volts. We must find the best detecting bias, the required bias resistance, the required screen voltage, and the necessary resistance in the screen circuit, if any.

In order to get an answer to these questions we took four grid voltage, plate current curves with different screen voltages. In each case the voltage in the plate circuit was 112.5 volts and the plate resistance 250,000 ohms. The curves are shown in Fig. 3.

When the screen voltage is 22.5 volts, the best detecting bias is about three volts. But this requires a rather high grid bias resistance and the undistorted output is not so great as is desired. The next curve was taken with a screen voltage of 15 volts. The best operating bias is approximately 2.3 volts. The detecting efficiency is somewhat better and the undistorted output a little greater. But the required grid bias resistance is still larger than it should be.

Getting the Bias Resistance

The third curve, counting from the left, was taken with 7.5 volts on the screen. The best detecting bias is about 1.5 volts, the detecting efficiency is higher than in the case of either of the other curves, and the undistorted output just about the same as that for the 15 volt curve. The curve would be satisfactory if we could not get a better one. The fourth curve was taken under the same conditions as the third with the exception that a 50,000 ohm resistance was connected in the screen lead. Now the best detecting point is about 1.25 volts. The detecting efficiency is lower than that for the other 7.5 volt curve and about as good as that for the 22.5 volt

Direct Current Operation

Results in Satisfactory Reception

Bernard

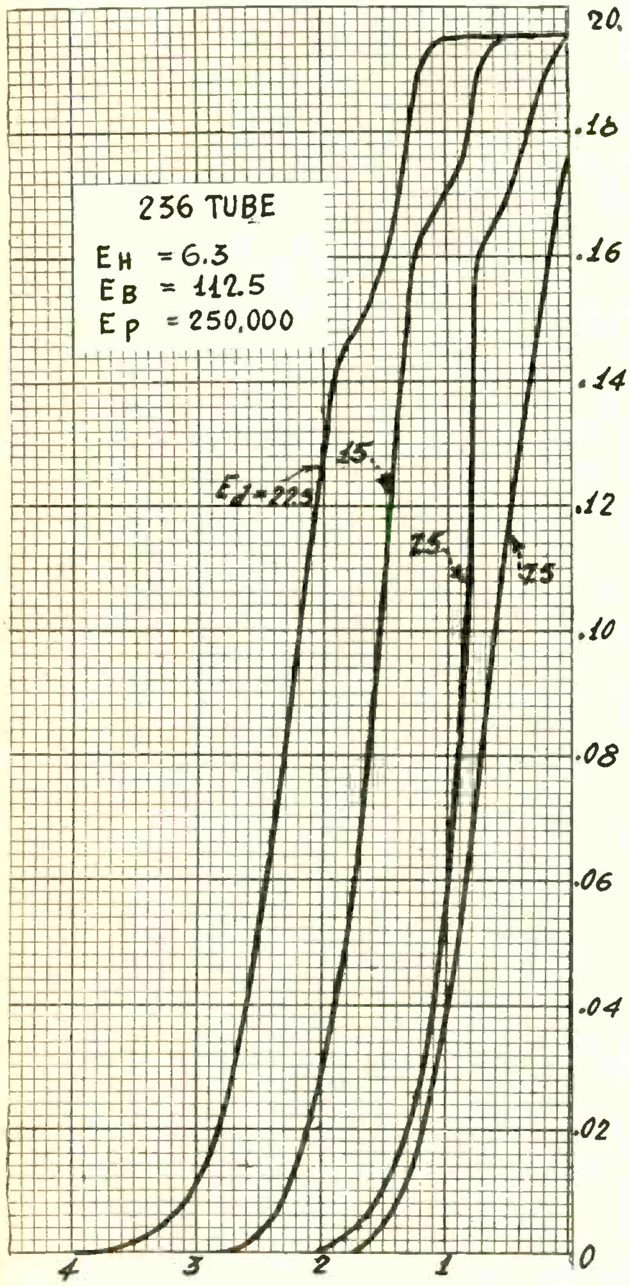


FIG. 3

Four grid voltage, plate current curves of a 236 with 250,000 ohms and 112.5 volts in the plate circuit and different voltages on the screen as indicated. The extreme right curves is for 7.5 volts and 50,000 ohms in the screen circuit.

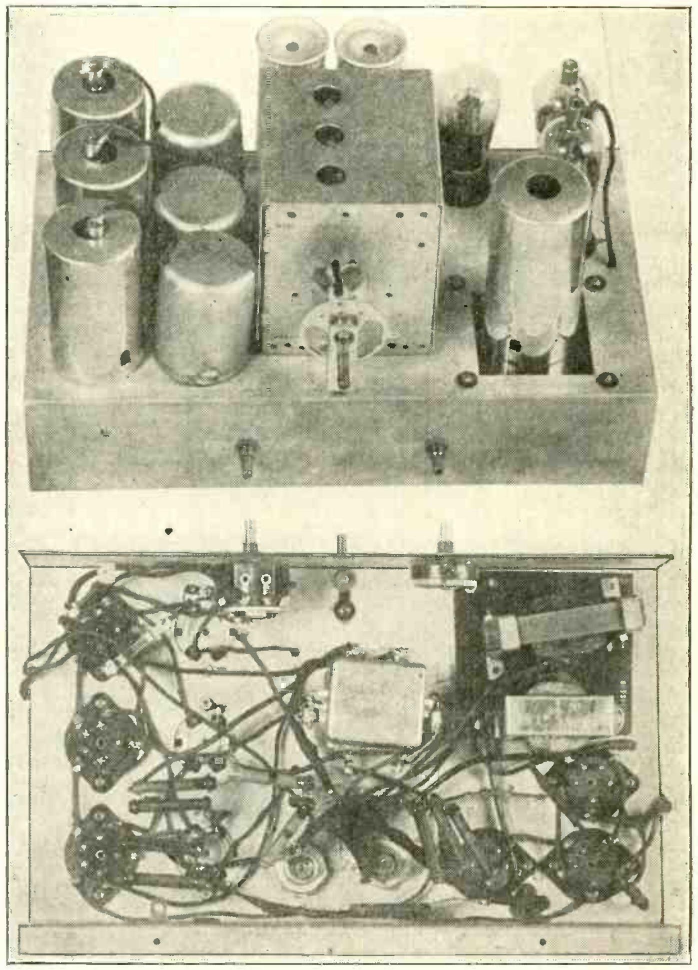


FIG. 4

Top view of the direct current receiver showing the layout of the parts.

curve. The undistorted output is greater than that for any of the other curves. Hence this combination was retained.

The required grid bias resistance is less than that for the other curves, and that was one object of lowering the screen voltage. To find the right bias resistance to give a bias of 1.25 volts, we have to add the screen and the plate currents at the operating point. By measurement it was found that the screen current was one-third as large as the plate current, and that the total was 0.0214 milliamperes. This makes the required grid bias resistance 58,500 ohms. This is not a convenient value, and we choose 50,000 ohms. This change does not shift the operating point appreciably, nor does it decrease the detecting efficiency. It puts the operating point at about 1.22 volts and makes the total screen and plate current about 0.024 milliampere. Of this the screen current is only 6 microamperes.

We have determined the values of R2 and R3 each of which is 50,000 ohms.

Voltage Divider Design

Now we are ready to determine the resistances in the voltage divider, so let us proceed with that before we go to the audio amplifier.

The value of R7, the bleeder current resistance, is more or less arbitrary, and we might as well select a value that is easily obtainable. The drop in it must be equal to the screen voltage on the detector plus the grid bias. The screen voltage is 7.5 volts and the bias is 1.22 volts. Hence the drop in R7 must be 8.72 volts. If we make the resistance of R7 2,000 ohms, the bleeder current will be 4.36 milliamperes. The drop in R8 should be 30.8 volts in order to make the effective bias on the radio frequency amplifier screens 37.5 volts. The same current flows in R8 as in R7, since the screen current taken by the detector is negligible. Hence the value of R8 should be 30.8/4.36 times 1,000, or 7,060 ohms. The nearest convenient value is 7,000 ohms.

The drop in R9 should be 75 volts. The current through this section is the sum of bleeder current and the screen current of the two radio frequency amplifiers, or 5.04 milliamperes. Therefore R9 should be 15,000 ohms. That finishes the voltage divider.

The volume control is a 10,000 ohm potentiometer P connected between the antenna and the return of the 300 ohm resistance R1, with the slider connected to ground.

Audio Amplifier

The first audio amplifier is a 237 tube, and it is coupled to the detector by a 250,000 ohm resistor R4, a 0.1 mfd. condenser C5, and a grind leak R5 of half megohm.

The bias resistance R11 for this tube is 1,500 ohms. This is shunted by a condenser of 0.5 mfd. capacity.

Two 238 tubes are used in the output stage and both are biased

(Continued on page 12)

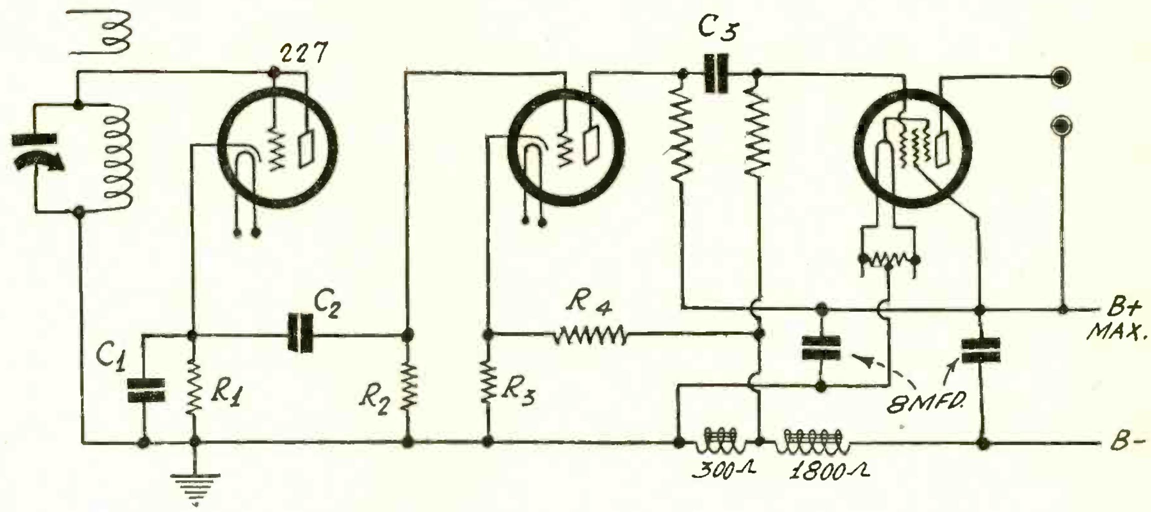
Diode Rectification for Pu

Modulation Method Suggested, Also,

By Herman

FIG. 1

A diode detector tube, followed by two stages of audio frequency amplification, along the lines of a complete receiver circuit published last week. The take-off is from the positive side of the rectifier.



[This is the second consecutive article dealing with rectifier type detectors. The first article was published last week, issue of November 7th, while another article will be published next week, issue of November 21st. The subject has aroused widespread interest. —EDITOR.]

THE rectifier type of detector is a single wave rectifier such as used in devices requiring small current, and is constituted, with modern tubes, of the unison of grid and plate, using the cathode for the positive return. So, with the 227 tube, the grid and plate may be tied together, a resistor may be placed in the cathode leg to ground, with a radio frequency bypass condenser across it, and the rectified output would appear across this resistor. Hence radio signals would be truly detected.

The system is workable either by connection of the resistor in the cathode leg (positive) or in the anode leg (negative), but in the second instance the effective use of a gang condenser would be eliminated, because the condenser itself could not be directly grounded.

Detector Without Plate Voltage

Fig. 1 shows the use of a rectifier type detector, with a two stage audio amplifier. Resistance coupling is used throughout. This is substantially the same audio circuit as was disclosed in last week's diagram, which included, however, a four circuit tuner. This is an easy and ready way of attaining excellent tonal and sensitivity results, and of including a detector that will not be overloaded by any radio signal fed into it. The current of the signal will be of the order of microamperes, while the rectifier would stand, say, 20 milliamperes without saturation.

The audio circuit, with this simple rectifier, is highly recommended. Those who have never experimented with it surely should give it a trial. Any detector tube in any a-c set can be converted to this use.

No plate voltage is applied to the detector tube, and heater, anode and cathode circuits of the tube are grounded. This total grounding eliminates feedback at radio and audio frequencies. Naturally, the tube can not be regenerated, and can not oscillate, as it is not an amplifier. Other types of detector tubes are amplifiers as well. However, if all we get from a detector is detection, we get all we need, especially if the tonal improvement is considerable.

Push-Pull Most Interesting

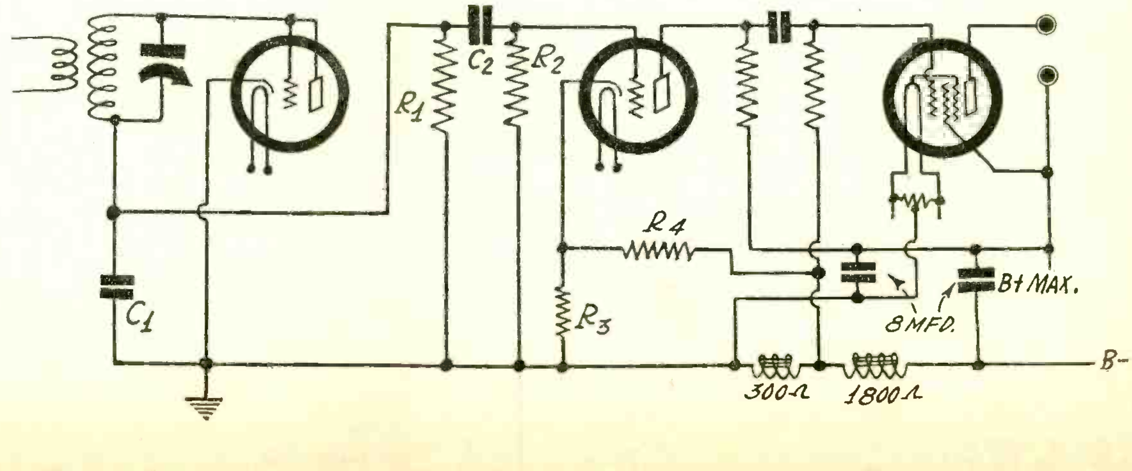
As soon as we leave this circuit we find that we can not resort to such complete grounding. Take Fig. 2 as an example. Here, instead of the coupling being from the positive side (cathode) it is from the negative side (anode), therefore the tuning condenser can not be directly grounded, nor can one completely eliminate the resistive load from the tuned circuit.

The cathode is directly grounded by this method, and of course ultimately the circuit reaches ground through the resistance load included for audio handling.

In both of these instances the audio channel is shown virtually

FIG. 2

Here the pickup is from the negative side of the rectifier, which makes it impractical directly to ground the tuning condenser. However, the rotor is at an r-f potential only slightly raised from ground, and the bypass condenser helps improve the situation.



sh-Pull and Other Circuits

with Automatic Impedance Matching

Bernard

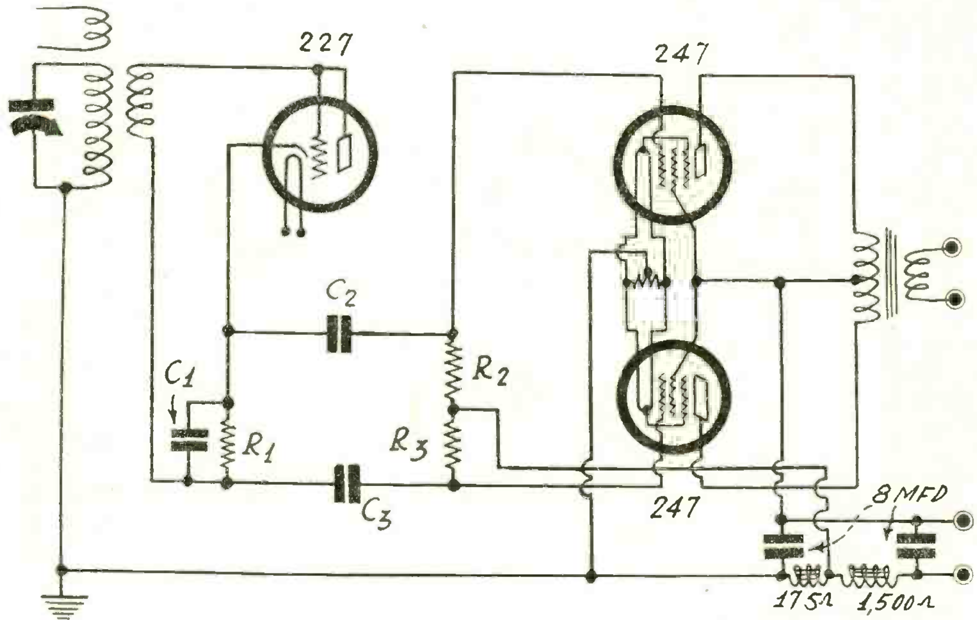


FIG. 3

For push-pull it is necessary that neither extreme of the resistor be grounded, and here we see the cathode resistor at high potential at both ends. The usual isolating condensers are included, whereas the center tapped leak has its tap grounded

complete, and the B supply choke is the field coil of a dynamic speaker, a tap at a certain d-c ohmage affording bias for the pentode output.

