RADIO WORLD

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The First and Only National Radio Weekly

Eleventh Year—530th Issue

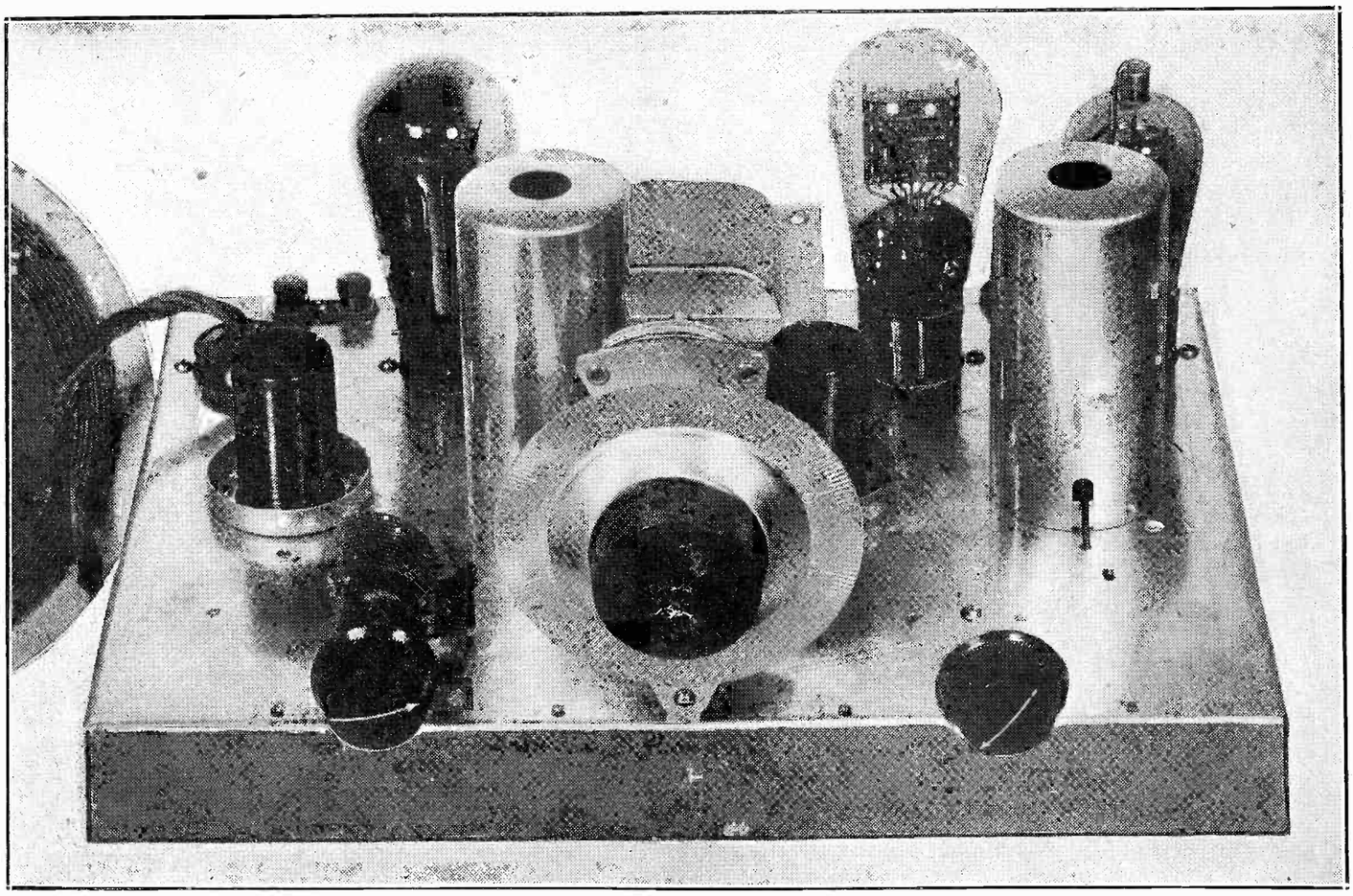
MAY 21 1932 15c

CALIBRATING ULTRA FREQUENCIES

Elimination of Noise Originating in Receiver

CLASS B AMPLIFIER

GETTING RESULTS ON SHORT WAVES



Excellent results were obtained with this five-tube receiver.
The explanatory article begins on page 3.

SHORT-WAVE PERFORMANCE ANALYZED

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One 0.0002 mfd. junior midline tuning condenser.... 1.35
Two 0.00035 mfd. fixed condensers (both)..... .30
One shielded block containing three 0.1 mfd. condensers (black, common, to a minus; reds interchangeable) ..... .57
RESISTORS
One 0.05 meg. pigtail resistor (50,000 ohms)..... .15
Two 4-ohm filament resistors in series, to constitute 8 ohms (both) ..... .20
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One vernier dial ..... .50
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Six 0.002 mfd.	1.20	Two knobs	.20
Two 0.01 mfd.	.30	One a-c toggle switch	.25
Three 0.1 mfd.	.57	National true vernier precision dial	3.84
One 1 mfd.	.45	Two insulators	.10
Two 8 mfd. dry, washers	1.24	Tubes: one '35, two '24, one '47 and one '80	7.35
One 800 ohm	.20		
One 0.05 meg.	.15		
Two 0.02 meg.	.30		
Two 0.25 meg.	.30		
Two 0.1 meg.	.30		
Two 0.5 meg.	.30		
One 5,000 ohm	15		

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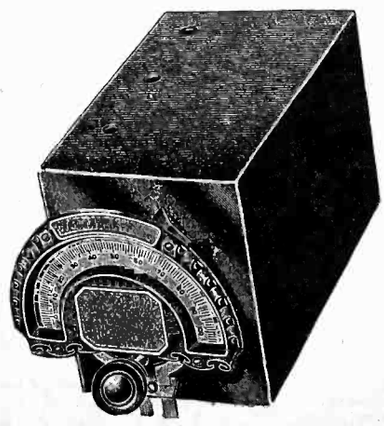

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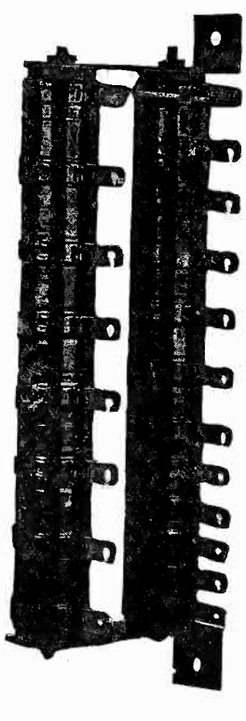

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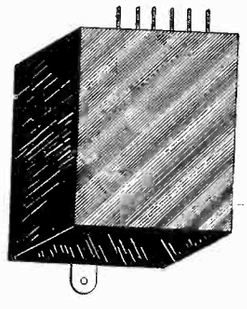

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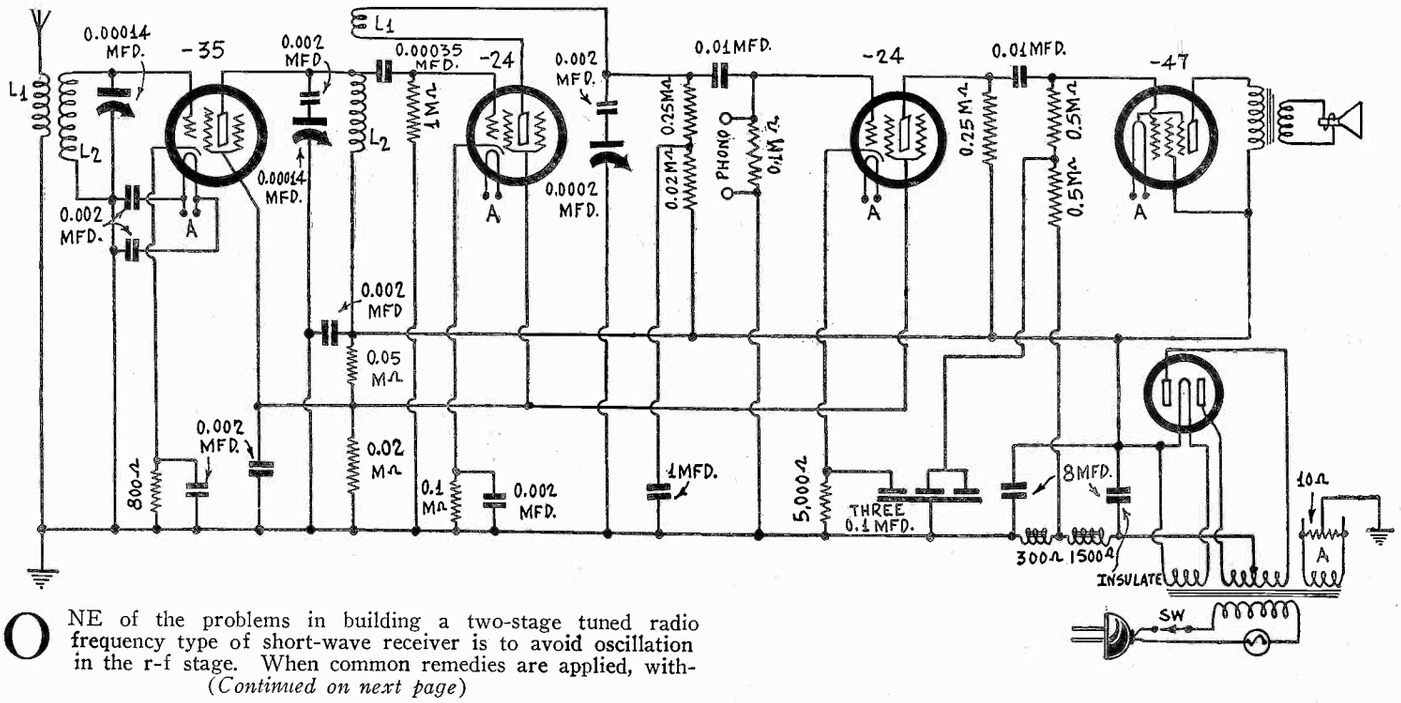
Getting Short Waves Well

Precaution in Five-Tube Model Does It

By Herman Bernard



ONE of the problems in building a two-stage tuned radio frequency type of short-wave receiver is to avoid oscillation in the r-f stage. When common remedies are applied, with-

(Continued on next page)

LIST OF PARTS

Coils

Two sets of plug-in coils for each tuned circuit, four coils to a set, total, eight coils (L1, L2).
One power transformer, four windings: primary, 110 volts, 50-60 cycles; one 2.5 volt winding, 8 amperes or more rating; one 5-volt winding; one high voltage winding, to afford 250 volts d-c after about 110-volt drop in field coil used as B choke.

Condensers

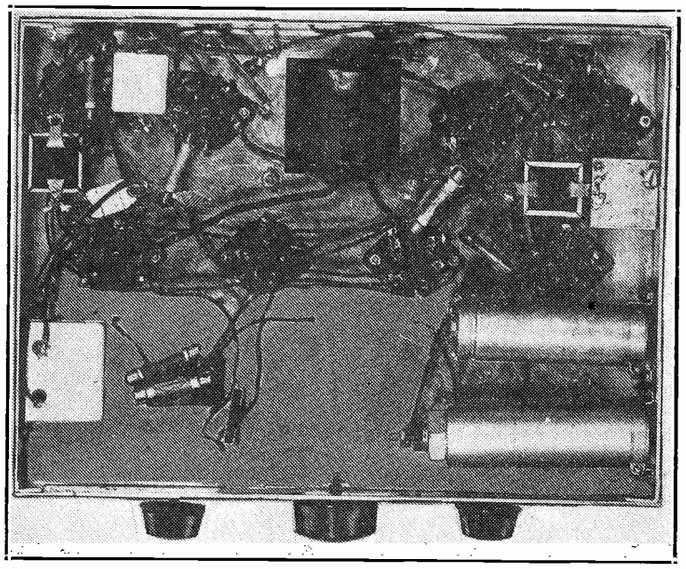
Two 0.00014 mfd. junior midline tuning condensers.
One 0.0002 mfd. junior midline feedback condenser.
One 0.00035 mfd. fixed condenser (mica dielectric).
Six 0.002 mfd. fixed condensers (mica dielectric).
Two 0.01 mfd. condensers (mica dielectric).
One block of three 0.1 mfd. condensers in shielded case.
One 1 mfd. bypass condenser.
Two 8 mfd. dry electrolytic condensers, one with insulating washer and special lug.

Resistors

One 800 ohm biasing resistor (metallized).
One 0.05 meg. resistor, 1 watt (metallized).
Two 0.02 meg. resistors, 1 watt (metallized).
Two 0.25 meg. resistors, 1 watt (metallized).
Two 0.1 meg. resistors, 1 watt (metallized).
Two 0.5 meg. resistors, 1 watt (metallized).
One 5,000 ohm resistor, 1 watt (metallized).
One 10-ohm center-tappeo resistor.
One fuse, about 1.5 or 2 ampere rating, with holder.

Other Requirements

One chassis, 12.5 inches wide x 10 inches front to back x 1.75.
One dynamic speaker; field, 1,800 ohms; tap at 300.
Four UY (five-prong) and one UX (four-prong) wafer sockets for tubes, two UX sockets for coil receptacles and one UY socket for speaker plug. On speaker socket use P for ground, G for tap on field coil, cathode for B minus, heaters for output transformer primary.
Two knobs (for r-f condenser and feedback condenser).
One a-c switch, toggle type.
One vernier dial (for r-f plate circuit tuning condenser); precision type dial preferred, as illustrated.
Two insulators for mounting bracket of one electrolytic condenser.
Tubes: one '35, two '24, one '47 and one '80.
One antenna-ground turn post, one phono twin post.



The sockets are: front, right, ant. coil; r-f tube; other coil; det. tube; rear left, first a-f tube, output tube; speaker plug.

(Continued from preceding page)

out result, naturally one has to look for a peculiar origin. Shielding the coils is tried, but does not stop the trouble, only reduces the sensitivity somewhat, although for more r-f stages shielding would be imperative. Various kinds of r-f filters are inserted in plate, screen and grid leads, including choke-resistor-capacity, to no avail. Voltages are reduced, but this does not help any, except that when amplification disappears, and nothing is heard, of course the oscillation goes with it. But what we want is to get rid of the oscillation and still retain the signal.

The trouble finally was located in the heater winding of the power transformer. There was enough resistance to create feedback in the right direction—wrong from our viewpoint—to produce oscillation. When this feedback was eliminated, by putting a condenser from one side of the heater winding to ground, stability was excellent. To make certain that the bypassing would be infallible one condenser was put from each side to center, and the two condensers were located right at the r-f tube socket, where the bypassing would be done as soon as possible.

Quite a Difference in Results

"The r-f tube oscillates but the detector won't," is an occasional complaint, and we have seen one way to get rid of the r-f tube trouble. As for the detector, if it does not oscillate, all that one need do is reverse the connections to either plate or grid coil. Take the plate coil as an example. If no oscillation is present, put the connection now going to plate instead to the resistor and condenser, and connect the other coil terminal to plate.

When there is no oscillation in the detector the receiver is not a bit keen and is good only for locals. When oscillation is present (and controllable by some manual means), then one has the familiar type of receiver that brings in European and other foreign stations when reception conditions are right, and, incidentally, when those stations are on the air. Many persons try for hours at night to "get Europe," when "Europe" has been in bed hours before the hopefuls started to try to tune 'em in.

What the control should be is a matter of choice. Various types were tried. The photographs show the condition existing when a resistor controlled regeneration, but the condenser method is at least as good, and is therefore recommended. A condenser of somewhat larger capacity than the tuning condenser is used from coil end to ground. The two windings are inductively coupled. In fact, the two coils are the same, in the antenna stage and interstage, and therefore are given the same designations, L1 and L2. These coils are wound on tube base diameters and are to be plugged into UX sockets. Data on page 7 may be used for winding.

Precautionary Series Condensers

Since all the tuning condensers have grounded rotors, and two of them have stators going toward plates, it is better to put a fixed condenser between the plate and the stator, to avoid a short of the B voltage if the rotor plates should touch the stator plates. If this series condenser is comparatively large, say, ten times as great as the tuning condenser, the capacity reduction will be of no importance.

The trouble from hum in two-stage resistance amplifiers has to be circumvented. One way found excellent is to use a 1 mfd. condenser across a 20,000-ohm resistor in the plate lead. The usual precaution is taken in the power tube grid circuit also, although larger resistor and smaller capacity are used there. Besides, another precaution is open to all, and should be tried. The set, even if reduced to a most unobjectionable hum level, will hum still less if the primary of the output transformer has been incorrectly connected and the remedies applied. The statement is often made that the output primary leads are interchangeable, and they are, in the sense that the set works no matter which end of primary goes to plate and which to B plus, and also the volume is about the same, as far as the ear can tell. But it so happens that hum often is much less when these two leads are connected as they should be. Since the terminals are not marked in the economy of the day, but may be brought out either way to lugs on a terminal piece attached to the speaker, the only advice to be given is to try the connections both ways, compare results, and accept the obviously better way. The speaker should be baffled when the test is made. This baffle is simply the one ordinarily used and may be even a midget cabinet.

The net result will be excellent freedom from hum, and the chief problems connected with a short-wave receiver of this kind will have been overcome: r-f oscillation; no oscillation or uncontrollable oscillation in the detector; hum.

Dead Spots

The fixed condensers used for series connection in tuning circuits as well as for bypassing radio frequencies are mica dielectric, whereas the others are of the paper type or, in the rectifier filter, electrolytic condensers. The reason for using mica condensers to bypass the radio frequency currents is that paper condensers may have an inductance that is troublesome on the higher frequencies of tuning. Unaccountable dead spots might result.

Indeed, the subject of dead spots is one that bears investigation. Sometimes they show up and no one seems to know why. The paper condenser offers one idea. Sometimes the aerial is at fault, in that it acts as a bypass. Occasions will arise when no matter if there is a long or short aerial (or a variable condenser in series with the aerial to give the option of effectively longer or shorter aerial) there will be dead spots nevertheless. It seems that one of the best ways of circumventing this trouble, so far as can be done in the circuit itself, is to see that any tube intended to be oscillating shall be oscillating with a vengeance. So it is in the present circuit. When the oscillation is under way, which is always, unless stopped or reduced to regeneration by the feedback condenser, you can hear a squeal as you cross carrier after carrier, which is a real test for sensitivity. On one spread of the dial as many as a hundred different squeals may be picked up—each representing the beat between the oscillating detector and the carrier. No dead spots were encountered.

