July 30th
1932

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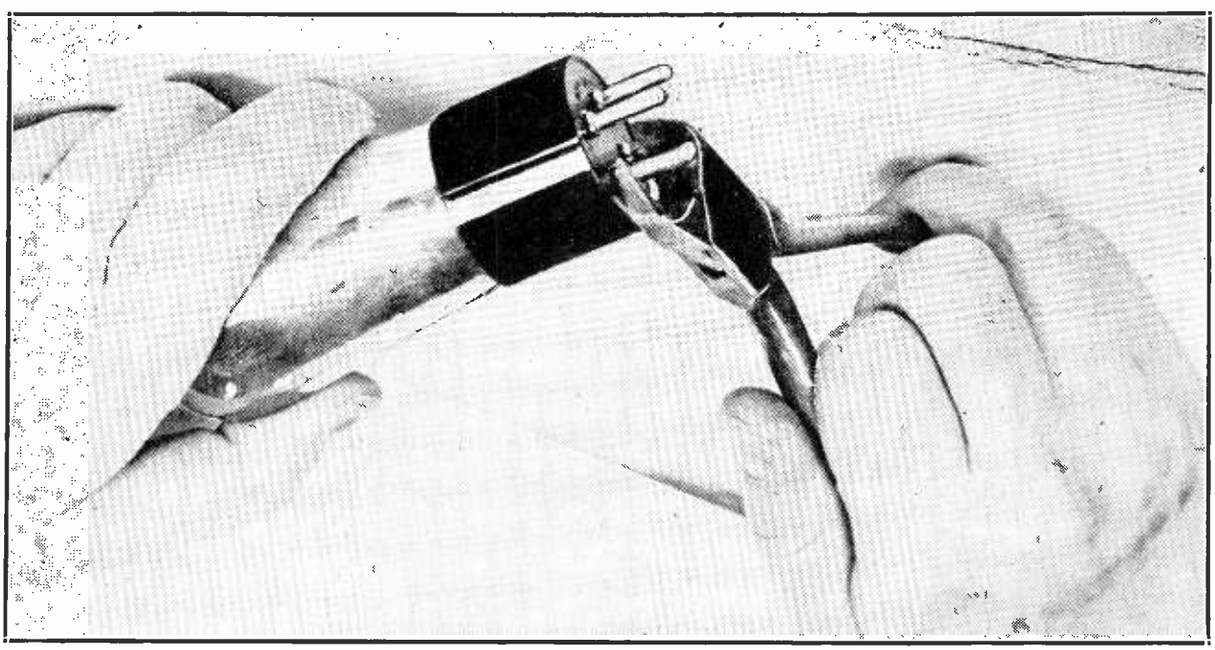

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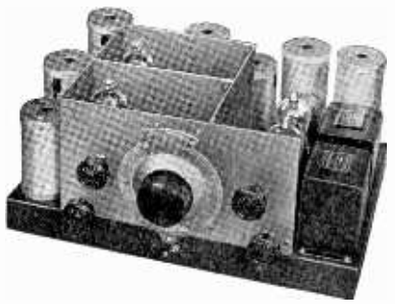

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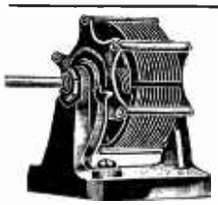

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'10	7.27	4.73	47	1.60	1.04
'22	3.15	2.05	'50	6.20	4.03
'24-A	1.65	1.08	55	1.60	1.04
'26	.85	.56	56	1.30	.87
'27	1.05	.69	57	1.55	1.01
'30	1.65	1.08	58	1.55	1.01
'31	1.65	1.08	'80	1.05	.69
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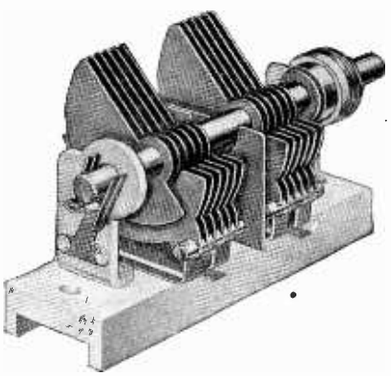

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ELEVENTH YEAR

J. E. ANDERSON
Technical Editor

J. MURRAY BARRON
Advertising Manager

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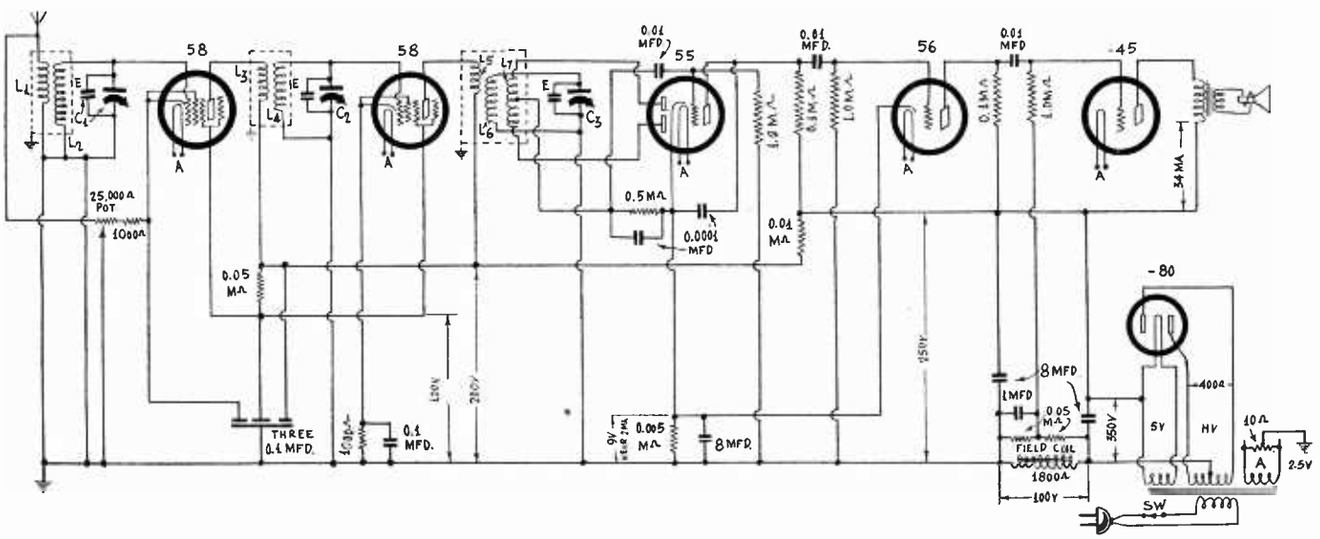
Latest Model T-R-F Set

Diode Full-Wave Detector, 3 A-F Stages

By Herman Bernard



Resistance and voltage values are given on this diagram of a six-tube tuned radio frequency set of latest design, using the 55 as full-wave detector. Supreme tone quality is the feature.

HERE is the latest tuned radio frequency set, using two stages of t-r-f, with 58 tubes, a full-wave 55 diode detector, three stages of audio frequency amplification, with the triode of the 55, the 56 and the '45 power tube, and a 280 rectifier. It is a six-tube set, on the basis of one tube ascribed to each socket, but a seven-tube set if one regards the 55, as used here, as two tubes, which technically it is. Somebody will have to decide officially what the count shall be.

(*Continued on next page*)

LIST OF PARTS

Coils

Two two-winding r-f transformers, L1, L2, and L3, L4, and one three-winding r-f transformer, L5L6L7.
One power transformer

Condensers

One 0.00035 mfd. three-gang tuning condenser, C1, C2, C3, with equalizers, E.
One shielded block of three 0.1 mfd. fixed condensers (black lead in common, to ground)
One 0.1 mfd. tubular fixed condenser
Three 0.01 mfd. fixed condensers
Two 0.0001 mfd. fixed condensers
One 1 mfd. condenser
Three 8 mfd. electrolytic condensers

Resistors

Two 1000-ohm resistors
One 0.005 meg. (5000 ohm) resistor
Two 0.1 meg. resistors
Three 1.0 meg. resistors
One 0.01 meg. (10000 ohm) resistor
One 0.5 meg. (500000-ohm) resistor
Three 0.05 meg. (50,000-ohm) resistors
(Above are pigtail resistors, 1 watt rating)
One 10-ohm center tapped resistor
One 25000-ohm potentiometer with knob

Other Requirements

One chassis, 13¾ x 7¾ x 2⅜ inches
One travelling light type vernier dial, with pilot lamp
One shaft type a-c switch (SW) with knob
One a-c cable with plug
Two tube shields for 58's, two for 55 and 56
One dynamic speaker, for '45 single-sided output, with 1800-ohm field coil. output transformer and speaker plug
Three six-spring sockets (for two 58's and one 55), two UY sockets (for 56 and speaker) and two UX sockets (for '45)
Three grid clips
One table model cabinet

[*Note: The speaker specified above may be of the tapped field type,* 800 *ohms and* 1,000 *ohms.*]

(*Continued from preceding page*)
Meanwhile we shall call it a six-tube set, lest describing it as a seven-tube set gives rise to the question, where is the seventh socket?

The outstanding virtue of the receiver is its tone. The sensitivity is about the same as that of the familiar five-tube midget, until now a sort of standard, but to be replaced no doubt by designs of this sort, for the 55 has virtues that must be capitalized even in modest sets.

The Detector Pick-up Coil

The two 58 tubes help boost the gain beyond what it would be were '35 or other variable mu tubes used as r-f amplifiers, but the detector is a diode, which is not an amplifier, and besides it is used as full-wave fashion, therefore the voltage input is halved.

If the winding L7 were considered as one with only the two extreme terminals, and the detector were half-wave, the voltage input would be twice what it is when the center tap is used for full-wave detection. This does not necessarily mean that the voltage put in always must be half, but rather it always could be double. The voltage depends on the coupling, which must be tight in all instances, and on the number of turns on L7. So, in view of the full-wave detection, may we beat about the bush a little way saying that if L7 is made up of considerably more turns than ordinarily would be selected, that the halving of the greater voltage results in not so much a depression of sensitivity?

So if the outside diameter of the coil form on which are L5 and L6 is 1 inch, and the inside diameter about ⅞ inch, then the form on which L7 is wound should be ¾ inch, whereby the L7 may be slid inside the other tubing without contacting with it, and may have 150 turns or more of No. 32 enamel wire, center-tapped. This size and insulation wire winds 115.6 turns to the inch.

Resistor Values

The 58 tubes, instead of being worked at 250 plate volts, take 200 volts at full-volume setting of the potentiometer, as better stability resulted that way. The screen voltage was around 75 volts, actual. The 200 volts may be measured with a standard voltmeter, but the screen voltage may not; a vacuum tube voltmeter or other electrostatic type would be necessary. When the reading was taken with a voltmeter of 2,000-ohms-per-volt resistance it was about 50 volts on a 300-volt maximum deflection scale. Since such a meter draws 0.5 milliampere at full-scale deflection, at 50 volts it draws 0.5/6, or a little more than 80 microamperes, but this is substantial compared to the screen current, therefore the error introduced by mere meter reading.

Also, the plate current does not run as high as expected in the 58 tubes, duplicating the situation obtaining with the '35, otherwise the 10,000-ohm resistor would drop entirely too much voltage. Also because of the current being lower than expected. the biasing resistors (1,000 ohms) are higher than expected.

In this regard, however, allowing for differences in tubes, it should be stated that these biasing resistors may be reduced in value until there is squealing at the higher frequencies of the broadcasting stations, and then increased just enough to stop the squealing. The operation may be performed on the first tube circuit alone, as this is the tube most likely to oscillate. The reason the higher values are given throughout is that with these there was no sign of oscillation.

Three 0.1 mfd. condensers in one shield case are used for bypassing the first r-f cathode, and the first and second r-f plate and screen voltage supplies, and if there is squealing trouble one way of tending to reduce it is to increase the capacities bypassing screen and plate voltages, particularly screen. This would not be necessary if the resistor method is used for accomplishing the same purpose.

Voltage Distribution

The aim in resistor method is to establish the minimum bias at no less than 2.5 volts negative, and such was the result, since the combined screen and plate currents for the two tubes passes through the 10,000-ohm resistor that drops 50 volts, hence 5 milliamperes flow, or 2.5 milliamperes per tube, equals 2.5 volts drop across each of the 1,000-ohm resistors.

The detector is one that can not be overloaded by this set, and also the volume control is such that cross-modulation is practically impossible, if the volume control is used to reduce the volume of sound at the output so it is not excessive. This protection against cross-modulation arises from the nature of the tube and the added advantage of reducing the signal input to and the amplification of the first tube at the same time.

If only the signal input were reduced the amplification obtained from the tube would be the same all the time, and for low volume levels the tube noise would be the same as for any other volume level, whereas if the amplification alone were reduced some very strong stations might lay down too great an intensity at the antenna and result in some cross modulation.

Easy Combination

A combination of the two functions is easily effectuated with the same type of volume control unit as used for the single-purpose methods. The arm or slider of a potentiometer is connected to ground, the extremes to aerial and to the limiting resistor in the cathode leg. Then as the arm is slid toward the aerial connection the ground is moved toward the aerial and finally the two input posts are shorted—aerial and ground interconnected—and there is no signal input. This position comes in handy in connection with the use of a phonograph pickup, when it is desired to exclude the radio signal no matter what may be the dial position.

Some of the resistor values in the r-f amplifier are a little unusual, otherwise the circuit does not depart from standard practice. The suppressor grid is connected to cathode. The socket pins, looking at the bottom, with the thick heater prongs toward you, reading in clockwise direction, are: heater, heater, plate, screen, suppressor and cathode. The control grid is the cap of the tube. Six spring sockets are used, but these are now generally obtainable. So are the new tubes, 55, 56 and 58, of which the 55 is the newest, just out.

Half-Wave Detection

The 55 is a tube that should be subjected to much experimental use by those highly interested in tone quality. You can have your choice of full-wave or half-wave detection, using the diagram for full-wave, or, for half-wave, interconnecting the two diode plates, to which goes one side of L7, and returning the other side of L7 to one side of the 0.5 meg. as resistor, ignoring the center tap. Even with full-wave detection the small condenser across the 0.5 meg. resistor should be retained, because of practical difficulty in attaining perfect symmetry in the detector handling varies radio frequencies of input, though full-wave, such lack of symmetry resulting in feedback, which may be either positive or negative and in this instance happened to be positive, for the condenser got rid of some squealing. Moreover, the output of the triode part of the 55 was not entirely free of radio frequencies, and again a small condenser was used to detour the r-f from the plate circuit in which it is intended there shall be only audio frequencies.

The 55 takes a six-pin socket, the connections for which, bottom view, large heater springs toward you, are, clockwise: heater, heater, triode plate, diode anode, diode anode, cathode. The grid cap is the control grid of the triode or first audio frequency amplifier, and the usual stopping condenser is inserted between the center-tap of L7 and the grid of the triode, with a leak of 1 meg. from grid to ground. This method provides fixed bias.

Virtue of Fixed Bias

It is necessary in a t-r-f set to use fixed bias, as the signal amplitude would not be great enough to provide always a sufficient negative bias if such bias were dependent alone on the drop in the 0.5 meg. resistor. Three or four locals would give fine tone, but all other stations would come in with much distortion, due to little or no negative bias on the first a-f tube. Of course, the plate voltage on the triode of the 55 could be reduced, but the remedy would be only relative, not absolute as it is with fixed bias.

The resistor in the plate circuit of the triode part of the 55 is 100,000 ohms. Not only does this reduce the plate current but also provides greater volume of sound. The usual recommendation in tube characteristic tables is 20,000 ohms, but this is not a critical value, and a 1-watt resistor may be used in the plate circuit, if 100,000 ohms, and likewise a 1-watt resistor for the bias (5,000 ohms). This bias is sufficient, about 9 volts negative, which is the specific recommendation of some of the tube manufactures for the 56 when resistance coupling is used. It is not necessary to use the full recommended bias for the triode of the 55, or 20 volts, especially as there is no possibility of any rectified voltage being fed from the diode that would require any such bias. On signal considerations alone 2 volts negative bias would be enough. However, we have combined the bias, making it the same for two tubes, and used a large condenser (8 mfd.) across the resistor.

That the whole circuit is gaited properly to audio frequencies is the belief of the author, and the low frequencies are well handled, compared to the usual shortcomings in this direction.

Incipient Motorboating

A slight drumming sound when the set is first turned on, due to the effectiveness of the capacities used for filtering not being instantaneous, is preliminary motorboating, and, if present, should be tolerated, as it subsides entirely before the heater tubes emit sufficiently for the program to be audible. If it is desired to get rid of this incipient motorboating it may be done quite handily by using a lower value of leak in any one of the audio grid circuits.

The B supply choke is shown in the negative leg, as it is assumed that a dynamic speaker's field coil will be used. At 1800 ohms d-c resistance, with 60 ma flowing, a little more than 100 volts will be dropped across this choke. Since the bias for the '45 tube is taken from a division of this voltage drop, if the two equal resistors are used the bias will be equal to half the voltage drop. Meters of the current-drawing type will not accurately read the voltage distribution across the resistors, as only 1 ma is flowing, but the total voltage can be read accurately, because of the choke coil carrying 60 ma, and the bias voltage will be proportionate to the resistance distribution, e. g., 50,000 ohms, or other equal values, will give a bias of half the drop.

Higher Plate Voltage

With the bias obtained in this way the plate voltage is the voltage between B plus and ground. Assume this is 250 volts, as shown on the diagram (voltage actually between filament center and plate return). Then the only remaining consideration is the voltage for negative bias of the '45. This is stated in the tube characteristic chart as 50 volts. Another handy piece of information is that the plate current under these

(*Continued on next page*)

Reading A-C Voltages

Diode and D-C Meter Are Used

By Braley Thompson

MANY persons have sensitive current meters, 0.1 or 0.5 milliampere, for instance, but these are d-c instruments, and it is desired to measure a-c voltages. This can be done handily by using a tube as diode detector, thus rectifying the a-c. The meter is put in the cathode circuit, which consists of the combined plate and cathode of a '27 or 56 tube, it matters not which, except that the heater current for the 56 is only about 0.6 that of the '27. The 2.5 volts for the heater may be a-c or d-c.

Thus a-c voltages of radio or audio frequencies may be measured, except that low voltages could not well be read, because they would not produce sufficient current. On the current score one would have to select for the resistor R a value that will give a good deflection for medium voltages, depending on the sensitivity of the meter. The less current drawn by the meter at maximum deflection the more sensitive the meter.