By far the most interesting audio circuit is the push-pull resistance coupled amplifier.

This has not been completely solved as yet, even though direct coupled systems have used push-pull, and even non-reactive amplifiers of the push-pull type have appeared. With single stage of audio in high favor no doubt attention will be directed to the resistance coupled methods and finally a perfected circuit will emerge.

Suggested Remedies

The circuit, Fig. 3, therefore should be viewed as experimental. Not that it has not been built. A push-pull amplifier of this type was first suggested in these colums years ago by J. E. Anderson, and has been built and discussed by him several times. A little trouble remains in the actual balancing of the circuit, as it appears to be more critical in this respect than expected, or maybe it is just a case of commercial leaks of equal rating being of too great actual divergence, plus static unbalance in the output tubes, although such unbalance can be corrected by independent bias attainment. A potentiometer at the juncture of the united resistors feeding the grids of the output tubes would help get rid of the dynamic unbalance, while independent biasing would be used to make the plate current in the symmetrical tubes truly equal. The static condition relates to d-c voltages, the dynamic to the signal.

However, the circuit deserves some explanation despite its unfinished state.

Why Push-Pull is Practical Here

The situation is ripe for push-pull because the resistor in the cathode leg is not grounded. The bugbear of attempted push-pull circuits using resistance coupling has been that the grounding of a resistor, whether to B minus or B plus or any other point at equivalent ground potential, constitutes the seemingly push-pull circuit really one-sided.

Here we need have no fears on this score, because the audio frequency is fluctuating across an ungrounded resistor, R1, both extremes of which therefore are at a high or so-called "hot" potential, and we are therefore able to take off the voltage from the extremes and introduce it to the grids of the push-pull tubes. The usual isolating or stopping condensers are used to prevent upset of power tube bias, and then the center of the resistor in the grid circuit is grounded. But it will be noticed that no extreme is grounded anywhere, at the rectifier output or power tubes' input.

Here, too, the tuning condenser can not have its rotor grounded, unless there is a third or pickup winding, which may consist of 20 turns of wire put over the secondary. As grounded rotors are necessary in gang tuning, and gang tuning is so prevalent, the third winding is recommended in conjunction with experiments with the push-pull resistance coupled amplifier.

Push-pull is wholesome, as it is a hum reducer, in fact, a general eliminator of even harmonics. It does not eliminate the odd harmonics. No system does, without removing the signal.

Use as a Modulator

Another suggested use for the diode or simple rectifier is in conjunction with radio frequencies, where it serves to as modulator. This is distinguished from detection, which is demodulation, although the two conditions often are expressed as detection because the hookup for them is the same.

The use of the diode as a modulator is suggested in Fig. 4. The incoming short wave frequency is tuned by C1, L1. The oscillator generates a different frequency. The resulting frequency is taken out of the modulator through the cathode circuit. The cathode is connected to set antenna post, and as the return of the antenna impedance in the set is to ground, that impedance is the load on the cathode circuit of the diode modulator.

This system has the advantage of being self-matching. It has been remarked time and again that a known converter is connected to an unknown set, in actual practice, so we may have a screen grid output tube and nobody knows just what as the load thereon,

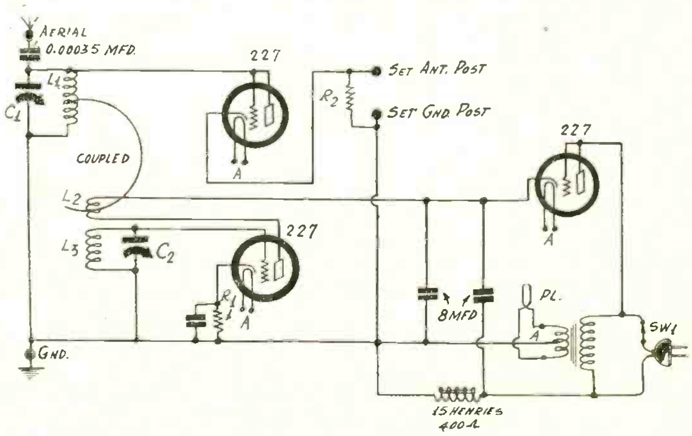


FIG. 4

Design for a short wave converter with built-in B supply, where the modulation is performed by a diode tube, and the problem of correct matching of converter output to the set's antenna load impedance is removed, because of the automatic satisfaction of the requirement for any type load.

Self-Matching Converter

Proper Load Automatic on Device as Modulator

(*Continued from preceding page*)

whereas a high impedance load would transfer more energy to the set.

Self-Matching Device

However, a low impedance or general purpose tube could be used, but that would simply create a better condition in a greater number of instances, but would not constitute a complete and final solution. What if a high impedance load actually is presented to the converter by the set? This often will be true of superheterodynes where there is no primary but simply a series condenser in the antenna circuit, and the converter (which itself must have some sort of plate load) has its output placed in parallel with the highest possible type of impedance.

The only completely satisfactory solution is one that is self-matching. This suggestion brings to mind the grid circuit of a vacuum tube. This circuit is suitable for whatever type of impedance is impressed across it, barring the silly exceptions of short circuits and the like. So it would be fine to turn the tube about. Yet all we would get out would be considerably less than what was put in. For reducing high voltages to low ones this would be satisfactory, but for gainful transfer of energy it would be impossible.

Conductive Path Needed

So perhaps the diode is the best device for solving the problem. If the antenna circuit has a resistor, or a coil, or a combination of coil and condenser or of resistor and condenser, and regardless of the values of any of them (assuming they serve their intended purpose in the set) the diode affords the best impedance matching device of automatic variety so far presented. Even if there is a series antenna condenser to contend with, the situation is unaltered, for a resistor across the output takes care of this.

The other features of the converter, Fig. 3, are that it has a similar rectifier for B supply, that the choke coil (about 15 henries, resistance about 400 ohms), is in the negative leg, that the oscillator bias is obtained from the drop in this choke (about 1.6 volts negative), that plug in coils are used, and that it is hardly possible to conceive of a simpler converter that has two tuned circuits.

The object of the discussion is to show the use of the diode as modulator, and not to detail the construction of the converter. The complete diagram is shown for the benefit of those experimenters who would like to try some work along this line and who have sufficient technical knowledge to proceed on their own account.

Constants Given

In Fig. 1 the rectified current flows through R1, which may be any value from 0.05 meg. up, higher values being favored. So, too, R2 may be 0.5 meg. or more. These resistors and the pentode leak should be as high as possible, up to the point where motorboating sets in. C2 and C3 may be 0.01 mfd. or more. R3 is 10,000 ohms, if R4 is used, R4 being a resistor to introduce audio regeneration, from 0.1 meg. (100,000 ohms) down, until motorboating appears. With R4 out, R3 may be up to 0.02 meg. (20,000 ohms) if the first audio plate load is 0.25 meg. (250,000 ohms) or more, as the full B voltage is applied, about 265 volts. C1 is a radio frequency bypass condenser, 0.0001 mfd. to 0.0015 mfd.

In Fig. 2 the output of the detector is taken from the negative side, while cathode is grounded. This leaves the tuning condenser rotor slightly above ground potential. C1, the bypass condenser, helps to lower the rotor potential as is of radio frequency proportions as previously outlined. R1 is 50,000 ohms up, R2 is 0.5 meg. up. while R3 and R4 correspond to the values for Fig. 1.

Push Pull Circuit

Push-pull is illustrated in Fig. 3. R1 is not grounded, which is the saving grace. It may be 50,000 ohms up. C1 is familiar. C2 and C3 are 0.01 mfd. up. R2 and R3 should be exactly equal, and each of 0.5 meg. up, favoring higher values.

In Fig. 4 the condensers C1 and C2 may be equal, say, 0.0002 mfd., 0.00015 mfd. or 0.0001 mfd. L1 and L3 are equal except for the first (lowest frequency) short wave band. L2 has one-third the L3 turns on this band, one-half for the smaller coils.

117 Stations, or 38.5% of Those Measured, Less Than 50 Cycles Off

Washington.

Much station improvement is shown in the report by the Radio Division of the Department of Commerce on measurements during August, in that the number of stations in the class deviating under 50 cycles increased by 20 stations to 117 stations over the month of June, the best month previously reported, when 97 stations entered this class. Nearly 2 out of every 5 stations measured, or 38.5% of those measured during August, kept under the 50-cycle mark.

A total of 304 stations was measured during August for an aggregate of 5,201 times.

UNDER 50 CYCLES

Call signal	*Transmitter location, studio location in parentheses*	*Call signal*	*Transmitter location, studio location in parentheses*
KDKA	Saxonburg, Pa. (Pittsburgh).	WFAN, WIP	Philadelphia, Pa.
KFBB	Great Falls, Mont.	WFI	Do.
KFDM	Beaumont, Tex.	WFOX	Brooklyn, N. Y.
KFEQ	St. Joseph, Mo.	WGES	Chicago, Ill.
KFI	Los Angeles, Calif.	WGN	Elgin, Ill. (Chicago).
KFJI	Astoria, Ore.	WGR	Amherst, N. Y. (Buffalo).
KFJR	Portland, Ore.	WGST	Atlanta, Ga.
KFKA	Greeley, Colo.	WGY	Schenectady, N. Y.
KFKX, KYW	Bloomingdale Township, Ill. (Chicago).	WHAP	New York, N. Y.
KFLV	Rockford, Ill.	WHAS	Louisville, Ky.
KFQU	Alma-Holy City, Calif.	WHO	Des Moines, Iowa.
KFSD	San Diego, Calif.	WHP	Lemoyne, Pa. (Harrisburg).
KFVD	Culver City, Calif.	WIBW	Topeka, Kans.
KFWB	Hollywood, Calif.	WISN	Milwaukee, Wis.
KFYR	Bismarck, N. Dak.	WJAY	Cleveland, Ohio.
KGBZ	York, Nebr.	WJDX	Jackson, Miss.
KGEF	Los Angeles, Calif.	WJKS	Gary, Ind.
KGFJ	Do.	WJR	Sylvan Lake Village, Mich. (Detroit).
KGGF	Coffeyville, Okla.	WJSV	Mount Vernon Hills, Va. (Alexandria).
KGHI	Little Rock, Ark.	WJZ	Bound Brook, N. J. (New York City).
KGIZ	Grant City, Mo.	WKBF	Clermont, Ind. (Indianapolis).
KGW	Portland, Ore.	WKBI	Chicago, Ill.
KHQ	Spokane, Wash.	WKBN	Youngstown, Ohio.
KLX	Oakland, Calif.	WKBW	Amherst, N. Y. (Buffalo).
KLZ	Denver, Colo.	WKRC	Cincinnati, Ohio.
KMBC	Independence, Mo. (Kansas City).	WLAP	Louisville, Ky.
KMO	Tacoma, Wash.	WLBZ	Bangor, Me.
KMOX	St. Louis, Mo.	WLIT	Philadelphia, Pa.
KMPC	Bevelry Hills, Calif.	WLS	Downers Grove, Ill. (Chicago).
KOIL	Council Bluffs, Iowa.	WLW	Mason, Ohio (Cincinnati).
KPO	San Francisco, Calif.	WMOL	Washington, D. C.
KSAC	Manhattan, Kans.	WMOQ	Addison, Ill. (Chicago).
KSTP	Radio Center, Minn. (St. Paul).	WMT	Waterloo, Iowa.
KTAR	Phoenix, Ariz.	WNBH	Fair Haven, Mass. (New Bedford).
KTRH	Houston, Tex.	WOAI	Selma, Tex. (San Antonio).
KTSM	El Paso, Tex.	WOC	Davenport, Iowa.
KVOO	Tulsa, Okla.	WOI	Ames, Iowa.
KXO	El Centro, Calif.	WOL	Washington, D. C.
KYA	San Francisco, Calif.	WOR	Kearny, N. J. (Newark).
WAAB	Lexington, Mass. (Boston).	WOS	Jefferson City, Mo.
WABC	New York, N. Y.	WOWO	Fort Wayne, Ind.
WADC	Tallmadge, Ohio (Akron).	WPAW	Pawtucket, R. I.
WAWZ	Zarepath, N. J.	WPTF	Raleigh, N. C.
WBSO	Needham, Mass.	WQAM	Miami, Fla.
WBT	Charlotte, N. C.	WRAX	Philadelphia, Pa.
WBZ, WBZA	Millis Township, Mass. (Boston).	WREC	Whitehaven, Tenn. (Memphis).
WCAM	Camden, N. J.	WRUF	Gainesville, Fla.
WCAO	Baltimore, Md.	WRVA	Mechanicsville, Va. (Richmond).
WCBA	Allentown, Pa.	WSB	Atlanta, Ga.
WCBM	Baltimore, Md.	WSMB	New Orleans, La.
WCFL	Chicago, Ill.	WTAG	Worcester, Mass.
WCHI	Deerfield, Ill. (Chicago).	WTAM	Brecksville Village, Ohio (Cleveland).
WCRW	Chicago, Ill.	WTAR, WPOR	Norfolk, Va.
WCSH	Scarboro, Me. (Portland).	WTMJ	Brookfield, Wis. (Milwaukee).
WDAF	Kansas City, Mo.	WWJ	Detroit, Mich.
WEAF	Bellmore, N. Y. (New York City).	WWVA	Wheeling, W. Va.
WEAN	Providence, R. I.		
WEBC	Superior, Wis.		
WEEI	Weymouth, Mass. (Boston).		
WENR	Downers Grove, Ill. (Chicago).		
WEAA	Grapevine, Tex. (Dallas).		

A Pentode Power Amplifier

Gain is 720 Output 5 Watts, Stability Complete

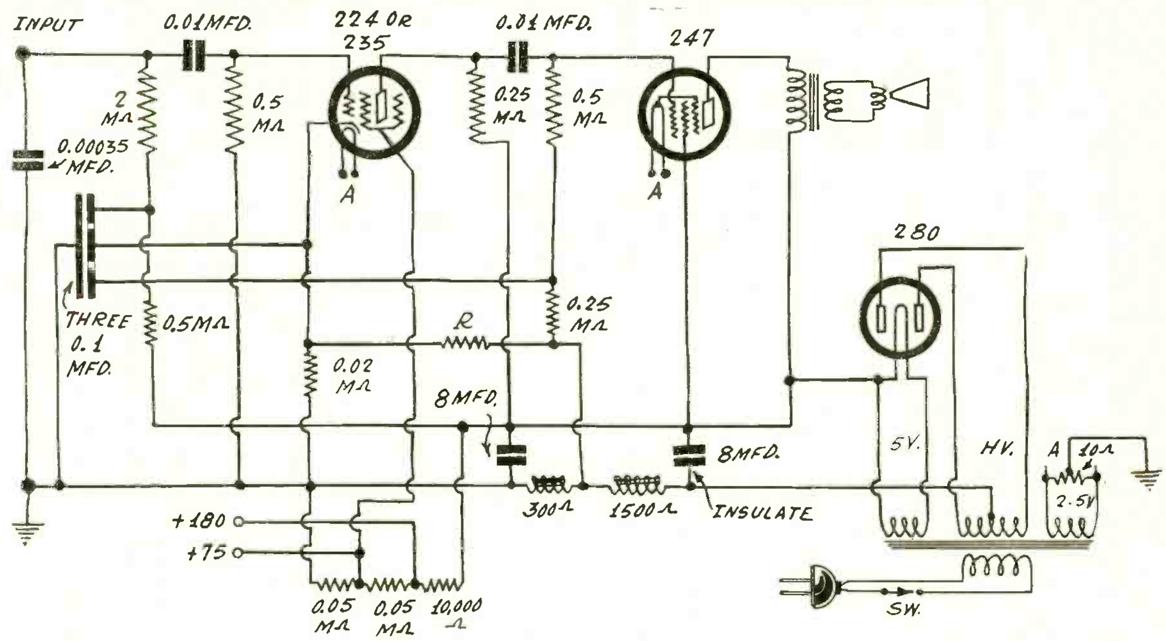


FIG. 1

Design of a 5 watt power amplifier, using screen grid first audio and pentode amplifier, with voltages available for serving a tuner. The speaker is an integral part of such an amplifier system.