The first precaution against dead spots is to see that the voltages are as they should be, that the coils are well made, with excellent contacts and connections, and on a good form, and that the sockets to serve as coil receptacles have strong-gripping prongs. Any losses due to poor contacts are equivalent to introducing a serious resistance, and the performance that otherwise would be excellent becomes inferior.

Voltage Distribution

The voltage distribution is as simple as can be. The maximum B voltage is applied to all four tubes. Thus 800 ohms for the r-f tube bias is not too low. In fact, it may be advisable in some cases to use up to 400 ohms, as the variable mu tubes of different types of manufacture draw different amounts of plate and screen current.

Next in d-c voltage line comes the screen voltage, which will read around 50 volts on a 1,000-ohms-per-volt voltmeter, but which is actually higher. If for any reason a higher screen voltage is desired, the 20,000 ohm resistor between screens and ground may be replaced with 50,000 ohms, and then a reading of around 90 volts will be obtained on such a meter, although the actual voltage will be somewhat higher. There need be no hesitancy about putting the full B voltage on the r-f tube, some 250 volts, as the biasing resistor limits the current, and the limitation of the tube is the current passed through it, rather than the voltage applied. In the case of the detector and first audio tubes, the maximum voltage is dropped very considerably in the load resistors, whereas in the output tube the actual application in the plate circuit may be the full 250 volts, but on the plate is usually round 230 volts, due to a drop of 20 volts in the primary of the output transformer.

LIST PRICES OF TUBES

First Figures on Five New Valves

Herewith is the latest list of tube prices—forty-four tubes in the receiver and amateur classes. The list prices of the five new tubes are revealed—46 at $1.50, 56 at $1.25, 57 at $1.60, 58 at $1.60 and 82 at $1.25.

Type	*List Price*						
11	$3.00	'24-A	1.60	'38	2.75	'81	5.00
12	3.00	'26	.80	'39	2.75	82	1.25
112-A	1.50	'27	1.00	'40	3.00	'74	4.75
220	3.00	'30	1.60	'45	1.10	'76	6.50
'71-A	.90	'31	1.60	46	1.50	'86	6.50
UV-'99	2.75	'32	2.30	47	1.55	841	10.00
UX-'99	2.50	'33	2.75	'50	6.00	868	7.50
200-A	4.00	'34	2.75	56	1.25	864	2.00
'01-A	.75	'35	1.60	57	1.60	852	28.00
'10	7.00	'36	2.75	58	1.60	865	15.00
'22	3.00	'37	1.75	'80	1.00	866	7.50

Getting Rid of Noises

Remedies Applied to a Midget Receiver

By Rodman Markham

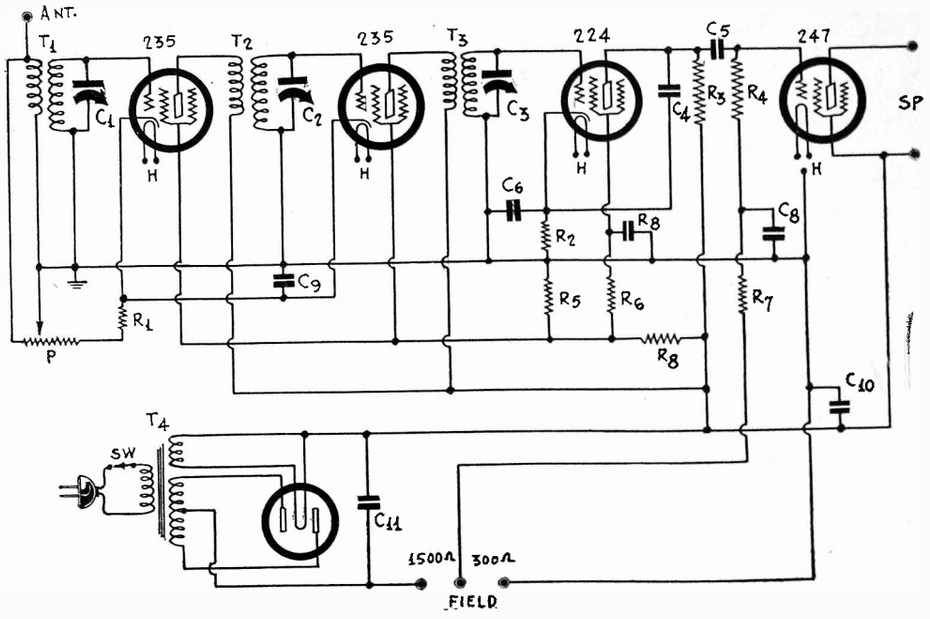


FIG. 1

A midget receiver of this type sometimes develops undesirable noises that can be removed or greatly reduced by simple treatment.

THOSE who have midget receivers of the type that has been popular the last year often complain that they turn out many undesirable noises in addition to the signal. The most frequent complaint is that the hum is excessive. Another complaint is that there are many crackling noises in the set, especially on the low waves. Still another complaint is that the high audio frequencies are too strong in comparison with the low notes. All the complaints, of course, are made with the object of finding a remedy.

Perhaps the explanation of these difficulties lies in the cost of the set. A midget set is made with the object of getting the greatest possible results for a small amount of money. Necessarily something must be sacrificed. It is impossible to put as many and expensive parts in a set that sells for about $25 as into one that sells for $250, using round numbers. The sacrifices that can be made with the least loss in all around results are those which are likely to result in some of the difficulties complained of. Since we cannot incorporate the missing or inadequate parts without entering into a much more expensive class of receiver, we must examine the circuit to find out what can be done to minimize the defects that may be in some of the midgets. We do not wish to convey the impression that midget receivers are not good. The great popularity that these sets enjoy at this time and have enjoyed for over a year attests to the fact that most purchasers of them are entirely satisfied.

The Typical Circuit

In Fig. 1 is the diagram of a typical five-tube midget of the type referred to. We shall describe it in some detail and point out some of the troubles and remedies.

In the first place it has three tuned circuits all tuned with the same control. If these circuits are properly aligned the selectivity will be adequate for the sensitivity, and there is no particular difficulty in making the condenser track, provided good tuning condensers and equal coils are used. Every good three gang tuning condenser now has a trimmer condenser across each of the sections so that in any case the minimum capacities of the circuits can be made equal. This is one condition for alignment. Then if the tuning coils are made by a reputable coil manufacturer we are sure that the inductances are the same in all the circuits. This is the second condition for tracking.

Assuming that the coils are not only equal in inductance but that they are encased in the same size shield we may be sure that the coils are equal after they have been installed. That, of course, is absolutely essential, for equality before installation does not mean anything. However, there is one factor that may cause trouble here, and that is the size and winding of the primaries. These do not necessarily have to be equal. When a set has to be made as sensitive as possible, the sensitivity is usually obtained by increasing the number of turns on the primaries. The two coils following tubes will remain equal regardless of the number of primary turns used, as long as they start equal, but the coil following the antenna will not change the same way and there is likely to be a deviation if the primary winding is large and very closely coupled to the secondary. This change is not caused so much by the primary as by the antenna. If a short antenna is used a large primary can be used on the first coil. If the primary is large, and is placed very close to the secondary, there is likely to be a high capacity between the two windings which will prevent full coverage of the broadcast band. However, this is not likely to be a fault with a purchased set for one of the tests always made is to see that it tunes to 1,500 kc.

Capacities Different

But the trouble may be that the first tuned circuit will be out of line with the other two so that the set will be relatively weak and broad on the short waves.

The volume control in these sets is also such that the selectivity will be lower in the first circuit when a strong station is tuned in. This is due in part to partial short-circuiting of the primary and in

(Continued on next page)

LIST OF PARTS

Coils

T1, T2, T3—Three shielded r-f transformers as described
T4—One midget power transformer

Condensers

C1, C2, C3—One gang of three 350 mmfd. tuning condensers, with trimmers
C4—One 250 mmfd. condenser
C5—One 0.1 mfd. condenser
C6, C7, C9—Three 0.1 mfd. or larger condensers
C8—One 0.25 mfd. condenser
C10, C11—Two 8 mfd. electrolytic condensers

Resistors

P—One 10,000 ohm volume control potentiometer with switch (Sw) attached
R1—One 300 ohm resistor
R2—One 30,000 ohm resistor
R3, R7—Two 250,000 ohm resistors
R4, R6—Two 500,000 ohm resistors
R5—One 18,000 ohm resistor
R8—One 20,000 ohm resistor (3 watt rating)
R9—One 30 ohm center-tapped resistor across heater, not shown

Other Requirements

Four binding posts
Three grid clips
Four UY sockets
One UX socket
One dynamic speaker with 1,800 ohm field tapped at 300 ohms
One midget chassis
One close adjustment dial

(*Continued from preceding page*)

part to altered tuning characteristics. This trouble is present in nearly all a-c sets regardless of class, except in those incorporating automatic volume control. And even in these it is present in some degree. It is customary to use a 5,000-ohm potentiometer for P, but the effect just discussed is reduced if it be made 10,000 ohms and therefore this is suggested. If the tubes in the r-f amplifier are those indicated, namely, two 235s, the limiting resistor R1 should be 150 ohms, unless r-f oscillation is present, when it may be made as high as 600 ohms.

The secondary of each of the three r-f transformers, T1, T2 and T3, should be wound on one-inch bakelite tubing with No. 32 enameled wire, 127 turns being required for a 350 mmfd. tuning condenser. A layer of insulator 1/32 or 1/16 inch thick should be placed over the ground end of each secondary and then the primary should be wound over that layer. No. 36 double silk or cotton covered wire may be used, and the primary should be started as near the ground end of the tuned winding as possible. Forty turns of the fine wire should be used.

The Detector

The detector in the midget is nearly always a 224 and this is coupled to a 247 pentode with resistance and capacity. It is in the detector and the power amplifier where hum enters the receiver. Various filters have been tried with more or less success. One that seems to be essential is the resistance-capacity filter in the grid circuit of the power tube. If R4 is a grid leak of 500,000 ohms, and a higher value cannot be used safely, the filter condenser C8 should be at least 0.25 mfd. and the filter resistor R7 should be 250,000 ohms. If R7 is made higher the filtering action will be greater but leakage from the grid to ground may not be sufficient to prevent blocking.

If the plate coupling resistor R3 is 250,000 ohms the grid bias resistor R2 should be 30,000 ohms. This makes a sensitive detector combination provided that the screen voltage on the tube has the right value. The usual voltage applied in the screen circuit is 67.5 volts, but the effective value should be much less than this. C4, the r-f bypass condenser in the plate circuit, should be a 0.00025 mfd. although a 0.00035 mfd. condenser is all right. C6 across the bias resistor should be 0.1 mfd. or larger.

As described so far the set is likely to give out considerable hum for lack of filtering. However, it has been found that if a resistance of 500,000 ohms, R6, be placed in series with the screen lead of the detector and the applied voltage be made 67.5 or 90 volts in place of the desired effective voltage, the hum will practically vanish. Yet there will be no reduction in the sensitivity. The bypass condenser C7 from the screen to ground is necessary, and it should have a value of at least 0.1 mfd.

Effectiveness of Filter

The increased effectiveness of the filter appears to be due to the fact that a condenser of given value is more effective across a high resistance than across a low. Hence it is the resistance R6 rather than the increased applied voltage that counts. The increased voltage is merely to compensate for the voltage drop in the resistance. It is interesting to note the degree of suppression of the hum due to this change. Before the resistance R6 was connected in the circuit, and when the screen was returned to a comparatively low voltage, the hum in a certain set was so loud that it could be heard easily 10 feet from the speaker. After the change it could not be heard when the ear was put up close to the speaker. Thus it may be truly said that the hum entirely disappeared.

The voltage divider in a midget set of this type is made of one-watt resistors in most instances. A frequent complaint is that one of the resistors, R8 in this instance, overheats or actually burns out. The reason for this, of course, is that the power actually dissipated is greater than one watt. To lower the wattage we have to lower the current, and that is done by lowering the bleeder current. Suppose we let the bleeder current be 5 milliamperes. Also assume the voltage on the screens is 90 volts. Then the drop in R5 should be 90 volts when the current is 5 milliamperes. This requires a resistance of 18,000 ohms. Now the current in R8 will be 5 milliamperes plus all the screen currents. These will not amount to more than 4 milliamperes. Hence we have a total current in R8 of 9 milliamperes. The voltage at the positive end of R8 is about 275 volts with respect to ground, or the drop in R8 is 185 volts. Therefore R8 should be 20,000 ohms, approximately. The power dissipation in R8 under these conditions will be 1.62 watts. If the one-watt resistor is conservatively rated, it will stand up, but it would be much better to use a 3-watt unit. Incidentally, it is not practical to reduce the bleeder current to a lower value, but it may be that the screen current will be less than 4 milliamperes. With a bleeder of 5 milliamperes the wattage will be reduced to one watt if the screen current can be reduced to 2 milliamperes. All resistors other than R8 can be one-watt units.

The High Audio Tones

The predominance of high audio frequencies in the output is often attributed to the 247 pentode tube. It may be at fault, but it is more likely that the highs predominate by virtue of relative absence of the lows. Lows are suppressed in the coupler between the detector and the power tube in order to suppress hum. Now if hum is suppressed by the method suggested above the low notes may be favored more, and that is done simply by increasing the capacity of C5. It should be made 0.1 mfd. Increasing bypass capacities will have the same effect, especially those of C6, C7 and C4. However, C4 should not be made larger than 0.0005 mfd. C8, C10 and C11 should not be increased unless it is necessary to do so to remove hum that may have developed as a result of favoring the low notes.

Another method of reducing the high notes is to put in a tone control. This might consist of a 0.01 mfd. condenser in series with a 100,000 ohm resistor, the two being connected in shunt with R4. If the 100,000 ohm resistor is made variable most of the high notes may be cut out by lowering the value of the resistance in series with the 0.01 mfd. condenser. Incidentally, this tone control cuts down the amplification. It is obviously better to increase the low note amplification than to decrease that on the high notes.

The B Supply

The B supply transformer R4 is one that has been designed especially for midget receivers. It has one 2.5-volt winding of current capacity adequate for the four tubes, one 5-volt winding for the filament of the rectifier tube, and one center-tapped high voltage winding that will give a voltage high enough to supply about 100 volts for the field coil of the speaker and 275 volts for the amplifiers.

Two 8 mfd. electrolytic condensers are used in the B supply of nearly all midget receivers. They are C11 and C10 in Fig. 1. The first of these must be insulated from the chassis. Ordinarily these are large enough to remove hum, assuming the precautions discussed have been made, but in some instances it may be necessary to put in additional bypass capacity.

Crackling Noises

One common complaint about midget receivers is that there is a great deal of crackling noise in the output, especially on the shorter broadcast waves. The causes are not definitely known. Some, no doubt, comes from the outside, and are due to static and electrical disturbances. Some comes from the tubes, the so-called shot-effect. Very little can be done about these noises.

It is a fact that these noises are mostly due to high audio frequencies. Hence if the highs are suppressed by the methods suggested above, a large proportion of the noise will be eliminated.

Short Wave Club

The following is a list of new members of the Short-Wave Club:

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William Necas, 3504 West 61st Place, Chicago, Ill.
E. C. Atkerson, 2019 1st Ave., No. Birmingham, Ala.
George F. Krygier, 583 Morgan Ave., Brooklyn, N. Y.
Rudolph Kraatz, Jr., 619 So. 11th St., Saginaw, Mich.
Carl Irwin, 401 Collicello St., Harrisonburg, Va.
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F. A. Rambie, Jr., 433 Harriman Pl., San Antonio, Texas.
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Short Wave Editor, RADIO WORLD, 145 *West 45th St., New York.*

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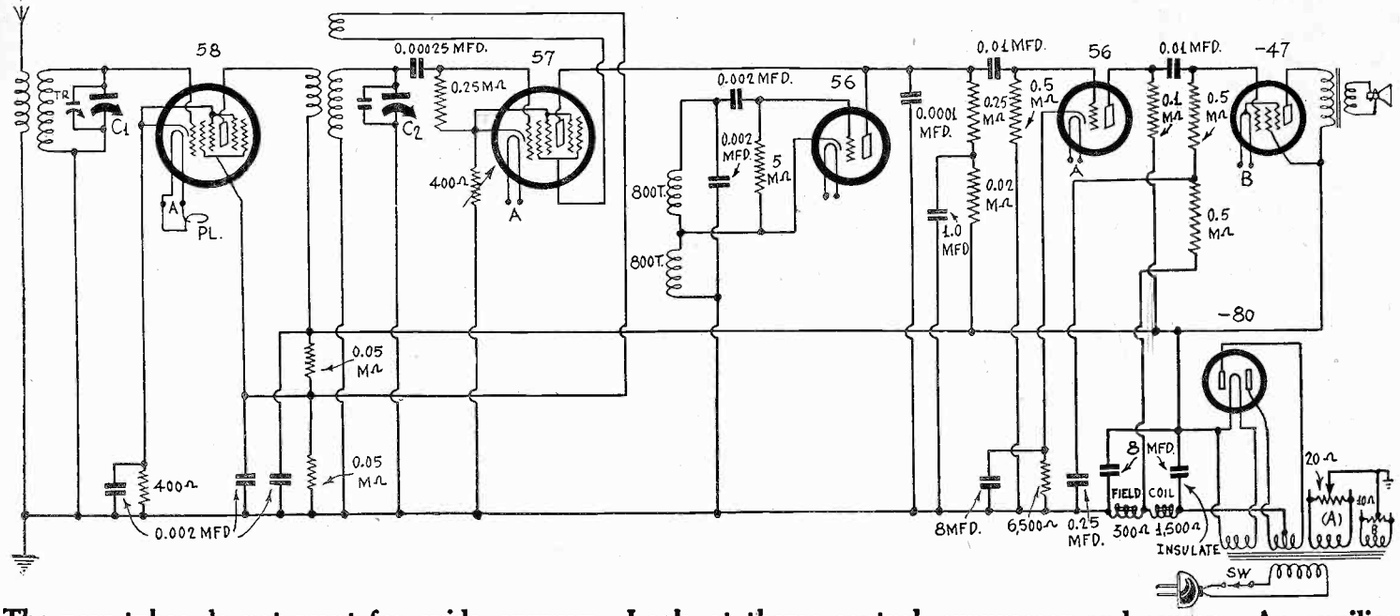
Try Super-Regeneration

New Tubes in Experimental Circuit

By Jack Tully



The new tubes do not want for grids, anyway. Look at them: control, suppressor and screen. An auxiliary frequency, around 25,000 cycles, is introduced into the 57. One of the audio grid leaks—either one—may be 50,000 ohms to stop any motorboating.