Needs High Resistance

Like the diode used as detector in radio receivers, this one will need a high resistance for R, because we have to limit the current. Disregarding the low resistance of the tube itself, the resistor R may be around 100,000 ohms, to enable putting the a-c line voltage across the connecting points, for approximate full-scale deflection. Assuming the line voltage to be 110 volts, the resistance that gives full-scale deflection is the one that limits the maximum reading to 110 volts, whereas the other extreme depends on how closely the low current readings may be taken. The number of meter divisions likely will be 20 or 30, so, roughly, around 5 volts would be the lowest reading. To read lower voltages use a lower value of resistor, but of course then the whole scale is shifted, in a sense, and the maximum reading will be lower, too. If the resistance is halved the voltage reading possible is approximately halved.

Thus you may select the desired range. When that is done it is necessary to calibrate the meter in terms of current plotted against the known a-c input voltages. But the input a-c voltages are the very ones you desire to obtain. True, but you will have to borrow an a-c meter, and by using a resistor across the 110-volt line, with an a-c meter as check, take off various voltages and run a curve wherein the other variable is the current.

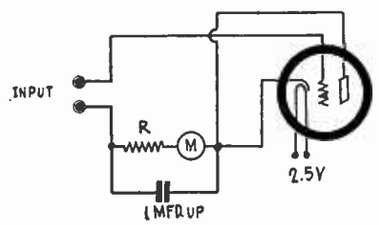


FIG. 1

Very simple tube circuit, requiring no B voltage, but enabling reading a-c voltages, audio or radio frequencies, with the aid of a sensitive d-c meter.

By selecting just the right value of resistance the calibration can be made to come out fairly even, so that even numbers of voltages will fall on even numbers of the meter scale.

Approximate Linearity

The series resistance is so high compared to the sum of the resistances of the meter itself and of the tube, that the voltages are substantially proportional to the current, or the resistance of the total is approximately steady. A limiting factor is the varying resistance of the tube when too much current is drawn, so that if the current is limited to 0.5 ma, even though you have a 0-1 ma, the result will be closer to linearity.

Another fact to consider is that the calibration will be made at audio frequency (60 cycles) and it would be difficult indeed to get hold of an r-f voltmeter, for it is expensive and a person doesn't like to lend (or borrow) it. However, the tube rectifier is better than the copper oxide type so far as permitting a wider range of frequencies, with smaller error, and radio frequencies may be measured on the basis of the audio frequency calibration. The accuracy will not be quite as good, as for a-f, but it will be passable. The tube capacity will detune the measured r-f circuit in many instances, also, but this could be compensated for by putting a large coil, with a small tuning condenser across it, in parallel with the input points. It would have to be a coil the impedance of which is suitable for the frequencies handled, but as radio frequencies are at stake at the moment, a 300-turn honeycomb coil with a 0.0001 to 0.00015 mfd. condenser across it would suffice.

Why Compensation Results

The parallel coil reduces the inductance, but the parallel condenser increases the capacity, so that resonance may be established, whereas without this or some other similar arrangement there'd be some detuning, which would make the voltage read less than it actually is in the set without the tester connected.

As audio frequencies are to be read, the bypass condenser across the load resistor must be at least 1 mfd., and if you have an 8 mfd. electrolytic condenser, or any other capacity more than 1 mfd., you may use that. While the condenser-resistor circuit has different impedances to different frequencies, this applies to audio frequencies only, and the larger the condenser, the smaller the difference. Besides, if notation is made of various audience frequencies, calibration for the usual selection of test frequencies may be carried out. These frequencies are 60 cycles (due to easy access to the line), 200, 400, 800, 1000 and 5000 cycles.

Voltage Options for T-R-F Set

(*Continued from preceding page*)

conditions should be 34 ma, so, knowing the plate voltage, the bias may be adjusted, if desired, to produce a flow of 34 ma in the '45 plate circuit alone.

Shielding Precautions

If the voltage actually is more than 250 volts, up to 275 volts, the bias should be increased a little, for instance, for 275 volts the bias should be 56 volts negative, and the plate current then 36 ma. No matter if the plate voltage is higher, the plate current should not exceed 36 ma, as it is the current limitation that is important, rather than the plate voltage. Higher voltages than 250, up to nearly 300 volts, may be treated on this basis, but no alteration need be made in any other part of the circuit on this account, for instance r-f plate, screen and biasing resistors, or audio load or biasing resistors.

It has been said that the sensitivity is about the same as that of the previously standard t-r-f set. This is true despite the use of the '45 power tube (mu of 3.5), chosen for its standing of a greater signal input, and also because of the much better quality obtainable, for the second harmonic distortion is under 5 per cent. and the third harmonic distortion virtually absent, though it abounds in pentodes (mu of 95). There is little use in designing a circuit to take the 55 tube and then use a pentode output tube. Then you would be building up quality to destroy it.

Coil Information

Three coils are used and they must be shielded. Also the tuning condenser, a three-gang, should be shielded. Besides, there are special tube shields for the 58, and these should be used. The shields for the 58 have a removable cap that fits over the top of the tube dome as a companion to the shield built inside the tube. Also, the 55 should have a tube shield, though this may be of the general type, whereas the use of a shield for the 56 is optional. The '45 and the '80 should not be shielded. All shields must be grounded.

Careful shielding is recommended for the 58 in circuits that are very sensitive, but the rule in practice should be to use all care in shielding even in a set like this, for the sensitivity easily may rise to the squealing point. Therefore commercial coil and other conditions taken into consideration, the voltages at the r-f end should be derived through resistors approximately as stated.

Twins for 0.00035 Mfd.

The coil data are as follows: For L1, L2 and L3L4, wind secondaries L2 and L4 on 1 inch diameters, 127 turns of No. 32 enamel wire. Put on three layers of insulating fabric, or wrapping paper if you can't do better, then wind the primaries, consisting of 30 turns of any kind of insulated fine wire, say No. 40 silk. L5L6 is wound the same way, but inside this form, and finally attached to it by means of nut and machine screws, a ¾-inch diameter form is wound with 150 turns or more of No. 32 enamel wire, center tapped.

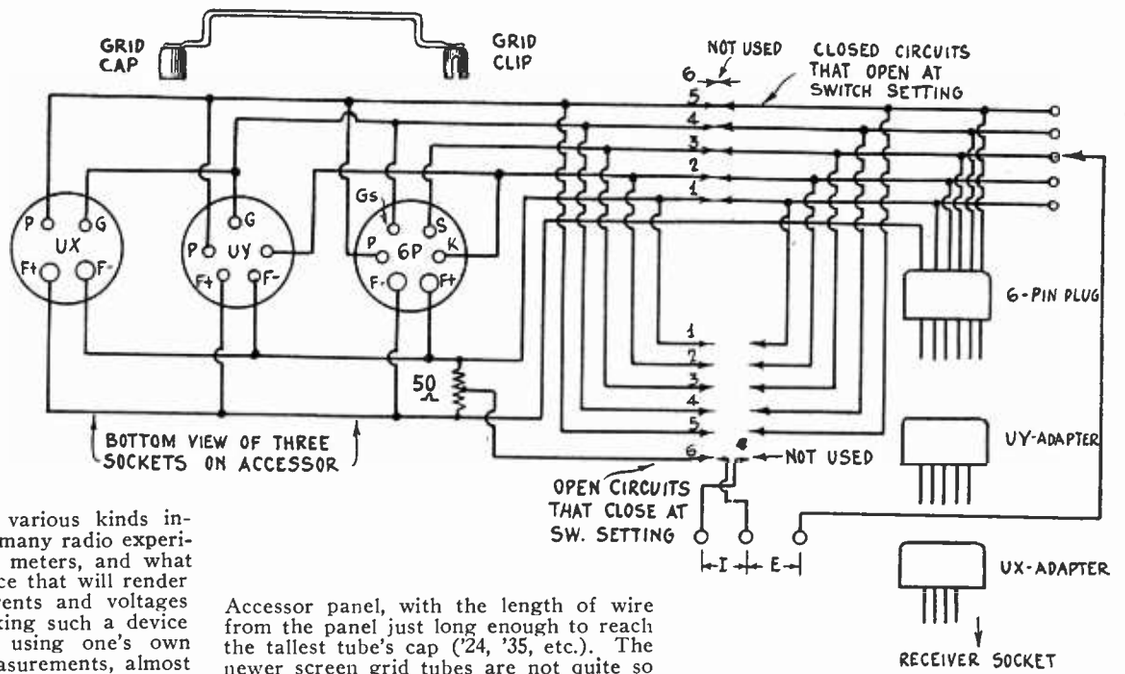
The data are for condensers of 0.00035 mfd. capacity.

Automatic volume control can not well be used with a receiver of this type but is reserved principally for superheterodynes.

DEVICE GIVES ACCESS TO SET CAN TAKE

By Paul

Diagram of a device for rendering the currents and voltages of a receiver accessible by plugging in. The meter is external and its connections thus may be reversed if circumstances require. The different readings are obtained by switching



SET TESTERS of various kinds include meters, but many radio experimenters have the meters, and what they want is some device that will render access to receiver currents and voltages for measurement. Lacking such a device it is necessary when using one's own meters for current measurements, almost always to break the line, actually cut or unsolder, and that is no nuisance to have to tolerate.

Therefore consideration was given to a device that would render the currents accessible, as that is the principal difficulty, the voltage access being simple enough, for one would have merely to turn the chassis upside down. Yet when the currents are readable so are the voltages, with slight extra provision, therefore the present device, called the Accessor, requires only that you plug into the receiver socket to read both currents and voltages.

One Avoidance of Adapters

Since the six-pin tubes came on the market, with sockets to fit, quite a few changes became necessary so that existing testers would meet the most modern requirements. The easiest method perhaps is to use the six-pin socket as a starter, but of course adapters may be used instead. For the Accessor instead of adapters being used on its panel it was deemed preferable to include three sockets—UX, UY and six-pin—which would take care of virtually all the tubes that are taken from set sockets to be put into the Accessor. Exceptions are the WD-11, WD-12, UX-199 and UV-199, but these are not often encountered, and any who desire to provide for testing them may obtain the adapters.

Remember that we are talking about only the panel of the Accessor, and are excluding adapters, save for the special purpose of the few uncommonly used tubes. The three sockets on the Accessor panel suffice, therefore, but one extra provision has to be made. Two of the sockets may on occasion (one at a time) contain a screen grid tube that has grid cap on top. When a tube is taken from the receiver it is placed in the appropriate socket of the Accessor. Therefore a grid clip would be left unconnected, and yet its destination must be the cap of the tube. Thus a grid clip is provided on the Accessor panel, with the length of wire from the panel just long enough to reach the tallest tube's cap ('24, '35, etc.). The newer screen grid tubes are not quite so high as the '24 or '35. The clip goes on the cap, but then a lead is continued from clip, under the Accessor panel, to between the next two sockets, where emerges a very long lead with a grid cap to reach over to the grid clip of the set for connection. This lead may be 4 feet.

Adapters at Plug End

The warning has been given that only for the Accessor panel are adapters omitted, and sockets of three varieties used to take their place. However, at the receiver we don't know just what kind of a socket we shall have to plug into, so we provide a six-lead cable with a six-pin plug, which will take care of six-pin tubes, with or without grid cap, but will take care of no other tubes. Therefore we need adapters here for a certainty.

The advent of the six-pin tube has brought on the market adapters that, when used with the six-pin plug of the cable, will render access to UY and UX sockets, also to sockets for 11, 12, UX-199 and UV-199 and special types of tubes, as found generally in old sets made by the smaller manufacturers. Other than UX and UY these adapters would have to be duplicated at Accessor and receiver points. However, we are stressing the general use of the Accessor for sets with the most popular and prevalent types of tubes.

Now, let us see how we accomplish the very thing we set out to do.

In the first place, we wanted to obtain access to the current-carrying lines, so a meter could be slipped in series, for measurement of the current. Obviously we must create a condition whereby when the meter is in circuit the current flows through it, but when the meter is out of circuit the circuit is closed and the current flows through the circuit but not through the meter—at least not that particular current.

We shall use a switch, so it must be one that has closed circuits, except as one circuit at a time is opened by particular switch settings. If the greatest number of leads is six, then we need at least five different positions, for filament or heater need not be duplicated, but as we desire also to measure voltage we must include a sixth position on the switch to enable the meter to be thrown off the current-reading points to a voltage-reading point.

Operation Tabulated

Now let us obtain access to the currents.

The operation is as follows:

(1)—A plugged six-lead cable is used, as previously stated, being inserted in the receiver socket from which the tube whose circuit is to be tested has been removed. The tube is put in an accessor socket.

(2)—The free ends of the six-lead cable are connected to the corresponding springs of the six-pin socket in the Accessor, through the points of the switch that have closed circuits except when at a particular switch setting the circuit is opened. Across the five positions of this switch are connected equivalent points, representing identical switch pointer positions, of switches that are open circuits until closed by the switch point setting. The open-circuit switch consists simply of two tabs or lugs with contact positions which are met by two sliders, one for each tab. To these sliders the meter is connected, at the binding posts on the Accessor panel.

(3)—Now the current flows through all the circuits, without interruption, except for the one instance of a particular switch setting for current reading, when the closed-circuit switch is opened and the meter is put in between the open points, thus closing the circuit in fact, but with the meter as the closing element. In this way by turning the switch to any one of five positions the currents may be read, although the precaution must be taken to have the right meter, or right deflection option where there is a multiple-purpose meter, so that a 0-1 milliammeter will not be at 0-1 position for reading

SO YOU READINGS WITH OWN METER

Erwin

power tube plate current, or indeed that a current-reading meter should not be used when voltages are to be read.

Code Explained

The switch, shown at left on the panel diagram, bears numerical markings actually, but if you want to engrave the panel you may do so as shown. I_{fh} means filament or heater current; I_k means cathode current; I_{gk} means current in the grid adjacent to cathode; I_{gp} means current in the grid adjacent to plate; I_p means plate current and E means voltage. Thus for voltage readings the current switch must be turned to E, which accounts for the sixth position.

Socket pin adjacency, not tube geometry, is meant.

At right is another switch, separate and distinct, for obtaining the voltage readings when the current switch is turned to E. These voltages are E_f, for half the fila-

$$\frac{}{2}$$

ment voltage; E_k for cathode voltage; E_{gk} for voltage of grid adjacent to cathode; E_k for cathode voltage and E_p for plate voltage.

Since the neutral point is the center of the filament or heater the total voltage across the filament of a battery-operated tube, filament or heater of an a-c type tube, can not be read, but the half reading must be multiplied by two to obtain the total. When a-c is used the meter has to be of the a-c type.

Correct Interpretation

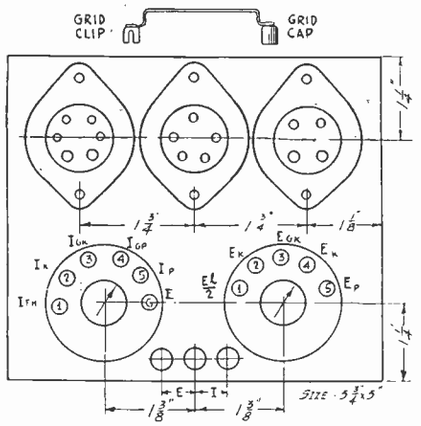
The reason for selecting the midpoint of filament or heater is that in most a-c circuits, and such circuits are in the preponderance, the center is grounded and is B minus. This is an easy and good way to pick up grounded B minus, otherwise hard to establish through plug-in devices and requiring a separate lead to chassis. The method, however, introduces the possibility of erroneous interpretation of readings, and therefore the correct basis of application will be explained.

In battery-operated tubes the reference point is the negative filament, and the reading is always taken from center to negative filament, that is, half the filament voltage is read. Therefore a plate voltage reading would give, say, 135 volts, on the meter, but we know this has been taken from the center of the filament, which is positive in respect to filament minus by half the filament voltage. If the tube has a 2-volt filament voltage and the plate voltage reading is 135 volts, the actual plate voltage is the sum of half the filament voltage reading and all the plate voltage reading, or 136 volts.

With heater type tubes the voltage on the plate, screen grid or other positively or neutrally biased grid, as the suppressor, is the difference between the cathode and the B voltages. Here we have no method of directly measuring that difference, for one side of the voltmeter goes not to cathode but to heater center, which is nearly always grounded B minus, and the voltage we read is that between the set's B minus and the effective plate voltage.

Meter Error

However, we can read the cathode voltage itself. Therefore the B voltage



Three sockets are on the panel of the Accessor, to receive different type tubes, while grid cap and clip connections also are provided. The code is explained in the text.

distribution includes plate and cathode voltages as read for E_p, and if we subtract the cathode voltage E_k from the plate voltage reading we have the effective plate voltage. It will be the true effective plate voltage, too, except for error due to the current drawn by the meter, which is of no importance whatever, except where there is a plate load resistor. As the meter is no part of the Accessor, it is up to the user to provide a meter of sufficient sensitivity if he desires accuracy even in the case of resistance-coupled amplifiers. Voltmeters of the 1,000-ohms-per-volt type are not nearly sensitive enough for real accuracy in such cases, as the error may be as much as 50 per cent. At least use the highest voltage scale possible, as this reduces the percentage of error, because less current is drawn by the meter for the reading of the voltage.

The switch used is a commercial product. It has five thick insulators stacked up, one for the detent, for preventing play at switch points, two for the open circuit switch and two on the closed circuit switch. The slider connections are to two lugs non-symmetrically placed. The other lugs, four to a position, or 24 lugs, are symmetrically disposed. The Trade Editor of RADIO WORLD will answer questions concerning commercial products.

Radioists are familiar enough with the old tubes to be able to obtain definite guidance from the symbols given, but as to the new tubes there may be some confusion, due to lack of familiarity. At present not enough such new sets are in use to make this important, and they probably won't require servicing for six months or so. Meanwhile the service man and experimenter should familiarize himself with the connections, characteristics and other pointers about the new tubes, and keep posted on still newer ones as they come along. The full information of the 46, 56, 57, 58 and 82 will be found in the April 30th, 1932, issue of RADIO WORLD, that on the 55 in the July 16th, 1932, issue, that on the 89 in the July 23rd, 1932, issue, and that on the 83 in the present issue. As new tubes are brought out detailed information concerning them will be published in these columns.

Some Pointers on Tubes

The 82 and 83 are mercury vapor rectifiers, and their connections are the same as those for the familiar '80 rectifier.

The 56 and the '27 have identical connections.

The 58 has six pins and a grid cap. The heater pins are at the familiar position, and next to heaters are cathode and plate, on either side, the suppressor grid being next to cathode and the screen grid next to plate.

The 57 has the same connections as the 58.