A POWER amplifier of almost 5 watts output power rating is diagrammed in Fig. 1. Two stages of resistance coupling are used, and regeneration is introduced, through the resistance R, to cancel any negative feedback effects. As such effects will depend to some extent on the actual constants used, which may not always follow those specified, it is suggested that R first be tried at 0.1 meg. (100,000 ohms) and lower values substituted until motorboating appears, whereupon clearly a higher resistance is necessary, and then may be inserted. This resistor is not necessary for mere performance but will improve the tone quality, supplanting large condensers.

The power transformer takes care of the power amplifier, as well as three more heater type tubes, which may be in the tuner. Even four more have a total of four extra heater tubes can be served, but then the voltage will be a little less than 2.5 volts on the heaters.

Also, B power for the tuner may be derived from the power amplifier. Resistors of 1 watt rating may be used for all purposes shown, excluding the 10 ohm center tapped resistor, as the current through none of the others will be large enough to warrant special precautions, except perhaps the 10,000 ohm unit. If variable mu tubes are used in the tuner, this resistor may be 1 watt, also, if the minimum bias on two of the tuner tubes r-f is provided by a common 600 ohm resistor. For general utility, however, the 10,000 ohm resistor would have to be rated at 5 watts.

The input has a radio frequency bypass condenser across it, less the detector in the tuner has none.

It is advisable to have a screen grid detector work into such an amplifier, so if your tuner has a 227 or other tube, the change should be made.

To change 227 detection to screen grid, disconnect the coil connection to the G post of the socket and instead bring it up through the panel and solder a grid clip at the end for connection to tube cap. Then connect a resistor of 2 meg. from the G post to the B plus screen voltage that serves the rest of the tuner, connecting a radio frequency bypass condenser (0.00035 mfd. or higher) from screen of detector to ground. If grid bias detection is used the biasing resistor value need not necessarily be changed, although it is a little preferable to raise it to 0.05 meg. (50,000 ohms).

If the tuner is battery operated, the change is made in the same manner as described for the 227.

The plate load is filtered, as a device for hum reduction, and the same process is repeated in the grid circuit of the pentode. The result is a true-tone amplifying system that is as free from hum as any amplifier you ever heard.

The audio channel is along lines familiar to readers of these columns who have been following the series of articles on regenerated audio, while the B supply is in line with the present ex-

(Continued on next page)

LIST OF PARTS

Coils

[Note: B supply choke and output transformer built into speaker]

Condensers

One block of three 0.1 mfd. condensers in one shield case
Two 8 mfd. electrolytic condensers, with insulating washers and separate lug for one of them
Two 0.01 mfd. mica fixed condensers
One 0.00035 mfd. fixed condenser

Resistors

One 2 meg. pigtail resistor
Three 0.5 meg. pigtail resistors
Two 0.25 meg. pigtail resistors
Two 0.05 meg. (50,000) pigtail resistors
One 0.01 meg. (10,000 ohm) pigtail resistor
One 0.02 meg. (20,000 ohm) pigtail resistor
One pigtail resistor of 0.1 meg. (100,000 ohms) or less, value to be determined experimentally (R)

Miscellaneous Parts and Accessories

One chassis 7 x 5½ x 1½ inches, with six holes
Binding posts: one for output, one for ground, two for 2.5 volts a-c, one each for 75 and 180 volts.
One a-c cable and plug
One a-c switch, toggle type
One dynamic speaker, 1,800 ohm field coil, tapped at 300 ohms; pentode output transformer built in; speaker plug and cable
Three UY sockets (one used for speaker) and one UY socket
Tubes; one 224, one 247, one 280

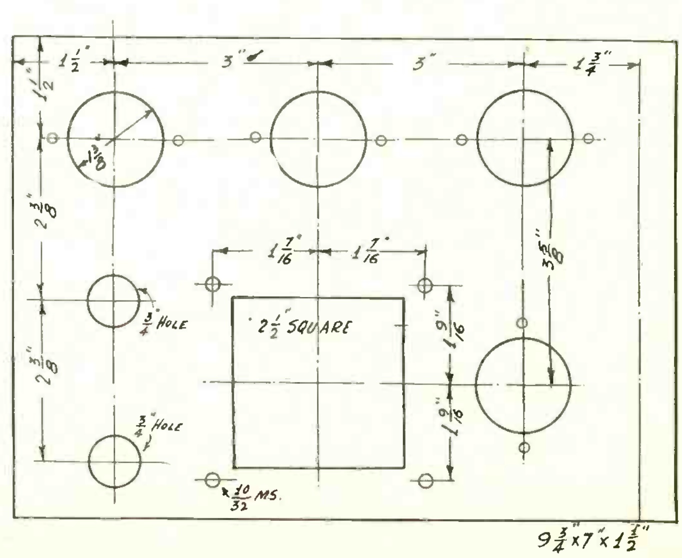


FIG. 2

Layout for constructing the power amplifier diagrammed in Fig. 1.

An 8 Tube Superh

Automotive Type Tubes Use

By Brunsten

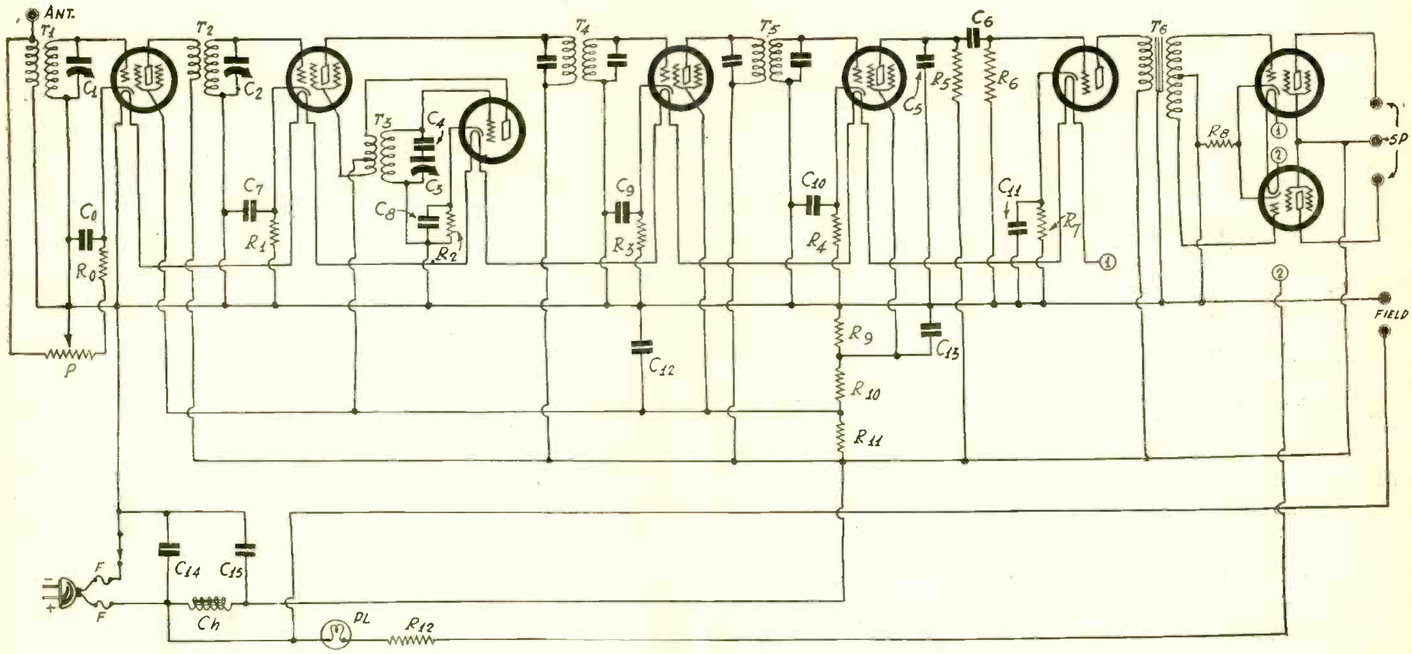


FIG. 1

The diagram of an eight tube superheterodyne designed for use on a 110 volt direct current line and automotive type tubes.

THERE have been many requests for direct current receivers, both of the t-r-f type and superheterodyne. Elsewhere in this issue there is described a tuned radio frequency receiver containing six tubes which meets the requirements. Here we shall describe an eight tube superheterodyne which is built along the same lines. This should meet with the approval of those who want a more selective and more sensitive set than the tuned radio frequency receiver.

Fig. 1 shows the circuit diagram. We have first a radio frequency amplifier, then a modulator, then an oscillator, all operating primarily at radio frequency. Then follows an intermediate frequency amplifier, then a detector, then a stage of single sided audio amplification, and finally a stage of push-pull.

Tubes Used

All the tubes in the circuit are of the automotive type. The radio frequency amplifier, the modulator, the intermediate frequency amplifier, and the detector are of the 236 type, the oscillator and the first audio frequency amplifier of the 237 type, and the push-pull tubes are of the 238 type. These tubes all require 0.3 ampere on the heaters so that they can be connected in series without any complications.

Thre are two radio frequency tuners in the circuit to insure that there will be no image interference by tuning out completely any station which may happen to be operating on a frequency differing by twice the intermediate frequency from the desired station.

There are two intermediate frequency tuners, one between the modulator and the intermediate amplifier and another between that amplifier and the detector. Both these tuners are resonant both in the primary and the secondary. Each winding is adjusted to 175 kc by means of a trimmer condenser built into the transformer and accessible with a screwdriver.

Adjustment of Voltages

The design of receiver to give optimum performance depends largely on the correct choice of voltages on the grids, screen, and plates and for that reason we shall go into some detail in this matter. At this point it should be emphasized that if anything is changed in the circuit it is necessary to make other changes to compensate for the first change. This is stated because frequently a coupler resistance, or a resistance is replaced by a transformer, without making the appropriate changes in bias resistances, with the result that the circuit does not perform. It may be said that any change in any way affecting the plate and screen voltages necessitates some compensating change. This may be in a grid bias resistor or in the voltage divider.

The normal screen current in the radio frequency amplifier with 37.5 volts on the screen and 110 volts on the plate is about 0.34 milliampere. This will be the screen current in the first tube in the circuit when the volume is set at maximum. The plate current is three times the screen current, and therefore the total current in the cathode lead is 1.36 milliamperes. If we allow a minimum bias of 1.25 volts on the grid of the radio frequency amplifier, Ro should have a resistance of about 900 ohms. But any value between that and 600 ohms is all right. We shall later allow for sufficient bleeder current to minimize the effect of any changes in this bias. The intermediate amplifier, the fourth tube in the circuit, operates under the same conditions as the first tube, so that R3 should have the same value as R0.

The Modulator

The modulator will work well when the bias resistance R1 is 2,000 ohms, assuming that the screen voltage is 37.5 volts and that the plate voltage is 110 volts. It may be, however, that individual tubes will work with a slightly different bias than that provided by a 2,000 ohm resistance. R1 may therefore be a 3,000 ohm variable resistor.

The oscillator is a 237 tube and is biased by R2, a 1,500 ohm resistor, which gives the grid a bias of about 3 volts.

The detector tube, which is the fifth in the circuit, is biased by R4, a 30,000 ohm resistor. This gives best detection when the screen voltage is around 1.5 volts, net, assuming that the load resistance R5 in the plate circuit is 250,000 ohms and the applied plate voltage is 110 volts. The detecting point is not extremely critical so that some variation is allowed in the applied screen voltage.

Pentode Audio

(Continued from preceding page)

cellent practice in midget and other sets of using the dynamic field coil as B supply choke in the negative leg of the rectifier.

The circuit is utterly stable and gives an overall gain of around 720.

The output transformer is built into the speaker, and therefore the speaker is really a part of the power amplifier, unlike in other

eterodyne For DC

d for Economical Operation

Brunn

R7 biases the first audio amplifier, and since this tube is a 237, the resistance value is 1,500 ohms. R8 biases the two output tubes, and the value of this resistance should be 600 ohms.

Design of Voltage Divider

Now let us determine the resistance in the voltage divider to give the desired voltages on the various elements. R9, which determines the bleeder current, is arbitrary, but once that has been chosen we have to determine the remaining resistances in the voltage dividr consistently.

The voltage drop in R4 is roughly 0.75 volt and the desired screen voltage is 1.5 volts. The drop in R9 should be the sum of these two, or 2.25 volts. If we allow a bleeder current of 7.5 milliamperes we need a resistance of 300 ohms to cause a drop of 2.25 volts. This is a convenient resistance and the bleeder current is large enough to stabilize the remaining voltages.

We want a screen current on the remaining tubes of about 37.5 volts, net, or a little more. Since the drop in R9 is small and also since we must allow a small voltage for the bias on the radio frequency amplifier tubes, let us assume that the drop in R10 is 37.5 volts. Practically the same current flows in R10 as in R9, that is, 7.5 milliamperes. Hence R10 should have a value of 5,000 ohms. That is another convenient value. A one watt resistance is all right.

Getting Final Resistor

R11 can only be determined by first estimating the current that flows through it. We already have 7.5 milliamperes. Then we have 0.68 milliamperes to the two screens of first and fourth tubes. Then we have the plate current to the oscillator and the screen current to the modulator. We can safely assume that the total is 10 milliamperes or slightly more. Now the drop in R11 is the difference between the line voltage and the voltage at the junction of R10 and R11. This difference is about 70 volts. Hence R11 should be 7,000 ohms.

While some of these values are only approximate, they are near enough to insure good operation. Closer values cannot be determined without knowing the exact voltage of the line, which may be different from 110 volts. The most critical values are the bias on the detector and the screen voltage on that tube and even these are not so critical that a change in the line voltage will upset the adjustment. The bleeder current was selected large to insure this stability.

While a bleeder current of 7.5 milliamperes is not large absolutely, it is large compared to possible changes that may occur in the plate and screen currents to the various tubes connected to the junction of R10 and R11.

The voltage on all the plates with the exception of that on the oscillator is 110 volts, or whatever is left after the drop in the filter choke Ch. At most, this should not be more than 7 volts. It often happens that the voltage of the line is 117 volts, which would leave just 110 volts for the plates.

The net voltage may rise and fall as the line voltage fluctuates but all the voltages will drop in proportion so that the adjustment remains once it has been attained.

All the heaters are in series and each takes 6.3 volts. Hence the total drop in the filaments is 50.4 volts. In addition to the heaters there is a pilot lamp in the circuit, and this drops about 3 volts. Thus the total useful drop is 53.4 volts. The rest of the 110 volts must be dropped in a ballast resistor R12. The values of this resistance should be such that it drops 56.6 volts when the current is 0.3 ampere. That is, it should be 189 ohms. A somewhat lower value may be used for the voltage across each heater may be slightly greater than 6.3 volts.

R12 will dissipate 17 watts. Hence the resistor that is selected for this must have a rating higher than this. It is well to select one that has a rating of at least 25 watts so that it will run tolerably cool. Regardless of the rating of the resistor used, if it has 189 ohms and a current of 0.3 ampere flows through it, the dissipation will be 17 watts. No more heat will be liberated if a 100 watt resistance of 189 ohms is used, but a 17 watt resistor might get so hot that the insulation will melt, even if it is porcelain, while a 100 watt resistance will run quite cool.

It will be noticed that the heater circuit is not drawn complete. The omission was only to avoid confusion of leads. The heater terminal on the sixth tube marked (1) should be connected to the terminal similarly marked on the seventh tube, and the terminal marked (2) on the eighth tube should be connected to the terminal similarly marked on the positive side of the line just below the tube.