A CIRCUIT using super-regeneration and new tubes is shown in Fig. 1. The radio frequency amplifier is a 58 and 250 volts may be applied. This tube is like the —35, —51, —39, and —34 in that it is of the variable mu type screen grid tube. However, it is unlike them in that it has five basic elements, the fifth being the suppressor grid. The tuble is thus a pentode, but the word is not used for it, to avoid confusion with output pentodes.

The elements are: cathode, screen grid, control grid, plate and suppressor grid. The suppressor grid is a new consideration in this type of service in a-c sets, particularly as the suppressor grid is brought out to a separate pin. Therefore the tube has six pins at the base. The control grid connection is to a cap at top.

For present uses the suppressor grid is connected externally to the cathode. For special and experimental purposes it may be connected to other points. The effects of various connections of this suppressor grid have yet to be fully explored.

Shield Is Inside the Tube

The suppressor grid is positioned inside the glass envelope between the screen grid and the plate and acts in a shielding manner. The suppressor, when cathode-connected, tends to suppress secondary emission, which secondary emission consists of electron emission by the plate.

It is practical, therefore, to work the tube at about the same voltage on the screen grid as is applied to the plate circuit, and yet avoid distortion from large signal swings.

The cathode in this tube has an internal shield connected to it. This internal shield occupies the bulb dome of the tube above the electrode assembly.

The standard conditions for operating the tube are: 250 plate volts, 100 screen grid volts, minus 3 control grid bias volts, whereupon the plate current is 8.2 milliamperes, the screen current 3 milliamperes, the plate resistance 800,000 ohms and the amplification factor 1,280.

Electron Coupling

The total B current is about 11 milliamperes in the tube in Fig. 1, and the bias arising from the 400 ohm cathode-leg resistor 4.4 volts. Since the tube is of the super-control type, the bias could be even greater than this. There is some amplification left even at 50 volts negative bias.

The cathode should be at zero d-c potential, or, if a voltage difference exists, the heater should not exceed 45 volts negative. An individual 2.5 volt winding for the r-f, detector, low frequency oscillator and first audio tubes permit the zero voltage preference.

The detector tube is the 57, also a screen grid tube of the triple grid type (screen, control and suppressor grids). It has six pins, grid cap and suppressor grid; also internal shield and dome construction. Here it is hooked up in an odd way as an oscillator. The feedback current is taken from the screen, rather than from the plate circuit. The regeneration is manually controlled by a 400-ohm rheostat and electrically by an auxiliary oscillator of low frequency.

Since the 57 is also of the internal shield type, no alterating current will flow in the plate circuit by virtue of resistance, capacity or inductive coupling, but only because of electron coupling between plate and screen. Likewise the same type of coupling is used for introducing the low frequency oscillation, since the two plates are tied together (57 and 56 tubes).

The auxiliary oscillator uses the 56 tube, which is especially recommended as an oscillator, and in this case the grid leak may be of high value, for the frequency is low as compared to radio frequencies, although high in an audio frequency sense. In fact, due to an inductance of 20 millihenries and a capacity of 0.0002 mfd., the frequency is around 25,000 cycles.

How to Wind Overlap Coils

It is intended that plug-in coils be used. The interstage coil form would have to have a six-pin base, and its receptacle would be a six-pin socket. If the condensers C1 and C2 are 0.00014 mfd. each, then the winding data may be as follows for home-made coils:

Secondaries No. Turns Enamel	*Tickler No. Turns Enamel*	*Plate Coil No. Turns Enamel*	*Approximate Range Meters*
60 of No. 32	32 of No. 32	15 of No. 32	200+ to 118
33 of No. 24	15 of No. 32	9 of No. 32	118+ to 69
20 of No. 18	10 of No. 32	5 of No. 32	69+ to 40
10 of No. 18	10 of No. 32	3 of No. 32	40+ to 24
4 of No. 18	7 of No. 28	3 of No. 32	24+ to 15

For the antenna coil use a UX form. Start at the top, wind the secondary, top to grid pin for grid connection, end of secondary to filament plus pin for grid return (ground). Begin primary adjoining, connect to filament plus pin (for B+ or ground), while end of primary goes to plate pin (for aerial or plate of tube). All windings in the same direction.

For interstage use a 6-pin form. The primary is on top, the secondary next, the tickler next. All windings in the same direction, polarities of beginning and end of secondaries as above.

These data are conservative, as there is considerable overlap. Besides, the largest coil goes into the broadcast band somewhat. With commercial coils, machine wound, and subject to segregation of quantity products so that inductances are virtually identical, the 15-200 meter wave coverage can be achieved with only four coils for each tuned circuit.

Short Waves Surveyed

Scope and Limitations Defined by Trade

THE following statement was issued by Radio Manufacturers Association, Inc., on short-wave uses, the statement having been prepared by its engineering division:

"The importance of short-wave reception in the past year is demonstrated by the wide interest shown in commercial short-wave receivers, the acceptance by the public and the dealer of a well-designed and engineered short-wave product, and the appeal which short-wave reception has to the user, especially when reception direct from foreign countries is possible.

"Unfortunately, however, very exaggerated advertising claims have been made regarding reception on short waves. Reception from stations in London, Paris, Berlin, Africa, Honolulu, Cuba, South America and other distant points, has been almost guaranteed at any time of the day or night with perfect clarity and fidelity. Thus, the misguided public is led to many disappointments when one of these short-wave receivers is purchased.

"This statement is intended to make clear just what can be expected in short-wave reception with receivers properly engineered and designed.

Phenomena Explained

"The term 'short waves' is used to indicate wavelengths shorter than those employed in the standard broadcast band—that is, below 200 meters. Short-wave reception at present includes wavelengths down to about 15 meters.

"The transmission and reception of short waves have been studied by the most brilliant engineering minds in the world. Many of its phenomenal characteristics are very well known and much has been accomplished in obtaining reliable and dependable broadcasting in the short-wave band. Successful trans-oceanic telephony on short waves is well known to every one and re-broadcasting of short waves from foreign stations on elaborate national broadcasting networks has passed beyond the stage of engineering achievement and is taken as a matter of fact by the public. The systems, however, have been developed with considerations given only to service and dependability and to obtain these two important requisites the cost of the associated apparatus has run into considerable sums of money, notwithstanding the time and cost for engineering research and development of the systems. Even with these elaborate and expensive systems service on short waves has been interrupted by atmospheric disturbances and other facts beyond the control of the systems used.

"In commercial short-wave reception, in which entertainment must be afforded, the problem is to design a receiver capable of good and satisfactory reception. Unusual and miraculous performance can be expected of this type of receiver no more than with a well-designed broadcasting receiver. No one in New York with a standard superheterodyne broadcast receiver would expect to receive a station from Los Angeles, California, consistently, although the receiver may be perfectly capable of this reception under favorable conditions, and yet many users of short-wave receivers expect 'round the world reception every day, in all seasons. The cost of short-wave receiving equipment increases at a greater ratio with improvement in operating characteristics than the cost of regular broadcast equipment.

Influential Factors

"Many factors influence the transmission and reception of short waves. Daytime reception is better on certain short waves than night reception, whereas in other short-wave bands the reverse is true.

"The short-wave stations of the world are allocated approximately as follows:

Police Stations

1,500 to 2,470 kilocycles.....200 —121.5 meters

Television

2,000 to 3,000 kilocycles.....150 —100 meters

Aircraft

1,600 to 1,700 kilocycles.....187.5—176.5 meters
3,070 to 3,256 kilocycles—night transmission.... 97.7— 92.2 meters
3,452 to 3,492 kilocycles—night transmission.... 86.9— 85.9 meters
5,500 to 5,690 kilocycles—day transmission..... 54.6— 52.7 meters
6,155 to 6,410 kilocycles—day transmission..... 48.75- 46.8 meters

Amateur

3,500 to 4,000 kilocycles..... 86 — 75 meters

American and Foreign Broadcasting

3,660 to 15,000 kilocycles..... 82 — 20 meters
(a little telephony and experimental transmission)

Mixed Telephony and Broadcasting

9,800 to 23,000 kilocycles..... 30.5— 13 meters

New Proposed Television Band

35,000 ot 80,000 kilocycles..... 8.5— 3.75 meters

Favors Frequency Calibrations

"It has been common practice to mark dial calibrations for short-wave receivers in wavelengths. In order to be consistent with dial calibrations now standardized on broadcast receivers, kilocycle or megacycle markings should be employed on all short-wave receivers in the future. All important American and international log books and newspapers are cooperating in bringing about a standardization of kilocycle or megacycle markings.

"Below 25 meters reception is generally more satisfactory during the day than at night, whereas in wavelengths above 50 meters night-time reception is better. It has been found experimentally that wavelengths below 20 meters can be heard only when the path between the transmitting station and the receiver lies entirely in daylight. For wavelengths between 20 to 35 meters, reception is best when either the transmitter or the receiver lies in darkness, but not both.

"It is important to keep in mind that the time of day must be taken into consideration in reception of short waves. When it is 8:00 p. m. in New York, it is 10:30 a. m. of the same day in Melbourne, Australia; 1:00 a. m. of the next day in London, England; and 2:00 a. m. of the next day in most of Europe. At these hours the European broadcasting stations are seldom operating. Consequently, in tuning of stations in Europe on the American continents, the best reception is obtained during the afternoon or early evening. Australian stations, on the contrary, will be received in the early morning.

Must Avoid "Fishing," Use Log

"Schedules, especially from foreign short-wave stations, are difficult to obtain accurately. There are, however, definite schedules kept by some of the large foreign stations and these schedules should be ascertained before attempting to receive them. Reception is the primary factor in the sale of a short-wave receiver. Unless a number of stations can be heard and unless this reception is reasonably good, interest in short-wave reception will be lost and sales will suffer accordingly. Good reception cannot be had simply by turning the dial. It is necessary to use one of the various short-wave station logs to know where to find the stations, and it is necessary to know when the stations are on the air.

"The seasons of the year materially affect short-wave reception. Better reception on the shorter waves may generally be expected during the summer months and better reception at 50 meters and above during the winter months. The lower wavelengths are affected least by atmospheric disturbances or static and good results may even be obtained in mid-summer during a severe thunderstorm. On the other hand, these shorter waves are affected more by interferences from trolleys, dial telephones, automobiles, electrical appliances, etc., than the standard broadcast waves.

"In all broadcast waves, reception is known to be received by two paths from the transmitting station, that is, either by the 'ground wave' or by the 'sky wave.' Reception from the ground wave of the transmitter is extremely reliable but can be received only over a comparatively short distance. On the other hand, reception from the path of the sky wave from the transmitter may be at considerable distances. Sky-wave reception, however, is critical to seasonal changes, night and day changes, and may develop large 'skip-distances,' where the station cannot be heard. By 'skip-distance' is meant the distance to points in a certain area outside the ground-wave range which the sky wave does not touch, making reception in that area impossible. Skip-distances are not stable and may change considerably from hour to hour and from day to night. The sky wave and skip-distance theories explain why short-wave reception may be good one day and very poor the next.

Reliable Range Varies

"Reception within the ground wave should be good at all times unless shielded by intervening buildings, or unless the local interference at the receiving station is excessive. It is seldom that the ground wave of a short-wave transmitter will be heard. The reliable ground-wave distance is approximately 90 miles at 100 meters and only 15 miles at 15 meters. Reception of short waves is mostly obtained from the sky wave of the transmitter. The reliable sky wave, depending whether it is summer or winter, noon or midnight, ranges approximately from 90-2,500 miles for 100 meters; 300 miles to an infinite distance for 25 meters; and 700-4,000 miles at noontime reception for 15 meters. At midnight for wavelengths lower than 15 meters, the transmitter can only be received within distance of the ground wave. At wavelengths below 7½ meters, there is no sky wave effect whatever and transmission follows more closely optical laws or line of sight transmission.

"The reliable range of the sky will vary slowly from season to season, but very rapidly from day to night. The 'skip-distance' is a minimum at noon and increases to a maximum at midnight. The most unusual conditions of reception will be encountered at sunrise and sunset when the most rapid changes occur. The 'skip-distance' is greater when the wavelength is shorter. It is for this reason that wavelengths below 20 meters are useful only during daylight and then over great distances. The maximum reliable range is sub-

(Continued on next page)

Now for Direct Pick-Up!

Flying Spot Discarded as Antiquated

By Leslie S. Gordon

President, DeForest Radio Company

WHATEVER may have been the rate of obsolescence in sound broadcast equipment during the first few years of the art, it might be considered relatively low when compared with that of television. The first few years of television transmission witnessed a medley of different scanning standards from which emerged the 48-line system, which soon made way for the 60-line system. A year ago we had every reason to believe that a good 60-line flying-spot pick-up would serve the visual broadcasting requirements for some time to come. Yet today, while still retaining the 60-line system for the moment, we find that the flying spot equipment is antiquated in view of far better results obtained with the latest television camera equipment.

Jenkins Started It in 1925

These facts are most forcibly brought home to us by our own visual broadcasting experience. Our subsidiary, the Jenkins Television Corporation, traces its visual broadcasting efforts back to the pioneer television transmitter W3XK of Dr. C. Francis Jenkins, in Washington, D. C. That 50-watt laboratory equipment began the transmission of television programs in 1925, building up a large and enthusiastic group of lookers-in scattered throughout the country.

In 1930, the Jenkins engineers constructed a new transmitting station, W2XCR, in Jersey City, N. J., with a power of 500 watts. Various types of transmitters and antenna were employed to develop the art while providing a regular program schedule for owners of television receivers. Later the Washington station W3XK was transferred to just north of that city, with power increased to 5,000 watts. W2XCR was transferred to Fifth Avenue, New York City, and its power increased to 5,000 watts. Working with WGBS for the synchronized sound channel, W2XCR was officially opened on April 26th, 1931. A sound track was provided. Until April 23rd of this year, or twelve months later, W2XCR, more recently associated with WINS, successor to WGBS, has been on the air every weekday with television programs in the afternoon and evening.

To bring our New York station up to the highest standards of present-day visual broadcasting we have temporarily suspended our program schedule. The flying spot equipment, considered the most advanced form of pick-up until now, is to be replaced with the latest DeForest-Jenkins television camera, with a flood-lighted stage. Important changes are to be made in the amplifying and transmitting equipment. A still more favorable location may be sought for the transmitter, so as to secure the best possible coverage of the New York metropolitan area.

Wider Scope with New Technique

The latest DeForest-Jenkins television camera has completely altered the television broadcasting technique, so far as the studio is concerned. This device works with the subject fully illuminated or flood-lighted, while scanning the photo-electric cell which it houses, rather than illuminating the subject with a moving spot of light and depending on the variable reflections for the actuation of exposed banks of photo-electric cells, as in the flying-spot technique.

Our present television camera is not unlike the present-day sound movie cameras in general appearance. The bulky housing for the scanning disc, photo-electric cell compartment and amplifiers, together with the driving motor, is supported by an adjustable mounting, which in turn is carried by a storage battery truck. The operator can drive the camera about by the manipulation of levers, to obtain the desired pick-up. Meanwhile, the subject is flood-lighted with filtered illumination for minimum eye strain yet maximum response from the photo-electric cell in the camera. The pick-up of the camera can be followed by the operator glancing through a small hood not unlike the usual camera finder, at the television monitor, which depicts exactly what is being picked up and sent to the transmitter while the amplifier and other adjustments can be made for the best image transmission.

Better Detail Promised

The latest television camera introduces new and startling program possibilities. A marked improvement in pictorial detail is now available together with more satisfactory lighting. With banks of photo-electric cells and the flying-spot illumination, the images are usually too contrasty for pleasing results. Again, the television camera pick-up permits a larger stage to be employed, with far greater freedom of action for the performers. The focus or distance between camera and subject, as well as the angles, may be varied for that much-desired variety heretofore lacking in television images.

In addition to the pick-up, important developments have taken place in the amplifying and transmitting equipment, making for still better pictorial detail. Refinements at the home end of television, particularly the replacement of plain-hole scanning disc and flat plate neon lamp with lens disc and crater neon lamp, have assured strong links in the television chain of functions, fully justifying the further strengthening of the transmitting end.

Getting Ready for the Next Phase

The advancement of the television art and its subsequent industry now waits upon the visual broadcasters. Better images and more attractive programs are in order. Therefore, television studios and television transmitters must be revamped, after having served for a year or more. We are setting the example by suspending our television broadcasting for a short time, to rebuild our studio and transmitter for the next phase of visual entertainment via radio.

The Television Receiving End

Two of the uncertainties in television that concern the receiving end are the frequency of transmission and the number of lines used in scanning. Receivers now serving for the intermediate band might be of little use if television stations go to much higher frequencies. Also, scanning discs of the 60-line type would not do if the number of lines is altered at the transmitter.

Best Short-Wave Results in Rural Districts

(*Continued from preceding page*)

ject to wide variations due to factors such as static, sun spots and magnetic storms.

"Full entertainment value of short-wave reception is governed by the type of receiver used, the care with which it is installed, and conditions surrounding the receiver. Fading encountered on the short waves, especially at a considerable distance from the transmitter, is much more apt to be destructive of quality than fading on the standard broadcast band. Selective fading and rapid periodic fading are both productive of distortion in the modulation of a radiophone signal. Power has not as much to do with the propagation of short waves as the longer wave lengths. In general, however, greater distances can be covered with less power on the shorter waves.

"Aerial installation for proper short-wave reception is much more important than for reception with a standard broadcast receiver. The aerial should be better insulated, as high as possible, and spaced from metal as much as possible.

"By understanding the foregoing it is plain to see that many factors control reception at the short waves. Influences beyond the control of the systems used make it impossible for reliable receiver manufacturers to guarantee long distance short-wave reception at any time of the day or night. Under favorable conditions it is possible to receive these distant stations with clarity and fidelity, especially in locations remote from metropolitan areas where man-made interference is at a minimum.

"Short-wave receiving development and design are requiring the skill and technical experience of the best radio engineering talent. Efficiency in receiver design is being reached with short-wave converters, short-wave receivers, and all-wave receivers in which the superheterodyne principle is employed.