The 46 is a power tube, with UY base, but only four connections used electrically, as for one type of service (Class A) the extra grid is tied to plate, while for the other type (Class B) the two grids are tied together. The unchanged grid is the one equivalent to G post of the '27 and 56 type tubes. The grid at the cathode position as found in the '27 and 56 is connected either to plate (Class A) or to control grid (Class B).

The 55 has the usual heater connection, cathode is as in the '27 and 56, plate is as in other tubes, while the two anodes are the remaining pins, in line with the heaters.

The 85 is the automotive tube equivalent to the 55 and the connections are the same as for the 55.

The 89 triple grid heater type power amplifier has a six-pin base, heater, cathode and plate standard, with the two grids in line with the heater. The three grids are (1) cap of tube, (2) grid that adjoins plate, and (3) grid that adjoins cathode. These grid numbers are standard. The complete exposition of this tube in last week's issue should be studied. The tube may be used as a Class A power amplifier triode, a Class A power output pentode or a Class B power output triode, depending on the connections of grids, as outlined last week.

The three posts on the Accessor represent one extra for safety, so that there will be less likelihood of meter injury.

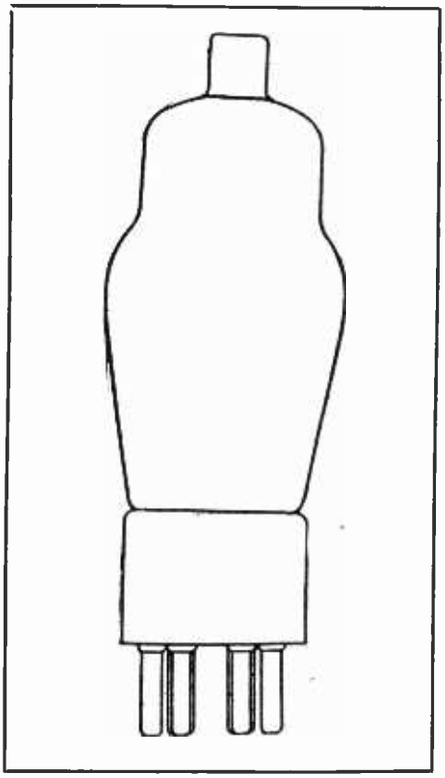
1,103,548 Receivers Are in Use in Japan

Washington

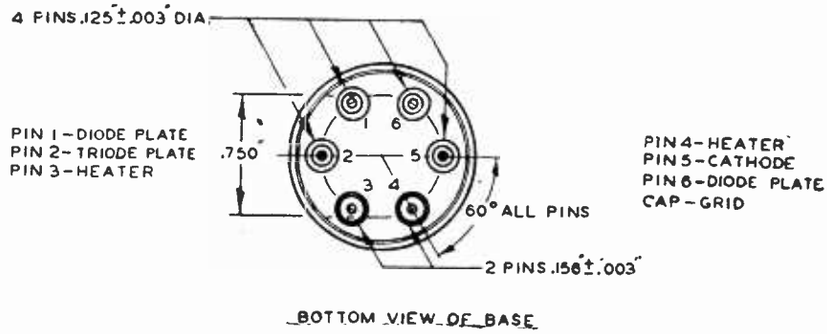
The total number of receiving sets in operation in Japan at the end of April was 1,103,548, according to a report to the Department of Commerce from Assistant Commercial Attache William S. Dowd, Tokyo. In that month alone 58,951 permits were approved, although all sets in private hands pay a monthly fee of 25 cents.

Increasing interest in short-wave international broadcasts, according to Mr. Dowd, seems to indicate that the Japanese government will eventually modify the ban on short waves to permit the public to use short-wave sets. Such action would undoubtedly increase the imports from the United States, for a while, at least, because at present Japanese manufacturers make only long wave sets. At the present time these sets are supplied almost exclusively by home manufacturers.

85 DUPLEX DIODE-TRIODE FO OFFICIAL DATA



The 85, actual size



BOTTOM VIEW OF BASE

Following are data from RCA Radiotron Co., Inc., and E. I. Cunningham, Inc.:

THE 85 is a heater type of tube consisting of two diodes and a triode in a single bulb. It is recommended for automobile service as a combined detector, amplifier and automatic volume control tube.

In operation, the two diodes and the triode are independent of each other, except for the common cathode sleeve which has one emitting surface for the diodes and another for the triode. This independence of operation permits of unusual flexibility in circuit arrangement and design. For example, the diodes of this tube can perform at the same time the functions of detection and of automatic volume control, with sensitivity control and time delay action confined to the avc circuit, while at the same time the shielding incorporated in the design between the diodes and triode makes possible operation of the triode as an amplifier under its own optimum conditions.

The design of the 85 is characterized physically by the small overall size, the dome-top bulb, the rigidity of electrode assembly, the symmetrical arrangement of diode plates, and the separate terminals for each electrode.

Diode Detector Considerations

The simplest form of tube detector is the diode. Its action depends on the unidirectional passage of current between plate and cathode. In the direction opposite to that producing current, the resistance of the diode is extremely high while in the other direction its resistance is quite low. This means high rectifying efficiency.

The current flowing between plate and cathode through a low resistance current measuring device depends not only on the applied signal voltage (at a fixed cathode temperature), but also on the tube resistance and follows approximately the relationship $i = k$ times the 3/2 power of the signal voltage. If the load resistance is made sufficiently high the effect of the tube resistance is negligible and the dynamic characteristic becomes linear. Since the diode resistance is low, the load resistance required to produce approximate linearity is conveniently obtainable. Under these conditions the diode as a means of rectifying the incoming signal is particularly suitable because of its freedom from distortion.

Since the diode is a simple rectifier, it does not amplify. If increased voltage output is desired, an auxiliary amplifier stage is necessary.

Two diodes may be used for full-wave rectification or their plates may be connected in parallel (with decreased tube resistance) for half-wave rectification. With full-wave rectification, the circuit may be balanced for carrier input so that no carrier frequency is supplied to the grid of the following amplifier and no carrier-frequency filtering is theoretically necessary. Half-wave rectification as compared with full-wave rectification provides approximately twice the signal output but requires carrier-frequency filtering.

Tentative Characteristics of 85

Heater Voltage	6.3 Volts
Heater Current	0.3 Ampere
Overall Length	4 9/32"—4 17/32"
Maximum Diameter	1 9/16"
Bulb	ST-12
Cap	Small Metal
Base (Refer to Drawing No. 92S-4190)	Small 6-Pin

TRIODE UNIT

Operating Conditions and Characteristics: (Class A Amplifier)

Heater Voltage	6.3 Volts
Plate Voltage	250 Volts Maximum
Grid Voltage	—20 Volts
Amplification Factor	8.3
Plate Resistance...	8300 Ohms
Mutual Conductance	1000 Micromhos
Plate Current	7 Milliamperes

DIODE UNITS

Two diode plates are placed symmetrically around a cathode, the sleeve of which is common to the triode unit. Each diode plate has its own base pin.

Rating Conditions and Characteristics:

With an applied d-c plate voltage of 10 volts, the space current per plate with no external load should exceed 0.5 milliampere.

Installation

The base of the 85 is of the small 6-pin type. Its pins require the use of a standard six-contact socket which may be installed to operate the tube either in a vertical or in a horizontal position. For horizonal operation, the socket should be positioned with its heater pin openings one vertically above the other. Base connections and external dimensions of the 85 are given in the drawing. The control-grid connection is made to the cap on top of the tube.

The bulb surface temperature on the hottest part of the bulb under operating conditions should not exceed 150° F. as measured by a small thermo-couple. Shield-cans, if used, should provide sufficient ventilation to prevent the bulb temperature from rising above the recommended maximum value.

The heater is designed to operate under the normal conditions of voltage variation of a 6-volt automobile battery. Due to the heater-cathode design, the heater voltage may range between 5.5 and 7.5 volts during the charge and discharge cycles of the battery without affecting to any great extent the performance or serviceability of this tube. The heater should be connected directly across a 6-volt battery: leads to the battery should have as low resistance as practicable.

The cathode circuit in most d-c re-

85 Designed Especially for Mobile Services

Designed especially for all types of mobile service, the 85 is in reality three tubes in one—two diodes and one triode employing a common cathode sleeve, but each operating independently of the other. The 85 is capable of performing simultaneously the functions of detection, amplification, and automatic volume control of the input signal.

The design features of the 85 permit of unusual flexibility in its application to receiver circuit design. Numerous compact designs with excellent performance capabilities are thus made possible by this new type.

R AUTO SETS; ON THAT AND THE NEW 83

ceivers is usually tied in either directly or through biasing resistors to the negative side of the heater circuit. The potential difference thus introduced between heater and cathode should preferably be kept as much as possible below the recommended maximum of 45 volts.

Complete shielding of detector circuits employing the 85 is generally necessary to prevent r-f or i-f coupling between the diode circuits and the circuits of other stages.

In the case of full-wave detection, with circuits balanced to ground, shielding and i-f by-pass filters are not theoretically required. However, due to the practical difficulties of circuit balancing, their use is desirable. In the case of half-wave detector circuits, their use is always necessary.

Application

The 85 is recommended for performing the simultaneous functions of automatic volume control, detection, and amplification. This three-in-one feature is of decided practical importance to the set designer.

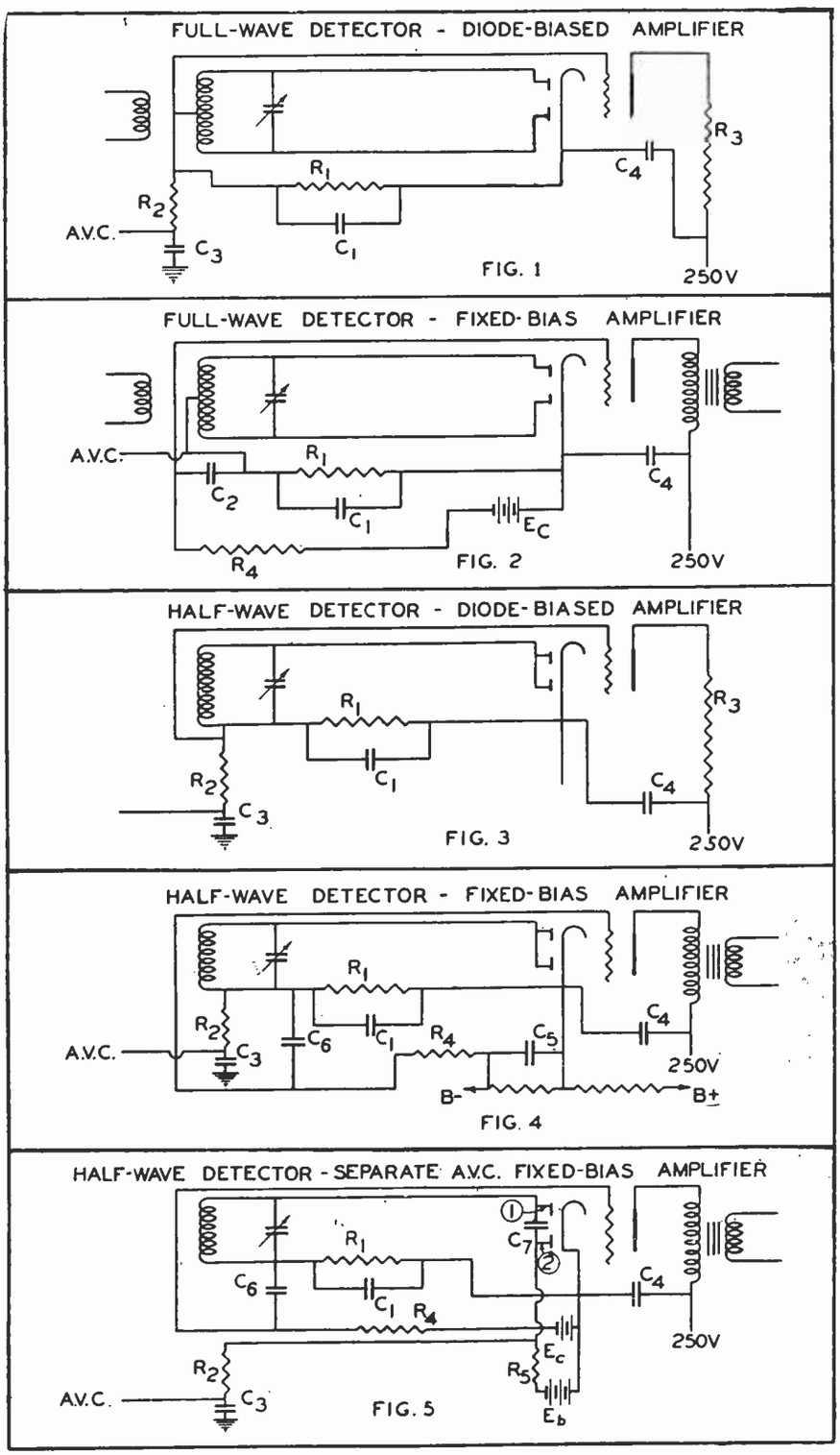
The application of this tube to receiver circuit design gives the engineer wide latitude in possible tube-unit connections. Since the 85 really consists of two diodes and a triode, each of these tube-units may be used in a circuit just as though it were in a separate bulb.

For detection, the diodes may be utilized in a full-wave circuit or in a half-wave circuit. In the latter case, one plate only or the two plates in parallel may be employed. The use of the half-wave arrangement will provide approximately twice the a.v.c. voltage as compared with the full-wave arrangement.

For automatic volume control the controlling bias voltage may be obtained by either of two general methods. In one case, the required voltage is obtained from the detector circuit by utilizing the voltage drop caused by the rectified current flowing through a resistor in the detector circuit. In the other case, the required voltage is obtained by utilizing one diode for the sole purpose of automatic volume control. This latter method is of particular interest since it confines the sensitivity and time delay function to the a.v.c. circuit. Time delay action is, of course, determined by the use of a resistance and condenser combination having the desired time constant. The sensitivity control action is determined by applying a negative voltage to the a.v.c. diode plate of such a value as to accomplish the desired reduction.

For amplification, the triode may be employed in conventional circuit arrangements. Grid bias for the triode, depending upon circuit design, may be obtained from a fixed voltage tap on the d-c power supply or may be obtained by utilizing the variable voltage drop caused by the rectified current flowing through a resistor in the detector circuit. In this connection, it should be noted that the accompanying diagrams designate this latter arrangement as "Diode-Biased Amplifier."

The diagrams of Figs. 1 to 5 illustrate the application of the 85 to typical circuits. Fig. 1 shows Full-Wave Detection and Automatic Volume Control with the triode "diode-biased." R1 is a resistor of



the order of 0.5 megohm shunted by a condenser C1 of approximately 150 mmfd. for broadcast frequencies or approximately 600 mmfd. for usual intermediate frequencies. The load resistance R3 is not critical and may be about 100,000 ohms. The values of resistors and condensers having the same subscripts on all diagrams are of the same order of magnitude.

Fig. 2 shows a full-wave detection and automatic volume control arrangement with a fixed-bias triode. R4 and C2 are approximately 0.5 megohm and 0.01 mfd. respectively.

(*Continued on next page*)

(*Continued from preceding page*)

Fig. 3 shows a half-wave detection and automatic volume control arrangement with the triode "diode-biased."

Fig. 4 shows a half-wave detection and automatic volume control arrangement with a fixed-bias triode.

Fig. 5 shows an arrangement whereby one diode serves as half-wave detector, the other diode as automatic volume control tube, and the triode as an amplifier with fixed bias. The use of a voltage Eb for sensitivity control is also illustrated. Diode plate 1 serves as demodulator (detector), while diode plate 2 is used for a-v-c purposes.

In the diagrams with fixed-bias applied to the triode, transformer coupling has been shown. This arrangement, however, is not recommended for the "diode-biased" circuits.

83

THE 83 is a full-wave, mercury vapor rectifier tube of the hot-cathode type for use in suitable rectifying devices designed to supply d-c power from an a-c power line. It is particularly recommended for supplying power of uniform voltage to receivers in which the direct current requirements are subject to considerable variation. Typical of such receivers are those employing Class B power amplifiers.

The excellent voltage regulation characteristics of the 83 is due to its low and practically constant voltage drop for any current drain up to the full emission of the filaments. Under normal operating conditions, the tube voltage drop is only about 15 volts. This desirable feature makes it possible to attain very high overall operating efficiency.

The coated filaments employed in this tube provides an efficient source of electron emission, and reach their dull red operating temperature quickly.

Under operating conditions, the 83 has a bluish-white glow filling the space within the plates and extending to some degree into the surrounding space. This glow, caused by the mercury vapor, is an inherent operating characteristic of the 83.

The effect of the mercury vapor in the 83 is to neutralize the space-charge voltage drop so that it amounts to only about 15 volts at normal operating temperatures. This drop remains practically constant with any current drain up to the full emission of the filaments. It is apparent therefore that this tube under operating conditions has very low internal resistance, and that the current it delivers depends on the resistance of the load and the regulation of the power transformer. Sufficient protective resistance or reactance must always be used with this tube to limit its current to the recommended maximum value.

If current in excess of the total effective emission of the filaments is drawn, the tube voltage drop increases rapidly with current and thus causes harmful positive ion bombardment of the filaments. This bombardment may be so great as to cause permanent damage to the coating on the filaments in a short time.

It is characteristic of mercury vapor rectifiers that no appreciable plate current will flow until the plate voltage reaches a certain critical positive value. At this point the plate current rises steeply to a high value in a small fraction of a second. This surge of current reoccuring each time either plate becomes positive, may excite circuits in the vicinity of the tube to damped oscillation and result in noisy radio receiver operation. In receivers of low sensitivity, this noise may not be apparent but in very sensitive receivers it may be necessary to enclose completely the mercury vapor rectifier tube with perforated metal or wire screen shielding to eliminate objectionable noise. The shielding must be designed to provide sufficient ventilation to prevent overheating of the tube. It is usually necessary to place within the shield, small radio-frequency choke coils of low distributed capacity in series with each plate lead of the rectifier so that the slope of the current wave front to the filter is reduced sufficiently to eliminate impact excitation.

A further consideration in the operation of this mercury vapor tube is that the full plate load must not be applied until its filaments have reached their normal operating temperature. Under normal conditions of operation, they heat quickly when the set is "turned on" and are ready to supply the full load current before the tubes in the receiver require it.