Two terminals are provided for a dynamic speaker field and they are so marked. One of them, the positive, goes directly to the positive side of the incoming power line, while the negative is connected to the chassis of the set, which goes to the negative side of the line through the line switch. A field designed for a 110 volt line will do. A speaker having a 1,800 ohm field has been used, but it runs slightly hotter than it should. One of 2,200 ohms would be better. Or if it is desired to use a 1,800 ohm field speaker, which is very common in midget sets, the current may be cut down by connecting a resistance in series with it. A speaker of 1,800 ohms designed for a drop of 100 volts across it should have an external resistance of 180 ohms when used on 110 volts, if the wattage in the field is to be the same in the two cases. This external resistance, if used, should have a current carrying capacity of 1/18 ampere, or a wattage rating of one watt or more.

The three terminal for the speaker assumes that this contains a push-pull output transformer. If it has not, it is necessary to interpose one between the speaker and the output tubes, and this transformer must effect the proper match. Incidentally, it costs no more to get a speaker with a push-pull than one with an ordinary transformer.

LIST OF PARTS

Coils

T1, T2—Two shielded radio frequency transformers for 0.00035 mfd. condensers.
T3—One oscillator coil as described.
T4, T5—Two Supertone 175 kc intermediate frequency transformers.
T6—One push-pull audio frequency input transformer.
Ch—One 30 henry choke (not more than 400 ohms resistance).

Condensers

Co, C7, C8, C9, C10—Five 0.1 mfd. by-pass condensers.
C1, C2, C3—One gang of three 0.00035 mfd. tuning condensers, or a special gang for oscillator matching, or one two gang and one single.
C4—One 0.00075 mfd. with one 100 mmfd. trimmer condenser to be used only if C1, C2, and C3 are equal and ganged.
C5—One 0.0005 mfd. fixed condenser.
C6—One 0.1 mfd. fixed condenser.
C11—One 2 mfd. by-pass condenser.
C12, C13—Two one mfd. by-pass condensers.
C14, C15—Two 16 or 8 mfd. electrolytic condensers.

Resistors

P—One 10,000 ohm potentiometer, with line switch.
Ro, R3—Two 600 or 900 ohm bias resistors (or intermediate values).
R1—One 2,000 ohm fixed or a 3,000 ohm variable resistor.
R2, R7—Two 1,500 ohm resistors.
R4—One 30,000 ohm resistor.
R5—One 250,000 ohm resistor.
R6—One one megohm resistor.
R8—One 600 ohm resistor.
R9—One 300 ohm resistor.
R10—One 5,000 ohm resistor.
R11—One 7,000 ohm resistor.
R12—One 189 ohm resistor, 25 watt rating at least.

Miscellaneous Parts and Accessories

F—Two 3 ampere fuses.
PL one pilot light (3 volts, 0.3 ampere).
Six grid clips.
Five tube shields.
Eight UY sockets.
One special midget chassis with eight socket holes.
One six foot cord and plug.
One vernier dial (or two if dual control is used).

Power Amplifier

days when the two were quite separate. In fact, a socket is used as speaker plug receptacle, and the three choke terminals (extremes and tap) and output transformer primary terminals (plate and B plus) are connected to the five pin plug. A common way to connect is: P of socket to ground, G to tap on the field coil, K to B minus; heater terminals interchangeably to plate and B plus (primary of output transformer).

The Monitor Receiver's

Tests of Primaries and Minimum C

By Rolan

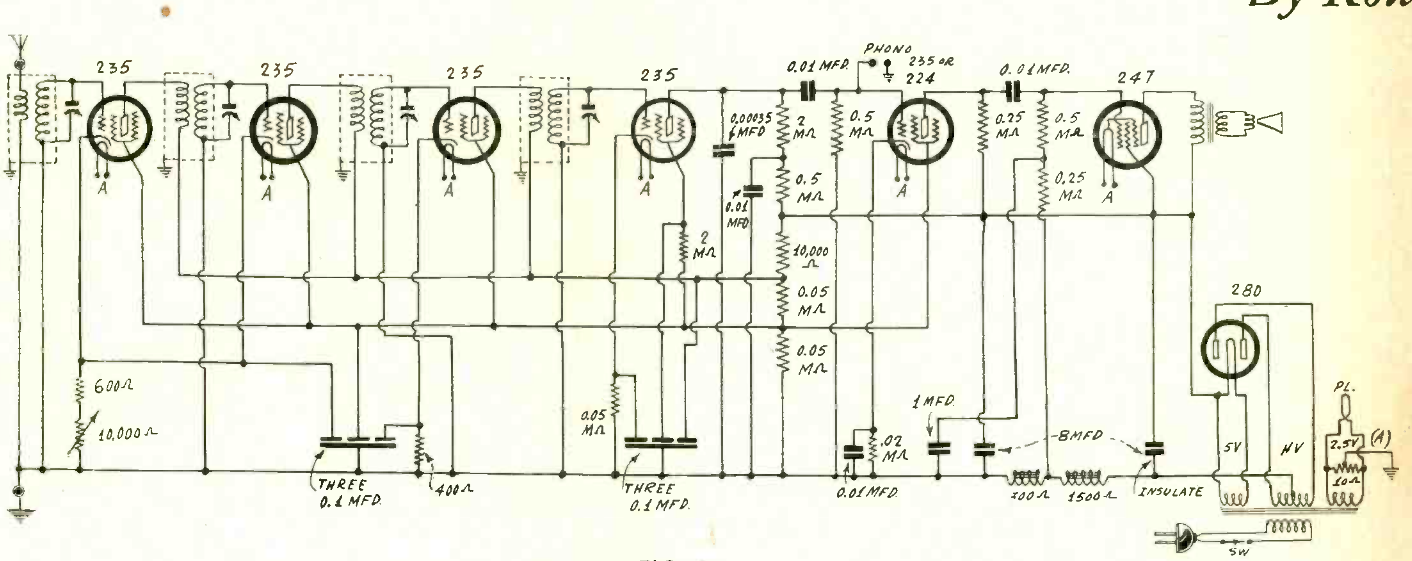


FIG. 1

The monitor circuit as built by the author, the results of which are stated in the accompanying article. Hum trouble was wholly removed, while sensitivity and selectivity were high. There are three stages of t-r-f, power detector and two stages of resistance audio, with pentode output.

[Herewith is a report on the laboratory receiver, of the monitor type, using shielded plugin coils, to cover nearly all of the broadcast band. It is intended next to develop the coils for the first short wave band that can be covered, the tuning being from about 1,300 kc to about 3,000 kc, since the frequency ratio found in the broadcast band was 2.4 to 1. Thereafter coils will be used for the lower waves, to as far down as the set will go, and later coils for waves below the broadcast band, to 150 kc.—EDITOR.]

AN a-c set consisting of three stages of tuned radio frequency amplification, power detector, two stages of resistance coupled audio amplification and B supply was built, with a separate dial and condenser for each tuned stage, and it was possible to develop high sensitivity without squealing, and also to produce great volume without any hum.

The set is to use plug in coils, and as the condensers are 0.000325 mfd., it was assumed that the broadcast band could be fully covered without changing the coils, but there was a slight missout, as with 540 kc as the lowest frequency, the highest frequency receivable on one of the dials was 1,300 kc. This would seem correctible if the low were altered to 550 kc, whereupon the high would exceed 1,500 kc, and it would be true if all the circuits tuned exactly alike, but they did not.

It was amazing to discover the height of the minimum capacities due to the shielded screen grid leads and shielded plate leads, as well as to the use of tube shields. Only the tube shield effect was measured, and there was an increase of 7 mmfd. when the shields were put on. They can not be left off, either, otherwise the set would squeal.

With the tube shields off, oscillation started at 1,100 kc, but with them on there was none at the highest frequency receivable. However, the limiting biasing resistor for the first two radio frequency tubes had to be 600 ohms. This heightening of the bias is a squealing corrective and is also a slight improver of selectivity.

Tests Made at Different Primaries

On the selectivity score, the set was excellent, as it was possible to tune out the strongest local, WABC, and bring in a distant station 20 kc removed. With locals of lesser strength, compared to distant stations, complete separation at 10 kc was enjoyed. Selectivity stood up at the high broadcast frequencies, unusual for t-r-f.

The coils were wound on 1⅛ inch diameter tubing. The secondaries consisted of 120 turns of No. 31 enamel wire, but any size thereabouts may be used. Then the primaries were wound with No. 28 enamel on top of the secondaries, at the end nearer the bottom of the shield, and consisted at first of 25 turns. Any reasonable size of wire may be used. The 25 turns proved entirely too much, as was expected, since coils with such primaries are used on sets with only two stages of t-r-f, and here we have three, so feedback has to be considered. The selectivity was not good enough and the squealing was bad. Ordinarily one would expect a set to be more selective if regenerative, and while this is true, the fact is that only one stage may be squealing, and the other stages suffer from selectivity because of the oversized primaries.

Therefore the number of turns on the primaries was reduced, until just the right amount was left—12 turns. While this is a small number of turns, counted simply as turns, the coupling is by no means too loose, as there is considerable capacity coupling, due to the primary being wound right on top of the secondary, with only insulating fabric between.

Unequal Dial Settings

Some tests were made of 25 turns, 20 turns and 12 turns, and it was found that the difference between 25 turns and 20 turns was represented by a dial adjustment equal to 12 mmfd., while the difference between 20 turns and 12 turns was represented by 9 mmfd. So with a tube shield capacity effect of 7 mmfd., and an equal condenser minimum, 14 mmfd. are thus accounted for. Then, too, other leads in the set, not thus far accounted for, contributed extra minima.

Connections for

(Continued from page 5)

by a common resistor R6 of 600 ohms. No by-pass condenser is necessary across this resistor. A push-pull input transformer couples the 237 tube to the power tubes. The dynamic loudspeaker contains the push-pull output transformer. If another speaker is used it is necessary to add a suitable output transformer.

The Heater Circuit

All the heaters of the six tubes are connected in series and each tube must have a voltage of 6.3 volts across its terminals when 0.3 milliampere flows. That is, the total voltage drop across the six heaters should be 37.8 volts. If the line voltage is 110 volts there is an excess of 72.2 volts. This should be dropped in the ballast resistor R10, which, therefore, should have a resistance of 240 ohms. It must have a wattage rating of 21.6 watts or more. A 60 watt Mazda lamp has approximately this resistance. A lamp may be used if a wire wound resistor of 240 ohms is not available. The lamp should not light up but may glow a dull red.

There will be a pilot lamp in the circuit to illuminate the dial. This should also be connected in series with the heaters provided one can be found that will carry 0.3 ampere. The resistance of this lamp will be so small that it is not necessary to make any allowance for it in determining the value of R10.

In case the line voltage is higher than 110 volts, which it will be

Broadcast Performance

Capacities—Circuit Successful So Far

nd Tookle

If equal coils are put in equal positions we would expect, with equal condensers and equal shields, equal dial settings, but these did not obtain. At first there was quite a considerable difference, when staggered primaries (different number of turns in each stage) were used, while the dials were drawn more closely toward tracking when the primaries were equal in the interstage couplers. At first the antenna coupler had an r-f choke coil as the primary, and this made tracking with the subsequent stages impossible. as only over part of the dial would the antenna stage condenser anywhere nearly follow the other dials.

The reason became apparent when tuning curves were taken. First the frequency characteristic was plotted against dial settings and it looked as if there might be too little inductance. Innocently enough, the tuning condenser was inspected, on the chance it might have a few more plates than the other condensers, and the fact had gone unnoticed. But of course such was not the case. Then extra turns were put on the secondary, and a new curve taken. The manner of the crossing of the curves showed there had been too much inductance previously. So a check-up was made, and it proved that the r-f choke as primary, being broadly resonant around the lower frequency end of the broadcast band, caused the mutual inductive coupling with the secondary to be greater at the low frequencies, and the inductance of the secondary became less, due to mutual reactance. As the frequency increased, the coupling became looser, and the mutual reactance less, so that the secondary had a variable inductive feature, which enabled coverage of a wider range of frequencies with a given condenser.

Detracking Confined to One End

However, the succeeding stages also would have to be equipped with r-f choke primaries if the circuits were to tune anywhere nearly alike, and as such chokes would introduce squealing trouble, as tests had showed, the antenna primary was made like the other primaries.

The differences then were not very material, as at the higher capacity settings the dials then tracked fairly well, while at the lower ones they separated, say, from 25 down. The separation was small at first, but of course became larger, since the condensers are of the midline tuning type, which has close to a straight frequency line curve. The lower numerical settings of the dial (lower capacities) therefore represent very small differences in capacity, the same actual differences present at the other extreme, but unnoticed there. Also there was some dissimilarity in frequency, as previously stated, one circuit going higher than another. Obviously the different lengths of wire leads in the respective circuits accounted for that.

The sensitivity has not actually been measured yet, but it is better than 5 microvolts per meter at the low frequency end, as a measured set of that sensitivity was compared with it.

Hum always has been troublesome with two stage resistance coupled amplifiers, and sometimes motorboating as well. However, in the present circuit there is no trouble from either. The hum originally present was taken out by using a detector plate load resistor of 2 meg., assisted by a filter circuit consisting of an 0.5 meg. resistor and a 1 mfd. condenser. Originally some reduction had been effecutated by the resistor-capacity filter in the pentode circuit, consisting of 0.25 meg. and 0.1 mfd. Both filters were retained.

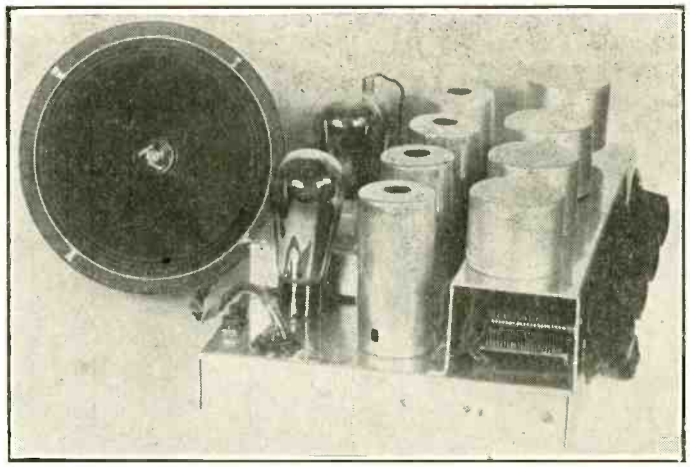


FIG. 2

Side view of the chassis after the author had completed the construction. The speaker plug carries leads to the output transformer and the dynamic field coil that is used as B supply choke.

Hum Absence Causes Comment

The absence of hum caused some surprise to an engineer who had been experimenting with a two stage resistance coupled audio channel and had run into hum trouble that he had solved in another but somewhat more expensive way. The present solution was complete and inexpensive.

Any who build the circuit should duplicate the values precisely, in the audio channel. The screen voltage on the first audio tube, open to theoretical doubt as being too high, is not too high, as with lower values results were decidedly inferior and volume less.

It will be noticed that the full B voltage is applied to both detector and first audio for bias and plate voltage, so that this plate applied voltage is around 270 volts, while the screen voltage is around 70 volts.

When the tuner is worked at broadcast frequencies it can be seen that there is a difference in dial settings, noticeable at the lower numerical and capacity readings, and not effective on the dial at the low frequencies. However, when higher than broadcast frequencies are to be tuned in, the difference will become more effective. The next step is to dip down to about 3,000 kc, or around 100 meters. The condenser will be used for this purpose as on the broadcast band. From 100 meters down a series condenser will be cut in, to reduce the tuning capacity to around 75 mmfd., but as the series condenser will be adjustable, the circuits could be lined, say, at the geometrical mean frequency of any band. The dials then would not read off to any appreciable degree for lower frequencies, but only for higher frequencies.

There is no particular disadvantage in unequal dial readings, as for each band there should be a chart with four lines on it, each line representing one of the dials, and tuning should be done on that basis, as this is a laboratory instrument. For local reception it is necessary to "know the combination" also, otherwise 50,000 watt stations close at hand will be hard to "find."

Incidentally, the situation of tuning diversity as developed (which is nothing new) is somewhat of a commentary on gang tuning in respect to the higher broadcast frequencies.