"The short-wave receiver has a place in the field of engineering. Many phases of its engineering are being considered by committees of the RMA Engineering Division, such as standardization of dial markings, choice of intermediate frequency and other factors. The short-wave receiver is capable of entertainment value under favorable conditions. Too much stress, however, must not be employed in claims of remarkable reception which cannot be substantiated or duplicated readily.

"The members of the Radio Manufacturers Association can do much toward stabilizing the growing interest in short-wave reception by advertising and stating the true facts. In this way the confidence of the public is assured and a satisfied customer will aid in the future success of the radio industry."

The report was mailed to all members.

HOW TO MEASURE ULTRA
LECHER W

By Con

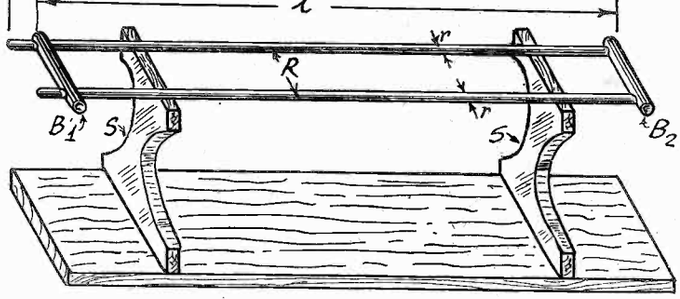


FIG. 1

This shows the arrangement of a pair of Lecher wires for the measurement of short waves below 5 meters. The length of the wires, or rods, must be greater than half wavelength.

INTEREST in wavelengths below ten meters is increasing rapidly among all classes of radio workers. This interest naturally includes measurement of wavelengths or of frequencies. And this is not an easy problem when extreme accuracy is required. Indeed, at the present time an accuracy of 2 per cent is considered good.

There are two methods of measuring in this region. One is to measure the length of a wave and then compute the corresponding frequency. The other is the reverse, that is, to measure the frequency and compute the wavelength. In either case the computation is based on the assumption that a radio wave travels at the rate of 299,820 kilometers per second. Since the velocity is equal to the product of the wavelength and the frequency we know both as soon as we know either.

Lecher Wires

For measuring short waves below 5 meters a pair of Lecher wires is used. Standing waves are induced on the wires and the distance between modes is measured. It can be shown that the distance between any two adjacent nodes is equal to half a wavelength. Hence if we have a means of detecting the positions of the nodes and a meter stick for measuring the distance between them we can find either the wavelength or the frequency.

One set-up of Lecher wires is illustrated in Fig. 1. Two long brass rods are mounted parallel to each other on an insulating support. The rods may be of any good conductor that is not magnetic, but brass is specified because it is inexpensive, easily obtainable in desired shapes, and satisfies the electrical conditions. The rods must also be mounted far away from other objects as far as it is possible to do this. The figure shows the rods mounted on bakelite spreaders S which are several inches high. These, in turn, are mounted on a wooden baseboard.

Dimensions

The diameter, r, of the rods, or brass tubing may be 3/16 of an inch and the distance between them 2 inches, measured from center to center of the rods. The length of the rods depends entirely on the wavelength to be measured, and must not be less than one-half wavelength. Thus if we are to measure a wave of 3 meters the rods must be at least 1.5 meters long, and 2 meters would be a suitable length. If we are to measure a wave of 10 meters the rods would have to be about 5.5 meters, but when we reach such wavelengths the Lecher wire system becomes inconvenient bcause there is no place to erect it. It is much more suitable for the measurement of waves less than five meters.

Incidentally, a meter is 39.37 inches, or 3.28 feet.

At one end of the wire system is a heavy conducting bridge B2. This, too, may be of brass tubing or rod and it may be soldered to the long rods. Near the other end of the wire system is a movable bridge B1. This is notched so that it makes good contact with the rods and so that it may be moved in direction of the rods.

Coupling to Oscillator

The Lecher wire system is coupled to the oscillator genera the wave to be measured at the B2 end of the rods. This e simply placed near the oscillator coil. The oscillation will in a wave in the two parallel wires, and this wave will travel d the rods at the velocity of a radio wave in free space. At open end, assuming for the moment that B1 is not in place wave will be reflected, and it will travel back at the s velocity. A standing wave results. If the length of the ro just one-quarter wavelength, or any odd number of qua wavelengths, there will be sharp nodes and antinodes. A there will be a current maximum and a voltage minimum. one-half wavelength toward B1 there will be another poin minimum voltage and maximum current. It is only necessar find the second point.

Now assume that B1 is in place and that the oscillator is erating a certain frequency. If a current indicating devic connected in series where the current is maximum. The connected in series with the bridge B1, and B1 is moved lo tudinally, a point will be found where the current is maxim The distance 1 between the two bridges then gives the wavelength.

Instead of putting the current indicator in the bridge B may be put in the oscillating coil. As B1 is moved through voltage node there will be a sharp dip in the meter reading, dip being due to the power absorbed by the Lecher wire sys when B1 and B2 are just half wavelength apart. The point be sharply defined so that it is necessary to move B1 very c fully or the point will be passed over. It is suggested that i moved with a long insulating rod so as to keep the hand a from the system. After 1 has been found the wavelengt known, as well as the frequency. Suppose 1 measures five The wavelength is therefore 10 feet, or 3.05 meters. There the frequency is 98,300 kc.

Indicating Meter

A thermo-couple type indicating meter should be used. It be put in series with B1 or in series with the oscillating coi was stated. The range of the meter, of course, must be adju to the current involved. It is better to put the meter in se with the coil because the presence of the meter in B1 will cha the position of the current maximum. Of course, the pres of the meter in the oscillator circuit will change the freque but it is assumed that this is compensated for.

Heavy rods are suggested to make the radio frequency re tance negligible. If there is resistance in the two Lecher w there will be an error in the measurement, and this erro greater the greater resistance. With the rods specified the e is entirely negligible, and other unavoidable errors will be grea The method is not one of high precision, but it is as accurat calibrated wavemeters and is accurate enough for pract measurements. The method is often used for calibrating o wavemeters of the inductance-condenser type.

Measurement with Beat Method

A short wave, or a high frequency, also can be measured the beat method, and this offers a way of checking the meas ment with the Lecher wires. We can easily set up an oscill which can be calibrated against broadcast stations, or aga the 5,000 kc. standard transmitted by the Bureau of Standa Suppose we have an oscillator that covers the broadcast b and that any frequency within that band can be obtained f the calibration. If we beat this oscillator against the high quency oscillator the wavelength of which is to be determi we will get heterodynes resulting from beats between harmo of the low frequency oscillator with the fundamental of the h frequency oscillator. The only difficulty here is to determ which harmonic is involved.

Suppose that we have reason to believe that the frequency the high frequency oscillator is 100,000 kc. If then we beat against the broadcast frequency oscillator we should ge heterodyne between the 100th harmonic of 1,000 kc. and fundamental of the other oscillator. It is possible that this h will be so weak that it is impossible to hear it, and this is pr able. We can, however, use an audio frequency amplifier

EQUENCIES; E AND BEAT SYSTEMS USED

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igh gain to make the beat audible. If this is not possible we an proceed in steps.

Stepping Up the Frequency

We can set up an oscillator covering a frequency range in which each frequency is ten times the broadcast frequencies. We can surely beat the tenth harmonic of 1,000 kc. against a 0,000 kc. frequency and be able to hear the heterodyne. After ve have established the 10,000 kc. frequency we can beat this gainst the 100,000 kc. frequency and get the heterodyne. Thus f we use two steps we need only use harmonics as high as the enth.

Even if we can hear the 100th harmonic beat it is advantageus to step the frequency up in stages because of the difficulty f distinguishing between the adjacent harmonics when the rder is so high. For example, the 100th harmonic of 1,000 kc. 100,000 kc. The 101st harmonic differs from this by only one er cent and they would be extremely close together on the ,000 kc. oscillator dial. This difficulty is not nearly as great hen we use the tenth harmonics and step the frequency up in wo stages, for in this case there will be a 10 per cent separation.

The work would really amount to stepping down the freuency. We start, let us say, with 100,000 kc. Then we set up he intermediate oscillator and find a beat. If the intermediate requency oscillator is calibrated we can find the harmonic ithout a great deal of difficulty. No doubt there will be many oints at which we hear heterodynes. If the range of the interediate oscillator is from 25,000 to 10,000 kc. there will be beats ith the 100,000 kc. frequency at seven different frequencies. Vhen each of these frequencies is multiplied by the proper armonic the product should be equal to the high frequency. n the assumed case the first squeal will be heard at 10,000 kc. f this is multiplied by 10 we get 100,000 kc. The next will be eard at 11,111 kc. This will yield 100,000 kc. if we multiply it y 9. The last frequency will be 25,000 kc., which will yield 00,000 if we multiply it by 4. If the intermediate oscillator is ccurately calibrated we do not need to go any further because he common product is the frequency we desire. However, we ight average all the products to reduce the probable error.

Using the Broadcast Oscillator

If we are not sure of the accuracy of the intermediate oscillaor we can select one of the frequencies, say 10,000 kc., the enth harmonic of which yields 100,000 kc., as near as we can epend on the intermediate oscillator. Then we beat 10,000 kc. gainst the broadcast oscillator. Again we get a series of queals, and if we multiply the corresponding frequencies by the roper number we get 10,000 kc. If the broadcast oscillator oes up to 1,500 kc. we get the first squeal at 1,430 kc., which vhen multiplied by 7 gives 10,000. The next is at 1,250 kc., vhich gives 10,000 kc. when multiplied by 8. We can get squeals own to 555.5 kc., with the 18th harmonic. We can use all within the tuning range of the broadcast oscillator, or any elected number, and average them. Suppose the average is ,982 kc. instead of 10,000 kc. Then we know that the high frequency is 99,820 kc. instead of 100,000 kc. The accuracy of this nethod is as great as the accuracy of the calibration of the roadcast oscillator, provided that the adjustment between the igh and the intermediate oscillator was made correctly at the 0th harmonic and provided that there was no drift during the vork, that is, drift of the intermediate frequency of 9,982 kc.

After a point has been found on the broadcast oscillator where here is a squeal, a check may be taken directly against the high requency oscillator. For example, the 70th harmonic of 1,426 kc. hould beat with the high frequency oscillator, and it may be hat the heterodyne can be heard when the location on the roadcast frequency oscillator is known.

Calibrating Upward by Steps

If we start with an oscillator covering the broadcast frequency ange we can calibrate a series of oscillators by steps until we inally have one with which we can measure a frequency of the rder of 100,000 kc. directly, using no higher than the second or hird harmonic. First we calibrate the broadcast oscillator gainst broadcast frequencies. Then we rig up another oscillaor covering a range about three times the frequencies in the

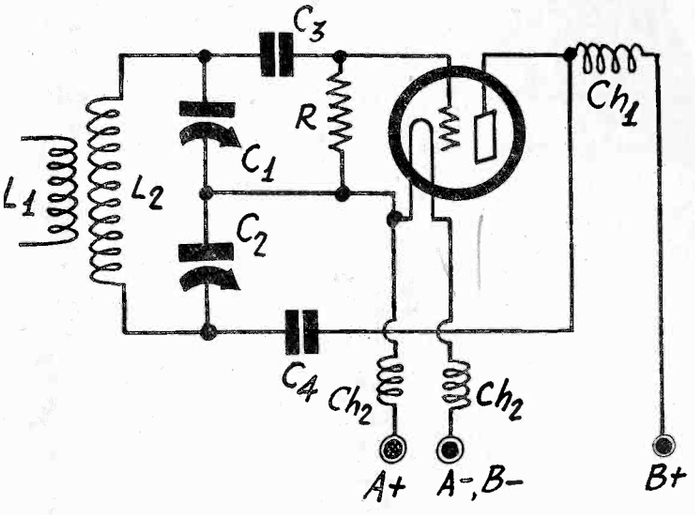

FIG. 2

A Colpitt's type oscillator which can be used as an auxiliary oscillator in calibrating an ultra-short wave oscillator by the heterodyne method.

broadcast range. The oscillator circuit may be the same and the only change we need to make is to decrease the inductance, although it may also be well to reduce the capacity. Suppose the second oscillator covers the range from 1,500 to 4,500 kc. The 1,500 kc. point we can get directly from a broadcast station or the oscillator covering this range. The 4,500 kc. frequency we can get by using the third harmonic of the highest broadcast frequency. Between the two limits we can use second or third harmonics of the broadcast frequency oscillator.

Having calibrated the second oscillator from 1,500 to 4,500 kc. we can set up a third oscillator which covers a range of still higher frequencies, beginning at 4,500 kc. We would have no trouble making this go up to 13,500 kc. A fourth oscillator could go up to 40,000 kc. and a fifth to 100,000 kc. or more. Of course, it would be too much work to go through all this just to measure a single frequency or any frequency in a range about 100,000 kc. The work of setting up a pair of Lecher wire would be much less and the advantage of that method of measuring wavelength is that it is done directly, or in terms of absolute measurements. That is, the wavelength is measured with a unit of length, such as a meter stick or a tape measure. While this method is subject to errors, greater errors may be introduced by the heterodyne method of stepping up known frequencies. Errors may be introduced in calibrating the first oscillator and in each subsequent oscillator and errors may also be introduced in reading any one of the calibrated oscillators. Again, the oscillators may drift in frequency between calibration and use.

Auxiliary Oscillator

In Fig. 2 is a Colpitt's type oscillator that can be used as auxiliary oscillator in calibrating. Suitable value for the broadcast range would be C1, C2, each 350 mmfd.; C3, 0.001 mmfd.; Ch1, 85 millihenries; R, 50,000 ohms; C4, 0.001 mfd. The chokes Ch2 and Ch3 may be omitted. The pick-up winding L1 can also be omitted for it is sufficient to put a wire near L2 for coupling. L2 should have a value of 480 microhenries. This can be obtained by winding 80 turns of No. 32 enameled wire on a 2 inch form. The same oscillator can also be used for higher frequencies. The number of turns needed, on the same form and using the same wire, can be obtained approximately by dividing the turns by the frequency ratio. For example, suppose the frequency ratio of the first coil is 3. Then the next coil should have 27 turns, the next 9, and the fourth 3. A single turn coil would probably not oscillate unless the turn were made of 3/16 inch copper rod or tubing.

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Volume Control in Battery Set

SUGGEST a good volume control in a battery-operated set. I have tried many but have not found one that is satisfactory. The best seems to be one that controls the filament current but I do not like to use this type because it affects the quality of the output.—A. N. W., Baltimore, Md.

There is no good volume control for battery operated sets. A control is illustrated in Fig. 1,009. Here a 10,000 ohm, or some higher value not more than 100,000 ohm, potentiometer is connected across the primary and the antenna is connected to the slider. Theoretically this should work but it is not satisfactory in all cases. Another way is to connect the antenna to the top of the coil and the slider to ground, without connecting the low side of the primary and the resistance to anything. This works quite well but there is a tendency to be a minimum at the middle of the potentiometer rather than at the antenna end. Another possibility, and this has not been used much, is to connect the potentiometer resistance between the antenna and the ground, to connect the low side of the coil to ground, and the high side to the slider. This has the disadvantage that the primary tends to become short-circuited as the volume is reduced and thus to impair the selectivity of the first tuned circuit. However, the change in volume is rapid as the slider is moved from the antenna end of the resistance so that it is not necessary to move it far down. This should at least be tried where the other methods fail. The circuit illustrated also has a rheostat for varying the filament current. If this only controls the r-f tubes, and possibly the detector, it can be used without impairing quality. Still another way is to connect a 500,000 ohm potentiometer across C, with the slider connected to the grid. But this should not be used alone but rather as a course control.

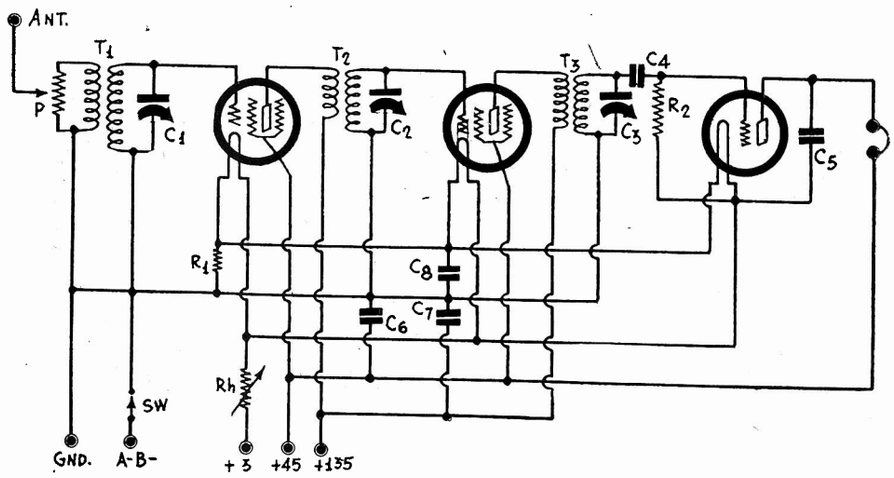

FIG. 1009

In a battery-operated set it is usually necessary to combine signal input and filament current variation to get complete volume control.

* * *

Push-pull Detector

COULD TWO grid biased detector tubes be connected in push-pull and made to deliver an audio signal into a push-pull output transformer in the same way as a Class B amplifier works? What are the objections to this scheme?—G. W., Kansas City, Mo.

The thing does not work. You would have a Class B amplifier but not a detector, but it would function at radio frequency. If you have a push-pull audio transformer as a load the output would not be anything. However, if the two plates were joined and an ordinary transformer connected to the two, there would be detection, and both tubes would contribute to the detected component.

* * *

Troubles with Padding

SO FAR it has not been possible to adjust a superheterodyne that I built according to one of your diagrams, although I followed very closely the circuit as well as the directions for adjusting the padding. I have measured the frequency of the oscillator and found that the highest frequency attainable is 1,300 kc, whereas the highest should be 1,900 kc. I can easily bring in the high frequency stations by turning down the oscillator trimmer, but then I miss out entirely on the lower frequencies. Can you suggest the cause of the trouble and the remedy?—F. R. L., Stamford, Conn.

It appears that you have too much distributed capacity in the oscillator coil. This may be due to too little separation between the tuned and the tickler windings. Rewind the tickler and make the separator about 1/16 inch. It is also well to keep the tickler winding as near the ground end as possible. This is a trouble that often develops.