TENTATIVE RATING AND CHARACTERISTICS

Filament Voltage.....	5.0 Volts
Filament Current.....	3.0 Amperes
Maximum A-C Voltage per Plate.....	500 Volts (RMS)
Maximum Peak Inverse Voltage.....	1,400 Volts
Maximum D-C Output Current, continuous.	250 Milliamperes
Maximum Peak Plate Current	800 Milliamperes
Tube Voltage Drop (approx.)	15 Volts
Maximum Overall Length	5 3/8"
Maximum Diameter..	2 1/16"
Bulb	ST-16
Base	Medium 4-Pin

Installation

The base of the 83 is of the medium 4-pin type. Its pins fit the standard four-contact socket which should be installed to operate the tube in a vertical position with the base down. Only a socket making very good filament contact and capable of carrying 3 amperes continuously should be used with the 83. Unless this precaution is followed, poor contact at the filament pins will cause overheating at the pins and socket, lowered filament voltage. and also high internal tube drop with consequent injury to the tube. Base connections and external dimensions of the 83 are given in a drawing.

The bulb becomes hot during continuous operation. Provision should be made, therefore, for adequate natural ventilation to prevent overheating. This point must be given proper consideration if shielding is employed around the tube.

The filament is intended for a-c operation from one of the secondary windings of a power transformer. This winding provided with a center-tap or center-tap-resistor should supply at the filament terminals the rated operating voltage of 5.0 volts when average rated voltage is applied to the primary.

The high current taken by the filament and the danger of damage to the tube caused by applying plate voltage to the tube with its filament insufficiently heated, make it imperative that all connections in the filament circuit be of low resistance and of adequate current-carrying capacity. All wire connections should be carefully soldered.

The plate supply is obtained from a center-tapped high voltage winding on the power transformer. This winding should be designed so that the maximum a-c input voltage per plate will not exceed 500 volts RMS under varying conditions of supply line voltage. The return lead from the plate, i.e. the positive bus of the filter and load circuit, should be connected to the center-point of the filament transformer.

The secondary windings of the power transformer should be adequately insulated from each other to withstand the full peak voltage of the high voltage winding. Under recommended maximum operating conditions, the full peak voltage will be about 1,400 volts. The resistance of the transformer windings should of course be low if full advantage of the excellent regulation capabilities of this mercury vapor rectifier is to be obtained.

Shielding this tube, particularly in sensitive receivers, may be necessary to eliminate objectionable noise.

Radio-frequency choke coils, connected in series with each plate lead and placed within the shielding if used, are usually necessary in receivers having high sensitivity. The inductance of the chokes should be of the order of one millihenry or more.

A fuse having a rating approximately 50% in excess of normal lead requirements should be inserted in the primary of the power transformer. This fuse is necessary to prevent damage to the power transformer in case of excessive current which may flow under abnormal conditions.

Application

The 83 is recommended for supplying d-c power to receivers, particularly those employing Class B amplification in the audio output stage. The direct current requirements of such receivers are such as to cause considerable variation in the load impressed on the rectifier tube. Unless the tube and its associated circuit can take care of the load demand with good regulation, unsatisfactory receiver performance fill be obtained. To meet this operating requirement for extremely good regulation even though the load current is subject to considerable variation depending on the signal, the 83 is especially suited.

In order to take full advantage of the regulation capabilities of this mercury vapor rectifier, the resistance of the transformer windings (refer to "Installation") and the filter choke windings should be as low as practicable. Since the drop through the tube is practically constant, any reduction in rectified voltage when the load is increased, is due to the drop in the transformer and/or the filter windings.

If is it impracticable to use a transformer with sufficiently low resistance to give the desired regulation, improved regulation of the ouput voltage may be obtained by employing a bleeder across the filter circuit.

Filter circuits of the condenser input or the choke input type may be employed provided that the maximum voltages and currents tabulated under "Rating and and Characteristics" are not exceeded.

If the condenser input type of filter is used, consideration must be given to the instantaenous peak value of the a-c input voltage which is about 1.4 times the RMS value measured from plate to filament with an a-c voltmeter. It is important, therefore, that the filter condensers (especially the input one) having a sufficiently high break-down rating to withstand this instananeous peak value. It should be noted that with condenser input to the filter, the peak plate current of the tube is considerably higher than the load current. With a large condenser in the filter circuit next to the rectifier tube, the peak current is often as much as four times the load current.

When, however, choke input to the filter is used, the peak plate current is considerably reduced. This type of circuit, therefore, is to be preferred from the standpoint of obtaining the maximum continuous d-c output current from the 83 under the most favorable conditions.

[*Illustrations regarding the 83 were published last week.*]

The 55 for R-F and Detector

One-Tube Set May Work Speaker

By Caswell Henry

REMEMBER the old one-tube set that operated a loudspeaker? The set that used one regenerative tube, a crystal detector, and a magnetic speaker? While this set did not give a great deal of volume it did bring in signals from the low-power local stations in vogue at the time. The set had one very disagreeable feature, and that was the inconstancy of the crystal rectifier. It was forever necessary to make adjustments of the cat whisker. (Quaint, old word, is it not?)

There is a certain reviving interest in the one-tube set, but the crystal and the cat whisker must be left out. We have in the 55 tube a means for returning to the one-tube regenerative set without the nuisance of continuous adjustment, for the 55 can be used as a regenerative amplifier and as half-wave rectifier.

A circuit of this type is shown in Fig. 1. First, it consists of a regular three-circuit tuner comprising a primary, a tuned winding, and a tickler. This coil should not be like the modern midget coils if loud signals are to be expected for they are only suitable in multitude sets utilizing screen grid tubes. No, the coil should be one of those low-loss coils which at one time were so popular in radio. Such coils are still available in radio stores, if they are not in the experimenter's radio morgue. It should not be shielded.

Aperiodic Coupling

In the plate circuit, coupling the amplifier to the rectifier, is an untuned radio frequency transformer. This is an old-time piece of apparatus, too, and there is evidence that it will come into wide use again. An untuned transformer requires tight coupling between the two windings, just about as tight as possible, provided that there is not too much capacity between the windings. Coils of this type have been made by winding two wires at the same time, using one of them for primary and the other for secondary.

It is possible that due to the high impedance of the primary of the untuned winding the regeneration will not be satisfactory. This can be remedied with a small variable condenser across the primary, such as a trimmer.

The detector circuit consists of the secondary of this transformer, a magnetic loudspeaker unit by-passed with a 0.0001 mfd. condenser, and two diode plates tied together. The loudspeaker is the load impedance in this case. The variable rectified current will flow through the speaker and the radio component will flow through the by-pass condenser. A somewhat greater output is obtained when a little larger condenser is used. It is permissible to use as high a value as 1,000 mmfd. (0.001 mfd.) because it is connected across a relatively low impedance. That statement applies even if the impedance of the speaker unit is as high as 20,000 ohms.

Control of Regeneration

In the cathode lead of the tube is a bias resistor of 5,000 ohms shunted with a condenser of 0.002 mfd. It is permissible to reduce this bias resistance to 2,500 ohms, but with the larger value the oscillation can be controlled a little better. The regeneration control is a 25,000 ohm variable resistance, also placed in the cathode lead. This is not by-passed in order to make it more effective.

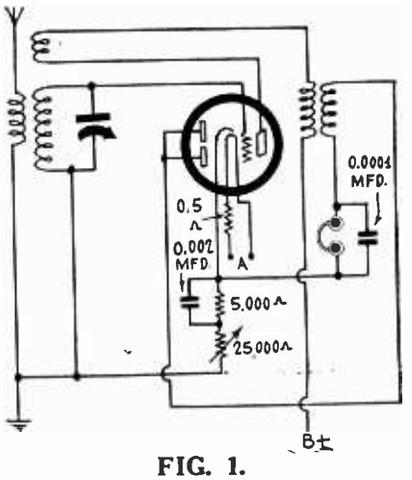


FIG. 1.

The diagram of a one-tube set utilizing a 55 duplex diode triode in a regenerative and a rectifier circuit.

Of course, if the three-circuit tuner has a good rotatable tickler, this can be used as the main control, but even so, it is well to have the variable resistance because sometimes the tickler is too critical. By the method illustrated a fixed tickler could be used.

The filament supply may be either a-c or d-c. In case a-c is used a 2.5 volt winding is required, one capable of delivering one ampere. If d-c is used, the best supply is a storage battery, one that gives either 4 or 6 volts. If dry cells are used, enough of them should be connected in parallel to give the one ampere required. If the cells are No. 6, not less than 3 in parallel should be used, because one cell is not supposed to deliver more than 0.25 ampere. This rating requires that four of them be used, and that will be more economical.

The tube requires a terminal voltage of 2.5 volts. Hence when we use batteries of different voltages we have to use a different ballast resistor. In case we have dry cells, two of them in series will give 3 volts, and we have to drop the excess half volt. Since the current is one ampere, the ballast resistor must be 0.5 ohm. This is indicated on Fig. 1. If we use a 4-volt storage battery we have to drop 1.5 volts, and therefore we have to use a ballast of 1.5 ohms. If we use a 6-volt storage battery the ballast must be 3.5 ohms, for we have to drop 3.5 volts. If a storage battery is fully charged, it is possible to operate the tube on a single cell, but the current will be a little less than normal. In that case, of course, we should not use any ballast resistance at all.

LIST OF PARTS

One three circuit tuning coil for a 350 mmfd. tuning condenser
One untuned radio frequency transformer
One 350 mmfd. variable condenser
One 0.0001 mfd. fixed condenser, or one up to 0.001 mfd.
One 0.002 mfd. by-pass condenser
One 5,000 ohm fixed resistor
One 25,000 ohm variable resistor
One ballast resistor to carry one ampere, resistance to be one ohm for each volt to be dropped
One six-contact socket
One grid clip
One 55 type duplex diode triode
One dial and one knob for tickler
One small magnetic type loudspeaker
One good antenna and ground lead
One small wooden sub-panel

Plate Voltage

The plate voltage to use depends on the volume desired. The higher the voltage the greater will be the amplification and the possible output. The tube will stand up to 250 volts. If a rectifier giving this voltage is available it can be used, but if batteries are to be employed it will not be practical to provide this high voltage. Results will be obtained from about 22.5 volts up.

It is not to be supposed that this single-tube circuit will perform like an eight-tube superheterodyne, nor even like a five-tube midget.

Extremely small loudspeaker units are available for small portable sets, and one of them would fit the circuit nicely. One measuring 6.25 inches in diameter is of the magnetic type and utilizes the well-known push-pull action, but it is not for a push-pull amplifier.

Good Near Big Stations

The proper place for a one-tube set like this is in the immediate vicinity of high power broadcast stations where the field strength is high. Of course, "the immediate vicinity" of a station depends on the radiated power from that station. For some the radius might be 25 miles, For others, only half a mile.

The distance at which results may be expected also depends on the kind of antenna circuit used. An outdoor antenna 75 feet high, or long, should be used. There should also be a good ground provided. It will not do to use the makeshift antennas and grounds often used for modern multitube sets. The amplication, even with maximum regeneration, is so low that we cannot afford to throw away pick-up like we can when a multitube is used. The very best antenna, and the very best ground, should be used, and the very best ground is a cold water pipe.

Tube List Prices

Type	*Price List*	*Type*	*Price List*
11	$3.00	'38	2.80
12	3.00	'39	2.80
112-A	1.55	'40	3.00
'20	3.00	'45	1.15
'71-A	.95	46	1.55
UV-'99	2.75	47	1.60
UX-'99	2.55	'50	6.20
'100-A	4.00	55	1.60
'01-A	.80	56	1.30
'10	7.27	57	1.55
'22	3.15	58	1.55
'24-A	1.65	'80	1.05
'26	.85	'81	5.20
'27	1.05	82	1.30
'30	1.65	'74	4.90
'31	1.65	'76	6.70
'32	2.35	'41	10.40
'33	2.80	'68	7.50
'34	2.80	'64	2.10
'35	1.65	'52	28.00
'36	2.80	'65	15.00
'37	1.80	'66	10.50

THE 55 AS A GRID VOLTAG
STEADY

By J. E.

IT IS WELL KNOWN that when self bias is used on audio amplifiers there is a reverse feed back reducing the amplification. This reduction is considerably decreased by putting a condenser across the bias resistor, but this leads to frequency discrimination because the condenser is not as effective on the low audio frequencies as it is on the high. It often happens that the high frequency response is already excessive, relatively, and the by-passed self bias resistor makes the discrimination still greater. The remedy, of course, is to use a very large condenser, but even with the largest practical condenser there is some suppression of the low notes.

When a Class B amplifier is used self bias is not possible because there is virtually no steady current in either tube. Therefore in these circuits the bias either must be obtained from a voltage drop in the voltage divider or tubes must be used which can be operated without bias. But such tubes require a driver stage due to the high power dissipation in the grid circuit when the bias is considerably positive, and it will be positive all the time the circuit is working.

There are other cases where self bias cannot be used without encountering obstacles. Hence it is desirable to have a means for obtaining a steady bias which is not subject to the objections of self bias, or even of bias obtained from a drop in the voltage divider. Batteries cannot be considered because of room they take and the necessity of frequent renewal.

A C Battery Eliminator

Using a small tube as a diode rectifier and getting its voltage from the power line has been successful and quite advantageous in circuits requiring a high negative voltage. These work well with filament tubes provided the output of the rectifier is well filtered. It is much easier to take out the hum from the output of a C battery eliminator than from a regular power supply because the current drawn need not exceed one milliampere. And with a heater type tube it will work even better because no hum can come from the heater. Incidentally, both the heater and the cathode of the tube can be grounded.

Since the introduction of the 55 and the 85 tubes we have means for constructing simple and effective C battery eliminators because they are of the heater type and they can be used in either full-wave or half-wave circuits. If they are used in a half-wave circuit we still have one of the elements for automatic volume control or for detection. Power from the line may be used for the grid bias supply. One of the best points about these tubes is that they are versatile.

It is not necessary, though, to use power from the line for supplying the grid bias rectifier, at least not directly. We can just as well take it from a high frequency oscillator. And this offers possibilities for many different circuit arrangements.

High Frequency Rectifier

Consider Fig. 1. Here we have a 55 tube operating first as a regular high frequency oscillator. Its cathode is grounded,

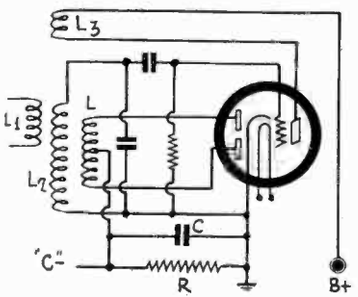


FIG. 1

In this circuit a duplex diode triode tube is used as oscillator and as a C battery eliminator. The oscillator may be the same one used in a superheterodyne.

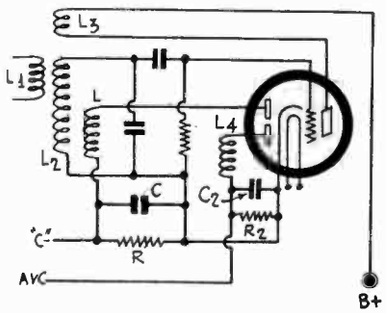


FIG. 2

In this circuit the oscillator in Fig. 1 is used as a half-wave rectifier for the grid bias and also as a half-wave rectifier for automatic volume control.

as usual. A center-tapped winding is put on the oscillator coil and this winding is connected to the diode plates of the tube. The tap on the winding goes to a high resistance R, the other end of which is connected to the cathode. What is the action of the circuit? As the power is first turned on the circuit begins to oscillate. A voltage is applied to the coil L in the diode circuit. Rectification takes place and a steady voltage develops across the load resistance R. It is steady because the voltage applied is not modulated and the ripple, being of very high frequency, is taken out by condenser C across R. The ground end of R is positive and the left end is negative. Hence we can use the voltage developed across R for bias on any tubes we wish, particularly the audio amplifiers.

There is one disadvantage in the arrangement, and this is the time delay before the voltage builds up across R. It takes some time for the oscillator tube to warm up to the point of oscillation and some time in addition for the voltage to build up. The time constant of the rectifier can be made small enough to be negligible without sacrificing filtering, so the only appreciable time delay is that of the heater circuit. If all the tubes in the receiver are of the heater type there would be no serious effects, but if the biased tubes are of the filament type, like the 245 or the 250, they would be operating a zero or a very low bias for a moment. There would be a rush of high plate current for a moment. But with quick heater tubes even this time would be short.

Use in Superheterodyne

This type of C battery eliminator does not necessarily require an extra tube in the circuit, especially in a superheterodyne. We need an oscillator in that type of circuit, and it might as well be a duplex diode triode tube. In addition to the oscillator and rectifier windings we can put on the regular pick-up winding, which is indicated by L1 in the figure.

This possible use raises the question as to the constancy of the voltage across R. Will that voltage be the same at all settings of the tuning condenser, or will it vary over a wide range? If it varies considerably the rectifier could probably not be used for biasing the power tubes. But this is a matter of design of the oscillator. No doubt, an oscillator can be designed that will generate a steady oscillating current. Indeed, such an oscillator should be used in every superheterodyne for it is just as important that the voltage in L1 be constant as it is that that in L should be constant.

Incidentally, the arrangement in Fig. 1 offers a simple means for testing the constancy of the amplitude generated by the oscillator. If a d-c vacuum tube voltmeter, such as that described in the July 16 issue, for example, is connected across R and measurements are taken at different settings of the variable condenser, the measured voltage would indicate the intensity of the oscillation, for it would be directly proportional to it. This would be better than to make the same study of the oscillator without the rectifier attached to it, because, without doubt, the rectifier alters the characteristics of the oscillator. That takes a little power from it. Since this is a damper we might assume that the variation in the intensity is less when the rectifier is attached than when it is not.

Combining A. V. C.

The duplex diode triode tube can be used as oscillator and C battery eliminator as in Fig. 1 and as an automatic volume control besides. How this may be done is shown in Fig. 2. The oscillator is just the same as it was before but one of the diode plates only is used for grid bias development and the other is used for automatic volume control A higher grid bias voltage can readily be obtained with this circuit since the entire winding L is used for rectification. For the same winding the voltage across R would be double.

The second diode plate is used for au-

E SUPPLY; I-F CURRENT IS RECTIFIED

Anderson

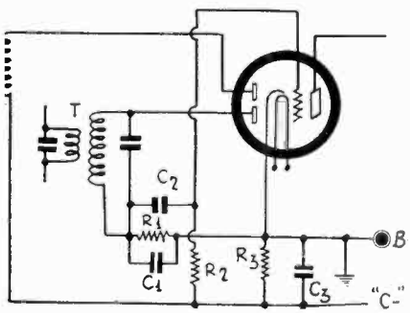


FIG. 3

In this circuit the duplex diode triode is used as half-wave rectifier for detection, and grid battery eliminator, and also as an automatic volume control.

tomatic volume control in the same type of rectifier circuit. The coil L4 is supposed to be coupled to a coil in which the signal current is flowing, for example, the last intermediate frequency transformer. There should be no coupling between L4 and the windings of the oscillator.