[The circuit described herewith was inspired by the circuits used at the Central Frequency Monitoring Station at Grand Island, Nebr., but the present one is original with the author. For layout and other data see October 31st and November 7th issues.—EDITOR.]

110 volt D-C Set

in most cases, it is not necessary to allow for it because the tubes will stand up to 8 volts per tube. If the voltage is to be 8 volts per tube the total line voltage will have to be 139 volts. This it will never be. It will probably never exceed 125 volts.

Filtering

Each of the condensers C12 and C13 is 16 mfd. and both are of the electrolytic type. This high capacity is necessary to remove hum in some instances but on most lines it should not be necessary to use more than four microfarads for each condenser. A 30 henry choke Ch is connected in series with the B supply. There is therefore ample filtering of the supply.

It will be noted that the heater circuit is so connected that the heater current does not flow through the choke Ch. Hence there is no saturation danger. The heater current is filtered only by C12. Since the tubes are all of the heater type there is really no need of filtering this circuit but C12 has to be used anyway.

Condensers C6, C7, and C10 are of 0.1 mfd. capacity. C9 is a 0.5 mfd. capacity. C4 is a 0.00035 mfd. mica type condenser.

It is not necessary to connect a ground to the circuit, although one is shown, because one side of the line is grounded. As far as radio frequency potentials are concerned both sides are grounded because of the large by-pass condenser C12. In case a ground connection is made it must be through a condenser Co, which may .01 mfd.

An All Wave Seven

Tapped Coils, Dynatron Oscillator,

By Joseph

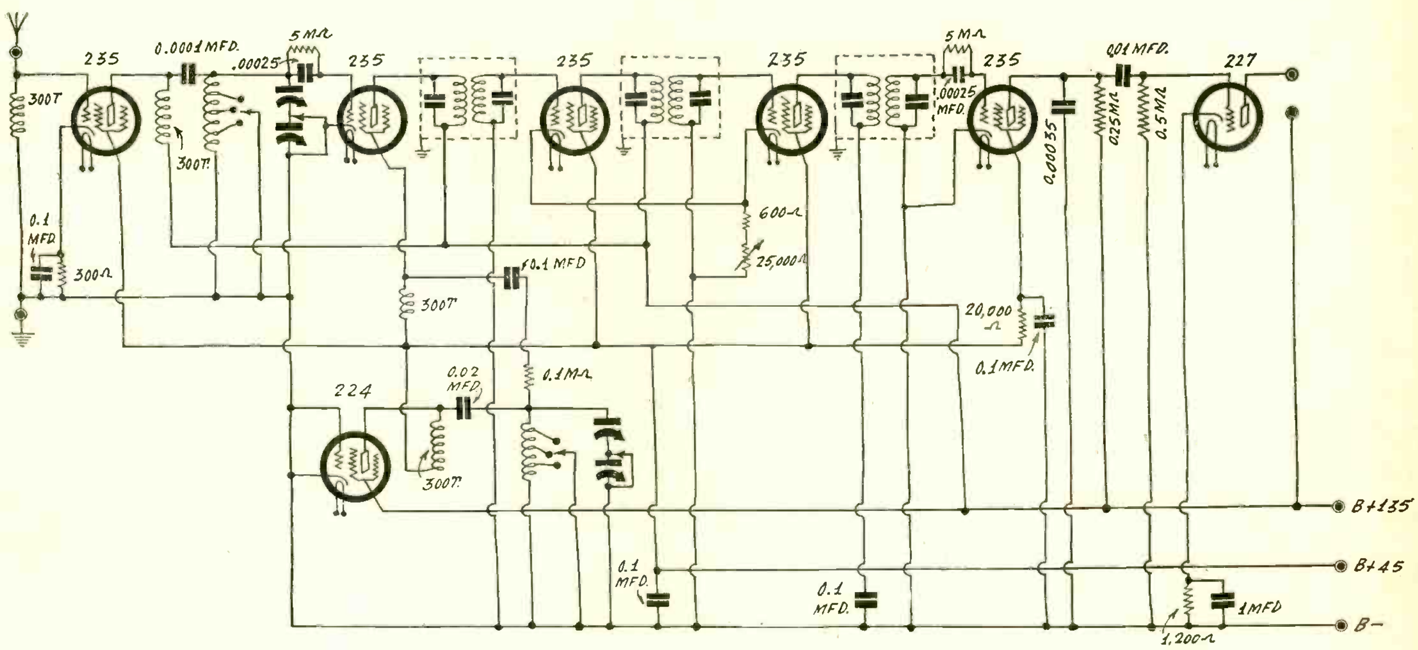


FIG. 1

This shows the diagram of Mr. Arena's seven tube short-wave superheterodyne.

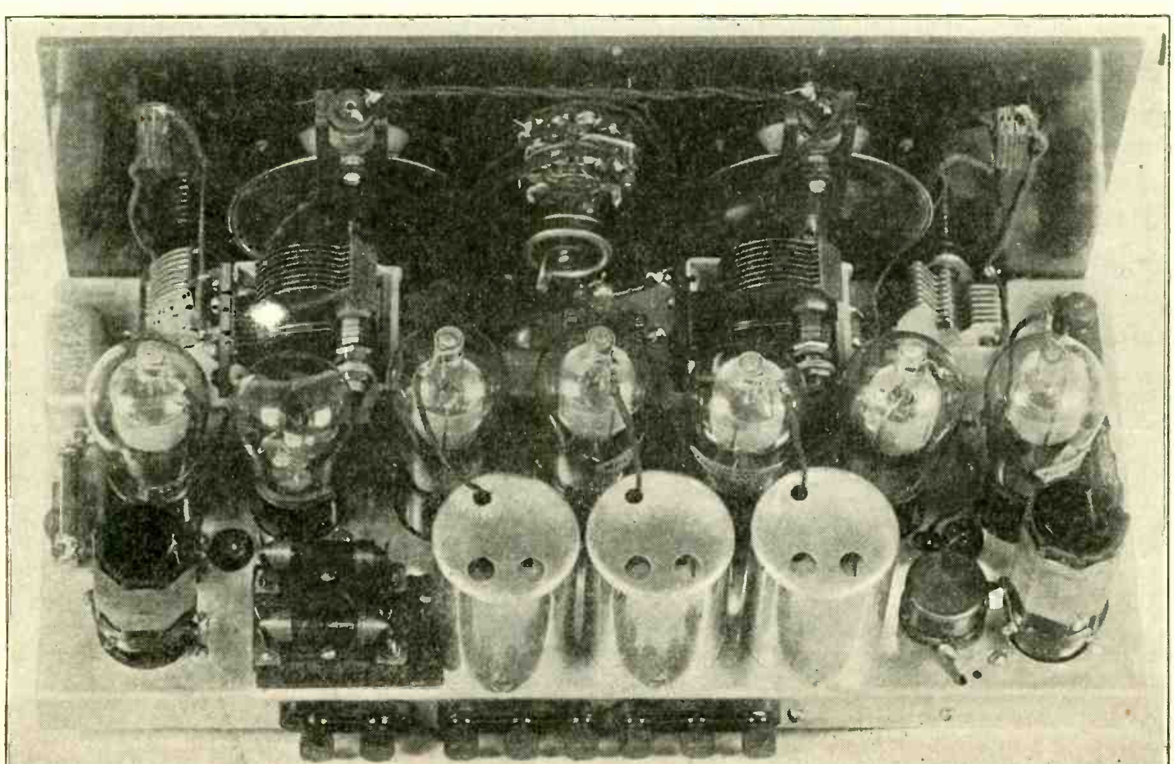


FIG. 2

This picture shows the layout of the parts on the chassis of the seven tube short-wave superheterodyne.

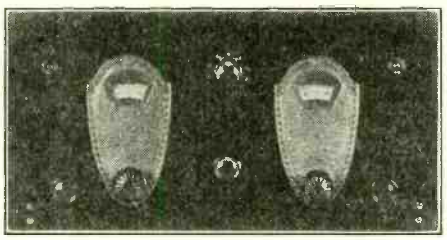
Tube Superheterodyne

and 175 kc Intermediate Used

Arena

FIG. 3

Front panel view of the seven tube short-wave superheterodyne.



HERE is an all-wave superheterodyne receiver that works, and works well. Of course, there is nothing remarkable about that fact, for there are thousands of receivers of this type that work. But the circuit employs an intermediate frequency of 175 kc. This is regarded, usually, as too low for a short-wave superheterodyne. It is not in this receiver. Moreover, it employs a 224 dynatron oscillator. It is usually said that this type of oscillator does not work on short waves, but it does in this. Again, the wave bands are changed by means of taps on the coils, the taps short-circuiting the unused turns. Some object to this arrangement on the ground that there are losses in the coils. But theoretical objections do not prevail against results.

The circuit diagram of the superheterodyne is shown in Fig. 1. As will be seen it is a seven tube receiver comprising a radio frequency amplifier with untuned input, a screen grid modulator with tuned input, a 224 dynatron oscillator, two stages of intermediate frequency amplification, each stage using a 235 tube, a detector of the same type, and finally a 227 type output tube. The set was not designed for great output power, but rather for high sensitivity, which accounts for the use of only a 227 tube in the final stage.

The Pick-up System

The coupling between the oscillator and the modulator is by means of a 100,000 ohm resistance connected between the screen of the modulator tube and the high voltage side of the oscillating circuit. A 300 turn choke, having an inductance of about 0.5 millihenry, is connected in the screen return lead to insure that a high frequency voltage be impressed on the screen. Due to the high resistance and the high impedance of the choke to the radio frequency, the pick-up arrangement introduces only a negligible change in the oscillation circuit. This is a fixed change so that it does not upset dial settings.

There are two variable condensers in series in each tune circuit, all four being separately adjustable from the panel. A switch, also accessible from the panel, is connected across each of the small condensers by means of which these condensers may be shorted out. Thus the large condensers alone may be used when the longer waves are to be received. When the small condensers are in the circuit they may be set at any value and the large condenser may then be used as vernier tuners. This is advantageous when short waves are to be received.

Volume Control

The volume is controlled by varying the bias on the two intermediate frequency amplifiers. A "hop-off" resistance of 600 ohms is used to insure bias when the volume control is set at maximum gain. The variable resistance has a maximum value of 25,000 ohms, which is large enough to insure complete control. This control is surely needed, for the amplification in the circuit is enormous.

Fig. 2 shows the arrangement of the parts on the chassis. The two coils are at the extreme ends of the set to insure a minimum of stray coupling. The intermediate frequency transformers are at the center rear in the aluminum cans. The wave-change switch may be seen in the center of the panel.

JOSEPH ARENA

Uses Shorting Method

The method used is to decide the full secondary turns for the capacity of main condenser used, then halve the turns twice, and make the switch short out the unused turns. The method worked surprisingly well in this set. Separate coils may be better but they take up ever so much more room.

Fig. 3 shows the layout of the controls on the panel. In the center top is the wave-change switch and just below it is the volume control knob. At each lower corner is the knob for the small condenser associated with the main condenser next to it, and directly above the knob of the small condenser is the short-circuiting switch. The coil taps are located equally by the halving process.

Ultra Frequencies for Vision

By Hollis Baird

Chief Engineer, Short Wave and Television Corporation

Boston:—Ultra short, micro and other descriptive terms applied to waves fall strangely on ears which have barely started to get accustomed to the term short waves, yet in these newly exploited waves there appears to be room for the many television channels.

The significance of these ultra short waves for television is emphasized by the leasing of the top of the new 1,250 foot high Empire State Building in New York City by the National Broadcasting Company for the admitted purpose of television transmission, for the one basic requirement of these short wavelengths is that they must be sent from some very high point if they are to reach very many people, since they act much like light rays.

The old Biblical statement of hiding one's light under a bushel shows that low light is of little use and the fact that the primitive people who wanted to reach the greatest number of their fellows with a signal always lit a fire on the highest hill in the vicinity shows the value of high lights for covering large areas.

Ultra short waves are like light waves in that they must travel in a straight line. Ordinary radio waves follow the curvature of the earth and that is why we can tune in on them when we are away beyond the horizon as viewed from the broadcasting station. But ultra short waves practically stop at the horizon. The higher one goes, the farther off does the horizon become. So an ultra short wave transmitter can cover the greatest area when placed at the highest point possible. It will then reach out to any receiving antenna which is visible from the transmitting antenna, that is, which is in a straight line of vision.

Unlike light rays, however, these ultra short waves, while affected by solid objects in the way, are not affected by darkness, fog, or other similar obstacles. Besides this, they are unaffected by static or fading, two of the greatest bugbears of ordinary radio waves. Thus they compensate for their limitations as to distance.

Even the distance limitation is an advantage, for it means that a transmitter will not spoil reception beyond its useful area. In broadcasting, for instance, a station which gives good coverage for say 100 miles may spoil all reception for a circle of 300 miles around it on that particular wavelength. That is why only some 640 stations are in operation in the United States in the broadcast band. But if every station reached only as far as it could be seen, why thousands of stations could be located all over the country, seldom over 50 miles apart, all giving good coverage within their areas and not overlapping into the distant areas.

With this condition and the fact that there is a very wide band of frequencies available so that many stations with channels twenty times as wide as the broadcast band can be accommodated side by side in the spectrum, the ultra short waves offer a promising future for television channels.

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. Answers printed herewith have been mailed to University Members.

Radio University

To obtain a membership in Radio World's University Club for one year, send $6 for one year's subscription (52 issues of Radio World) and you will get a University number. Put this number at top of letter (not envelope) containing questions. Address, Radio World, 145 West 45th Street, New York, N. Y.

Annual subscriptions are accepted at $6 for 52 numbers, with the privilege of obtaining answers to radio questions for the period of the subscription, but not if any other premium is obtained with the subscription.

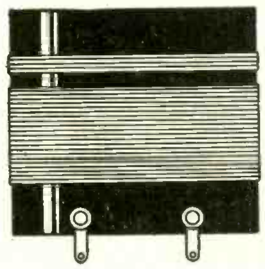


FIG. 966
Example of a primary wound adjoining the secondary.

Shielding a High Gain Tuner

HAVING built a five tube a-c set with two stages of t-r-f, I am now going to build a set with three stages of t-r-f. The number of primary turns on the coils in the present set is 30, compared with 127 on the secondary, or, roughly, a 1-to-4 ratio. May I maintain that ratio when the extra stage of radio frequency amplification is added?—P. O.

In general, the number of turns on the primaries in plate circuits will have to be less. The antenna primary need not be changed. Of course you are using and will use screen grid tubes, otherwise the large number of primary turns is out of question. The extra stage of radio frequency amplification is desired, no doubt, for additional selectivity, as, neglecting selectivity, the sensitivity of even two stages of t-r-f may easily be developed to the noise level. Considerable trouble with oscillation should be expected unless the primaries are reduced for the three stage construction. However, the number of primary turns depends on several things, including the screen plate and bias voltages, the separation between primary and secondary, the size and nature of the shields used, the proximity of the coils to one another, and the kind of material of which the form is made. The voltage effects on oscillation or amplification are familiar. The greater the separation between primary and secondary, the looser the coupling, the less the oscillation tendency, as increasing the distance is equivalent to removing turns. The size of the shield, and the material of which it is made, are important, for with small shields, especially of zinc composition, more turns on primaries may be used because of the greater eddy current effect of such metal and size. The 30 turns you specify for the set you built evidently refer to such shields, about 2⅛ inch diameter, with coils wound on 1 inch tubing. Larger shields, using aluminum or copper, will produce lower losses, and the coupling therefore should be looser than otherwise. Freedom of the winding form from iron or equivalent foreign substances, the lower the losses and the smaller the primaries must be. As the shielding will not be utterly complete for the thickness of metal usually employed, the distance between coils has an effect. The closer the coils are together, the looser the primary coupling should be. All these considerations have to do with avoidance of oscillation, but they also affect the selectivity, for the larger the shields, the more suitable the metal, the looser the coupling, the better the selectivity.

* * *

Volume Control of 235's

WHEN building a set that has a few stages of t-r-f, is it all right to put the volume control on two tubes, say, by varying the bias for 235's? What do you suggest?—T. H. H.