* * *

High Minimum Capacity

IN A SUPERHETERODYNE receiver the effective inductance is supposed to be 200 microhenries and it is supposed to tune up to 1,675 kc but it tunes only up to 1,550 kc. This is when the trimmer on the oscillator condenser is set at the lowest possible value. From these data can you determine how much the distributed capacity in the circuit is? Also, the r-f coils are supposed to have an inductance of 245 microhenries and the tuners are supposed to reach 1,500 kc, but the best I can do is 1,400 kc. How much is the distributed capacity in these circuits? —F. G. A., Danbury, Conn.

If the inductance of the oscillator coil is 200 microhenries and the highest frequency is 1,550 kc, the minimum capacity in the circuit is about 52.6 mmfd. In the r-f circuits the minimum is 52.6 mmfd. The minima in all the circuits must be reduced. In the oscillator the minimum capacity must be reduced to 45.1 mmfd. and in the r-f circuits to 45.9 mmfd. The most likely source of the high minimum is between the tickler and the tuned winding in the oscillator and between the primaries and the secondaries in the r-f coils.

Design of Oscillator Coil

WILL YOU KINDLY give the winding data for an oscillator coil of the Hartley type which will have an effective inductance of 145 microhenries when wound on a 1 inch form and placed in a shield can 2.5 by 2.125 inches? The winding is to be tapped for the cathode connection. There is also to be a pick-up winding to be connected in the cathode circuit of the detector tube.——R. T. R., Washington, D. C.

Using No. 32 enameled wire for the secondary you will need 85 turns. Place the tap for the cathode at the 38th turn from plate end of the coil, or at the 47th from the grid end. Wind the pick-up near the ground end of the winding, or if one end is not grounded, put it as far from the grid end as practicable. Separate the pick-up from the tuned winding by several layers of insulating paper or fabric. Ten turns will do for this pick-up, and these may be of any fine wire. This coil is suitable for a 400 kc superheterodyne and a 350 mmfd. tuning condenser. Slightly over 3 microhenries were allowed for the reduction by the shield can.

* * *

Degenerative Feed Back

PLEASE EXPLAIN how a grid bias resistance that is not adequately by-passed will cause degenerative feedback. I have seen this statement many times but never any explanation of it.—L. W. S., Atlantic City, N. J.

If you understand how a grid bias resistance causes a negative bias on the tube, it is only a small step to understanding degenerative feedback. The amount of bias depends on the intensity of the plate current. The higher the plate current, the greater the bias. But the greater the bias, the less the current. Therefore, if for any reason the plate current is increased, the bias is increased, and this has a tendency to decrease the plate current. That is, the plate current does not increase as much as it would if the bias resistance were not there. Now a signal will increase the plate current when the voltage swings in the positive direction. But the increase is check by the increased bias. The increase in the bias, therefore, has the effect of decreasing the signal voltage on the grid. Of course, the

principle works both ways. A decrease in the voltage is also checked. Hence there is a reduction either way the signal voltage swings.

* * *

Hum in Five-Tube Midget

THERE IS a great deal of hum in my five-tube midget receiver which I have been unable to remove. Will you kindly make suggestions?—J. E. W., St. Paul, Minn.

The removal of hum is largely a matter of more thorough filtering. All bypass condenser should be increased. However, one thing that has proved effective is to put a high resistance in series with the screen of the detector tube and then return this to a higher voltage to make up for the voltage drop in the resistance. For a discussion of a five-tube midget, and the reduction of hum see an article in this issue.

* * *

Resistors Burn Out

THE RESISTORS in the voltage divider of my set burn out quite regularly. I suppose that this is due to excessive current through them, or to lack of wattage dissipation. Will you kindly explain how I can determine the wattage necessary to make the resistor stand up, and also tell how it is possible to reduce the current?—R. L. W., Kansas City, Mo.

The wattage dissipated in a resistor is the product of the current in amperes squared and the resistance in ohms. This product must be considerably lower than the wattage rating of the resistor. For example, suppose that the current in the resistance is 20 milliamperes and that the resistor is 4,000 ohms. The current in amperes is 0.02. The square of this is 0.0004. If we multiply this by the resistance, 4,000 ohms, we get 1.6 watts. It is obvious that a one-watt resistor will not do. Even a two-watt resistor would not be safe. A 3 or a 5 watt resistor should be used. The current through the resistor may be reduced by increasing the bias on the tubes. If this is not practical, it may be reduced by increasing the resistances in the voltage divider so as to lower the bleeder current. This is the usual practice. If the current in any given resistor is cut in two and the resistance is doubled, the wattage dissipated is cut in half, which results from the fact that the current enters twice in the formula for wattage whereas the resistance enters only once.

* * *

Wattage Dissipation in Condenser

IF A CONDENSER of 350 mmfd. carries a current of one ampere at one million cycles per second, what is the power dissipation in it? This question is asked to settle an argument. One group of boys says that the power is the square of the current multiplied by the reactance of the condenser while another group says that there is no dissipation at all. Certainly both cannot be right, yet both have good arguments.—D. R. W., Milwaukee, Wis.

Both groups may be right, at that, if you stated the bone of contention correctly. One group speaks of power in the condenser while the other speaks of power dissipation in the condenser. If we assume that there is no resistance in the condenser, there is no power dissipation. Yet there is plenty of power surging in the condenser. In general, the power is the product of the current squared by the impedance. In this case the impedance is the reactance and the current is unity. Hence the power is numerically equal to the reactance. At one million cycles per second the reactance of the 350 mmfd. condenser is 454 ohms, which is numerically equal to the power surging in the condenser. But no part of this is dissipated because of the assumption that there is no resistance in the condenser. But there undoubtedly is some resistance in it. Hence there is some loss. If we assume that the resistance is R ohms, R watts would be dissipated. The current is still supposed to be one ampere.

* * *

Voltage of Air-Cell

WHAT IS the voltage of an air-cell battery when it is new? Is it necessary to use a resistance to cut the excess voltage down when using the battery on 2-volt tubes?—A. B., New York, N. Y.

The voltage of the air-cell battery when new is 2.53 volts. It is best to use a small ballast resistance to cut the voltage down to about 2.2 volts. That is, it should be cut by 0.33 volts. The amount of resistance needed, of course, will depend on the number and type of tubes used. In one receiver three 232s and three 231 tubes are used, and the total current is 0.597 ampere. This would require about 0.55 ohms as ballast.

* * *

Operation of Class B Amplifier

IF A PAIR of 247 tubes are used in a Class B amplifier and the tubes are biased to near the cut-off point, is it necessary to use a driver stage capable of delivering power, or is it practical to use an ordinary amplifier stage which will deliver voltage only? Why was it necessary to design the 246 tube so that no bias voltage was necessary?—W. H. C., Mineola, L. I., N. Y.

It would not be necessary to use a power driver provided that the 247 tubes were operated so that at no time grid current would flow, that is, so that the peak of the signal voltage on each tube was always less than the negative bias on the grids. An ordinary voltage amplifier would do. However, it would be necessary to bias the 247 tubes with a battery, as self-bias would not work. It was for this reason that the 46 tube was made so that the cut-off was near zero bias, that is, so that no bias was needed. But this change required that the grids take current throughout the active portions of the cycle, and that in turn required a power driver. Any tube could be operated on the positive as well as on the negative side of the characteristic provided the grid current caused no voltage drop in the secondary transformer feeding the grids. The secondary would have to have nearly zero resistance, and practically zero reactance too. Instead of biasing the Class B amplifier tubes with a battery they could be biased with a drop in a resistance through which a steady current flowed, a current that would not be affected appreciably with the signal current. This would require a low resistance and a high current.

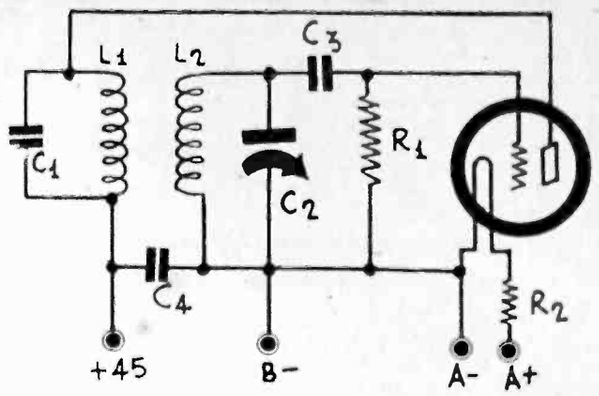

FIG. 1,010

This oscillator is built with an intermediate frequency transformer and may be used for lining up i-f amplifiers. It can be modulated by applying a plate voltage rich in hum.

* * *

Economical Receivers

WILL IT be possible to build receivers that are more economical to operate with the new 2.5-volt tubes, that is, the 56, 57, 58, and 46, assuming equal sound output and equal sensitivity? Where is the gain if any?—J. M. B., Brooklyn, N. Y.

Most of the new tubes require only one ampere, or 2.5 watts, for the heaters, whereas the old tubes required 1.75 amperes and 4.375 watts. Thus as far as the 56, 57, and 58 tubes are concerned the saving per tube is 1.875 watts. There is also a slight saving in the plate current. The saving is worth while all right. Of course, there is the question of relative cost of the tubes and their relative life.

* * *

An Intermediate Frequency Oscillator

PLEASE show how to hook up a simple oscillator for lining up intermediate frequency amplifiers. I prefer a 230 tube. I do not care to have it modulated as I intend to apply plate voltage that contains very much hum.—G.W.G. Rockford, Ill.

See Fig. 1,010 for such an oscillator. C1L1 and C2L2 are the two tuned circuits in an intermediate frequency transformer. C3 may be 0.001 mfd. and R1 50,000 ohms. Apply two volts to the filament and 45 volts on the plate, modulated with hum if you like. C4 is not needed since it ought to be in the B supply that you have. To adjust it to the frequency you want compare its harmonics with broadcast stations.

* * *

A Push-Pull Tube

WOULD IT NOT be possible to build a single push-pull tube, one having two equal grids and two equal plates both placed symmetrically about a single cathode? Would there be any advantage in such a tube as compared with two equal tubes in a push-pull circuit?—W. H. J., Wilmington, Del.

It would be quite possible to make such a tube and it would have several advantages. In the first place it would take only half as much room in the receiver and would be considerably more economical in respect to heater wattage. Another advantage is that if the tube were properly constructed an increase in the amplification factor would result. Suppose the plates are placed on opposite sides of the cathode with the two grids placed between the plates and the cathode. In effect, there would be two independent tubes but sharing the same cathode. As one grid changes voltage in one direction the other would change it in the opposite direction. The grid momentarily less negative would let more electrons to its plate but at the same time it would help the other grid preventing the electrons from going in the other. This would be a mutual effect so that the push-pull action would be more complete, beginning right at the common cathode. Undoubtedly such a tube will appear on the market soon. It would also have other uses besides push-pull amplification. By tying two plates together the tube would be a full-wave detector, like the Wunderlich tube. The tube could also be used advantageously in mixer circuits. Work already has been done on a tube of this type.

(Continued on next page)

(*Continued from preceding page*)

Inductance of Single Turn

WILL YOU kindly publish a formula for the computation of inductance of a single turn of wire? I am playing with short waves and need inductances which can only be made of single turn copper tubing. I presume that there is a formula.—O. W. A., Los Angeles, Calif.

If dimensions are measured in centimeters, and a is the radius of the loop of wire, and R is the radius of the wire, the inductance is given by $L = 28.95a (\log a/R + 0.143)$, the logarithm being common. This gives the inductance in centimeters and the result should be divided by 1,000 to give it in microhenries. As an example of the use of this formula, let us assume that the radius of the turn is 10 centimeters and the radius of the wire is 0.1 centimeter. Then $a/R = 100$, the common logarithm of which is 2. Hence we have $L = 28.95 \times 10 \times 2.143$, or 620 centimeters, or 0.62 michrohenries. If we measure everything in inches the formula becomes $L = 0.0735a (\log a/R + 0.143)$ microhenries. This is the more practical form. Let us take another example. Suppose the radius of the wire loop is 2.5 inches and the radius of the wire is 0.125. Then $a/R = 200$ the common logarithm of which is 2.301. Then $L = 0.0735 \times 2.5 \times 2.444$, or 0.45 microhenries.

* * *

Oscillation in Short-Wave Set

I HAVE a short-wave set of the regenerative type. The regeneration is controlled with a variable condenser in the plate circuit. I get signals over the upper part of the tuning condenser but at about the middle it stops. However, as I turn the dial I can hear squeals so I know the set is oscillating and also that there are stations to be received. What is the trouble? —S. G., New York, N. Y.

Apparently the trouble is that you cannot stop the oscillation with the variable condenser. It may be necessary to reduce the number of tickler turns. If you do this set the regeneration control condenser at maximum and also the tuning condenser at maximum. Then reduce the turns until you can just stop the oscillation as you turn the control condenser. Another way you can stop the oscillation is to put a variable resistance of about 25,000 ohms maximum value in series with the plate return lead of the detector. You can also reduce the plate voltage on the detector.

* * *

Power and Voltage Amplifiers

WHAT IS the difference between a power and a voltage amplifier? Is it not a fact that if the voltage is amplified the power is also amplified? For example, if we put in a resistance coupled amplifier ahead of the power tube, is not the output power amplified by virtue of the resistance coupled stage, which is admittedly a voltage amplifier?—W. H. Y., Columbus, Ohio.

The voltage amplifier amplifies voltage without delivering any power to speak of. The power amplifier amplifies voltage but it does so at the same time that it delivers a great deal of current. In a resistance coupled circuit the voltage amplification is greater the greater the resistance in the load circuit, although the current in the plate circuit is less. Very little power is delivered to the plate load resistance because the current is so low. If it were possible to operate the tube with an infinite resistance in the load and no current, the voltage amplification would be greatest but the power in the plate circuit would be zero. In the power amplifier the product of the current and the voltage across the load is the important thing, and this should be as high as possible. The maximum power output occurs when the resistance of the load is equal to the resistance of the tube. In the voltage amplifier the voltage output is greatest when the load impedance is very large as compared with the resistance of the tube. If the input circuit of a tube takes current of appreciable magnitude, the amplifier ahead of that tube must be operated so that it can deliver power as well as voltage.

* * *

Uses of "Do-All" Oscillator

WILL YOU PLEASE define the uses of the "Do-All" modulated-unmodulated oscillator? An article on this device was published in the May 7th issue (last week).—C. L. P., New Brunswick, N. J.

The uses of the outfit are:

(1)—To afford oscillation from 150 kc to around 20,000 kc, modulated or unmodulated, exclusively by switching and tuning, with a stage of amplification. The modulation may consist of phonograph music or test frequencies, if desired.

(2)—A 180-volt B eliminator, with intermediate taps. The voltages particularly at the taps, and also to a lesser absolute extent at across the entirety, will vary with the drain.

(3)—An audio power amplifier, one stage of resistance-impedance audio, one stage of resistance coupled audio. This is possible because the stage of amplification works radio or audio frequencies. The output and attenuator are gaited for audio frequencies and thus are suitable for radio frequencies. The reverse would not be true.

(4)—An all-wave converter for use with any intermediate frequency that is in the broadcast band or below that band in frequency. The stage of amplification increases the oscillation voltage about eight times and the output tube renders excellent coupling to a broadcast set. The aerial must go to plate instead of grid (shown through a fixed condenser) because the grid circuit will stand very little coupling. As little as 10 per cent. would stop oscillation.

* * *

An Inexpensive Power Supply

I HAVE a five tube midget set completed with the exception of the power supply. The last tube in the circuit is a 245 and that is preceded by a 227 audio amplifier. Now my problem is to provide a power supply. I wonder if it would be all right to use a 227 tube as a rectifier and connecting it as you have done in short-wave converters. Will it work?—R. G. A., Trenton, N. J.

It will not work. The 227 tube would quickly burn up if enough current were taken from it to operate a power tube of any kind. The best rectifier for your purpose is the 280 connected in the regular full-wave circuit.

* * *

Direction of Mutual

WHEN TWO COILS are coupled they are said to have inductance in common, or mutual inductance. Sometimes the coupling is said to be aiding and sometimes opposing. How is it possible to tell which way the coils are coupled?—J. J. B., Boston, Mass.

One way is to measure the inductance of the two coils in series when they are coupled and also when they are far apart. Let the inductance be L when they are far apart. If the inductance is greater than L when they are coupled, then they are aiding. If it is less than L when they are coupled, they are opposing. Another way is to imagine that a current is flowing in a certain direction and then by inspection of the turns determine the direction of the magnetic field. If the field is in the same direction in both coils the coupling is of the aiding type. If the directions of the two fields are opposite, the coupling is of the opposing type. The test can also be made with a little compass. Hold it near one end of one of the coupled coils and note which way the needle points. Then hold it in a similar position with respect to the other coil and note the direction of the needle. If unlike poles are together the coupling is opposing. Of course, current must flow through the coils while the compass test is made, for otherwise the coils will not be magnets.

* * *

A Colpitt's Oscillator

PLEASE show a circuit diagram of a Colpitt's type oscillator using a 230 tube. I desire it to cover the broadcast band and it is to be used as an auxiliary in testing superheterodynes. Please specify values.—G. W. W., Racine, Wis.

You will find a Colpitt's oscillator on page 13 of this week's issue. The identifying feature of a Colpitt is that voltage across the tuned circuit is divided between the grid and the plate by capacity.

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Radio World's

University Club

And Get Free Question and Answer Service for the Coming 52 Weeks. This Service for University Subscribers Only

Subscribe for RADIO WORLD for one year (52 numbers). Use the coupon below or write on a separate sheet of paper, if preferred. Your name will be entered on our subscription and University Club lists by special number and you will be apprised of the number. When sending questions, put this number on the outside of the forwarding envelope (not the enclosed return envelope) and also put it at the head of your query. If already a subscriber, send $6 for renewal from close of present subscription and your name will be entered in Radio University.

NO OTHER PREMIUM GIVEN WITH THIS OFFER

[In sending in your queries to the University Department please paragraph and number them. Write on one side of sheet only. Always give your University Club Number.]

RADIO WORLD, 145 West 45th Street, New York City.

Enclosed find $6.00 for RADIO WORLD for one year (52 nos.) and also enter my name on the list of members of RADIO WORLD'S UNIVERSITY CLUB, which gives me free answers to radio queries for 52 ensuing weeks, and send me my number indicating membership.

Name .....

Street .....

City and State .....