The automatic volume control voltage develops across resistance R2 and it is filtered with condenser C2. The lead marked AVC is negative and is to be connected to the grid returns of the tubes to be controlled, through the usual filter resistors and condensers to prevent feedback. Since the positive ends of the two load resistors R and R2 are grounded, it is clear that the tube cannot be used to apply both a steady and an automatically varying voltage to the same tube. It could be done, of course, but the desired results would not be obtained. The two resistors would be in parallel.

Using Second Detector for Bias

The second detector of a superheterodyne can be used for biasing some of the tubes in the circuit, including the triode part of the tube. How this may be done is shown in Fig. 3. One of the diode plates is used for detection in the usual way. The other plate is connected to a coil L which is coupled to the oscillator. The detector part of the circuit develops a signal voltage across R1 and this signal voltage is applied to the grid of the tube through a stopping condenser C2 and a grid leak R2. The other diode and the coil L develop a steady voltage across R3, the ripple being removed by C3.

The grid leak of the amplifier part of the 55 is connected to the negative end of R3 and therefore the bias on the tube is the drop in R3. Other grids to be biased can also be connected to the negative end. If the bias developed across R3 is too high for the grid of the 55, the low end of R2 may be connected to a tap on R3. It is possible to adjust L, or its coupling to the oscillator coil, so that the voltage drop in R3 is just right for biasing a power tube. Lower voltages can then be obtained by tapping R3. Tapping a grid leak of high resistances is done by connecting resistors of lower and suitable values in series.

In some circuits the leads from coil L to the rectifier will be long but they run in the direction of the intermediate amplifier so there is little danger of causing serious coupling, and they can always be placed so they will not interfere. The bias voltage developed across R3 should not be used for any of the r-f or i-f tubes unless the filtering is thorough because there may be strong undesired feedback. Even this possibility is not so serious because the oscillation frequency is far removed from any signal frequency as well as from the intermediate frequency.

The use of the second detector for obtaining a steady bias does not exclude its use for automatic volume control. The d-c drop in R1 is often used for that purpose and there is no reason why it should not be used in this arrangement. First a high resistance of about 0.5 megohm is connected to the negative end of R1 and then the grid returns of the controlled tubes are connected to this resistor. This is the usual way. A limiting self bias resistor may be used for each of the controlled tubes, or one may be used for all of them without any complications. Indeed, the usual manual volume control in which the potentiometer is connected between the antenna and the cathode returns of the controlled tubes, with the slider to ground, can also be used without complications. This is because the catrode of the 55 is grounded. When the circuits shown in Figs. 1 and 2 are used the only type of oscillator that can be used is one in which the cathode is connected to ground, except that a grid bias resistor may be put in the cathode lead above the grid return. But this resistor should be well by-passed and it should not have an excessively high value. An oscillator in which the cathode is connected to a tap on the coil is excluded. The reason for this is that the cathode must be at ground potential as far as the high frequency is concerned.

Third of Farms Have Sets in Pennsylvania

Washington

The Department of Agriculture reports that almost one out of every three farm homes in Pennsylvania is equipped with radio receivers. Latest estimates show that of the 172,500 farms in the state, 55,330 have radio sets.

Every year since information was first available in 1924 has shown an increase over the preceding year. The estimated sets for each year are: 1924, 10,378; 1925, 18,225; 1926, 21,630; 1927, 27,860; 1928, 35,460; 1929, 42,050; 1930, 48,560; 1931, 52,900; 1932, 55,330. The rate of increase was lower for the last two years but despite the depression there was a decided trend of radio toward the rural sections. The most rapid increase occured between 1926 and 1927.

Better Tone Possible with Class B Negative

A separate rectifier for C bias supply may be applied to all the tubes in a receiver that require negative bias. The circuit is so arranged that its positive side is to the negative side of the heavy-duty rectifier circuit of the receiver, so all points on the C bias supply are "more negative" than B minus or chassis.

So very little of the signal travels through the separate grid voltage supply that it becomes much easier to produce audio circuits of excellent tone without danger of crossing the forbidden threshold beyond which distortion of the worst type is met, i.e., motorboating.

Of course, since no current is drawn from the C voltage source it is not necessary to attain any real power, but only enough to run a small rectifier. This may be any type of tube hooked up for use as a rectifier.

While it would be necessary to supply a relatively high voltage to the C bias supply, if the high negative bias required for Class B operation of low mu output tubes is to be furnished, even that presents no special problems. While a power transformer likely will not have the extra winding for high voltage (say, 110 volts), certainly there are enough 2.5-volt filament transformers obtainable and the 2.5-volt side may be connected across a 2.5-volt winding supplying the heaters of receiver tubes, and the secondary connected to the C bias rectifier tube.

The situation that obtains is simply the reverse of what exists when the filament transformer is used in customary fashion. Instead of 110 volts a-c line voltage being dropped to 2.5 volts, 2.5 volts are raised to 110 volts. Naturally the transformation ratio is the same in either case, but the method of connection changes the direction of the transformation.

In Class B amplifiers, as at present in vogue in a-c sets, tubes are used that have a very high mu, resulting in substantially no plate current flow when there is no signal input. The entire operation depends on the signal casting the grids positive, hence grid current flows, and might reach 60 microamperes or more. Thus a special transformer is needed, working out of a driver stage, so that the secondary resistance will be low. Nevertheless there is power consumption in the grid circuit and this really accounts for the need of a driver.

The first presentation of Class B amplifiers concerned battery-operated sets, for low current drain and for high output values from small tubes. For a-c sets the same system—high negative bias, rather than zero bias with grid current—is applicable when the C voltage supply is a separate rectifier-filter circuit.

How Much on 5 Tubes?

. Diode and A-V-C in Experimental Set

By Carter Wallingford

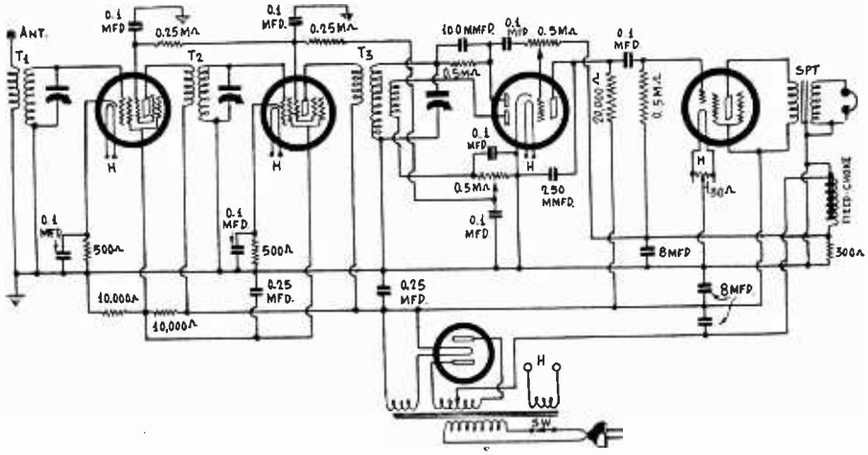


FIG. 1

A five-tube midget receiver incorporating automatic volume control, diode detection, and two stages of resistance coupled audio amplification.

CAN A FIVE-TUBE midget receiver be built with the new tubes, including the 55 and automatic volume control? Of course it can, but just how good a receiver of this kind will be that is a question to be answered by experimenting. Just now the circuit in Fig. 1 is being studied with the object of getting a five-tube midget which meets the specifications and which at the same time will be more sensitive than the ordinary type of midget receiver, using the old type tubes.

But how does it differ from any other midget receiver, other than in the tubes used? For one thing, it has automatic volume control, and the controlling voltage is applied to the suppressor grids. It also has a manual volume control associated with the automatic. This is a particularly noteworthy feature. It is well known that automatic volume controls reduce the sensitivity of a receiver somewhat. But it is not necessary to connect the circuit so that this reduction must be tolerated. In this case the manual control allows adjustment for full automatic volume control, none at all, or any degree of control between these extremes. The load resistor on the automatic volume control rectifier is a 0.5 meg. potentiometer, the slider of which goes to the controlled tubes. By moving the slider to the negative end of the resistance the full range of automatic control is obtained and by moving it to the positive or grounded end, there is no automatic control at all.

Additional Control Needed

In any position of the slider the circuit is always at its most sensitive adjustment as long as there is no signal coming in. A weak signal will cause a low bias and a strong signal a high bias and the amplification will be less the greater the bias. Therefore most signals will come in with about the same intensity. This is particularly true if the full range of the control is utilized. Of course, we cannot expect the leveling to be good enough to justify the omission of the manual control. Even if the signals from all stations came in at the same intensity we should still want a manual control to vary the amount of output according to mood or the nature of the program.

The manual control can take the form of a potentiometer in the antenna circuit or of a potentiometer in the input to the audio amplifier. If the antenna potentiometer is used, 10,000 ohms will do, and the resistance should be connected between the antenna and cathode returns of the two r-f amplifiers. Of course, it would be necessary to disconnect the cathode returns from ground. The slider of this potentiometer should be connected to ground instead.

If the manual volume control is put in the audio amplifier a good place for it is in the grid circuit of the 55 triode. The grid leak takes the form of a 0.5 megohm potentiometer, and the grid of the triode should be connected to the slider. This arrangement is shown in Fig. 1.

Detector Design

Note that the by-pass condenser across the load resistance of the detector diode circuit is only 100 mmfd. The reason for using such a low value is to prevent high frequency suppression. We can easily estimate what the suppression will be. Let the load resistance be R and the capacity C. Then the impedance is $R/(1+C^2w^2R^2)^{\frac{1}{2}}$, where w is 6.2832 times the frequency in cycles. We are interested in the relative values of this impedance at low and at high frequencies.

For the purpose of comparison we can take zero frequency and compare the impedances at other frequencies with the impedance at zero frequency. Well, at zero frequency the impedance is just R. Hence we get the relative suppression by dividing the expression for impedance by R. If we compare powers we square the expression, and if we tip the expression upside down we get the attenuation in relative units, not in decibels.

The expression for power attenuation becomes $(1+C^2w^2R^2)$. In Fig. 1 the value of C is 100 mmfd. and the value of R is 0.5 megohm. Hence the expression becomes $1+0.0987f^2$, in which f is the audio frequency measured in kilocycles. At 10,000 cycles the value of f is 10 and the attenuation becomes 10.87. At 1000 cycles the value of f is unity and the attenuation is 1.0987. At 5,000 cycles the attenuation is 3.47. This shows that even a condenser as small as 100 mmfd. when across a half megohm resistance will cut the higher audio frequencies considerably. For this reason it is allowable to use an even smaller by-pass condenser, especially if the detector circuit is full-wave.

The lack of complete filtering is not serious because a condenser of 250 mmfd. can be put across the triode load resistance to remove some more ripple before it has attained much amplitude. There is little attenuation by the 250 mmfd. condenser because it is connected across two comparatively low resistances, the load resistance of 20,000 ohms and the plate circuit resistance, which is also rated at 20,000 ohms. Thus the condenser is across only 10,000 ohms, the two being in parallel. Hence at 10,000 cycles the attenuation amounts to only about 2.5 per cent. If the resistance were increased to 0.5 megohm the same condenser would cause an attenuation of 63.5.

Bias on Audio Tubes

The bias on the audio tubes is obtained from a drop in a 300 ohm resistor placed in the B minus lead. The filter choke, which may be the field coil of the loudspeaker, is also placed in the B minus lead, and the bias resistor is put between the choke and ground. The same bias is used on the power tube and on the triode part of the detector. This is all right if a 47 type power tube is used for the 55 triode will work on the bias required by the power tube. The bias resistor is bypassed with an 8 mfd. condenser to reduce degenerative coupling between the two grid circuits.

The first two r-f coils used in the circuit are standard shielded midget type coils but the third is different in that it has an extra winding for the automatic volume control circuit. This winding should be about the same as the tuned secondary as to number of turns but it should be wound with finer wire near the ground end of the coil, over the primary winding. There should be an insulating layer of about 1/32 inch between the windings so that stray capacity will be low. Of course, T3 should be shielded like the other two coils.

The sensitivity of this receiver will not be quite as great as it would be if a screen grid tube were used for detection with grid bias. But the quality will be much superior, and then we have the automatic volume control feature in addition. The loss of sensitivity is due entirely to the detector. The triode amplifier, which has a gain of about 6, does not quite compensate for the decreased sensitivity of the diode rectifier. Yet the difference is slight. It is more sensitive than it would be with old type tubes.

Type of Automatic Volume Control

The application of the automatic volume control voltage to the suppressor grids rather than the controls grids is not often done, but it is a method recommended by the manufacturers of the tubes as a means for varying the selectivity so that it will be greatest on weak signals and least on strong. When the voltage is applied in the control grid circuit the variation is in the opposite direction, which is not so desirable. However, the effect of a change

(*Continued on next page*)

A Portable Amplifier

Suitable for Phonograph, Microphone or Radio

By Louis Moses

Try-Mo Radio Co.

THE LOFTIN-WHITE amplifier lends itself admirably to the use of the 235 and the 247, or to a 58 and the 247. Such an amplifier has been built in a treasure-chest cabinet and is giving excellent results. We show the circuit diagram of it in Fig. 1, including the values of resistances and capacities used.

The circuit is primarily intended for the amplification of signals from phonograph records but it may be used just as well for the amplification of signals from a radio detector or a microphone.

At the input side we have an audio frequency transformer which may be coupled to any signal source we wish. The transformer actually used was one that matched the plate impedance of a three-element vacuum tube. Hence the amplifier may be connected to the output of a detector. The terminals of a pick-up unit can also be connected across the primary without change. If a low impedance microphone is to be used, however, a matching transformer should be used between the microphone and the transformer, or else a special microphone-to-grid transformer should be substituted. This substitution is advisable if the circuit is to be used primarily in conjunction with a microphone.

The First Amplifier

The first amplifier is a 235 tube. It is biased by a combination of cathode drop and drop in the voltage divider. First we have two resistors in parallel, one of 0.5 megohm and another of 100,000 ohms. Of course, these act as one resistor of value 91,000 ohms. A single resistor of this value could be put in, if such a resistor can be found. The 91,000-ohm resistance provides the self-bias. There is also a 300-ohm resistor in the cathode circuit, if we consider the cathode circuit to extend to B minus. Through this 300-ohm unit the bleeder current also flows so it adds considerably to the bias. There is little danger of overbiasing the tube since it is of the remote cut-off type. The self-bias portion of the cathode resistance is more for stability than for bias.

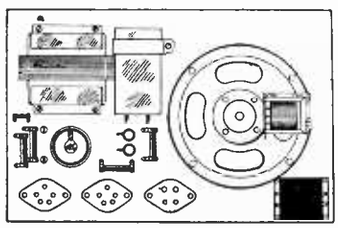


FIG. 1.

The circuit of a Loftin-White type amplifier utilizing a 235 and a 247 tubes. It may be used for the amplification of any audio signals.

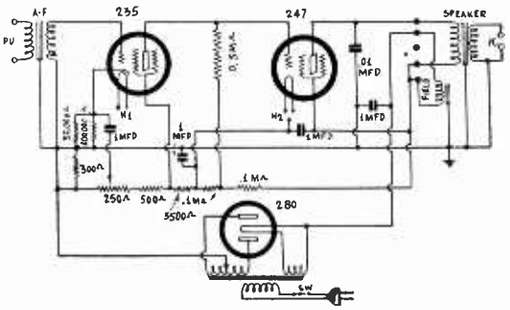


FIG. 2.

The layout of parts of the Loftin-White amplifier diagrammed in Fig. 1. The large circle represents the loudspeaker.

A comparatively low screen voltage is used on the tube, which is necessary by the fact that a very high resistance, 500,000 ohms, is used in the plate circuit. If the screen voltage were high the plate voltage might be less than the screen voltage during part of the signal cycle, and then nothing but distortion would result. The screen voltage must always be less than the effective voltage on the plate.

Hum Bucker

Connected between the cathode of the first tube and the slider of a 250 ohm potentiometer in the voltage divider is a one microfarad condenser. This is used for balancing out hum. A point can be found on the potentiometer where the hum introduced in the plate circuit is exactly balanced out by a hum introduced in the grid circuit. This point must be found by trial.

The second amplifier tube is coupled to the first by the direct method without the use of a stopping condenser. This requires certain manipulation of the leads to give the power tube the right voltage. If the half megohm coupling resistor were connected to the cathode, that is, the filament, the grid would be greatly overbiased by the steady drop in the coupling resistor. For this reason the cathode is connected to a point on the voltage divider lower than the line. The actual bias on the pentode power tube is the difference between the drops in the coupling resistor and in the 100,000 ohm resistor between the filament and the coupling resistor connections to the voltage divider. Normally, this difference is 16.5 volts. The next 100,000 ohm resistor is used to establish a current in the portion of the voltage divider to the right of the filament connection.

A full-wave rectifier giving out a high voltage is used. This is typical except that the speaker field is used for filter choke.

Two separate filament windings are used for the two amplifier tubes. This is done to eliminate the high voltage that would exist between the cathode and the heater of the 235 if a single winding were used.

Suppressor Grids Tied to A-V-C

(*Continued from preceding page*)

in the selectivity with a change in the sensitivity is relatively small, and the reason the voltage is applied in the suppressor grid circuits is that it simplifies the connections and avoids complications. It will be noticed that both the coil and the condenser in each of the tuned circuits inputting the controlled tubes are grounded. If the automatic volume control voltages were applied in the control grid circuits the coils could not be grounded directly.

Necessity for Shielding

The suppressor grids behave in about the same way as the control grids in respect to changes in the negative voltage. The gain decreases with increased negative voltage. The suppressor grid, being near the plate and negative, prevents electrons from reaching the plate, and the more negative it is the more it reduces the plate current.

The two controlled tubes are supposed to be 58s, the detector a 55, and the power tube a 47. The rectifier tube should be a 280, but if an 82 is to be used it is only necessary to make the heater winding for the filament 2.5 volts instead of 5 volts and to put an r-f choke of one or two millihenries in each lead to the plates.

The gain in the 58 tubes is much greater than that in tubes like the 235. For this reason more thorough shielding is essential. Special shields are available for the tubes, which fit snugly over the tubes and still allow natural circulation of air for cooling the tubes. But using shielded coils and shielded tubes may not be sufficient. Box shielding of stages is recommended in so far as this can be done. Of course, it is not necessary to separate the tuning condensers in order to put these also in the box shields with the tubes and coils with which they belong. If an 82 rectifier is used that tube must be well shielded from the rest of the circuit with a metal screen which will allow ventilation.