It is all right to put the volume control, consisting of a rheostat of around 10,000 ohms or so, in the common return to ground of the cathode circuits of the first two tubes. Then a limiting resistor of from 300 to 800 ohms should be placed between one side of the control and the cathode, so that zero bias will not result. The plate current in these tubes may be less than you expect, and the choice of value for the limiting resistor will depend largely on what this current is. The object is to attain a minimum bias of around 1.5 volts for the tubes, when the volume control rheostat is effectively out of circuit, set at zero resistance value. If the rheostat has a much higher resistance you may use it to control the voltage of the first tube only, and give the second tube a steady bias of 1.5 volts.

* * *

Effect of Shield on Inductance

HOW does the inductance change in respect to the size of a shield used on a radio frequency transformer?—P. K.

The inductance, in general, increases as the diameter and height of the shield are increased. Therefore inductance computation by the formula based on no shielding does not apply. As an example, a coil encased in a shield 2⅛ inches in diameter, and wound on a form 1 inch in diameter, tuned in 526 meters at 90 on the dial, but when a similar shield, of 3¼ inch diameter and 4 inch high was used, with the same coil, the station came in at 85 on the dial, a difference of 42 mmfd. The inductance change is sharper and more extensive than the shield capacity change, so the larger shield enables wider wave band coverage. No formula has been developed yet for the computation of inductance of shielded coils, and the determinations are made experimentally.

* * *

Questions His Power Amplifier

PLEASE let me know if I have made a poor amplifier, as it motorboats, and as yet I have not reached the solution. Is there any way of curing the trouble without resorting to frequency discriminating devices?—Y. D.

The fact that your audio power amplifier motorboats is a good sign. There is regeneration at low audio frequencies. The solution is met properly when the motorboating is eliminated by increasing the bias on an audio tube ahead of the power tube (which is usually too low anyway), and by reducing the grid leak value in any audio stage. Perhaps you mean that such reduction of resistance is discriminatory as to frequencies, as cutting down the low frequency amplification more than the high, but the circumstances call for just that, because the low frequencies, due to regeneration, now are being overamplified, and therefore motorboating, a severe form of distortion, is present. The old idea it being runinous to tone to reduce leak values is being discarded as realization spreads that the reduction effaces existing discrimination.

* * *

Desires a Short Wave Circuit

WILL you please show a detailed pictorial design for a short wave a-c receiver? I desire one economical to build and operate.—I. H.

The October 31st issue contained an article on such a receiver, with illustrations, including a schematic diagram. Lack of room prevents publication of the full scale pictorial diagram, but this is available as Blueprint No. 628.

* * *

Rectifier Type Detector

WHEN a rectifier type detector is used, is it not possible to introduce push-pull resistance coupling? Also, may not the rectifier be used for a single sided input, with the negative leading to the coupling resistor?

It is possible to introduce push pull, because the resistor in the cathode lead of the rectifier type detector need not be grounded, but the center of the subsequent leak is grounded, isolating condensers separating the two. The output may be taken from the negative side of the rectifier type detector in the method you suggest. See the article on pages 3 and 4 of this issue.

* * *

Pentode's Tone

SOME remarks have been made about the pentode tube not producing good tone, and you have published quotations on this, as well as answered a question on the subject, but I do not find that you have committed youself.—T. G. F.

The statement that there is third harmonic distortion in pentode tubes is true, but it is the amount of distortion that counts, and it may be kept at a sufficiently low level in the most popular types of pentodes. We did commit ourselves to the statement that the pentode is satisfactory. The distortion in some sets that use pentodes is principally due to other causes than to the output tube. We recommend the pentode where high sensitivity power tubes are required.

* * *

The Blue Glow in Pentodes

AFTER having tried out several pentode power tubes I desire to report that they are no good, because gassy. While it is true they are very sensitive, the inevitable result is that the gassy blue glow appears, and this is first and foremost evidence of a defective tube. Will you please state why the tube manufacturers cannot make pentodes that are not gassy?—H. D. W.

The blue glow in pentodes is not due to gas but to electron bombardment of the glass envelope, and is a tribute to the tube, rather than a defect. Usually tubes that show a blue glow are gassy, but you will notice that the high gas content is evidenced by a glow filling the inside of the tube from one side of the wall to the other, and especially between elements. If you will scrutinize the glow in the pentodes you will find that it is confined solely to the inside wall of the tube, and at a particular place. This is due to the high acceleration of electrons by the accelerator grid. Some of the tube manufacturers go so far as to say that if the pentode does not show a blue glow it isn't a good pentode, although we have tested pentodes that glowed and others that did not, and found both types satisfactory. It will be found that the glow does not always appear instantly, but may build up, or is suddenly introduced when a loud signal passage occurs. Another eccentricity is that the pentode may lose its high sensitivity for a fraction of a second when a regenerative set is brought abruptly out of or into oscillation. This is due to the plate current change affecting the output tube.

* * *

Perplexed by Short Wave Calls

SOMETIMES I hear short wave stations in the broadcast band. Can this be due to inverse harmonics? I am puzzled over this phenomenon.—O. S.

The stations you hear are not short wave stations, but are regular broadcasting stations that have short wave transmitters. The call letters of both the broadcast station and the short wave station are given in the same announcement. Hence short wave and broadcast wave listeners hear exactly the same announcement. You hear the short wave call letters given on broadcast waves. There are such things as inverse harmonics, but they do not appear in broadcast tuners.

* * *

General Purpose Output for Converters

IN regard to the statement that good matching has to prevail between a short wave converter and a receiver, is it not true that if instead of using a screen grid tube as the output tube, which may be the modulator, a general purpose tube is used, that there will be more sensitivity, due to better matching?—U. S. G.

That is generally true. A converter well may have as modulator a general purpose tube. The matching will be better, in general, because of the relatively low impedance of the antenna load of the set. If the converter has a screen grid output tube and a general purpose tube is preferred, the change is easily made by cutting off the connection to G post of socket (a B plus lead) and joining the G post to the plate post.

* * *

Volume Control at the Station

WHEN music is received it is generally toned down by the recipient, but when voice is received it is generally toned up. So why do not stations make allowance for this, and increase the volume of sound in the modulation process for speakers, and tone it down for orchestras? That would spare many of us the constant necessity of adjusting the volume control when the program is changed from one type to another. —H. G. D.

Some stations do make allowance for this difference, and the added modulation strength is taken care of by the man in charge of the monitor. However, a general adoption of this plan, or a rule of the Federal Radio Commission making such adjustment compulsory, would have to be predicated on the supposition that a listener hears the same station all the time, or that all stations have the same field strength about the listener's antenna, or that the listener's set is equally sensitive to all radio frequencies it tunes in. All these assumptions would be contrary to the fact. It should be remembered, also, that many persons listen to distant stations, and that the volume control must be turned up all the way for voice or orchestra. An automatic volume control in a set is to a degree a corrective for the situation you bring up.

* * *

Sensitivity Varies

UNDER ordinary circumstances I am able to get good sensitivity out of my broadcast receiver (t-r-f), but sometimes the set seems more sensitive than at other times, and besides the volume is greater when I use a longer aerial, and the high waves come in fine, but if I use a shorter aerial, while the low waves come in well, and with better selectivity, I hardly hear any high waves.—T. D.

The sensitivity of the set may change with meterological conditions, and also the penetration of the radio waves may change. These factors have to be accepted as variables in radio reception. An automatic volume control will introduce some steadying effects, but will not constitute a complete remedy. The longer aerial delivers more power to the input of your set, and also lifts the natural period so that higher waves get a disproportionately greater amount of assistance. It is practical to have an antenna winding with a center tap and use a switching device to pick up the tap or the extreme for aerial connection. This is one type of local-distance switch. Then the long antenna may be kept on permanently, and the switch thrown to one position for long waves and to the other for lower waves.

* * *

Primary's Position

SOMETIMES in your coil data you mention a primary wound alongside of the secondary, and then a primary wound on the secondary. Will you please explain the difference?—E. S.

A primary is wound alongside of the secondary when both are wound directly on the same form, as in Fig. 966, which shows the primary (smaller winding) in the upper position. The other condition is where the primary is wound over the secondary, that is, not on the form directly, but some insulating fabric is placed over part of the secondary, and the primary is wound on this fabric. In the first case the primary merely adjoins the secondary, in the second case the primary is superimposed on the secondary.

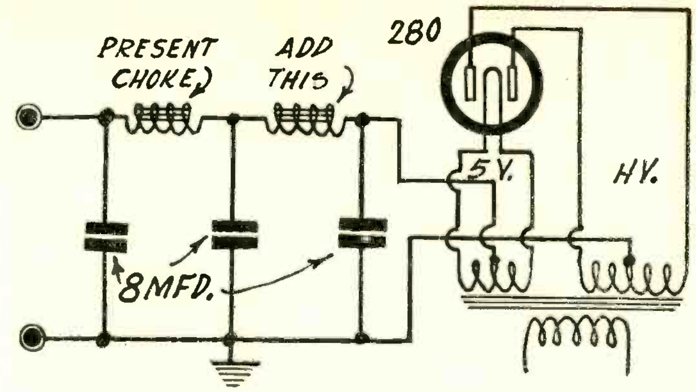


FIG. 967

Adding another choke coil to increase the filtration, so hum will be greatly reduced.

* * *

Better Filtration

MY B eliminator uses a 280 tube. There has always been some hum. I am using a single 8 mfd. next to the rectifier and two 8 mfd. in parallel at the end of the rectifier.—V. M.

You may add another B supply choke coil and split up the two single 8 mfd. as shown in Fig. 967. Where the choke is to be added is designated on the diagram. Since you have fairly high capacity already, it is evidence that the shortcoming is due to the use of a choke of too low inductance, hence the suggestion for added choking. The capacity need not be increased.

Canadian Stations by Call and Frequency

Station	*kc*	*Station*	*kc*	*Station*	*kc*	*Station*	*kc*	*Station*	*kc*
CFAC	690	CHCK	1010	CJGC	910	CKIC	1010	CNRE	930
CFBO	890	CHCS	1120	CJGX	630	CKLC	840	CNRH	910
CFCA	1120	CHCT	840	CJOC	1120	CKMC	1210	CNRL	910
CFCF	1030	CHGS	1120	CJOR	1210	CKMO	730	CNRM	730
CFCH	930	CHLS	730	CJRM	665	CKNC	960	CNRO	600
CFCL	930	CHMA	580	CJRW	665	CKOC	1010	CNRQ	880
CFCN	985	CHML	880	CJSC	690	CKOV	1200	CNRR	960
CFCO	1210	CHNS	910	CKAC	730	CKOW	840	CNRS	910
CFCT	630	CHRC	645	CKCD	730	CKPC	1210	CNRT	840
CFCY	580	CHWC	960	CKCI	640	CKPR	890	CNRV	1030
CFJC	1120	CHWK	665	CKCK	960	CKUA	580	CNRW	780
CFLC	1010	CHYC	730	CKCL	580	CKWX	730	CNRX	960
CFNB	1210	CJBC	690	CKCO	890	CKX	540	CPRY	690
CFOC	910	CJBR	960	CKCR	640	CKY	780		
CFRB	690	CJCA	930	CKCV	880	CNRA	630		
CFRC	930	CJCB	880	CKFC	730	CNRC	690		
CHCA	690	CJCJ	690	CKGW	840	CNRD	840		

A THOUGHT FOR THE WEEK

LEASES amounting in the aggregate to $70,000,000 have already been signed for space in Radio City, the new town of magic that is raising its beautiful head in New York's Fifties. Leases involving many more millions are in the making. Who says that "Depression, 'Tis of Thee" is likely to become our national anthem? "Here Comes the Sun" fits in much better!

RADIO WORLD

Trade Mark Reg. U. S. Pat. Off.

The First and Only National Radio Weekly
Tenth Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.

Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor.

Television Demand

TELEVISION is in a baffling mist just now, with such part of the public as has been given projected demonstrations desiring something of the sort in their homes. The smaller views obtained from present home apparatus does not meet with hearty response. But the demonstrations that have won the public's attention, and even its favor, are not and have not been of apparatus reproducible for the home, which has no room for the bulky apparatus, nor is there any desire to pay many thousands of dollars for an installation, as would be required.

So the public now has a choice of small pictures, with good definition, around 1.5 to 2 inches square, or somewhat larger pictures, several inches square, where the size has been improved at the expense of the definition. Where there is only a limited quantity of light, as from the neon lamp, concentration makes for definition, and diffusion makes for a view simulating the print of an overexposed negative. More light is afforded in theatre installations at enormous expense, and could be obtained from a home lamp of larger plate area, but again cost increases.

Meanwhile methods are used for conserving the illumination as much as possible. Instead of pinhole apertures in scanning discs, lenses are used, for the same reason that a lens supplanted the pinhole of the first camera.

The world is waiting not so much for the sunrise as for the lamp rise, some lamp that gives intense light, and it should be white, since the pinkish effect of the neon lamp is not wholesome. A cathode tube accomplishing such objects is in the works, but it may be a few years before it is ready for the public.

Experimenters will find excellent fun in using television receivers and scanning apparatus in conjunction with present transmissions, and also their delight will be heightened as the transmitters turn to higher and higher frequencies. But the fun is for those who live not far from the transmitter, as DX television is not a fact. As for the public, there is nothing now offered that quite meets the demand for large, clear and preferably black and white pictures. Moreover, there are not enough programs to interest the public at large, nor are the programs that obtain of sufficient interest. Experimental joy abounds. But entertainment value is not yet here. And nobody knows when it will be. No matter how famous the participants in the guessing contest have been, they have not known any more about the future of television than the gypsy fortune teller knows about what will happen to you next week. Television as entertainment —the dark man with a bundle—is yet to come along.

Farewell to Dialects?

LINGUISTS are interested in the effect of radio on speech standardization. Almost any country of any size, and some countries of hardly any size whatever, have their assortment of dialects. It has always been interesting to linguists to assume a standard speech and hope that all would conform to it. Even the large broadcasting systems in this country have been won over by linguists who have prompted the choice of the prize winning announcer of the year o na certain standard of rating, which includes absence of localized pronunciation.

It is all very well to strive for a standard, and no doubt some dialects should lose out, while yielding so much as is valuable in them to the new standard of the countries, but for our own land we would miss the manner of speech of the Southerners and mid-Westerners as compared to the Yankees, and far-Westerners. Even if no improvement in programs is noticed as one tunes in stations from various parts of the country, the difference in the pronunciation is marked, and there is no a-wearyin' of the contrasts.

In some parts of all countries certain expressions and words that have not survived in the accepted speech of the land still prevail, and perhaps these will win back, in the standardized language, the place they lost. Perhaps it will be left for radio to be the forum of speech correctness—an honor it now fails to warrant by an undiscussably wide margin—just as in Germany the speech of the stage has become accepted as the proper and correct one, and the pronunciation is used even in the teaching of German in foreign countries, including our own.

A lagging language student, unable to understand a foreign tongue spoken in the pretendedly standard manner, could always fall back upon the speaker's fellow-countryman, who, being of a quite different patois, also could not understand. This alibi will be lost to the future, when a nation becomes agreed upon a standard of speech and pronunciation, but what will become of the Shavian jest of being able to tell not only what part of London a man came from, but the very street, and, on occasion, the house number, by the dialect?

FORUM

Delighted With Regenerated Audio

HAVING been a steady reader of RADIO WORLD for the past four years, and being a nut on excellent quality of reproduction, I have built dozens of amplifiers and I desire to say that the Bernard regenerated audio amplifier produces the most beautiful and natural result I have attained yet.

Merely as a suggestion, many of us would be pleased to see hookups without that 247 tube with its odd harmonics and punk reproduction.

JOHN R. BUCKMAN,
130 Clinton Street,
Brooklyn, N. Y.

Argentina Leads in Latin America with 400,000 Receivers

In its pamphlet, "Broadcast Advertising in Latin America," the Department of Commerce lists an estimate, obtained from local trade sources, of the number of receiving sets in use. Argentina is far in the lead, with 400,000 sets; Brazil is second, with 190,000; Mexico is third with 100,000, Peru fourth with 70,000, Uruguay fifth with 60,000, Chile sixth with 35,000, Cuba seventh with 28,875, the rest having 5000 or fewer.

The Spanish language is used almost universally, except in Brazil, where Portuguese is spoken. The economic distinctions are very sharp, and only the well-to-do have sets in these countries, and automatically constitute the greatest buying power for goods advertised over the air.

Recently the climatic difficulties have been somewhat overcome, the report states, by the installation of improved transmitting equipment, but reception in summer is nowhere near as good as it is in winter, bearing in mind that when it is summer north of the Equator it is winter south of the Equator.