MANY HEARING POLICE ALARMS IN THEIR HOME

Some broadcast receivers tune to an upper limit of frequency to take in a police transmission, while other sets have a switch control to enable tuning from 200 to 80 meters at one setting, and covering the broadcast band at the other. Also, of course, short-wave receivers frequently go as low in frequency as the lower limit of the police allocations.

Most of the large cities of the United States have instituted police radio service, and listeners who want "something different" get a kick out of listening to the messages sent over police waves. Voice is used, although in some instances the message sent out refers to a number, which the official recipient refers to in a code book, and thus gets directions where to go. This information naturally the broadcast listener does not possess, but, after all, he doesn't want to go there, anyway. A burglar is breaking into a building, a holdup man is shearing his victim or a roadway has collapsed. After all, there is no place like home.

Dispatcher Moves Discs Over Map

The way the police radio telephone system is handled in New York City is shown in the photograph. At a table shaped like a U sits a policeman, a wire line telephone nearby. On the table are permanently affixed maps of the five boroughs of the greater city,—Manhattan, Bronx, Brooklyn, Queens and Richmond. These boroughs are identical in boundaries to the five counties, Manhattan's county name being New York and Brooklyn's county name being Kings.

Metal discs placed on the map show the locations of patrol cars that tour the city. These cars answer local demands for service and also demands from the radio center of the police department. The discs identify the cars by license number and also by name of the make and type of car.

The man sitting before the maps is the dispatcher. When he gets a message by line telephone from the police telegraph bureau he is ready almost instantly to put that message on the air. The message sent out is called an alarm. He does so by first writing it down, then passing the slip to the operator at the radio transmitter, shown at left.

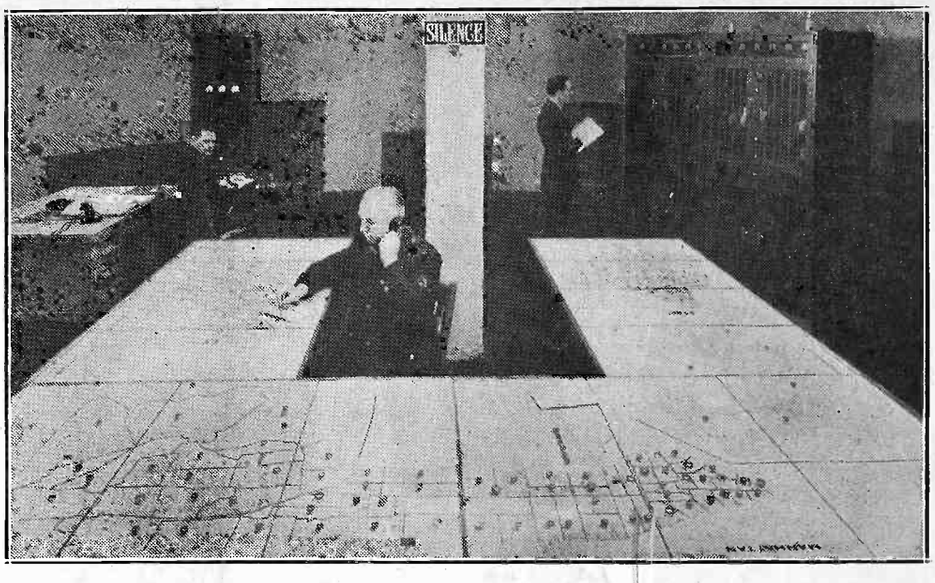
Three Transmitters Erected

If there is special urgency he may deliver the message orally from his chair, for quick action, and write the message on a slip later.

The transmitting equipment is shown at right. The power of the transmitter is 500 watts. The policeman at right, a radio technician, is taking a reading of the meters on the transmitter.

Besides this main transmitter there are two more transmitters, one in Brooklyn and one in the Bronx. These two use 400 watts. All three transmitters are Western Electric equipment.

"CRUISER 804! ROBBER ENTERING 62 BURP AVENUE!"



The center of radio activities of the New York Police Department. An operator, at left, sits before the microphone to receive messages from the despatcher who gets them by land wire telephony. The man at right is checking up the meter readings of the transmitter. The call is WPEG, power 500 watts, frequency, 2450 k.c., wavelength 122.4 meters.

RADIO SHOP MOVES

The Experimenters Radio Shop has moved from West Street to 80 Cortlandt Street. A complete line of replacement parts for radio receivers, amplifiers, etc., will be carried, and some new departments installed.

AMATEURS IN ANNUAL MEET

Hartford, Conn.

To outline for the coming year the policies governing the radio amateurs of the country, the largest transmitting service in radio, the board of directors of the American Radio Relay League, the national amateur organization, convened for their fifteenth annual meeting.

The fourteen directors coming from all sections of the United States and Canada combined with the officers of the league to consider such questions as the plans regarding amateur representation and participation in the next International Radiotelegraph Conference, to be held in Madrid in the autumn, and a reapportionment of the division boundaries in the internal A.R.R.L. political structure.

Most pressing of the numerous topics affecting the welfare of the more than 25,000 licensed amateur stations of the United States considered by this board was the license fee and radio set tax measures before Congress.

Numerous other matters of policy, including amendments to the constitution and by-laws of the league, have been set up for attention on the tentative agenda sheet circulated before the meeting. The protection of amateur message-traffic handling rights, creation of new operating sections in outlying U. S. dependencies, and several matters concerned with the existing U. S. and Canadian amateur regulations are among the remaining topics for discussion.

The roll call this year includes President Hiram Percy Maxim, Drawer 2102, Hartford, Conn., W1AW; Vice-president Charles H. Stewart, St. David's, Pa., W3ZS; Alex. Reid, 169 Logan Ave., St. Lambert, P. Q., Canada, VE2BE; Eugene C. Woodruff, 234 W. Fairmount Ave., State College, Pa., W8CMP; Loren G. Windom, 1375 Franklin Ave., Columbus, Ohio, W8GZ-W8ZG; Lawrence E. Lindesmith, 1055-85th Ave., W. Duluth, Minn., W9GKO; M. M. Hill, P. O. Box 274, Natchitoches, La., W5EB; A. Lafayette Walsh, 220 West 42nd St., New York City, N. Y., W2BW; H. W. Kerr, Little Sioux, Iowa, W9DZW-W9GP; G. W. Bailey, Webster Rd., Weston, Mass., W1KH; K. W. Weingarten, 3219 No. 24th St., Tacoma, Washington, W7BG; Clair Foster, Carmel, Calif., W6HM; W. Tredway Gravely, Box 245, Danville, Va., W3BZ; Russell J. Andrews, 169 So. Ogden St., Denver, Colo., W9AAB; J. S. Hagler, Jr., 2424 McDowell St., Augusta, Ga., W4SS and Frank M. Corlett, 2515 Catherine St., Dallas, Texas, W5ZC.

Parts Business Improving

By J. Murray Barron

To one who remembers the days of '24, '25, '26, and '27 in radio, and the experimenter or fan of that time with his eagerness to build the latest, and his daily quest for that certain part or gadget, will recall the importance of a good window display to the experimenter, as well as a good location for the store. Well-displayed merchandise at that time meant a greater following. To-day one can see more radio stores, especially in the downtown section of New York, not only showing a greater assortment of small parts and replacement parts, but devoting the choicest and most prominent part of their window space to elaborate displays. Many of the trimmings not only show the hand of an artist, but of real merchandise experts.

Replacement parts for standard radio receivers, while in great demand, do not by any means represent the entire reason for the revival of the parts business. Midget sets, short-wave sets and converters, television and auto radios, home recorders and amplifiers are built by experimenters. We find that not only has the parts business once again become an important part of the radio business, but a most important part.

A THOUGHT FOR THE WEEK

EVEN as Eddie Cantor announced some weeks ago that the whole nation should help Kate Smith to get that moon over the mountain, so we ask the help of the millions of radio listeners-in to get Clarence off the air. The Presidential candidate who will incorporate this idea in his platform will smash all party lines and become a national hero.

RADIO WORLD

Title Reg. U. S. Pat. Off.

The First and Only National Radio Weekly

Eleventh 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; J. Murray Barron, advertising manager.

Television Moves On

DEFOREST RADIO COMPANY is having its subsidiary, Jenkins Television Corporation, remodel the television transmitter of W2XCR, so that when the station goes on the air again it will use the direct pickup method. This is a much-needed improvement. The adoption of a greater number of lines in scanning should follow.

The direct pickup consists of flooding the subject with constant light, so that a camera can pick up the view to be scanned. The method generally used is to have a flying spot of light play over the subject. The results from the flying-spot method have been fair, but the high contrasts, false pictures, whiskers, moustaches and head-and-shoulder restrictions left much to be desired. The company promises considerable improvement with the more advanced technique, and its contribution will be watched closely.

All the Eastern television stations now use 60-line scanning, but 120 lines should come soon. Shortwave and Television Corporation, of Boston, is considering trying it, and no doubt others will follow.

Now that lens discs of various types are in use, and also crater lamps, projected television pictures are quite common, and experimenters are losing interest in the peep-hole style of vision, although it was interesting enough to serve its purpose in its day.

Crater lamps of greater current capacity, better systems of modulating the lamps, direct pickup, 120 or 180 line scanning, and receivers built to capitalize such improvements will bring television forward. The number of lines should be increased so that there will be better picture detail when the images are thrown on screens of 5x6 feet or larger. At present 10x12 inches is about the limit that the best commercial crater lamps and the 60-line scanning system with flying spot will permit. The bigger lamps will provide better illumination, and of course the output of the receivers will have to be great enough to swing these larger lamps. So instead of a semi-power tube in the output of the set we are likely soon to see a turn toward two '50 tubes in parallel.

Always something of fascination to the experimenter, television promises to continue the course it has established to date, that of slow, steady but reliable progress. The shift to higher frequencies of transmission, with wider band allotted to each station, is bound to come, and finally we shall expect to have sound track and vision tuned in at the turn of a single dial.

Short Waves Analyzed

THE statement on short-wave transmission and reception, prepared by the engineering division of Radio Manufacturers Association, Inc., and issued by the association as the result of extravagant claims made by some manufacturers, informs the public sanely on what may be expected from short waves. The statement encompasses the attainments and limitations of short waves in a simple, direct manner.

Many curves have been published giving the average reception range of the different frequencies at different times of the day and night, as well as in different seasons, but the association sets forth the essential data in concrete form more readily absorbable than the plotted curves.

The existence of the two paths of transmission is stressed—the sky wave that flings itself against the Kennelly-Heaviside layer to rebound to earth, and the ground wave. The statement does not so characterize it, but the ground wave does not travel much through the ground, merely close to the ground. The sky wave goes up like a million rockets.

As for reliable distance reception, the ground wave varies from 15 miles at 15 meters to 90 miles at 100 meters. The sky wave's reliable range differs with hour and season, from 90-2,500 miles for 100 meters, 300 miles to an infinite distance for 25 meters, 700-4,000 miles for noontime reception at 15 meters. Below 7½ meters there is no sky wave.

The usual advice about tuning for a station when it is on the air, which requires that a log be at hand, is given, while infallible repetition of extremely long-distance reception is put beyond expectation.

A statement such as the association issued will cause more short-wave devices to stay sold than all the extravagant claims ever made. When the public is led to expect too much the fault lies with those who raised the expectations that high, and they are rueing their mistake right now. A great deal of enjoyment is obtainable from short-wave reception, there will be many nights, and particularly days, of extremely long-distance reception, and foreign stations will become familiar to the household, but the difference in dependability between the reception of local broadcast stations on a standard set, and remote stations on a short-wave device, is well brought out in the statement.

Less Knocking!

AN advertising sheet released to the trade by RCA Radiotron Company goes a little too far, pointing out that new tubes are designed in RCA laboratories, which are therefore best able to make them, and that competitors advertising quick-heater tubes do so because that's about all they have to discuss, all RCA tubes of the heater type being quick heaters. The philosophy about not knocking the other fellow always has been a good one, until that point is reached where an abuse must be rectified as an act of public service. However, in the present instance the abuse, if any exists, is from the other direction. RCA would do well to remember that, besides deserving of less harsh comparisons, the other tube manufacturers are entitled to some consideration as RCA customers, for they are licensed by RCA.

NEW CHANGES

North American Broadcasting System, Ltd., to Vigilante, Inc., Los Angeles, Calif.

ASSIGNMENTS IN NEW YORK

Redifone Corporation of America, Inc., radio dealers, 72 Cortlandt St., to Philip P. Lubart, 474 Crown St., Brooklyn, N. Y.

Read 'Em and Weep

The best way to get short waves is to use highly polished wires for coil winding and set wiring. The polish should be at least equal to that on the seat of an old pair of blue serge pants.

* * *

The radio trade offers some helpful advice. First get some device that can receive short waves, then tune in the station when it is on the air, in preference to when it isn't, and then listen in with one of those hard-of-hearing devices.

* * *

Stations that are tuned in when they're not on the air are called phantom stations. A phantom is something you can have although it does not exist.

* * *

The ground wave is the one that seems to be most favored by receivers and most disfavored by listeners. Like the dollar in the night club, it doesn't go far.

* * *

The sky wave is the heaven-sent blessing that enables long distance reception. One good sky wave is worth 16 earth-bound waves. Yet the ultra frequencies are an exception. There the wave is grounded or it doesn't fly.

* * *

Due to the depression short waves are considering going off the sky-wave standard. Since the choicest short waves come from abroad, any such move would deal a sad blow to the foreign program market.

* * *

Radio waves are about the only things left that can get out of one country and into another country without duty.

* * *

Congress should tax short waves so much per kilocycle and then watch the rush to 10,000 meters.

* * *

The first man to send colored television on waves below one meter should be honored with a stack of station stamps.

* * *

The amateurs found out what short waves can do and Radio Manufacturers Association, Inc., found out what they can't do.

* * *

Congress should balance the national budget with a Wheatstone bridge.

* * *

Nobody should kick if the quest for short-wave stations serves no better than to take one's mind off the more distressing facts of the moment.

* * *

Whenever a fellow gets a verification of reception from a foreign short-wave station these days he begins to suspect it is counterfeit and takes it to the bank nonchalantly.

* * *

If short-wave reception was as bad as it's supposed to be it would be worse than it could be.

* * *

One thing to worry about now is how to get an ultra frequency oscillator to do what it's supposed to do, oscillate and hold its frequency. After that, extraction of energy from the atom will be easy.

* * *

No home is complete without a short-wave set or converter and no home is ever quiet with one.

BANKRUPTCY PROCEEDINGS SOUTHERN DISTRICT, N. Y.

Petition Filed Against

Apco Electric Corp., 1164 Sixth Ave., by Joseph Kurzon, Inc., $225; Midway Electric Supply Co., $221; Garfield Electric Supply Co., $262; Irving Electric Supply Co., Inc., $250

STATION SPARKS

By Alice Remsen

The Lay of the Old Minstrel

FOR PICK AND PAT

WOR, Thursday, 9:45 p.m.

Gee, but it's great to think that I am on the road again;
I cannot realize the fact; can't get it through my brain.
I stayed away so many years I almost went insane,
And now it's too good to be true—I'm on the road again.

I'm playing all the same old towns that I have played before,
I never thought that I would ever see them any more,
But there's the same old post-office, the same old general store,
The same old "upstairs opry-house"—I've played them all before.

When we arrive in town the village girls all primp and fuss,
They loiter on the corner and they smile their best at us.
Some boys'll rush to get aboard the hotel bus,
But I prefer to walk uptown when the girls all primp and fuss.

And when we get the signal shrill to march on down the street
To slide trombone and cornet's blare, and snare drum's rattling beat,
The natives all turn out to watch, it's what they call a treat,
To see the minstrel band and boys parading down the street.

Oh, a minstrel life is a grand old life, a minstrel life for me!
A king or millionaire, a lord or duke I would not be.
I'm back again to the cork and sponge, and one night stands! Oh, gee!
In all this world there's nothing like a minstrel life for me.

—A. R.

* * *

AND BELIEVE ME, Pick Malone and Pat Padgette will carry you back to the good old days of minstrelsy, if you tune in on them over WOR. You may also hear these clever boys in "Friendship Town" on Fridays, over WJZ, at 9:00 p.m. They are fine entertainers, with many years of theatrical experience behind them. Malone is a Westerner from Dallas, Texas, and Padgette, a Southerner, from Bogard, Georgia.

* * *

NEWS OF THE STUDIOS

WOR

Pauline Haggard, formerly with NBC, is now presenting a series of pianologues over WOR every Monday at 12:00 noon and each Wednesday at 11:15 a.m. Miss Haggard is a relative of the late novelist, H. Rider Haggard. She first came to radio in 1926. Since then her "songs at the piano" have won her many admirers. Miss Haggard uses both her pianistic and vocal ability in her radio work. Her technique is revealing and expressive, particularly in her beautiful "tone" pictures.

* * *

Headed by Russ Tarbox, young American composer and conductor, who recently joined the WOR staff, "The Song Makers" have made their bow to WOR's audience and will be heard each Thursday night at 8:15 o'clock. A novel idea, a new song written each week, Max Hawkins writing the lyric, Russ Tarbox the music, and Billy Dauscha singing the finished product.

* * *

It has been my contention for some time that what radio needed was engineers who could read music at sight in order to properly interpret musical scores. WOR has one such godsend in the person of Mackenzie Reid, who is a musical engineer. He it is who officiates at the fine Toscanini broadcasts whenever they are put on the air by WOR, he always has a complete musical score of the program on a stand in front of him; consequently the broadcasts are not only technically, but musically perfect. Toscanini appreciated this so much that Mackenzie Reid is one of the select few who has an autographed photograph of the great conductor.

* * *

WABC

The Columbia Broadcasting Company is to be congratulated upon the number of interesting international broadcasts heard over its networks recently. On Sunday, May 8th, band music by the Grenadier Guards, from London, and a talk by Arnold Zweig, noted author, from Berlin, were heard. On May 9th, a series of talks, arranged by the British Broadcasting Corporation, was inaugurated, with the Right Hon. J. H. Thomas, M.P., as the first speaker. This series of talks, entitled "Rungs of the Ladder," will be heard every Monday, at 4:30 p.m. for a period of ten weeks. British notables in widely divergent walks of life will tell the story of their careers. Among those to be heard are Davies, the Welsh poet; Lord Beaverbrook, Canadian-born newspaper magnate; Lord Ashfield, head of London's subway system; C. B. Cochran, theatrical producer, and John Masefield, Poet Laureate of England.