Detector Arrangement

Attention is called to the arrangement of the detector rectifier circuit. The load resistance and the 100 mmfd. by-pass condenser are put above the tuned circuit. This is done to permit grounding the tuning condenser. Incidentally, exactly this is done in the ordinary grid leak and condenser detector, and this circuit differs in no respect from such a detector except that the amplifier part is operated at its optimum adjustment as an amplifier. But the arrangement has one undesirable feature, which, however, is not enough to offset the advantage of grounding the condensers, and that is that a considerable r-f signal is impressed on the amplifier grid. The 250 mmfd. by-pass condenser is necessary in the plate circuit.

This condenser eliminates the signal ripple with little audio suppression.

Radio University

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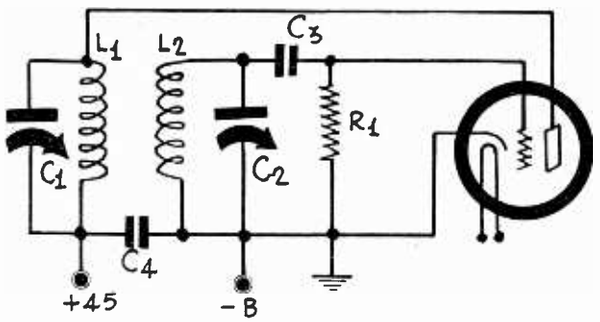

FIG. 1021 A simple oscillator, for battery or a-c operation.

Bypass for Diode

WHEN THE 55 TUBE is used it is recommended that there be a condenser across the load resistor (the resistor between coil return and cathode), but different values are prescribed, not only for different purposes but also different values for the same purpose. Please clarify.—J. C. N., Dubuque, Ia.

There has been no discrepancy as to the 55. The load resistor you refer to is recommended at 0.5 meg., and the condenser across it as 0.00015 mfd. for t-r-f and 0.006 for intermediate frequencies of the popular types. However, as to the 85, the counterpart for the automotive series, the value of the condenser for superheterodynes has been specified as 0.01 mfd. The only reason there is any difference at all between capacities for t-r-f and superheterodyne purposes is that the smaller t-r-f capacity is not sufficient of an r-f bypass condenser or filter for the popular intermediate frequencies. However, the specification of 0.01 mfd. for superheterodyne frequencies, for the 85, may be an indication that 0.006 was found in practice not to be quite high enough, since the 85 was announced after the 55. It has been found in practice that for t-r-f 0.0015 mfd. should not be exceeded, which does not mean it can not be less, as less than half that capacity has been used successfully.

* * *

Screen Voltage Trouble

IN THE T-R-F that I built, using screen grid tubes, I do not get the bias that I should get on the r-f amplifiers, as it is around 1.5 volts negative at minimum, though the common limiting biasing resistor for two tubes is 600 ohms. I thought that, at 200 volts and around 5 ma per tube, I should get a minimum drop of 6 volts. The circuit consists of the usual t-r-f hookup, the plate B voltage being dropped through a fixed resistor of 5000 ohms, and the screen voltage through a fixed resistor, from the plate feed line, of 0.25 meg. Sensitivity is not what it should be, either. The screen voltage reads around 50 volts on a 1000-ohms-per-volt voltmeter.—D. B., Ames, Ia.

We, too, have found that the variable mu tubes, which seem to be what you are using, do not draw as much plate current as the average characteristics chart would indicate. However, in your case you have an actual screen voltage of around 80 (for the meter reads low, due to the considerable current through the meter compared to the current to screens through the resistor), and you should increase the voltage. Then more current will flow through the biasing resistor. You should get a starting bias of around 5 volts if you reduce the 0.25 meg. resistor, in series with the plate feed and screen, to 0.05 meg. (50,000 ohms). Then the voltage actually will be around 100 or a little more, which is satisfactory from an operating viewpoint. Also the sensitivity will increase materially when you have done this. Be sure that a good-sized bypass condenser is from screen voltage feed line to B minus, also from cathode of r-f tubes to B minus. About 0.1 mfd. is the usual value. If the sensitivity rises so high that squealing results, the 600-ohm limiting resistor may be increased to such value as stops squealing at the highest broadcast frequency. Another remedy, not changing the resistor, is to increase the capacity of the bypass condenser from screen to ground.

* * *

Problem of D-C Line Set

IS THERE ANY WAY of building a set for operation on the d-c house line without using the heavy resistor to drop the line voltage to the sum of the voltages across the series filaments or heaters?—P. C., Brooklyn, N. Y.

There is no practical way of solving the problem except by using a reducing resistor, whether filaments or heaters are in series or parallel. If you use 2-volt tubes, since the filament current is small (usually 60 ma), the resistor will not have to be as "heavy" as if you use the automotive series tubes. However, since the automotive series tubes are of the heater construction, the plate voltages available are not reduced, the two circuits being independent, and it is recommended that the automotive series tubes be used. A theoretical solution would be to institute a high frequency oscillator, rectify the oscillation current, and feed the filaments or heaters with this, using the line voltage for plate. However, there would have to be considerable power available from the oscillator, and it would have to be of husky enough construction to permit this power rating.

* * *

A-V-C "Silent Spot" Hiss

WHEN HISS and other noise are heard on a set between stations (when no station is coming in), due to the automatic volume control, whereby the amplification is greatest when the signal is absent entirely, would not a suitable corrective be the lifting of the bias on the controlled tubes, so that even at no signal there would be the recommended bias for maximum amplification?—G. R., Roanoke, Va.

The method you outline is a helpful one, tending to correct for the noise between stations on the dial, in that the noise is reduced, especially if the limiting bias is raised sufficiently, probably to more than the minimum, but the improvement is merely one of degree. The fact still remains that sensitivity is greatest when there is no signal, hence tube and circuit noises are amplified most under that condition. If the starting bias is raised high enough so that the noise is unobjectionable at no signal input, then of course the solution you propose is satisfactory, provided, however, that you are willing to stand the sacrifice of sensitivity involved.

* * *

I-F Oscillator

KINDLY let me have the diagram of a simple intermediate frequency oscillator, of good frequency stability, for either battery or a-c operation, preferably battery.—K. J., Bangor, Me.

Fig. 1021 shows the diagram A '27 or the new 56 tube is used, preferably the 56, if operation is to be from batteries, as the heater current is 1 ampere at 2.5 volts, compared to 1.75 amperes for the '27. L1L2, C1C2, may be a commercial intermediate frequency transformer. Indeed, it may be practical to take a transformer you intend to use in building a set, use it in this hookup for adjusting two other transformers in the set, then use the intermediate frequency in the set for lining up the transformer taken out of the oscillator. This would be all right if you are to have two stages of i-f (three coils). Aside from this, if you want to use 300-turn commercial honeycomb coils, closely coupled, C1 and C2 may be 0.00035 mfd., and the circuit would have to be calibrated. C3 is 0.00025 mfd., R1 is 0.1 meg. or higher, while C4 is 1 mfd. or higher.

* * *

Is It a Cure for Fading?

IS IT TRUE that automatic volume control cures fading? Does it help a great deal of short waves, where ordinarily there may be considerable fading?—H. R., Tappan, N. Y.

It does not cure fading, but it does reduce the fading effect quite considerably. Fading is due to the arrival of the transmitted wave by two paths, one the ground wave, so-called because earth-bound, the other the sky wave, so-called because it rises skyward until it strikes the Kennelly-Heaviside layer, when it is reflected back to earth. Since the two components take paths considerably different in geographical distance, despite the tremendous speed of travel (around 186,000 miles per second) there is a sufficient difference in time between the arrival of the two components to be measured without difficulty, or, if detected, to be distinguished by ear. The time difference is equivalent to a phase shift, so the signal strengths of the two may add up at one instant and buck each other at another, the result being a waxing and waning familiarly identified as fading. Since automatic volume control tends to keep the signal supply voltage to the second detector relatively constant despite original differences, the quantity of sound otherwise heard when receiving fading stations is almost equalized. There is no absolute levelling because the effect of bias variation on amplification is not linear.

* * *

Needs a Sensitive Set

FORMERLY I LIVED IN DETROIT and my t-r-f set was satisfactory. I listened to locals, but the chains were represented and I was satisfied. Since then I have moved to Reading, Pa., and the

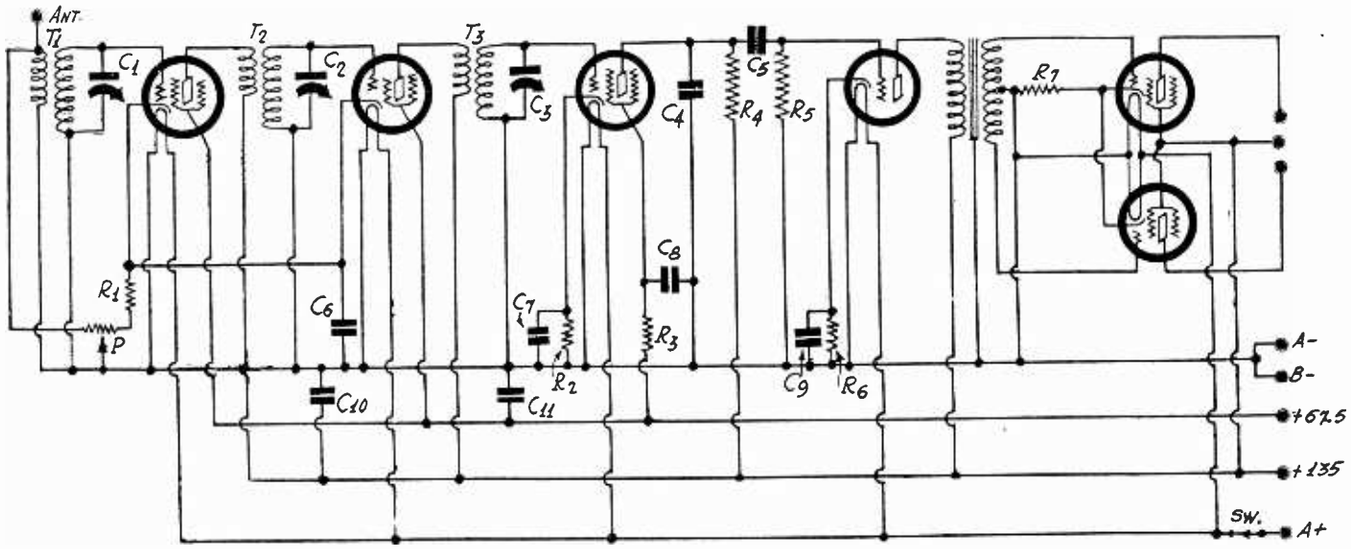

FIG. 1022

A t-r-f set, push-pull output, using automotive tubes for battery operation in the home.

set that was O. K. in Detroit is O. K. here, too, for local reception, but there is not enough in local reception to interest me. I want to get New York stations direct. The receiver will not do that—isn't selective or sensitive enough. I tried out a six-tube superheterodyne midget, and while that was more sensitive, it did not do the trick. New York stations could be heard faintly, if the volume control was advanced all the way, but then there was a racket, like static, that would make listening unbearable. Have you any suggestions?—S. A. E., Reading, Pa.

The situation in Reading is reported by our trade correspondent to be one requiring a highly sensitive receiver to bring in New York stations direct. There are many localities in the United States where especially sensitive receivers are necessary to make distant reception possible. Therefore as yours seems to be one of them, to cure the situation you would have to get a "big" receiver. There are several available that will render satisfactory service. They are superheterodynes using 10 tubes or more. The racket you complain of may be due to local disturbances, called man-made static, or simply to the fact that when you made the test on the midget super there was a storm in your locality or near it, with its accompanying static. Go to one of the radio stores and listen to a very powerful set actually bringing in New York stations direct. Thus you can verify the existence of adequate sensitivity and selectivity, and also note the amount of background noise normally to be expected. It should not be so high as to be objectionable.

* * *

Use of Cheap Meter

IN BUILDING a certain type of testing equipment I shall not be able to use an expensive meter, and I am wondering if it would be all right to use an inexpensive one (250 ohms per volt) provided the circuit is so arranged that the meter is in it all the time?—H. E. F., Montreal, P. Q., Canada.

The reason why high resistance voltmeters are necessary, for general use, is that they are applied only for short intervals across potential sources and there must be very little current in the meter compared to the current through the measured circuit, otherwise the accuracy of the reading will not be nearly enough. But if the meter is to be left in the same circuit all the time the one you propose to use will be fully adequate.

Wonders if Rug's to Blame

MY T-R-F SET BEHAVES peculiarly. It worked fine for a long time, so long as it was kept in one place, which was true before we got a large rug for the living room. Now the front feet of the console are on the rug, and as the rug is taken up to be cleaned the console is naturally moved, and may be rolled about the room for other cleaning purposes. I just happened to put two and two together and assume there was a connection between the consequences of the rug and the poor reception. This reception consists of distorted, thin, weak, tinny results, compared to the former full, rich, loud tones. The volume control is not nearly as effective as before. In fact, the only time reception can be heard is when the control is full-on. Meanwhile results are unbearable. There is some improvement when aerial is connected to cap of the second r-f screen grid tube, instead of to antenna post of set.—C. S. R., Toledo, O.

Evidently the first r-f tube was sprung out of the socket sufficiently to disestablish contact. Stray coupling gives enough input to the second r-f tube to permit some sort of reception, but the tone is bad, and the result weak, because absence of the first r-f tube from its socket puts false voltages on the second r-f tube, and perhaps at other points, too, because there isn't enough current through limiting resistors to drop the required voltage. For instance, the bias may be far too low for an abnormally high plate voltage on the second r-f tube, if a common bias is used for both, and if the volume control is in the bias circuit it then would have little effect. Push down the tube. If the socket is too defective to hold the tube in place despite slight jars, surely put in a new socket. See front-cover illustration.

* * *

Incipient Motorboating

MY RECEIVER STARTS to motorboat when it is turned on, but the motorboating ceases about the time that a program becomes audible (heater tubes emit sufficiently). Should I correct this, and if so how?—R. W., Madison, Wis.

This may be corrected by putting some more capacity at the output of the rectifier filter (assuming you have an a-c set), or you may reduce the value of an audio grid circuit resistor until the trouble disappears, no matter what type of set you have. Extra capacity from the maximum B voltage source to B minus, for any type set, is a preferable solution, but the reduced leak method is simpler and cheaper.

* * *

Leak as Multiplier

FOR USE with a 0-1 milliammeter would it be satisfactory for 1,000-volt full-scale deflection to use a leak of 1 meg., as the wire-wound type of resistor of such high value costs more than I can afford at present?—D. A. C., Paris, France.

Just in a pinch, and until you can get enough money to buy a wire-wound resistor of an accuracy of 1 per cent. or better, the leak may be used, but first you must measure various leaks supposed to be 1 meg. or so, until you find one that has a resistance value close enough. The commercial variation may be 10 per cent., so you'll have to test until you find one temporarily suitable. After that you can feel certain of temporary good use even from the leak, but as its resistance value will change with age and use, you had better expedite as best you can the happy day when you get the wire-wound resistor.

* * *

The T-R-F Set, Auto Tubes

WHAT ARE DESIRED are two stages of t-r-f, one resistance coupled audio, with push-pull pentode output, for battery operation. Choose your own tubes.—K. B., Wilmington, Del.

The diagram, Fig. 1022, uses two 234 tubes for r-f, 232 detector, 230 first audio and 238 push-pull output. The values of constants are: C1, C2, C3, three-gang 0.00035 mfd.; C4, 0.0001 mfd.; C5, 0.01 mfd.; C6, C7, 0.1 mfd.; C8, C9, 1.0 mfd.; C10, C11, 2 mfd.; R1, 400 ohms; P, 25,000 ohms; R2, 0.05 m-r.; R3, 0.1 meg.; R4, 0.25 meg.; R5, 1 meg.; R6, 2,000 ohms; R7, 600 ohms, 25 watts. The coils have 30-turn primaries (any insulated fine wire) over secondaries of 127 turns of No. 32 enamel wire on 1 inch diameter.

* * *

Confidential

IS IT PERMISSIBLE to disclose the contents of a talk between amateurs, overheard on the air? I understand that messages in general must be kept secret, but as to the amateur talks, as they are informal, I wondered if there is any restriction—K. S. W., Altoona, Pa.

The amateurs are bound by law not to reveal the subject or contents of any talk or message heard, and importance of the subject-matter of the talk or message is in no way controlling. Likewise, listeners who are not licensed as operators are also bound by this rule of secrecy.

A THOUGHT FOR THE WEEK

DON'T smile coldly, or at all, when some television concern goes up the financial flue. Perhaps everybody connected with the concern did his level best to put the enterprise on it feet. The time might have been too early or the money structure too wabbly or the goods offered not appealing enough to the public. Remember the many failures early in the automobile, motion picture and radio games? Television is on its way—make no mistake about that. Millions more will be lost before television becomes a paying commercial proposition. Since the beginning of time it has always been a case of the survival of the fittest. That truism holds good in connection with television.

RADIO WORLD

The First and Only National Radio Weekly

Eleventh Year

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Meeting the Tax

THE usual difficulty in getting the radio industry to agree on anything was absent in regard to the new tax that includes some radio products. Trade conferences resulted in the increase of list prices, really to make the consumer meet the extra burden by the amount of the tax on the manufacturer. This has the advantage of not upsetting trade discounts.

The tax is 5 per cent. on the manufacturer's selling price, and that is the amount that is to be passed on, if the consumer is to absorb the entirety. However, there is no law against raising list prices, so the addition may be twice the amount of the tax, to net the manufacturer approximately the amount of the tax.

In the case of tubes the general price readjustment, in view of the tax, is one of reduction, since out of 44 tubes the prices of 9 are unchanged, and as to two others the prices are reduced 5 cents, whereas the seeming increases of list prices, by 5 per cent. approximately, indicates that the tube manufacturers are absorbing half or more of the tax.

The radio industry has met the situation fairly, particularly since it is losing money in virtually all its branches, including sets and tubes. There is no tax on sets as such, but there is a tax on the chassis, as well as on speakers, tubes, phonograph pickups and some other articles sold with or intended to be used with a set that is sold. By the certificate plan the actual manufacturer may not have to pay the tax. For instance, if he makes speakers for a set manufacturer, he may obtain the set manufacturer's certificate, and the set manufacturer pays the tax.

No doubt the radio industry feels, like other industries, that it can ill afford to pay taxes or raise prices. But it should take into account that it can not continue indefinitely the policy of manufacturing giveaways. The best sign of improvement of business conditions will come when the markups are sufficient to render a profit to manufacturers and sellers. The number of employees is reduced, and the salaries of retained employees are reduced, because businesses are losing money. So the general public, no less than business big or small, should be interested in the restoration of conditions that guarantee a fair return on manufacturing and selling. Confiscation is no fuel for hill-climbing. The sharp lines separating capital and labor are largely fictitious when the lines prove, as in the present depression, to have merged into a common plight.