Argentina has 29 broadcasting stations, 19 of which are located in Buenos Aires.

All the Latin American countries put on good musical programs, particularly of native music that delights the listeners most, and there is also a large preponderance of broadcasting of phonograph records.

SUNDRY SUGGESTIONS FOR WEEK OF NOVEMBER 15

Sun., Nov. 15: N. Y. Symphony; WABC—3.00 p. m.
Sun., Nov. 15: Footlight Echoes; WOR—10:30 p. m.
Mon., Nov. 16: Death Valley Days; WJZ—8:30 p m.
Mon., Nov. 16: Carl Fenton and Bing Crosby; WABC—7:15 p. m.
Tues., Nov. 17: Andy Sannella; WEAF—10:00 p. m.
Wed., Nov. 18: Muriel Pollack and Vee Lawnhurst; WJZ—6:15 p. m.
Thurs., Nov. 19: Basil Ruysdael, Weaver of Dreams; WOR—10:00 p. m.
Fri., Nov. 20: Theatre of the Air; WEAF—10:30 p. m.
Sat., Nov. 21: Little Symphony; WOR, 8:00 p. m.
Sat., Nov. 21: Nocturne, with Ann Leaf and Organ; WABC—11:45 p m.

[*The foregoing are the selections of Miss Alice Reinsen.*—EDITOR.]

Jewett Recuperating at Parents' Home

Ted Jewett, National Broadcasting Company announcer, seriously injured in a taxicab accident a few minutes after he had participated in broadcasting the departure of Colonel and Mrs. Lindbergh for the Orient July 29, left Flushing (N. Y.) hospital and went to the home of his parents, Mr. and Mrs. John H. Jewett, at Hazlett, N. H., for recuperation. Jewett's bride died of infantile paralysis in the same hospital where he was a patient.

Jewett has recovered the use of his broken leg sufficiently to walk a bit during the last few days.

WE'RE DELIGHTED—AND ENCOURAGED!

A recent survey of Radio World's subscription orders for ten weeks of a normal period of activity, proved that the amount paid by new and old subscribers during those ten weeks was 15.9% more than was paid during the corresponding period of 1930.

We're going to try and increase this percentage for the whole year—and know full well that this can be accomplished only by turning out a paper that gives the service expected by a particular and ever-growing radio public. THE PUBLISHERS.

Station Sparks

By Alice Remsen

REMEMBRANCE

(Salon Singers, WEAF,
Thursdays, 4:00 p.m.)

THIS is the tree 'neath which we sat to dream
Of our old home, dear home across the sea.
Night was bereft of moonlight's ghostly beam.
We listened to night's trembling melody.
Sweet, I remember how we blessed the rain
As it came dripping on us in the gloom,
Taking us back to leafy Kentish lane,
To lovely English hedgerows, all in bloom

With hawthorn blossoms, budding pink and white,
Where ivy and convulvulus interlace,
Their perfume seemed to permeate the night,
Effacing for a while both time and space.
That precious moment, lost beyond recall,
I've often tried to capture once again,
Off'ring surrender to its magic thrall—
Receiving in return but poignant pain—

For thinking of that night I think of you.
But you have gone away from life, and me—
Leaving a saddened mortal here to rue
The loss of love—begotten 'neath a tree.

—A. R.

* * *

George Dilworth, who directs the Salon singers brings back many beautiful old English ballads, and memories, joyful and sad, of other days, and other times. A mixed quartette with Amy Goldsmith, soprano; Alma Kitchell, contralto; Fred Huffsmith, tenor, and Donald Beltz, baritone, dividing the solo honors and singing Mr. Dilworth's harmony arrangements very pleasingly together. ....

* * *

Electrical Transcription is coming on apace, making headway in the radio field. One of the best of these companies is that of the American Recording Company, with headquarters in the Liberty Building, at 1776 Broadway, near Columbus Circle, very thoroughly American both as to location, address and personnel. Charles Goetz is the manager of the electrical transcription department, and Frank Hennig, production manager, in complete charge of recordings. The American Recording Company is an old-established firm, the largest distributors of phonograph records in the world. Only recently it added radio transcriptions to its output and reports a tremendous interest in this program method throughout the country. While going over the studios and recordinging rooms one day last week, I ran into such well-known folk as Gus Van, Roy Smeck, Uncle Don Carney, Mann Hollinger, Claude MacArthus, Arthur Q. Bryan, Marie Cardinale and Ernie Golden, who were either rehearsing for or making transcriptions.

* * *

Carl Fenton's contract with Cremo is for a year, six days a week, twice a day. That's what you might call a tall order, but one that Carl is well able to fill.

* * *

Leopold Stokowski is the third recipient of Columbia's medal for "distinguished contribution to the radio art." Sir John C. W. Reith, Director General of the British Broadcasting Corporation, was the first, and Colonel Charles A. Lindbergh, the second to receive the award.

* * *

B. A. Rolfe is taking an extended vacation by order of his doctor, and I should think the portly conductor would need a rest after conducting his lightning tempo band through 468 broadcasts without a break, during which time he has played 7,460 tunes. During Mr. Rolfe's tour of Europe he will study the methods of European orchestra broadcasting, programs and music.

* * *

Louis A. Witten makes a most engaging Master of Ceremonies on the Countess D'Orsay program, over the WJZ-NBC network, Saturday nights at 8:30 p.m.

* * *

And Now It Appears that the lyric Lew Conrad, who is still leading his band at the Hotel Statler in Boston, has a nation-wide Club Conrad, with chapters in every state, run by his admiring fans, the Club runs a monthly paper called The Club Conrad Musketeer, which each member receives. It contains the latest news about the Lyric Lew. A good ..publicity stunt!

* * *

Have you Listened In on the Regal Radio Reproductions program over WABC, Friday nights at 9:00? Unmentioned artists impersonate stage, screen and radio stars, in some instances doing a much better job than the stars they are supposed to represent. Quite a novel program, with a clever advertising tie-up that is not too annoying.

* * *

Arthur Quick Bryan was sent for by WCAU of Philadelphia. He opened there last week and is now announcing, writing continuity, producing programs and singing over that enterprising station. WCAU was recently awarded 50,000 watts by the Federal Radio Commission and is on the Columbia network. Arthur has made a very advantageous contract with the station, containing a special clause allowing him to continue with his New York writing and records.

SIDELIGHTS

HARRIETT LEE, Miss Radio of 1931, is making a tour of the RKO theatres around town . . . ARTHUR TRACY, the Street Singer, has made a record of his theme song, "Marta" . . . DAVID ROSS was once secretary to a Russian Baroness . . . EDDIE DUCHIN graduated from the Massachusetts College of Pharmacy . . . Eugene Ormandy was born in Budapest, Hungary . . . DICK ROBERTSON has a country home in Berryville, N. Y. . . . CATHERINE RENWICK and JOHN HOLBROOK, radio actress and announcer respectively, have announced their engagement. Congrats! . . . BEN ALLEY has written another song, this time with the title, "Linger in His Arms". . . . PHIL COOK has been broadcasting for nine years, and during that time he has used only his own songs . . . GEORGIE JESSEL'S favorite author is James Branch Cabell . . . LEE CRONICAN has just moved into a new apartment at Jackson Heights . . . WOLFIE GILBERT is going to Europe for a vacation . . . TOMMY WEIR has three new commercial programs on WAAT . . . NYRA DORRANCE is going into the business of radio production . . . GORDON THOMAS can do a perfect imitation of Jimmy Melton . . . BENNY BLOOM of Berlin's can do a creditable impersonation of Lee Morse . . . CHARLIE CANTOR does a perfect Bert Williams and you should hear UNCLE DON do Russ Columbo . . . LINDY'S RESTAURANT has a theme song, "Just a Crooner, a Song Publisher and a Band Leader." A perfact combination!

BIOGRAPHICAL BREVITIES

ABOUT ROY SMECK

Roy Smeck, the Wizard of the Strings, was born in Reading, Penn., of Pennsylvania Dutch parentage and possesses all the happy-go-lucky characteristics of those people, inheriting from them a desire to play some kind of an instrument. So young Roy, at the tender age of fifteen, purchased himself a ukulele with his earnings as part-time sweeper in a shoe factory and proceeded to teach himself to play on that much abused instrument.

As it happens, Roy really had a musical soul and managed to extract music out of the little wooden box. He played it in the morning, he played it at night, at work and at play, until the foreman of the shoe factory got mad and told Roy that it was a shame he should allow work to interfere with play and promptly fired him on the spot.

Nothing daunted, Roy procured backing from a kindred soul and proceeded to open a music store in Binghamton, N. Y. Here he was in his element, playing the uke for any chance customer straying into the store. He increased his musical vocabulary, and mastered in turn the guitar, steel guitar, harmonica and banjo, also inventing a weird instrument of his own which he calls the octochorda.

Then his big break came! Paul Specht played Binghampton—needed a banjoist—heard Roy—hired him—started him on the road to fame and he's been traveling it ever since.

Roy has played all over the States on the R-K-O circuit, is known from Coast to Coast as a preeminent radio artist—and his phonograph records are among the best sellers. He played in a revue three years ago, fell in love and married the star—is still in love, which accounts for the faraway look in his eyes.

Roy's income from records alone is more than that of the Prime Minister of England.

In appearance Roy is dark of hair and eyes, of medium height, slender, nice teeth, pleasant smile. Is very good company, always ready to oblige with a solo, or his famous impersonation of Bill Robinson's tap dance, which he does with his fingers on the side of his ukulele while playing the accompaniment. All in all, he's a great lad, is Roy Smeck!

* * *

(If you would like to know something of your favorite radio artists or announcers drop a card to the conductor of this page. Address her, Miss Alice Remsen, care RADIO WORLD, 145 *West 45th St., New York, N. Y.)*

TELEVISION ON BROADWAY AS 150,000 "LOOK"

About 20,000 persons a day attended a week's television demonstration given by the Television Manufacturing Company of America in a converted store in the Hollywood Theatre Building, Fifty-second Street and Broadway, New York City. During the week the attendance, of about 150,000, showed much interest in the results, which are those obtainable in the home.

The viewed image was about 2 inches square, but a magnifying glass in front of the frame made the picture seem larger. The familiar neon glow rendered the illumination reddish, but the detail was good, and many remarked on the clarity.

Showed What Home Can Enjoy

Best results were obtained from transmissions of the Columbia Broadcasting System, and the exhibition concentrated on these. The receiver used was along the lines of the familiar five tube a-c sets, but with the tuning covering only the television frequencies in the continental band.

William Starkenstein, representing the company, said that the demonstration was given to show the people just what could be duplicated in the home, at modest cost, and all efforts to show large, projected pictures, to create a big impression, but without being able to offer anything a home could contain or afford, were avoided.

Some of those viewing the television reception asked about larger pictures, but it was explained that the present state of the art, as applicable to home use, did not enable larger pictures without loss of considerable definition.

The sixty hole 20 frame scanning method was used, as being applicable to most television stations, and the pictures were held with good constancy.

Experimenters Mostly Responsive

The company has a television receiving set and a scanning disc and motor combination, and while offering a complete installation in a tallish midget cabinet with magnifying glass in front of the viewing frame, also is catering to the kit constructors, particularly as greatest response is obtained from those experimentally versed in radio, rather than from the lay public.

At the radio show a month previously, in Madison Square Garden, larger or projected pictures were shown, and simultaneously with the store demonstration in the theatre building there was a daily television showing as part of the program at the Broadway Theatre, using a 10x10 foot screen, both of these the work of U. S. Sanabria. These facts excited the lay public to queries about larger size pictures, but did not deter the experimenters, because they knew the futility of attempting to duplicate the projected pictures in the home at the moderate prices obtaining for the apparatus demonstrated in the store.

NEW 2 VOLT FILAMENT

A new type filament for two volt battery tubes and for future application to other types of tubes was announced by the De Forest Radio Company. It is a cobalt alloy filament said to overcome the handicaps of a finely drawn nickel filament.

The cobalt alloy filament is said to have greater hot tensile strength, with increased diameter for a given resistance. The cobalt alloy filament has low thermal emission.

Will Retain Stations, Says Westinghouse Head

"Certain rumors, which have been brought to my attention," states F. A. Merrick, president of the Westinghouse Electric and Manufacturing Company, "have been to the effect that this company is contemplating disposing of its interest in radio stations KDKA in Pittsburgh, WBZ in Boston, WBZA in Springfield, Mass., and KYW in Chicago.

"The Westinghouse Electric and Manufacturing Company has no intention of divesting itself of ownership, operation or control of its broadcasting stations, or any one of them. These stations have been and we expect to continue them as pioneers in the business of broadcasting and its continued development and progress."

SAVANT NOTES DIALECTS WANE

Stockholm.

Radio will in time polish off local dialects and at the same time make the common language richer in words and their use more accurate, predicts Professor Otto von Friesen of the University of Upsala, linguist and member of the Swedish Academy which annually picks the winner of the Nobel Prize in literature. What he says about the effect of broadcasting in Sweden holds true in other countries.

Like most lands, Sweden has many dialects and when a person speaks on the national radio program it is often possible to tell from his enunciation what province he comes from. It is the deliberate policy of the Swedish broadcasting service, which is under the control of the press, to admit all dialects and not attempt restriction of its speakers.

"In Germany the speech of the stage has become the standard for good spoken German, and I sense from that how much more important the radio broadcast which reaches so many more people will be for the future development of our tongue," says Professor Friesen. "Not that I look forward to anything that might be called "radio Swedish" but I do believe that the radio will gradually smooth out the various dialects and intonations into a more national speech."

The country dialects have also preserved many old words which the national language has dropped and radio may bring back those which still serve a purpose. The Swedish radio chiefs believe, furthermore, that the pronunciation of foreign words will be greatly improved by the radio.

Whiteman's Early Bent

When Paul Whiteman, the National Broadcasting Company's music supervisor in Chciago, was a baby, his father was the supervisor of music for the Denver public school system and so interested in fiddle playing that when he took his baby out for a wheeling in his carriage, the fiddle reposed on the right side of young Paul. This particular time that the Whitemans went a-wheeling his father bought a watermelon and placed the melon on the left side of the carriage. Along the road they hit a large stone and all three—the baby, the fiddle and the melon were jolted out of the carriage. Here was a predicament—which would the baby grasp—the fiddle or the melon. So, showing his deep interest in music, he grabbed the watermelon.

HARVARD AND OXFORD AGREE TO AIR DEBATE

Oxford University accepted the challenge of Harvard to the first international collegiate radio debate. M. H. Aylesworth, president of the National Broadcasting Company, invited the English and American university debating teams to a transatlantic broadcast debate.

Short wave transmission will be used to carry the American debating team's voices across the Atlantic for rebroadcast in the United States. The National Broadcasting Company has invited the British Broadcasting Corporation to rebroadcast the debate in England.

The subject to be debated and the date of the contest are being negotiated.

Audience to Judge

While international debt cancellation and also the dole were tentatively proposed as subjects by Harvard undergraduates interested in debating, Mr. Eckles doubted whether either of these subjects would meet with the agreement of the debating clubs of the two universities.

The debate will last one hour. The first week in December has been provisionally agreed upon by both Harvard and Oxford.

Plans to have one English and one American judge appoint a third judge for the debate have been dropped in favor of permitting the millions of listeners on both sides of the Atlantic to register their own decisions on the outcome of the contest.

Marks a Resumption

The event will mark the resumption of debating between the two great American and English universities, which have not met in verbal conflict since 1925. At that time, Harvard won by upholding the negative side of the question, Resolved: That the growth and activity of the Socialist movement are detrimental to human progress. The 1925 debate was held in Symphony Hall, Boston.

New Book Deals with Writing for Radio

"How To Write For Radio," has just been published by Longmans, Green and Company, of New York City. Katharine Seymour, assistant continuity editor of the National Broadcasting Company, and J. T. W. Martin, radio writer of the staff of Batten, Barton, Durstine and Osborn, an advertising agency, are co-authors.

"How To Write For Radio" explains the fundamentals of radio writing. Because of its joint authorship, it presents the points of view of both network and agency.

The chapter headings are: Opportunities for the Radio Writer; Early History of Radio Writing; "Straight" Continuity; Dramatic Radio Writing; Radio Adaptations; Production (of Musical and Dramatic Programs); Sound-Effects, the "Props" of Radio; Radio Advertising Writing; Properties of the Air.