* * *

The newest station to join the Columbia network is WHAS, Louisville, Ky., it was given an official welcome on May 15th, by a special program featuring outstanding radio stars headed by Ted Husing and Howard Barlow. WHAS was the first broadcasting station to be licensed in Kentucky, and it has a long list of "scoops" and outstanding individual programs to its credit. On joining the Columbia network, WHAS broadcast on 25,000 watts, with the probability of another increase to the maximum of 50,000 watts later.

* * *

Ida Bailey Allen has discovered a novelty in the person of the International Chef, who sings in all languages on her morning program, Round the World Cooking School, over WABC, Wednesdays and Fridays, 11:30 a.m. He is an exceptionally versatile young man, with a fine microphone personality.

* * *

N. B. C.

"Love Songs and Waltzes" is the descriptive title of a series of programs which was introduced to listeners over an NBC-WJZ network recently, starring Frank Munn, romantic tenor, who rose to radio fame as Paul Oliver with the Palm-Olive hour. Waltzes of the past and present, played by a string orchestra under the direction of Daniel Lieberfeld, and semi-classic and popular love songs, sung by Mr. Munn, comprise this fifteen-minute period, sponsored by Sterling Products, Inc., makers of Phillips' Milk of Magnesia. Program may be heard each Monday and Friday at 10:30 p.m., E. D. S. T.

* * *

Very glad to know that George Olsen has a commercial "break." He's a fine chap personally and a good band leader. He is now featured with his wife, Ethel Shutta, and Jack Benny on the Canada Dry program over WJZ, each Monday and Wednesday at 9:30 p.m.

* * *

Ed Wynn, silly zany of the theatre, has started something. He is being funny over the air and making them like it. Now agents, managers, and impresarios are touting the comicalness of their own particular star, and asking unheard of salaries for a few minutes funny talk from sponsors who are cautiously considering the value of laughter as a sales promoter. But, alas! They'll find that all stage comics are not funny with a handful of sad gags; in most cases they're better seen than heard.

* * *

A new mystery singer is being plugged by NBC under the nom de radio of Beau Balladeer. It is problematical whether any mystery singer will create the stir Joe White did when he was known as "The Silver Masked Tenor." Then the air audience was not so show-wise.

* * *

Sidelights

PHILLIPS H. LORD owns a hymn book which was carried across the continent in the covered wagon days. . . . ALICE JOY did very well at the Palace, New York, recently she sang my favorite song, "Daddy." Thank you Alice! . . . HERBIE KAY is now a member of the Sioux tribe of Indians. His Indian name is "Chaydah-Sappa," which means "Happy Music." . . . WAYNE KING is singing his own vocal choruses on records. . . . FREEMAN F. GOSDEN, "Amos," was born in Richmond, Va., April 26th, 1899. . . . CHARLES J. CARRELL, "Andy," was born in Peoria, Ill., in 1890. . . . HARRIET LEE once played popular songs in a Chicago music store. . . . JESSICA DRAGONETTE began her musical career by singing from the wings in the stage production of "The Miracle." . . . FRANK VENTREE is one of eight brothers, seven of whom are musicians. . . . PIERRE BRUGNON, genial master-of-ceremonies for the Bourjois "Evening in Paris" program over WABC, sang in opera all over Europe, including Paris, Milan and Genoa. . . . NORMAN BROKENSHIRE intends to rebuild a country house during the summer. . . . LENNY HAYTON, who met Bing Crosby when Hayton was arranger for Paul Whiteman and Crosby was with the Rhythm Boys, is accompanying Bing on his vaudeville tour. He builds the radio programs and directs the different orchestras encountered in various cities. . . . DOROTHEA JAMES has done modelling for several well-known sculptors. . . . TOM TERRIS, the Vagabond Traveler, heard over WOR each Sunday night, has made fifty trips across the Atlantic and traveled twice around the world. . . . MAX SMOLEN, popular conductor of the Bourjois "Evening in Paris" orchestra, spent many years in the musical comedy field before entering radio. He was born in Russia and came to this country at an early age. . . . MARIA CARDINALE has

(Continued on next page)

CANADA FAVORS NATION-OWNED STATION PLAN

Ottawa, Canada

A committee reported unanimously to the House of Commons in favor of national ownership and operation of radio stations, and Premier Bennett announced that the United States is co-operating to make the plan effective, as joint use of some frequencies is at stake.

The plan calls for a chain of high-powered stations, distributed through Canada so as to give adequate coverage, as well as an assortment of low-powered stations for local service. All these would be government stations, but local stations of 100 watts or less may be privately owned and operated under the plan, while experimental and amateur operations would remain in private hands.

A Federal Radio Commission, consisting of three Dominion members, and with an extra member from each Province whose jurisdiction would be restricted to to his territorial domain, is to be provided.

5% Limit on Advertising

The system of taxing radio receivers will be continued. The tax is now $2 a year per set, having been increased recently, and there are almost 800,000 sets, although 600,000 pay the tax. A more rigorous enforcement, to include many of the tax dodgers, is expected to yield a revenue of $1,500,000 a year. Moreover, transmitters are to be taxed, the amount to be fixed later.

The committee reported that the present plan in Canada is excellent, yet could be better, as full scope and equal quality sometimes are lacking

A notable feature of the plan is the limitation of time for advertising announcements to not more than 5 per cent of the total time of the sponsored program.

Favored by United States

Washington

The plan for national ownership and operation of radio stations in Canada has met with the approval of the Federal Radio Commission, which is called on to make some readjustments because of frequencies used by United States stations being used also in Canada under the plan. Principally among these are 1100 kc, used by WPG, Atlantic City, and 1050 kc, used by KNX, Los Angeles, both being cleared channels. What adjustment, if any, is to be made in regard to these two stations has not been disclosed. The numerous small Canadian stations, for local service, will use channels occupied for the same purpose in the United States, but by proper geographical separation no interference is expected, despite simultaneous operation. The same condition prevails in the United States now.

Canada, besides, will use 540 kc, but this channel is 10 kc outside the broadcasting band used in the United States.

Harold A. Lafount, Federal Radio Commissioner, declared that the Canadian plan would not do for the United States, as stations costing around $30,000,000 would have to be bought, and a tax levied of $6 per set per year, besides a tax on stations. A bill to tax stations, by imposing transmitting license fees, is now before Congress.

Stations in New York City in general declared against the plan for use in U. S.

Station Sparks

(*Continued from preceding page*)

a most beautiful collection of old-fashioned jewelry, garnets, pearls, amethysts and jet, set in the quaintest of old settings.

* * *

Biographical Brevities

ABOUT B. A. ROLFE

B. A. Rolfe, known to radio listeners everywhere for his famous dance orchestra, was born in Brasher Falls, N. Y., October 24th, 1879, the son of A. B. Rolfe, himself a noted band leader of his day.

Benjamin Adolphus, as he was named, began early in life to show musical talent. At six he was already adept at playing the piccolo and in 1891, when he was only eleven, he toured Europe as a boy wonder on the trumpet. At ten he appeared as soloist with Sousa's Marine Band. He also learned the trombone and for the next few years "B. A." became a versatile vaudeville artist and circus performer.

At twenty Rolfe organized his own band and played for a time in Lowville, N. Y., and later in Utica. Finally, in 1903, Rolfe came to New York and joined the B. F. Keith organization as a builder of vaudeville acts. He stayed with them until 1914, when he became associated with Jesse L. Lasky to produce vaudeville acts. Later they separated. In one year Rolfe turned out thirty-six films for Metro. He made money, but his heart always turned to music. His friends insisted that he was wasting a great talent as a trumpet player, and when circumstances turned against him and he lost his fortune, he immediately joined Vincent Lopez as third trumpeter in a touring vaudeville show. Then he formed his own orchestra and slowly but surely fought his way back to the top of the musical world. For four years he conducted his band at the Palais d'Or Restaurant in New York and established himself on Broadway as a great trumpet player. In 1925 he went into radio, and has been in it ever since. His Lucky Strike dance orchestra was one of the most popular hours on the air. He kept it going for two years. He may now be heard each Thursday and Friday at 8:30 p.m. over an NBC-WJZ network with his Ivory orchestra.

Rolfe is not temperamental. Has a fondness for dogs. Owns a yacht. Likes motoring. Is rotund and ruddy cheeked. Tremendously popular with his musicians and radio associates.

Aerovox Settles Patent Suit Mallory Brought

Aerovox Wireless Corp., 70 Washington Street, Brooklyn, N. Y., has settled the suit brought against it by P. R. Mallory & Co., Inc., for infringement of Ruben patents Nos. 1,710,073 and 1,714,191, covering features of electrolytic condensers.

An announcement from Aerovox sets forth:

"We have therefore taken a license under these patents on a royalty basis and have made available to the Mallory Company and only to those others manufacturing under the Ruben patents the right to operate on a royalty basis under our own patents to Georgiew Nos. 1,789,949 and 1,815,768.

"We believe what we have done is of great advantage to all users of condensers as it eliminates troublesome patent litigation and enables us to devote our wholehearted attention to the manufacture and sale of condensers, which is our business."

NBC EXECUTIVE DISAPPOINTED ON TELEVISION

San Francisco.

Radio City, National Broadcasting Company's gigantic architectural project in the heart of New York, may be ready for occupancy in little more than a year—but television still is far away.

This is the word which Don E. Gilman, vice-president in charge of the Pacific Division, National Broadcasting Company, brings back from the East, where he spent several weeks in conference with NBC heads.

"Television's progress has been more or less of a disappointment to those who hoped for great things from it in the near future," said Mr. Gilman. "Like many other developments in the field of research, television gives great promise. but has not gone as its supporters anticipated.

Calls Opera Biggest Event

"Radio City is progressing rapidly. One building, the one which will house the business offices, was complete externally, and the structure of the studio building was well under way when I left. The entire unit, it is expected, will be finished in little more than a year."

The biggest achievement in radio during the past year, Mr. Gilman believes, was the broadcasts from the Metropolitan Opera House.

"It may be regarded as a milestone in the progress of radio development and a portent of the better things which may be expected in the future," he said. "The radio audience has been quick to express its approval

"There are few big names in the artist world who have not yet been heard on the ether, and the few who remain seem ready to respond to the urge of the times."

Feels Censorship Bills Won't Pass

Despite the trying economic period through which the world is passing, there is no retrogression in chain broadcasting, Mr. Gilman declared, pointing out that public interest has risen higher and higher, not only in the number of listeners but in the quality of the audience which now follows broadcasts.

"Many bills have been presented both to Congress and to State Legislatures for regulation and censorship of radio broadcasting," he said. "There seems to be a disposition on the part of our public servants, however, to permit radio to work out its own salvation, on the principle that free speech and freedom to develop industrially as well as culturally is an inherent right of every American enterprise."

Lion Breaks Loose, Injures 6 in Studio

Boston.

A 900-pound lion caused a panic among 150 persons who had come to the studio of WBZ to witness the first appearance of the lion before the microphone. Before the lion had been driven back to his cage six persons had been injured, two of them being trampled in the stampede out of the studio. The lion jumped through two plate glass windows into the control room into a gathering of workers.

Noise of Great Voices Measured

The "noise" made by the artists, audience, and the orchestra at the Metropolitan Opera House has been measured with the "electric ear," an instrument developed at the General Electric Company, Schenectady, N. Y. The loudest noise was made by the orchestra, which at times registered 96 decibels, which is one decibel louder than the noise made by the subway. Of the singers, Beniamino Gigli, the tenor, made the greatest "noise." He scored 77 decibels twice during the performance. Lily Pons, coloratura soprano, was the "noisiest" woman artist, with a score of 75 decibels during her rendition of "Caro Nome" in "Rigoletto."

The audience, too, supplied a great deal of noise. The highest came after Lily Pons had finished her "Caro Nome" song, when the applause reached 80 decibels. On the average the men artists made more noise than women artists. The men scored between 60 and 70 decibels and the women slightly less. The bassos and baritones brought the score down.

During intermissions the noise level of the audience was between 50 and 53 decibels. The quietest moment during the evening was the stabbing of Gilda, when the instrument recorded only 24 decibels, which was just a little more than the rating of a quiet country residence, which is about 20 decibels.

The measurements were made by M. S. Mead, engineer of the General Electric Company, and were taken only as an experiment. The instrument was installed in the booth used when opera is broadcast and use was made of the stage microphones connected with the WEAF-WJZ networks. During the performance Mr. Mead took more than 100 readings of the noise level. The instrument does not distinguish between art and plain noise, but only between intensities of sound.

A decibel is unit based on the logarithm of a ratio of two powers.

Thor Introduces De Luxe Basement

A visit to Thor's Basement Store, 167 Greenwich Street, between Cortlandt and Liberty Streets, New York City, will prove not only interesting but educational, and if one is a buyer of radio merchandise, also profitable to the visitor. This is a unique organization. Here in the radio selling center is an establishment where everything in the way of small parts and replacement parts may be had in what is considered one of the largest if not the largest stocks of such radio goods to be found anywhere.

The array of counters, and their arrangement in the departments, can hardly be described. The whole plan shows careful thought and great knowledge of radio parts. Two types of radio receivers are on demonstration, while parts to build them are for sale there.

In this basement a large modern ventilating system has just been installed which keeps the air properly refreshed and at the right temperature. In fact, during warm weather it is more comfortable there than in the street. In addition to the basement one finds a main store with double display windows, showing the latest in radio receivers, tubes, batteries, short-wave sets and converters and a full line of all other radio merchandise. Behind all this is not just space, radio goods and a good location, but an institution of service, built up through twelve years of radio merchandising and leadership, by M. Krantz.

35-lb. Transmitter Tested on a 'Plane

A tiny radio transmitter weighing only 35 pounds, developed by laboratories associated with WABC's organization and designed especially for connecting airplanes, vessels, and land vehicles with broadcasting stations, was tested by engineers of WABC in a plane flying over New York City.

The program sent from the plate was relayed by WABC and listeners to that station could hear the miniature transmitter for a period of 15 minutes. Two toy pianos and two artists were carried by the plane, and the tinkling of the little pianos could be heard clearly. The small transmitter has been designed to carry musical programs without appreciable loss of quality and it is claimed that its tonal range is as great as that of the new WABC 50-kilowatt transmitter erected in New Jersey.

The Eastern Air Transport cooperated in the tests and supplied an eighteen-passenger Curtiss Condor plane. The altitude of the plane during the test was about 10,000 feet. The transmitted waves were intercepted with a receiver on top of the building at 485 Madison Ave., New York, in which the WABC headquarters are located.

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.

R. B. Graybill, 108 E. High St., Manheim, Pa.
Hugh Koskinen, 846 3rd Ave., New York, N. Y.
Lloyd A. Woodell, 315 N. 22nd St., Portland, Ore.
E. E. Allen, 2130 Perkins Way, Sacramento, Calif.
J. Krulish, 403 E. 73rd St., New York, N. Y.
O. Ingmar Oleson, Ambrose, No. Dak.
R. J. Powell, RM 2/c, Box 8, Navy Yard, Charleston, S. C.
Charles Davidson, 109 Sterling Ave., Jersey City, N. J.
S. J. Wasselle, 54 Lafayette St., care Dept. of Sanitation, New York City
Geo. Haverty, Haverty's News Agency, 32-32 Washington Blvd., Oshkosh, Wis.
S. Nichols Cash Store, De Quincy, La.
Canadian Radio Labs., 445 Sargent Ave., Winnipeg, Man., Canada
J. R. Everett, 3803 Locust, Philadelphia, Pa.
Roy G. Bray, Box 137, Thomasville, N. C.
Alfonso Altji, 3211 No. 20th, Tacoma, Wash.
George Dittiacur, parts for short wave sets, 103 Robie St., Bath, N. Y.
Arthur B. Myers, R.D. No. 2, Hamburg, N. Y.
W. N. Edwards, U. S. Receiving Ship (Band), San Francisco, Calif.
C. A. Peacock, 45 S. E. 7th St., Miami, Fla.
Elmer H. Earl (radio service shop), R. 6, Box 255, Santa Rosa, Calif.
C. T. Stillhomner, Madison, Ind.
R. C. Goodyear, 20 So. Stone Ave., La Grange, Ill.

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

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

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

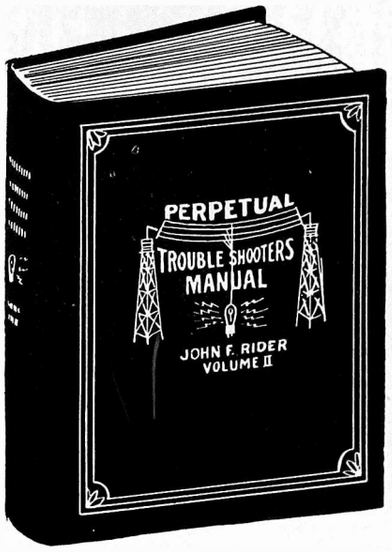
CONDUCTORS

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.

Volume No. 2 of Perpetual Trouble Shooter's Manual

{ Ready About June 6th }



Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1 but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.

All Electrical Values Given for First Time

This new detailed, comprehensive information gives the resistance values from point to point in all circuits in Volume No. 2—such complete information as is unobtainable elsewhere. All condenser values are given. Chassis diagrams (pictorial), schematic diagrams and photographic views of receiver "insides" are included. Parts are identified on photographs. Intermediate frequencies are stated. Socket and tube identities are revealed, color codes given, continuities of sealed units disclosed. The information is painstakingly complete. Rider made personal trips virtually all over the country to obtain the information, and it's now yours.

Everyone who makes his living as a radio service man, salesman, laboratory man or in any other technical capacity, as well as all students and teachers of radio, should possess Volume No. 2.

Volume II and Volume I are loose-leaf editions of 8½ x 11" page size, flexible fabrikoid binding.

Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider. Shipping weight 6 lbs. Order Cat. RM-VT @ $5.00
Volume No. 1 (8 lbs.). Order Cat. RM-VO @ $4.50

We pay postage in United States on receipt of purchase price with order. Canadian remittances must be in funds payable in New York.

We will send a copy of Volume No. 2 as soon as it is off the press—about June 6th—on a 10-day money-back guarantee, on receipt of remittance. Volume No. 1 can be shipped at once. Same guarantee, same postage defrayal.

RADIO WORLD
145 WEST 45th ST., NEW YORK, N. Y.