* * *

Air Vogues

THE crooner's perch has been threatened these many months, first by heman baritones, now by comedians. The singers, either type, have the easier job, for with their voice and personality as natural endowments, albeit improved by experience, they can rely largely on the songwriters. The comedians do not find a great industry turning out material for them, and as they have particular methods for drawing laughs, or a "line" of their own, as they call it, they frequently resort to their own devices. This works out all right when they have a vaudeville act or are in a show, for the same material is used perhaps for forty weeks. But on the air it must be something different each time, and that is where the comedians are having their troubles.

Most of them are backed up by script men who write their stuff, but if it is still a general rule of the show business that puns aren't bought but made, it seems, from the frequent punning, that the comedians are economizing, too, and turning to "original" humorous thought. Thus enjoyment of many a good meal or palpitating sociable is menaced when the puns spout from the console.

* * *

Tubes Expected

THE choice of tubes for receivers is certainly a wide one now, and one may expect that only few more tubes will be announced presently, There is no triple grid tube for the 2-volt battery-operated series of tubes, equivalent to the 46 and 89, nor a separate suppressor type, equivalent to the 58, in 2-volt battery series or 6.3-volt automotive series, nor a duplex diode triode for these the 2-volt series. So one may expect that five more tubes will come along in due time.

The new tubes certainly produce improvements, and the sets including them are better performers than their predecessors. It has not always been true that one season's crop of sets was essentially better than the previous season's. Indeed. with the pentode popularity of last season's sets it may be said that the opposite was true in that very example.

This time the command is forward.

* * *

A Quiet Revolution

THE 50-cycle rule went into effect late last month and has worked smoothly, with scarcely any criticism. Some stations could not get their monitors on time, and were granted a respite. Aside from that we have found an entirely new degree of accuracy in frequency transmissions by broadcasting stations, accomplished easily, despite early misgivings that such accuracy could not be well achieved.

Now stations must not vary from their assigned frequencies by more than 50 cycles in either direction, whereas the rule formerly permitted 500-cycle deviation. Considerable reduction in interference was expected, for it was the very reason for the rule, and for once the promised land has become inhabited.

FADA HIRES 200 MORE

Frank A. D. Andrea, President of the Fada Radio and Electric Corporation, Long Island City, N. Y., announced that during two days approximately 200 employees were added to the payroll and that with continued evidence of increased buying power as recently experienced by the corporation, that between 1200 and 1500 workmen may be added to the FADA payroll by Fall.

PECK IMPROVES LENS SCANNER

A new television scanning wheel, only 5¾ inches in diameter, yet projecting a 5x6-foot picture which he says retains full brilliance and definition to the very edge of the screen has just been produced by William Hoyt Peck. The new wheel is similar in design to one he recently demonstrated in the Hotel St. Moritz, New York City, but gives a much clearer. brighter image.

The spot of light, which the disc projects from the crater tube to the screen by means of reflecting lenses, remains perfectly square at all parts of the screen. The results are much more perfect detail and shading, sharper contrasts and better definition.

To secure this improvement, Mr. Peck has fabricated a special optical glass according to a new formula which he has been working out during the past two months, with which he has been closeted in his laboratory.

Although thousands of dollars have been expended in research, the new glass can now be manufactured so cheaply that a dollar's worth of it will be sufficient for 225 lenses.

The new wheel has an optical axis of 2⅜ inches (center of wheel to center of lenses). Each lens measures ⅝ inch in diameter before being cut. A segment is then cut from each side, leaving the lens ¼ inch wide. The lenses are mounted in a perfect circle, rather than in the customary spiral, thus making use of all the light projected from the crater tube.

As the lenses are arranged in a perfect circle, there is no need to let the light spot spread, as in ordinary lens type scanning discs. Instead the spot is concentrated through a condenser lens system, and all the light is used, instead of 80% being wasted, as in other lens disc systems.

Audience Split Over Anonymous Announcers

WOR, Newark, N. J., recently made its announcers identify themselves by call letters rather than by name. Typical of hundreds of letters which have been received by the station are the following excerpts.

"I am at a loss to express my horror at the system of designating your announcers by code letters."

"I wish to commend you for taking the initiative in abolishing the custom of announcing the announcer's name. They are just mouthpieces. so why annoy listeners with incidental names?"

"I have always enjoyed knowing the name of the announcer. I am an ardent radio fan and I think that this is unfair to the announcer. I know that I speak for many other listeners."

"Just why none of the other stations have had this thought I cannot see. Who cares who the announcer is, as long as he gives the information? I think the other stations will follow suit."

"What, may I ask, is the big idea of eliminating the announcers' names?"

"The personality of the announcer has nothing to do with the program. A good nameless voice is ideal."

DID YOU KNOW THIS?

RADIO WORLD *has been first to reveal new tubes about to be announced officially, and first and occasionally the only magazine to print the complete official data, in the instances* of the 46, 56, 57, 58, 82. 55, 89, 85 *and* 83.

STATION SPARKS

By Alice Remsen

The Long Trek

For "Death Valley Days"
WJZ, Mondays, 8:30 P. M.

We set out with Life on an ardent quest,
And goad ourselves onward without a rest;
With never a spell to pause and think,
With time but to go—sleep, eat and drink.

We struggle along to the bitter end,
Believing ourselves on an upward trend;
But the higher we go, the harder the pull;
It's a heavier load when the knapsack's full.

And just as we're reaching a ledge above,
Life may give us a downward shove;
We hold up our head though our back is bowed,
And refuse to whine—for our spirit's proud.

Oh, Life is a beggar we cannot trust,
Traveling along in the heat and dust;
And little we know and less we reck,
Life barters with Death on our long, lone trek.

—A. R.

* * *

Death Valley Days is a dramatic program well worth the listener's ear. Sponsored by the Pacific Coast Borax Co., it tells the story of the long trek through Death Valley by our pioneer forefathers. Such sterling artists as Virginia Gardiner, Edwin Whitney, William Shelley, Jack McBride, Vernon Radcliffe, Joseph Bell and Tucker Battle comprise the cast, with John White doing the singing.

* * *

News of the Studios

WABC

"Lefty" Flynn, Yale football star of yesteryear, and his wife, the former Nora Langhorne, youngest of the five daughters of a famous Southern family, have been signed to appear as the regular featured soloists on the Gerardine "Midsummer Nights" broadcasts over the WABC-Columbia network; Thursdays at 8:30 p. m., EDST. Their success as singers on the program July 7th resulted in their engagement for the entire series. In addition to Mr. and Mrs. Flynn, the broadcast will include an orchestra under the direction of Jack Berger and different guest entertainers each week.

* * *

If you miss the name of Freddie Rich from the Columbia air-waves during the next two weeks, don't be alarmed; he is only on a two-week working-vacation to California, where he will serve as musical director for the screening of Bing Crosby's motion picture based on radio activities and to be known as "The Big Broadcast." During his absence his conducting will be turned over to Mark Warnow, Andre Kostelanetz and Johnny Augustine, the latter the first violinist in Freddie's ensemble.

* * *

Studios are now being commandeered at all hours of the day for commercial auditions. Hopeful artists are receiving calls from agents and casting directors. Sponsors are all praying for something different to lure the listening public to their section of the dial. Radio scribes are frantically writing comedy, old gags are being resurrected, new wisecracks are being thought out with concentration worthy of a better cause. Orchestra leaders are trying out new arrangers, hoping to get the almost impossible new angle in harmony; all of which proves that radio is taking on a new lease of life, at least around the Columbia studios.

* * *

NBC

Paul Whiteman is one of the busiest of band leaders. In addition to his daily and weekly broadcasts and his recording activities and numerous comings and goings in the music realm of New York, the Dean of Modern Music has announced that he will hold open house each Wednesday for music publishers and will also continue his search for promising radio talent. So, all ye would-be radio singers, go to see Paul Whiteman any Wednesday morning between 10:00 a. m. and noon, at the Cascades atop the Hotel Biltmore. If he thinks you have unusual radio possibilities he will present you over the NBC networks.

* * *

Ed Wynn has changed his mind and will continue to broadcast all summer. His original contract expired on July 19th, but the sponsors of the program, the Texas Company, liked his work so much and the audience response was so great that Ed decided to stay. He is very welcome; good air comedians are scarce!

* * *

WOR

Tommy Weir, the sweet Irish singer, now has three programs on WOR. He may be heard with Lee Cronican, pianist, on Sundays at 11:15 a. m.; on Mondays with an orchestra, at 5:45 p. m.; and on Fridays, also with orchestra, at 7:45 p. m. Tune in; you'll like him!

* * *

One of the most interesting periods on WOR is the "Unwritten History" series; Mondays at 10:30 p. m. Cosmo Hamilton, English novelist and lecturer, is the star of this program. He has a fine personality, an interesting background and talks well.

* * *

Sidelights

LOUIS DEAN once clerked in his grandfather's general store at Valleyhead, Alabama—his remuneration being all the candy he could take without being seen. . . . MARK WARNOW once taught English to emigrants. . . . BEN ALLEY worked with a Virginia road gang. . . . DON BALL played the ukulele and performed as master of ceremonies on a small time vaudeville circuit. . . . SANDRA PHILLIPS earned her first pay playing for dancing classes. . . . EARL SMITH, one of the FOUR ETON BOYS, set up type in a printing establishment. . . . ALICE REMSEN once owned her own tent show. . . . WILLIAM HALL once sold newspapers. . . . VERA EAKIN was a piano teacher. . . . HELEN NUGENT was a school teacher. . . . HOWARD BARLOW once was a stoker, tending the boiler in his father's furniture factory. . . . EDDY BROWN was born in Poland. . . . MURIEL POLLOCK, WILLIAM WIRGES, WILL DONALDSON, and JESSE CRAWFORD are among the NBC musicians who boast of thirteen letters in thier names; they're not a bit superstitious. . . . DONALD NOVIS was born in Hastings, England. . . . BOBBE DEANE, NBC actress, has a beautiful white Russian wolfhound named Czarina, and a Great Dane named Eric. . . . MONA LOWE, NBC contralto, has doubled for two well-known actresses in pictures which required vocal from a vocal-less leading lady. . . . BERT LAHR once worked in burlesque for thirty-five dollars per week. . . . VIRGINIA ARNOLD has a sister who is a psychologist. . . . GEORGIE PRICE has a secret ambition to be a jockey. . . . DOROTHEA JAMES first achieved fame by playing the feminine lead opposite Wesley Barry in the film, "School Days." . . . ENRIC MADRIGUERA is a personal friend of Ex-King Alfonso of Spain. . . . MARIA CARDINALE has a very beautiful home in Rockville Center . . . so has PHIL NAPOLEON; in fact, PHIL lives right opposite MARIA. . . . CLAUDE McARTHUR lives in New Rochelle, N. Y. . . . SAMMY HERMANN lives in Rye, N. Y. . . . JIMMY HAUPT is summering at Greenwood Lake. . . . so is PAUL SIMMONS.

* * *

ANSWERS TO CORRESPONDENTS

MARK CHASE, Erie, Penn.—Write to the Columbia Broadcasting Company, at 485 Madison Avenue, New York, N. Y., before you come to New York. They will send you passes for Chesterfield and Stoopnagle and Budd programs. All programs emanating from New York studios are on Eastern Daylight Saving time basis.

* * *

MOLLY PRAGER, Brooklyn, N. Y.—As far as I know, Lew Conrad is still in Boston. We rarely publish portraits. Write to the Boswell Sisters in care of the Chesterfield program. They will send you their picture. Will send you an autographed picture this week. Thank you for your kind words.

* * *

C. WHITTLE, Del Monte, Cal.—Sorry; we have no space for detailed programs. Look in your local daily paper for announcements. They are more up to date than any programs we could publish.

* * *

R. MUDIE, New York, N. Y.—Mabel Jackson is now broadcasting over WLW in Cincinnati. She has three commercial and two sustaining programs. You can reach her at that address.

* * *

Biographical Brevities

AS TO DONALD NOVIS

Donald Novis, the golden-voiced tenor, is from sunny California, and is the latest of the sun-kissed folk to achieve popularity on the NBC networks. He was born on March 3rd, 1906, in Hastings, England. At the age of two years he was brought to Canada by his parents. After a short stay in Canada the family moved to Pasadena, California, where Donald was raised and educated and where he first achieved fame.

Donald attended Whittier College and was the featured soloist of the college glee club. He won first place in the California State Eisteddfod. which, in case you don't know, is really a Welsh singing festival. Novis is his name, but he is very evidently no novice as a singer, for he has been a vocalist since childhood, and even in high school walked off with all the singing honors.

At the Pasadena Community Playhouse the lad sang the leading tenor role in the opera, "The Duenna," and created a sensation. In 1928 he won the Atwater Kent Audition prize of $5000.

He sang with the Coconut Grove orchestra at the Ambassador Hotel in Los Angeles, and came from there to New York, where he is now duplicating his Western success and is the sensation of the season on the NBC network.

Has a fine tenor voice and uses it in marked contrast to the mooing style of crooning delivery. It is to be hoped that he has started a new vogue in radio singing, although I must in justice say that Lanny Ross did that some time ago, but Lanny was not fortunate enough to be "spotted" for a big build-up by NBC. Donald Novis is being "built up" and will do NBC more credit than a great many of their former proteges.

SECRECY PLAN DISFAVORED IN POLICE TRAFFIC

Washington

The Federal Radio Commission collated statistics on police radio stations showing the average time required to transmit a call is 1 minute, 2 seconds, the number of arrests was 12,676, amount of property recovered $386,953 (260 stolen cars not included), number of autos equipped 2,255, service area 28,190 square miles, population 32,585,000. The statistics covered last April for cities of 100,000 or more. Smaller cities reported 453 arrests, $34,860 recovered. Total messages for both classes was 160,668.

"The majority of stations transmit each call three times, and the consensus is that the number is sufficient, says the Commission.

"Six cities did not report the number of arrests made as the direct result of radio. Only about fifty per cent of the cities had information available as to the amount of property recovered.

"A number of cases of interference was reported and in only one case was the source of interference within the same zone as the reporting city. In this case it appears that the two adjacent cities involved have established no means of co-operative use of the frequency and the city having an emergency announcement is unable to interrupt routine announcements being transmitted by the other city. It is believed that proper co-operation such as in effect between other cities sharing the use of a single frequency will completely eliminate this difficulty.

9 to 10 P.M. Busiest

"A study of the cases of interzone interference indicates that the receiving equipment furnished police cars is, in many cases, not up to modern engineering standards, as stations 16 kilocycles from the assigned fre- In view of the lack of availability of frequency are reported as causing interference. quencies it will not be possible to provide for a greater separation between channels in the near future.

"The busiest hour of the day appears to be between 9 and 10 p. m. The four hours prior to 10 p. m. are reported as busy hours by at least fifty per cent. of the cities, while the same number of cities report only two busy hours after 10 p. m.

"Metropolitan area police radio systems, in which one city serves adjacent municipalities, are growing in favor. Twenty-eight cities have reported that they are regularly serving adjacent municipalities. Two cities report the rendering of service on special occasions. It is known that some of the cities which have rendered no report are actually conducting service for the benefit of surrounding municipalities.

Word-Economy Code

"Many licensees believe that secrecy systems have possibilities if they can be made mechanical, rather than of the code book type. The majority of licensees believe that secrecy systems are unnecessary and that the number of times that the transmissions are used for improper purposes is far outweighed by the salutary effect due to reception by the general public. One licensee, with reference to a secrecy system, states that it is his belief that any criminal organization having the ability to install and operate an intercept system for the protection of criminals against the police would be able to duplicate mechanical devices installed for secrecy purposes and render such a system ineffective.

"Opinion with reference to code designed with a view to transmitting the maximum amount of information with the minimum number of words is much more divided. At least one city reports the use of a very complete code based on a numerical system in which the type and gravity of the crime is indicated by the size of the number, such as Number 1 indicating a murder, Number 2 an armed holdup, et cetera. Other cities are experimenting with a code system but do not feel that hey are as yet in a position to report on its feasibility. A few cities have tried code and discarded its use. A large gorup of licensees feels that a code system is unnecessary if care is used by the dispatcher to avoid the transmission of unnecessary word and, therefore, do not recommend its adoption.

Call Letters Enough

"The Commission's observers report that some stations are transmitting an announcement periodically of call, frequency, wave, authorization, etc.

"This announcement is not required by the regulations and occupies valuable time which may be needed by some other city for the transmission of an alarm with reference to an extdemely important message. It is recommended that this practice be discontinued, as the transmission of call letters alone is sufficient. Certainly the transmission of call letters, city, name, and correct time should be the maximum material transmitted for test purposes.

15 Persons Caught in Act

"One city reports specifically that during the month of April fifteen persons were caught in the actual commission of crime. Another city believes that police radio could be better administered by the installation of cinct for the purpose of serving that presmall, lower powered transmitter in each precinct alone, while another has completely abolished all precinct stations and operates the entire system from the central headquarters. Still another reports that it connects the telephone system to the police transmitter during the reception of emergency calls in order that all cars may hear the actual conversation between the dispatcher and the citizen reporting the emergency.

Two-Way Talks

"It was suggested that a two-way communication system should be provided to permit patrolmen in cars to transmit back to headquarters or to other cars information of general imporance in combating crime. It is recognized that a two-way system of communication has distinct advantages and would permit greater flexibility in the handling of a motorized police force. However, no consideration can be given to the authorization of such a service until a sufficient number of frequencies become available."

Engineer's Ring Heated by Wave

National Broadcasting Company engineers recently found their most carefully designed microphones acting in a strange manner. The technical men immediately suspected interference was caused by broadcasts from the NBC experimental television studio. A right and that the clender metal rod which check-up proved that the engineers were supports the microphone formed a perfect antenna for the television waves.

In another case an engineer working near the NBC television transmitter atop the Empire State Building, N. Y. City, felt one of his fingers grow suddenly hot. Investigation showed that a ring on that finger acted as a coil and could dissipate the power only as heat.

W8XK HAS NEW SCHEDULE AND TRANSMITTER

Pittsburgh

New short-wave broadcasting facilities have been installed at Westinghouse station W8XK, Saxonburg, Pa., approximately 30 miles from here.

The National Broadcasting Company and local programs broadcast through this American station are daily received by inhabitants of the remote plains of Argentina, dwellers in the teeming cities of distant India, residents throughout Europe as well as those of the Arctic who have been shut off from civilization. During the hours that the short-wave unit is on the air is broadcasts the programs of KDKA.