FRANK MASON JOINS N. B. C.

Frank Mason has been elected a vice president of the National Broadcasting Company. He was formerly president and general manager of International News Service.

RECORD LEASE BY 4 TENANTS IN RADIO CITY

The world's greatest group lease, for approximately a million square feet of office, studio and theater space in Radio City, was signed by the principal tenants who will move into the huge Rockefeller development in mid-town Manhattan during 1932 and '33.

The leases were signed by Colonel Arthur Woods, president of Metropolitan Square Corporation, Mr. Rockefeller's holding company, as lessor; David Sarnoff, president of the Radio Corporation of America and RCA-Photophone, Inc.; M. H. Aylesworth, president of the National Broadcasting Company; and Colonel Hiram S. Brown, president of Radio-Keith-Orpheum Corporation.

The leases covered space in a 66-story office and studio building, a 31-story office building, a great theater structure and a sound motion picture theater.

Music Hall Included

Approximately 725,000 square feet of office and studio space will be located in the 66-story office building, which will occupy more than half of the block between Fifth and Sixth avenues, 49th to 50th streets. Approximately 275,000 square feet of office space will be located in the 31-story office building, which will be occupied, with the exception of seven floors, by Radio-Keith-Orpheum Corporation and Radio Corporation of America.

In addition, the Radio-Keith-Orpheum Corporation signed a lease on the International Music Hall, world's largest theatre, with a seating capacity of 6,500, which will be located in the north block of the development, and for sound motion picture theatre seating 3,500 persons located in the south block.

Each lease represented many months of work by the legal departments of each company, as well as of Metropolitan Square Corporation, the lessor.

Occupancy Begins Next October

The leases provide for occupancy of the office space in the 31-story office building on October 1, 1932; and of office and studio space in the main building on May 1, 1933. Both theatres will be completed and ready for occupancy in October of next year.

The Radio Corporation of America will occupy the seventh, eighth, ninth and tenth floors of the main building, as well as portions of the fifty-third and fifty-fourth floors. It will also occupy from the nineteenth to the twenty-fifth floors, inclusive, in the 31-story building. The National Broadcasting Company's offices will occupy space on all the floors from the first to the twelfth inclusive. The RCA-Photophone Company's offices and studios will be on the nine floors from the third to the eleventh inclusive.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

Oscar W. Olsen, Jr., Box 456, Hartington, Nebr.
J. C. Ruif, 219 W. Chicago Ave., Chicago, Ill.
Cornelius C. Hayes (on short wave receivers), 458 South Maple Drive, Beverly Hills, Calif.
Wm. V. Quinn, 708 Buffalo St., Conneaut, Ohio.
J. E. Striplin, U. S. A. T. "Frank," Pier 5, Honolulu, T. H.
Edward T. Serovey, Service Mgr. (on radio & television), Paramount Electric Shop. 456 Colerick St., Fort Wayne, Ind.
Chas. P. Adams, Jr., Morrison Training School, Hoffman, N. C.
Alex. Green, General Delivery, Nelson, B. C., Canada.
John E. Penn, Florence, Ky.
W. F. Adams, Repair Shop, 1412 Bond St., Los Angeles, Calif.
W. H. Howe, 626 Gareau St., St. Boniface, Man., Canada.
D. H. Ballard, 2408 Camden Ave., Omaha, Nebr.
Rollo C. Hamer, 1018 No. 40th St., Omaha, Nebr.
C. du Prey, Agent (AT. 0627), 745 B. Champaigneur, Outremont, P. Q., Can.
J. A. Stephenson, Friona, Texas.
D. T. Lewis. care RADIO LIMITED, Box 1166, Auckland, New Zealand.
Robert M. Tillman, 300 Center St., Bessemer, Ala.
Henry E. Jacob, 1708 Mabert Rd., Portsmouth, Ohio.
H. S. Coonrod. So. Delco Light, Mercedes, Texas.
J. S. Dobes, 1402 College, Kansas City, Mo.
Horace Young, Box 483, Enice, La.
Harold Boddy, R. F. D. 2, Willoughby, Ohio.
Matejowsky & Co., Lyons, Tex.
J. Pandolf, 240 Kingston Ave., Brooklyn, N. Y.
Carl Danbury, Kanawha Falls, W. Va.
W. A. Stine, Jr., Rock Hill, S. C.
Andru Vosko, 327 Haercheis St., Pittsburgh, Pa.
Louis Coticchio, 11 Taggart St., Batavia, N. Y.
Pfc. Harvey D. Young (on short wave radios), 15th Signal Service Company, Fort Monmouth, N. J.
A. A. Johnston, Cheney, Kans.
Elmer Feigel, Saco, Mont.
A. S. Dodge, George, Iowa.
Bobby Powers, 903 South Main St., Benton, Ill.
Clarence Hunerdosse, Lacona, Iowa.
Wm. M. Schachele, Dougal Ave., Livingston, N. J.
J. M. Gillespie, Hotel Continental. Washington, D. C.

Canadian Television Station Getting Ready

Television pictures from Montreal may be received in New York and throughout New England within sixty days, if the Western Television Corporation engineers complete the installation of television equipment for the French newspaper, La Presse. Construction work, already started.

The Canadian television station will operate on 2050 kilocycles with 500 watts of power. It will be synchronized with CKAC, the 5,000 watt sound station, also operated by La Presse.

HIGHLY SENSITIVE SET

Next week's issue, dated November 21st, will contain an article describing a 9-tube a-c. superheterodyne for both broadcast and short wave coverage, especially designed for those who live in regions where high sensitivity is essential, due to distance from broadcasting stations, and the extra distance required to be covered to bring in Europe on short waves.

25,000 WATTS AWARDED WBZ; RISE OF 10 KW

After reconsideration the Federal Radio Commission decided in favor of an increase in power for WBZ, Springfield, Mass.

The station was licensed at 15,000 watts and was one of the applicants for 50,000 watts, but this application was denied when the 50,000 watt permit available to the First Zone was awarded to WOR, Newark, N. J. No increase at all was granted to WBZ then.

A rehearing was granted and the station put in new facts, resulting in a reconsideration of the entire case, whereby now the station is approved at 25,000 watts. The station is owned by the Westinghouse Electric and Manufacturing Company, which also owns KDKA, Pittsburgh, Pa., and KYW, Chicago, Ill. A recent rumor that the Westinghouse stations would be sold by the company was officially denied by its president.

There were eight vacancies in the 50,000 watt class, and all eight were filled October 1st, but WBZ's gain in power, newly granted, is considered as a tribute to the station's conduct and programs.

It was not expected by those who were closely watching the Commission's actions on higher power, as it was considered that the higher power case was closed.

KALEIDOSCOPE

More push being needed to sell products today, more sponsors are buying more time on the air. Thus modern radio resembles the apothecary, curing anything with a mixture.

* * *

More and more radio apparatus is being spread over the world. Putting a radio set on the fourth dimension will be the peak of achievement.

* * *

Restless radio science is laboring mightily to subjugate ultra high radio frequencies. The worry that there can be an overpopulation of radio ideas should be discarded. Radio invention is a pastime that has the world as players, crowding at the table.

* * *

The radio wave reaches all sets at almost the same instant. It goes around the world 7½ times a second at the equator. So DX time signals need a correction factor for chronometric work.

* * *

Radiotherm, General Electric Company's new short wave fever machine, is a corrective for special circulation disorders. Is it soon to become a miracle if anyone falls ill?

—A.B.

Television Has Own Housing Problem

With television seemingly about to seek a regular place in the living room, the question of housing this apparatus comes up.

Television, profiting by radio's experience, is now going out after artistic cabinet designs while the art is still young. This pursuit is a challenge to any cabinet maker or designer, since the problems met in television are considerably different from the mere housing of a radio set and loudspeaker.

First, if we use even the simplest form of television, the peep-show type, we have a large lens which must be peered into. It must be some distance in front of the scanning disc or drum. The drum or disc must be pretty large to get clear pictures and that takes up room. All this calls for an elongated cabinet, running to depth. Some efforts have been made to place the lens in front on a superstructure.

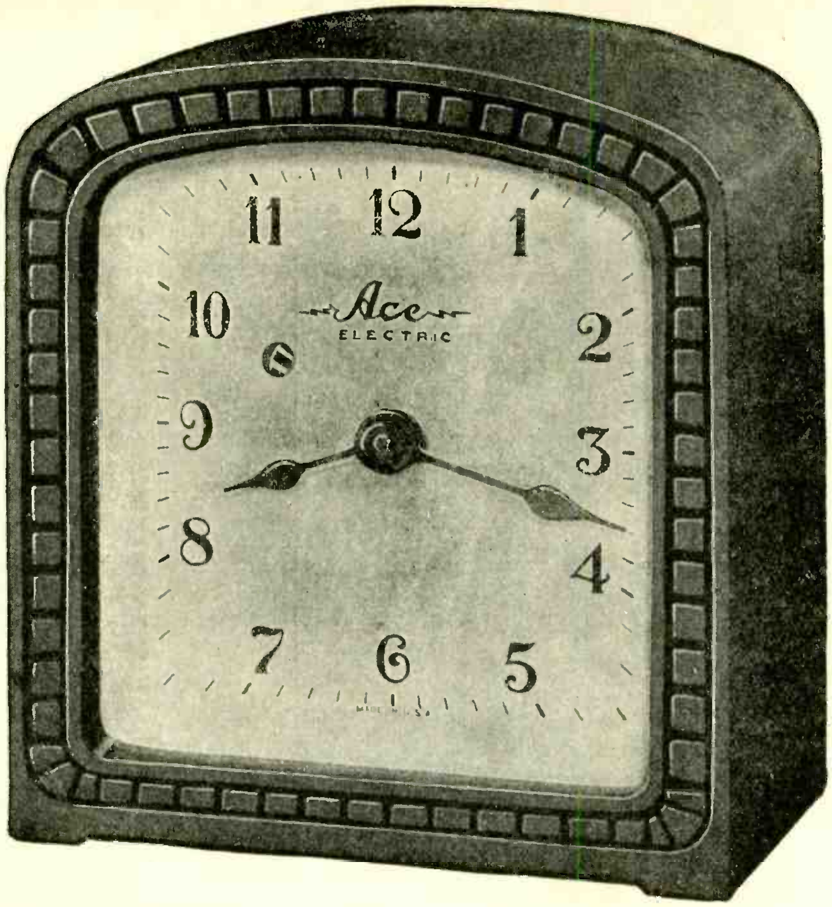
With projected television there is the question of a separate screen to be put in front of the television receiver, or better yet, to have the screen a fixed unit in the cabinet. But it takes an even greater distance between the scanning system and the screen than it did in the peep-show type of television and this again makes for a deep cabinet. Of course a small screen does not require this distance but with one foot pictures in the offing the problem is a real one.

In this same cabinet we want to house a short wave radio receiver and a loudspeaker, to monitor the picture carried.

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

7 cents a word—$1.00 minimum—Cash with Order



ELECTRIC ALARM CLOCKS

110 Volt AC 60 Cycles

BAKELITE CASE, EXACT SIZE AS ILLUSTRATED

An Ideal Xmas GIFT

Give one to a friend for Xmas. Keep one for your own use. TWO of these clocks for $3.00. Or get 4 for $5.75.

TWO FOR $3.00

No Orders Accepted For Less Than 2

25 YEAR GUARANTEED electric ALARM clock, 110 volt, 60 cycle. Bakelite case. Current indicator. Beautiful dial. Heavy lens. Works from your house current. Never needs winding. Nothing to wear out or go wrong. Almost a million in use. Complete with 6 foot cord and plug. Limited quantity. ORDER TODAY. Two of these clocks for $3.00. Or four for $5.75. Money refunded if not satisfied.

Send Cash, Money Order or Check to:

Orders shipped same day received. No delays.

R. A. MATLI CO.
1114 Mission Street San Francisco, Calif.

RADIO WORLD and "RADIO NEWS"

BOTH FOR ONE YEAR **$7.00** Canadian and Foreign $8.50

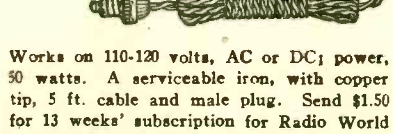
You can obtain the two leading radio technical magazines that cater to experimenters, service men and students, the first and only national radio weekly and the leading monthly for one year each, at a saving of $1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks is $6.00. Send in $1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months. Total, 64 issues for $7.00.

RADIO WORLD, 145 West 45th Street, New York, N. Y.

"RADIO FREQUENCY MEASUREMENTS", by E. B. Moullin, M.A., A.M.I.E., M.I.Rad. Eng. Second Edition entirely reset and greatly enlarged Illustrated. 487 pages, plus 12-page index. Indispensable for radio experts and engineers. $12.50. Radio World. 145 W. 45th St., N. Y. City.

PHONOGRAPH PICK-UP — Made by Allen-Hough. $3.32. Guaranty Radio Goods Co., 143 W. 45th St., N. Y. C.

SOLDERING IRON FREE!



Works on 110-120 volts, AC or DC; power, 50 watts. A serviceable iron, with copper tip, 5 ft. cable and male plug. Send $1.50 for 13 weeks' subscription for Radio World and get these free! Please state if you are renewing existing subscription.

RADIO WORLD
145 West 45th St N. Y. City

"RADIO TROUBLE SHOOTING," E. R. Haan. 328 pages, 300 illustrations, $3. Guaranty Radio Goods Co., 143 W. 45th St., New York.

BARGAINS

"A" ELIMINATOR PARTS

Choke coil, to filter out the hum. Wound with No. 16 wire on secondary. Husky choke. Only one needed. Will pass 3 amperes. In shielded case. Cat. AECH @ $5.50

Westinghouse Rectox metal disc rectifier, to pass 2 amperes, or connect rectifiers in parallel to pass 4 amperes; mounting brackets. Cat. WRX @ $1.95

Jefferson transformer, 110 v. 50-60 cycle primary; 12 volts, no load; 9 volts when used full load on Rectox rectifier; DC voltage at full load, 7 volts. Cat. J-12V @ 99c

Dry electrolytic condenser, 1,500 mfd. (two required). Cat. DRL @ $3.25

CABLE AND PLUG

Five-lead cable with 5-prong plug attached that fits into UY socket. Useful as a connector of set voltages or for short-wave adapters. Cat. CPG @ 62c

RESISTORS

Grid leaks 5 meg., 2 meg., ¼ meg., 1 meg., 5,000 ohms (specify which) Cat. CGL @ 11c

Filament ballasts: 4 ohm for one 201A, 112A, 200A, 240A, 171A; 2 ohm for two 201A, 112A, 200A, 240 or 171A, or for one 171 or 112 Mounting supplied. (Specify which.) Cat. FB @........11c

Wire-wound resistors: 1 ohm, 1-3/10 ohm, 6-5/10 ohms; 30 ohms; 50 ohms. (Specify which.) No mounting supplied or needed. Cat. WWR @ 16c

30-ohm rheostat with battery switch attached. Cat. 30RH @ 65c

75-ohm rheostat with battery switch attached Cat. 75RH @ 65c

Variable voltage divider; 10,000 ohms; will pass 100 ma; eight sliders and fixed terminal connections; mounting bracket. Cat. VVD @ $1.49

CONDUCTORS

2 ampere fuse, cartridge type, for fusing AC line entering receiver; with fuse holder. Cat. 2AFH @ 25c

GUARANTY RADIO GOODS CO.
143 West 45th Street, New York, N. Y.
(Just East of Broadway)

RADIO WORLD'S BOOK SERVICE has been found of great value not only by radio fans, constructors, etc., but also by radio and other technical schools throughout the country. See the radio books advertisement in this issue.

PHONOGRAPH PICK-UP—Made by Allen-Hough, $2.50. Guaranty Radio Goods Co., 143 W. 45th St.

THREE-IN-ONE TESTER *FREE!*

EVERYBODY who does any radio work whatsoever, whether for fun or for pay or for both, needs a continuity tester, so he can discover opens or shorts when testing.

A mere continuity tester is all right, but—

Often it is desired to determine the resistance value of a unit, to determine if it is correct, or to measure a low voltage, and then a continuity tester that is also a direct-reading ohmmeter and a DC voltmeter comes in triply handy.

So here is the combination of all three:

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