RCA NET PROFIT FOR QUARTER IS OVER $500,000

From a condition of losing money, as reported for the last quarter of 1931, Radio Corporation of America has gotten back to a profit basis by instituting economies. The net profit is shown as $503,223.72 after all charges, on a gross income of $20,585,222.54.

The consolidated statement for the three months ending March 31st, 1932, follows:

Gross Income:		
From Operations	$20,322,408.01	
Other Income	262,814.53	
Total Gross Income from all Sources		$20,585,222.54
Less:		
Cost of Sales, General Operating, Development, Selling and Administrative Expenses		18,334,903.60
Net Income for the Period (before Interest, Depreciation, Amortization of Patents, and Federal Income Taxes)		2,250,318.94
Deduct:		
Interest	319,014.76	
Depreciation	1,218,080.46	
Amortization of Patents	150,000.00	
Provision for Federal Income Taxes	50,000.00	
Total Deductions		1,747,095.22
Net Income for the Period Transferred to Surplus		503,223.72
Dividends:		
On "A" Preferred Stock		343,019.24
Surplus for the Period		160,204.48
Surplus at December 31, 1931		11,327,789.07
Surplus at March 31, 1932		11,487,993.55

The following directors, whose term of office had expired, were reelected for the term of three years: Gordon Abbott, Arthur E. Braun, John Hays Hammond, Jr., Edward W. Harden, Andrew W. Robertson and David Sarnoff.

The other directors of the company are: Owen D. Young, Albert G. Davis, Paul D. Cravath, James G. Harbord, Harold Smith, Cornelius N. Bliss, Frank A. Merrick, Edward J. Nally, Edwin W. Rice, Jr., Gerard Swope, James R. Sheffield, De Witt Millhauser and Frederick Strauss.

Industry Sound, Says Sarnoff

David Sarnoff, president, addressing the anuual meeting of the stockholders at which the quarterly report later was rendered, said in part:

"Conditions through which we have passed have emphasized the inherent soundness, rather than weakness of radio. We have been swimming upstream, but nevertheless the last year has been marked by a great deal of progress. Many industries much longer established than radio have suffered even more acutely from the curtailed purchasing power of the public and from the inability to carry out any enlarged programs.

"The figures which are being released show a gross income for the three months of $20,585,222.54 and a net profit after all charges of $503,223.72. While the amount of the profit is modest, it is in excess of the requirements for the 'A' Preferred dividend declared by the Board of Directors for the first quarter of 1932, and shows a great improvement over the final quarter of 1931. During the final quarter of 1931 we were in the red while during the first quarter of 1932 we are in the black.

"The prospect of radio for the remainder of the year is dependent largely upon the general business trend.

Television Awaits More Improvement

"With regard to television, we have continued the intensive experimental work which has been carried on in order to make television a practical, worthwhile service to the American home. Our experiments up to the present have confirmed the belief that practical television can best be accomplished on its own band of wavelengths, where it will be a service additional to the present system of sound broadcasting.

"Our engineers have done much research during the past year with television transmission on short waves and with various studio problems incident to television transmission. However, I am going to reemphasize what I have said before—that while the public was quite willing to experiment with radio in the early stages of broadcast development, it will expect television apparatus of a more advanced type than the early crystal radios.

"When broadcasting began the public had had no experience in taking sound and music out of space but the motion picture industry has given it a high standard of excellence in sound pictures, and television images which are obscure and difficult to follow can not be expected to sustain interest over a very long period.

Will Continue Television Experiments

"To attempt to market television equipment prematurely would severely retard a development that has great promise, and which we expect will grow into a great and widely accepted service. Premature marketing could only result in public disappointment, and an immediate loss of sales after the initial impetus.

"The experimental work we are undertaking will be continued energetically. As stated in the annual report, television receiving equipment will be offered to the public when this experimentation has shown that a system of sight transmission having practical value can be assured."

Tradiograms

By J. Murray Barron

News of New York City

Martens, Schroter & Co., Inc., service station for Balkite, have taken a ground floor store at 141 Cedar Street, near Washington Street. A retail department with radio receivers and accessories will be conducted.

* * *

Leotone Radio Company, 63 Dey Street, has taken the large store at the same address. In addition to replacement parts, eliminators and small parts, a large cone and speaker department will be installed.

* * *

Fulton Radio Company announces removal to 100 Sixth Avenue, for larger floor space.

* * *

Stanley Radio Company, 174 Greenwich Street, has installed a small parts and replacement department, specializing in Todd replacements and amplifiers.

* * *

Pyramid Radio Company has opened a store at 71 Dey Street, corner Washington Street. In addition to radio receivers and speakers, a replacement and small parts department has been installed. There is also a repair department.

* * *

Joart Engineering Co., 501 Graybar Building, handles items that can be sold to the home. Anyone who has an invention or an idea, radio or otherwise, is invited to consult them.

TRADE EXHIBIT OPENS MONDAY

More new radio products than at any period during the last five years will be disclosed to the radio industry and trade at Chicago, May 23rd to 26th, during the eighth annual convention and trade show of Radio Manufacturers Association, Inc.

From 15,000 to 20,000 visitors are expected. Over 100 leading radio manufacturers have reserved space. The exhibition hall and grand ballroom of the Stevens Hotel will be used. For the overflow, the Blackstone Hotel is an official headquarters. Admission to the trade show for view of the new radio products will be limited to the trade. The public will not be admitted, as many of the new products will not go into distribution for a few weeks or months. Refrigerators and other electrical products will also be displayed by the exhibitors.

In addition to the new tubes, new short-wave apparatus, new automobile receiving sets, new loudspeakers and amplifiers, new cabinet designs and other new products are promised.

Several radio and allied organizations will hold meetings at Chicago during the industry gathering. On May 24th the annual convention and election of officers of the Newspaper Radio Editors' Association, of which E. L. Bragdon, of New York, is president, will be held. Also there will be the semi-annual meeting of the Institute of Radio Service Men, the national organization of which K. L. Hathaway, of Chicago, is president.

New Incorporations

Northboro Radio and Music Co., Bronx, New York City—Atty., L. Feidherr, 18 East 41st St., New York City

Leibowitz Radio Corp., Bronx, New York City—Atty., I. Lederman, 259 West 14th St., New York City

American Television Exhibitors, Inc., New York, N. Y.—Attys., Prentice-Hall, Inc., of Delaware

Vanderbilt Concourse Electric Shop, New York City—Atty., R. J. Heisler, 11 Park Place, New York, N. Y.

Premier Refrigeration Sales and Service Corp., Bronx, New York City—Atty., L. London, 295 Madison Ave., New York City

World-Wide Radio Corp., New York City—Atty., I. Kantrowitz, 8 West 40th St., New York City.

WESG Radio plant, Elmira, N. Y.—Attys., Henry, Denton & McCann, Elmira, N. Y.

Griffen Electric Co., Brooklyn, N. Y.—Atty., L. L. Perosnick, 26 Court St., Brooklyn, N. Y.

Alessi Bros. Co., New York City, refrigerators—Atty., D. L. Black, 206 Broadway, New York City.

Buckeye Refrigerator Service, New York City—Atty., B. Grober 26 Court St., Brooklyn, N. Y.

Superior Radio Accessories Corp., New York City—Atty., J. C. Bohm, 165 Broadway, New York City.

Contact Manufacturing Corp., New York City, electrical supplies—Atty., J. E. Muson, 25 West 43rd St., New York City.

Starr Freeze Distributors, New York City, refrigerators—Attys., Hennessey & O'Connell, 5 Beekman St., New York City.

Hines Electrical Specialties, New York City—Atty., R. S. Allyn, 41 Park Row, New York City.

Boulevard Auto and Radio Supply Co., Queens, L. I., N. Y., garage—Atty., J. Korshin, 280 Madison Ave., New York City.

Rialto Electric Co., Passaic, N. J., electrical supplies.—Attys., Stolkin & Cohen, Passaic, N. J.

National Radio Advertising Corp., Wilmington, Del., radio, radio apparatus.—Attys., Corporation Service Co., Wilmington Del.

CAPITAL INCREASE

F. A. D. Andrea, Queens, L. I., N. Y., $250,000 to $1,000,000.

NAME CHANGES

Kelvinator Schenectady, Schnectady, N. Y., to Connelly-Murray Refrigeration Co.

F. A. D. Andrea, Queens, L. I., N. Y., to Fada Radio and Electric Corp.

CORPORATION REPORT

World Radio Corporation—Six months ended Jan. 30: Net income after depreciation and all charges, $41,430, equivalent after preferred dividends to $1.08 a common share. No comparison with corresponding 1931 period is available, but for fiscal year ended July 31, 1931, net of $54,529 was shown, equal to $1.35 on common.

Quick-Action Classified Advertisements

7c a Word — $1.00 Minimum
Cash With Order

LATHES — Used and reclaimed South Bend Lathes. One 9-inch $127; 13-inch $276; 16-inch $388; just a few left. Guaranteed good as new. Terms, or discount for cash. South Bend Lathe Works, 312 E. Madison, South Bend, Indiana.

"THE CHEVROLET SIX CAR AND TRUCK" (Construction—Operation—Repair) by Victor W. Pagé, author of "Modern Gasoline Automobile," "Ford Model A Car and AA Truck," etc., etc. 450 pages, price $2.00. Radio World, 145 W. 45th St., N. Y. City.

S. GERNSBACK'S "RADIO ENCYCLOPEDIA," SECOND EDITION. A Guide-Book of Radio Information topically arranged in Alphabetical Order. Radio in all its branches, described, explained and illustrated. Size 9 x 12, 352 pages, Red Morocco-Keratol Flexible Binding. Loose-Leaf Arrangement. Price $3.98 postpaid (Foreign and Canada add 35c extra). Radio World, 145 W. 45th St., New York City.

"SERVICING SUPERHETERODYNES," by John F. Rider. A reliable aid to the service man or to organizations in tackling superhet service problems. 161 pages, canvas cover. Price $1.00. Radio World, 145 W. 45th St., New York, N. Y.

RADIO WORLD AND POPULAR MECHANICS MAGAZINE—Radio World is $6.00 a year, and Popular Mechanics Magazine is $2.50 a year. Popular Mechanics Magazine does not cut rates, but Radio World will send both publications to you for one year for $7.00. Radio World, 145 West 45th St., New York City.

"AMATEUR MOVIE CRAFT," by James R. Cameron. A book dealing with the making and showing of 16 m/m pictures and equipment necessary for same. Paper cover, $1.00; Cloth, $1.50. Radio World, 145 W. 45th St., New York, N. Y.

THE FORD MODEL—"A" Car and Model "AA" Truck — Construction, Operation and Repair — Revised New Edition. Ford Car authority, Victor W. Page. 703 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

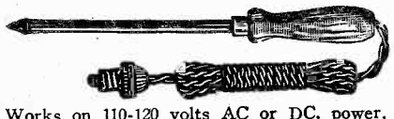
25,000 OHM POTENTIOMETER, 90c. Direct Radio Co., 143 W. 45th St., N. Y. C.

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.

SOLDERING IRON F R E E !



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

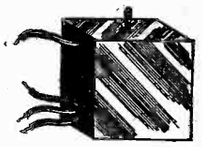
Dynamic Speaker Replacements

We can supply cone and voice coil replacement assemblies for dynamic speakers, as listed below, at stated prices. Besides, we can supply replacement cone and voice coil assemblies for non-listed speakers, prices furnished on request, if you will supply the following information: inside diameter of voice coil, extreme diameter of cone, including floating ring, depth of cone.

Make of Speaker	*Size*	*Price*	*Make of Speaker*	*Size*	*Price*
Peerless (1-turn)	7"	$1.60	Victor (RE 32, RE 45)		$1.35
Peerless (1-turn)	9"	1.95	R.C.A. (No. 106)		1.95
Peerless (1-turn)	11"	2.10	R.C.A. (No. 105)		1.95
Peerless (1-turn)	15"	2.85	R.C.A. (No. 104)		1.95
Peerless (wire-wound)	7"	1.45	Jensen (D7 concert)		2.25
Peerless (wire-wound)	9"	1.65	Colonial (No. 33)		2.25
Peerless (wire-wound)	15"	2.75	Symington	9"	1.90
Farrand	7"	2.25	Symington	11"	2.25
Farrand (Induct. Dynam.)	11"	1.35	Zenith (No. 52)		2.25
			Eveready	9"	1.90
			Eveready	11"	2.25
			Newcomb-Hawley	7"	2.25
			Magnavox	7"	2.25
			Sterling	7"	2.25

DIRECT RADIO CO.
145 WEST 45th STREET
NEW YORK, N. Y.

Three 0.1 mfd. in One Case



Three Supertone non-inductive fixed condensers of 0.1 mfd each, (250 v.) in steel case, provided with a 6/32 mounting screw, built in. The black lead is common to the three condensers, the three red leads are the other sides of the respective capacities. Size, 1½" square by ⅝" wide. Order Cat. SUP-31, list price, $1.00; net price, 57c.

GUARANTY RADIO GOODS CO.
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BLUEPRINT No. 627, full-scale, with schematic diagram also included, as well as a list of parts, is our most popular star circuit, since it is a-c operated and covers from 80 to 550 meters. Thus you can tune in television, police calls, some relay stations and the broadcast band. It uses five tubes: two vari-mu, either —35 or —51, one —24, one —47 and one —80. The chassis is 14½x7¾ inches, so may be fitted into a midget cabinet as illustrated.

The reason for the great popularity of this circuit is that it represents the highest achievement so far in a five-tube tuned radio frequency design, with high sensitivity all over the dial, including the high wavelengths, on which most t-r-f sets drop off considerably. For instance, patients at a sanitarium at Liberty, N. Y., were most eager to receive WEAF, 660 kc, about 150 miles distant, and all sets tried, including supers, failed to produce sufficient volume. But the 627 circuit not only brought in WEAF loudly but met all other requirements, arousing such enthusiasm that several such receivers now will be found in that sanitarium.

As to selectivity, strong local stations can be cut out within a very few degrees of the dial, to bring in distant stations, and it is nothing unusual of an evening, in Winter or Summer, to tune in fifty or sixty different stations without interference. From various points in the United States many users receive Cuban and Mexican stations with plenty of volume.

Special precautions have been taken to make the tone the very best. This includes complete filtration in the B supply, since hum is ruinous to tone quality. The circuit is as free from hum as any a-c receiver can be, which means you can scarcely hear the hum with no station tuned in, and your ear against the grille.

The 627 circuit was carefully engineered in **Radio World's** Laboratories, and represents the selection of fourteen different circuits, all of the five-tube t-r-f variety. So not only has the trouble been taken out by experts, but the virtues have been built in with great engineering skill.

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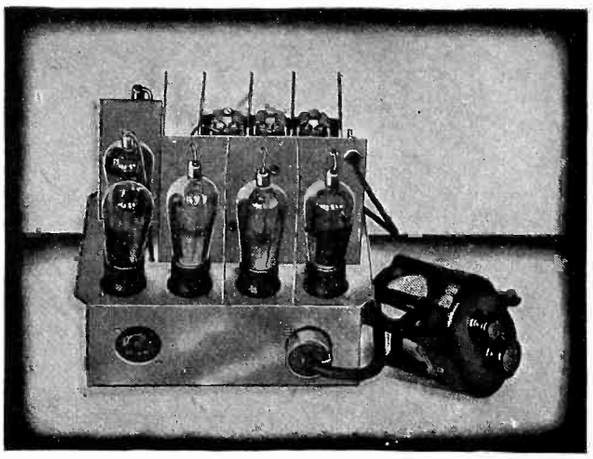

A SIX-TUBE automobile receiver, using remote control tuning, with tuning-switch-volume control assembly on the steering post, is covered by our Blueprint No. 629. The size of the chassis is only 7x9 inches, and the chassis, enclosed in a steel cover, may be placed at rear of the fireboard, just under the instrument board, to the driver's right. Since there will be little aerial pickup the receiver has been made extremely sensitive. It is of the t-r-f type, using the new —39 variable mu r-f pentode tubes, and two pentode output tubes, —38's, in push-pull. All the tubes are of the 6-volt automotive series, to work from the car's storage battery, and requiring 135 volts of B battery.

Steel partition walls serve to shield the r-f and detector tubes, while two outlets are for plugging in the remote control unit and the speaker, which should be an automobile dynamic, as set forth in the blueprint. A schematic diagram and list of parts are included on the full-scale print.

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WE have just completed an 8-tube pentode push-pull automobile superheterodyne, designed by J. E. Anderson, technical editor of **Radio World**. This is Blueprint No. 631, full-scale, including schematic diagram and list of parts.

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SHORT WAVES

A TOTALLY a-c operated short-wave converter that can be built for $7.60, comprising three tubes, and affording excellent results when worked with any broadcast receiver, including a superheterodyne, is covered by Blueprint No. 630. No plug-in coils are used, there are two tuning controls for maximum sensitivity, both oscillator and modulator tuned, and the construction is so simple that any novice can make a great success of this circuit.

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OUR blueprints also include two short-wave receivers for battery operation, one for earphone use, the other to work a speaker. These models use plug-in coils, with UX sockets as coil receptacles. The 2-volt tubes are used in both instances.

The earphone model, Blueprint No. 633, consists of an efficient and specially sensitized detector, with one stage of transformer coupled audio. With this circuit many foreign stations have been tuned in by hundreds of users. In fact, all our short-wave blueprints call for designs that yield foreign reception not as a rarity but as a fairly steady record. Two —32 tubes used.

The four-tube model, Blueprint 634, uses a stage of tuned r-f, a tuned detector specially sensitized, and two stages of transformer-coupled audio frequency amplification, the r-f tube being the —34 vari-mu r-f pentode, and the output being a —33 pentode. Schematic diagram and and list of parts included on blueprint.

These two blueprints, Nos. 632 and 633, are full-scale, on one large sheet, the complete data for one on one side, and for the other on the other side.

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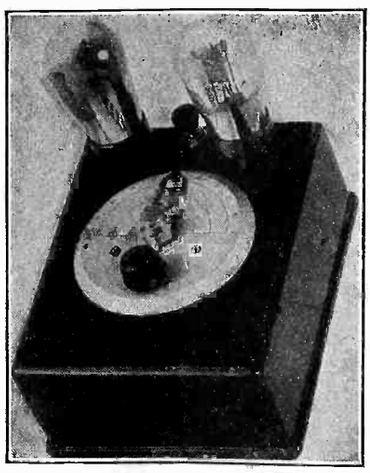
OSCILLATOR



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