Uses Four Waves

Since the installation of the short-wave equipment both KDKA and W8XK programs go on the air from that site. New equipment for broadcasting on 15,210 kilocycles (19 meters) and 21,540 kilocycles (13 meters) has been installed. The equipment for short-wave frequencies of 6,140 kilocycles (48 meters) and 11,870 kilocycles (24 meters) was moved to Saxonburg from its former location at the "hill" radio station on the Greensburg Pike, about 28 miles from the present Saxonburg location.

The Federal Radio Commission has granted a license for W8XK to operate on power up to 40 kilowatts. Not only are these short-wave programs of W8XK received direct on short-wave sets but millions tune in on them after the waves are picked up by relay stations and rebroadcast on standard wavelengths.

The 19-meter wavelength is used for morning short-wave broadcasting. In the afternoon and early evening 25 meters are used. After sundown and at night the 48 meter wavelength is placed in operation.

Schedule of Sending

The official daily broadcasting schedule of W8XK in Eastern Daylight Savings time is as follows:

48 meters— 6,140 KC — 5 p. m. to sign-off
25 meters—11,870 KC — 4 p. m. to 10 p. m.
19 meters—15,210 KC — 7:30 a. m. to 5 p. m.
14 meters—21,540 KC — 7:30 a. m. to noon

Dorothy Lewis Dies; NBC Staff Contralto

San Francisco

Dorothy Lewis, National Broadcasting Company contralto, died here.

Miss Lewis had been a member of the staff of KPO, key station of the NBC-KPO network, for about two years. She was born in Portland. While on a month's vacation at the home of her father, H. L. Lewis, she died after a long illness.

As a concert singer she toured vaudeville circuits of the West for seven years before turning to radio. Her first microphone appearances were at NBC station KGW, Portland.

REMOVAL REQUEST OPPOSED

Washington

Examiner Hyde, of the Federal Radio Commission, has recommended that the application of WJW, Mansfield, Ohio, to remove to Akron be denied. The station is operated by John F. Weimer as the Mansfield Broadcasting Association on a frequency of 1,210 kc with a power of 100 watts and unlimited time.

RULES RELAXED FOR ECONOMIES BY BIG CHAINS

The two big chains, those of the National Broadcasting Company and the Columbia Broadcasting system are making wide readjustments to meet conditions. Besides the reduction in number of employes and salary cuts for many of those retained, artists have had their pay reduced; indeed, were the first ones to feel the effect of the economy wave, and now other changes are being made.

One of them, in the case of the National Broadcasting Company, has been to permit the mention of prices during certain morning hours, on the theory that housewives have an interest in them. However, since night listeners have no particularly different interest it is expected that in time there will be no barrier against mentioning price, provided it is done in an acceptable manner.

Done Indirectly Now

At present price is mentioned indirectly, when expressible in terms of some unit cost of a commodity or a utility service. For instance, when the manufacturer of a tooth paste wants you to know it costs only 15 cents—whereas his competitors are charging a quarter—he says that his toothpaste, unlike others, costs no more than a package of popular brand cigarettes. What cigarettes of this type cost is well known to nearly all listeners, so the effect of a direct statement of price is achieved without offending the rule.

Again, if something, like package candy obtainable at news-stands, cost a nickel the manufacturer can let you know that fact by stating, as he does, that the price is no more than that of a local telephone call.

However, the reason for admitting specific mention of price, a practice that is not taboo at small radio stations, is to attract more sponsors. Just now the chains need business, and both have reduced their rates, at least for certain periods, while one chain is offering a monthly payment to member stations, instead of so much per program picked up.

Records Permitted

Phonograph record use has been taboo by NBC, but now the situation has changed, so that the local station manager can suit himself about the use of recordings. Such use has grown fast in radio, due to the large difference in cost between playing a record and having the performers in the studio, or receiving the program over telephone land wires from some other station. In case of the wired program, the toll for wire use is paid by the originating station; nevertheless the price actually becomes a part of the bill rendered to the sponsor, if a sponsored program is sent, and thus permission to use recordings comes as a measure of economy.

The rule against them used to be so strict that even birds were placed in a studio to give atmosphere to an orchestra, rather than use a recording of the warbling of some canaries.

The rule of the Federal Radio Commission, requiring that recordings be announced as such, in words clearly disclosing that a record is being played, remains in force. It was considerably modified for a while, but than the modification was rescinded.

The changes being wrought have an indirect effect on the negotiations between the American Society of Composers, Authors and Publishers, and the broadcasters. The society seeks a 300 per cent increase in fees charged to big stations, lesser or no increases to smaller stations, and cites the profits of the chains. The economies being instituted by the chains are to prevent a loss, and as the question of fees is to be decided largely on existing conditions, the conferees have a great deal about which to talk.

The truce between the two ends September 1st. a compromise is expected, so that copyright music can continue to be played, especially as broadcasting depends so largely on the use of such music.

Engineer's Wife Indorses the 55

While considerable technical comparisons and contrasts, with illuminating curves, are published regarding detector tubes, sometimes a practical demonstration before non-technical listeners serves as good a purpose—especially as radios are bought by non-technical folk, for the great part.

A radio engineer had a receiver operating in his home for several weeks, '24 detector. Along came the 55 tube and he put that in. He commented to his wife, who takes no particularly scientific interest in music, or the faithfulness of audio amplifiers and detectors, that the radio sounded fine. She agreed. The set played during two weeks. Then the engineer put in a 57 tube, but the input was too great, and that tube overloaded often, as had the '24. Next he used a 56 as detector. The 56 is like the '27, and detection as afforded by these two types is what had been regarded as standard of excellence.

One night, with the 56 tube doing its duty, the engineer's wife turned off the set, an unusual act, for she is a steady listener.

"Can't stand that racket," she complained.

The engineer replaced the 55 tube after the missus had fallen asleep and from then on the missus has been listening to the set with great delight.

NAMES SPELT AS PROTECTION

The reason why the simplest names and words are spelled over the radio is that unless this is done the listeners may get quite an erroneous idea of what was said. Even famous names of individuals—Floyd Gibbons, Lowell Thomas, Graham McNamee, etc.—don't "register" sufficiently, as the mail discloses. Letters addressed to Boyd Biggins, Roy Gilbert, Royal Gibson, Low Tommers, Laurel Thompson, Gray Nanny, Regan McName and the like are many, altogether too many. Therefore sponsors who desire to get a trade name across have it spelled, and while most listeners will feel they are being patronized, the sponsors want to feel that their own products will be patronized, hence go to the pains of utter simplicity.

Whether the fault lies exclusively with those listeners who do make the mistake in names, or whether the radio receivers must share the blame, has not been determined. The best minds of the country do not as a rule write letters to stations. In fact, many of the letters contain bad mistakes in English, both as to spelling of simple words and use of false syntax. This lends color to the assertion that listeners are to blame, to a large extent. But if one listens to an old-time regenerative receiver, with its badly cut sidebands, wretched audio amplification, and the climax-capping distortion of a 1926 model horn, it is hard for the most literate to determine the niceties of proper names.

EXPLOITATION RECOMMENDED TO EDUCATORS

Washington

Dr. C. M. Koon, specialist in education by radio at the United States Office of Education, recommends that the methods used by commercial broadcasting companies in attracting the interest of listeners to their programs be studied by educators interested in educational broadcasts.

"If a broadcast is intended for instructional purposes," he said, "the participation of listeners is of paramount importance, and the methods used by commercial stations in sponsoring, announcing, and determining the success of their programs are the results of important experiences."

Will Publish Book

This is recognized by the Office of Education in its preparation of a forthcoming booklet on "How to Broadcast—the Art of Teaching by Radio," Dr. Koon added. Many programs which have not been set up primarily as educational nevertheless have been instructional in many instances. The following additional information was made available:

Extensive publicity, aids to study, and listener cooperation are important factors in broadcasts for instructional purposes. A variety of ways is employed by the broadcast stations to secure effective use of the broadcasts.

Field Scanned

A number of the methods has been listed by the Office of Education in its study and are being analyzed as guides in mapping instructional programs. Announcements in newspapers in the form of feature articles, syndicated stories, photographs of participants, letters from listeners, announcement programs, for example, bring forcibly to public attention what to expect.

Instruction by radio, it was said, will not be successful without the mastery by those who sponsor it of certain technique, equally as important in attracting listeners as the program itself is of educating them.

Four Tenors Form Challenge Polo Team

A polo team has been formed by four tenors of the National Broadcasting Company Artists Service. Frank Parker, tenor of the A. & P. Gypsies and Cities Service programs, is captain.

Bob Simmons, tenor recently heard on The Campbell Soup hour, will play Number One position; Henry Shope, tenor of The Cavalliers Quartette, will play Number Two; Parker will play Number three, and Julian Oliver, Spanish tenor, will play Back.

All arrangements are handled by Parker at the NBC studios, 711 Fifth Avenue, New York City.

OPPOSES ABILENE STATION

Washington

Examiner Pratt, of the Federal Radio Commission, has recommended to the Commission that the application of Bernard Hanks, Abilene, Texas, for a new broadcasting station be denied.

INTERFERENCE SLEUTHS CURE VARIOUS ILLS

Two reports on cures for interference are contained in "The Pacific Radio Trade Association News," July issue, as follows:

BY PAUL E. CURRENT

Interference investigations in the new territory are progressing very nicely and the dealers are all highly enthusiastic over this service.

Many new problems have been encountered and some of them require a great deal of experimenting and tests to lower the noise level. These problems are especially hard when the complainant lives almost directly under some of the high voltage lines that network that country.

The interference encountered there is not the typical noise of power leaks of various sorts, but appears to be a noise field that is very similar to a magnetic field that surrounds a magnet.

The noise is encountered suddenly and stops very abruptly. Shield lead aerials and filters helped in some cases and in others did absolutely no good. In one case, the antenna coupler system eliminated the noise almost altogether, while in another place the filtered aerial did the trick.

We have taken several of the new dealers on trips with us and demonstrated to them what we do and how we do it. Several installations are sold each trip, and we feel very confident that the membership as a result will increase more each month.

BY FRED D. ROWE

The remodeling of an apartment house with wire screen and plaster on the outside was responsible for several complaints of radio interference. The set owners used inside antennas, resulting in a coupling with the nearby street cars.

Radio interference covering an area of two miles was caused by two guy wires fastened to a pole carrying 11,000 volts which were rubbing against a street light pole.

Dial telephones have been responsible for several recent interference calls. The installation of condensers by the Pacific Telephone & Telegraph Co. eliminated the trouble.

A defective aerial on an apartment rubbing against another caused noise in all the sets with aerials in close proximity to the ones found rubbing together.

Broken rail bonds and pitted trolley circuit breakers were responsible for several recent complaints. We recommended a shield leadin with the flat top portion of the antenna at quite a distance to the feeders, etc.

We are continually finding that loose fuses, switches and lamps in the building are responsible for many interference calls.

Another source of trouble is often found to be caused by the reversing of aerial and ground connections at the set.

M. B. SLEEPER IN NEW POST

M. B. Sleeper, following his resignation as sales manager of Pilot Radio, has been elected assistant vice-president of the United States Capital Corporation, Boston, Mass. In this capacity, he will be in charge of sales in three subsidiaries: Radio Television Industries Corporation, at Reading, Mass.: Globe Television & Phone Corporation, of New York City, and Television Products, Inc., which has purchased the equipment and patents of the Sleeper Research Corporation. Sales headquarters of the three companies are located at Reading, Mass.

Tradiograms

By J. Murray Barron

Recording Radio Programs

Lord & Thomas, advertising agency, which is said to place the largest volume of radio advertising on the air, has purchased special phonograph disc recording and reproducing apparatus from the Record & Recording Division of the R. C. A. Victor Company. It is understood that Lord & Thomas plans to make disc records of programs with the new apparatus as an inexpensive means of preserving the program exactly as it goes out on the air. The recording apparatus is simple, inexpensive and portable. It consists of a unit of two turntables, an amplifier and suitable volume control, a two-button studio microphone and a loudspeaker for playing back the records after they are made. Pregrooved records of a semi-flexible material are used for recording and the records may be played back immediately after they are made.

* * *

Even today, with all the readjustments called for by the business world, and the many persons who feel that they should mark time, we still find some who keep ahead of the times.

Leeds Radio Store, at 45 Vesey Street, N. Y. City, caused customers entering the store to be greatly surprised to find that they automatically announced their arrival even though they entered through an open door. A photo cell, with an electric bell in the circuit, did the trick. Just this simple arrangement caused a very great interest and naturally a lot of good publicity. It was an original idea applied to a retail store in a unique way.

Every day we find more and more new schemes for the phot ocells and they are finding their wav into practically every business.

* * *

From indications in the retail radio field in N. Y. City business must surely have taken a turn for the better. Harvey's, the radio store formerly at 105 West Forty-third Street, has moved to 103, a much larger quarters. In addition to two large and very modern windows which house one of the finest radio displays in mid-Manhattan, we find upon entering the store a cheerful and well-laid-out display salon with about everything in 1932 radio receivers. To the left side in the rear is a fully-equipped service department. Executive offices are placed on a large balcony in the back section of the store. These quarters are the third this concern has occupied on Forty-third Street. Each move has been into a bigger place.

* * *

One of the finest and most elaborate tube displays to be seen in New York City is now attracting attention at Walter H. Nussbaum, Inc., 61 Cortlandt Street. All details and most known advance information on tubes is here for the benefit of the public who have need for such and a special corps of men is on duty.

* * *

Once again New Jersey folk will find a radio shop handy as they rush to catch the train. Modell has opened a radio booth store at the Cortlandt Street end of the Hudson Terminal with a full supply of tubes, receivers and some parts.

* * *

Last week saw the opening of another new radio store on Cortlandt Street, the Cort-Wich, northwest corner of Cortlandt and Greenwich Streets.

* * *

Blair Radio Labs. have moved to new and enlarged quarters at 18 Warren Street, N. Y. City. Power amplifiers and public address systems, together with special lab work, demanded the additional space.

SHORT WAVE CLUB

E. O. Cole, R. E., Cole's Radio Service Co., 2714 Warren Blvd., Chicago, Ill.
Fausto M. Donastorg, Yngenio "Angelina," S. P. Macroris, Dom. Rep.

STANDARDS ON TUBES VOTED; PARTS DEFINED

New standards for radio adopted by the American Standards Association follow:

Four-pin bases of the large and small type, large four-pin base without bayonet pin, large five-pin base without bayonet pin, four-pin transmitting tube base, large transmitting tube base, four-pin sockets for receiving tubes, and five-pin sockets for receiving tubes.

The standard also specifies dimensions for terminal caps for both receiving and transmitting tubes and for connections between the tube elements and the pins.

The manufacturing standards applying to broadcast receivers establish a national standard for the frequency range of receivers from 550 kilocycles, or 545.1 meters, to 1,500 kilocycles, or 199.9 meters. The rating and design of socket-power devices and electric radio receivers are to be standardized for operation on coltages from 105 to 125.

A standard test for quality of soldering of cords tips or terminals to radio cards is also provided. This test is a straight pull of 5 pounds applied to the tip or terminal. Other details for which standard dimensions are established are cord tips, binding posts, cable terminals, radio plugs and packs, and pilot lamps. There are also standard definitions for the various parts of radio receivers.

NBC MANAGES GOLDMAN

Edwin Franko Goldman has signed an exclusive long-term management agreement with the National Broadcasting Company.

NEW INCORPORATIONS

Furst Radio Corp., New York City—Atty., J. Furst, 51 Chambers St., New York City.
Loomis Refrigerating Corp., New York City—Atty., L. E. Forman, 450 - 7th Ave., New York City.
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Name Change

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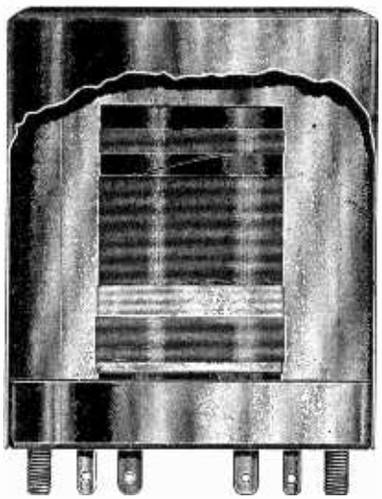

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The bases have punched openings through which four lugs protrude, and also are provided with rigid 6/32 machine screws for mounting. These screws protrude downward and are 1 11/16 inches apart. The coils may be mounted on chassis cut for the wafer type tube socket, or may be mounted by means of threaded bushings, elevated half an inch from a chassis top, requiring no cutout chassis.

The shield has a small protected opening at top so the lead for the grid cap may be brought through. The opening is bevelled. This constitutes the protection against fraying the insulation of leadout wire to grid cap. The shield cover is 2⅛ inches outside diameter and 2½ inches high.

Inside the shield base are stamped designations as follows: P, B, G and ground symbol. These stampings are near openings through which the corresponding lugs protrude downward. Besides, there is a side lug, protruding outward near the bottom of the form. P and B are always the primary connections, P going to plate an B to B plus, except in the case of the coil used for antenna coupler, when P goes to aerial and B to ground. G is always the connection for grid cap of the r-f tubes, also grid cap of the detector if it is a screen grid tube, otherwise to G post of socket of the detector tube.

The side lug is the grid return connection, usually grounded in circuits. The stamped ground symbol is not the ground connection but represents a tap on the secondary for tuning to 80 meters. The broadcast band is covered in full with the entire secondary—G and side lug—while from 200 to 80 meters are covered when the ground symbol tap is picked up by condenser stator.

To accomplish 80-550 meter coverage, therefore, a three-deck switch, two positions for each deck, is required, and must be of the insulated type. The moving arms connect to condenser stators, and pick up either the full secondary or the tap, which is about one-quarter of the secondary, in number of turns. The full secondary is always in the grid circuit, wired as previously stated, but the tuned circuit is made to consist either of the full secondary of one-quarter of the secondary, by switching the condenser stator to either point.

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The coils are of the same type of mechanical construction as the t-r-f coils. Since there is no secondary tap, the code for connecting the t-r-f coils of the superheterodyne combination is different: P and B, primary; G and ground symbol, secondary. P would go to plate or antenna, G to grid cap, while B and ground symbol are the returns.

The oscillator has a smaller inductance secondary, for padding, and moreover is a three-winding coil. The three windings are: pickup, secondary and tickler. The pickup winding consists of 10 turns, and is brought out to two side lugs. The polarity of its connections unusually is of no importance. The secondary is represented by G and ground symbol, G going to grid and ground symbol to grid return, usually ground. The tickler connections for oscillation require that the lug at B be connected *not to B plus but to plate*, hence the P lug goes to B plus. In any case, if no oscillation results, reverse the tickler connections.

Tuning Coils for 175 kc Receivers

CAT. NO. 4—Three shielded coils, two for modulator and r-f and one for oscillator, for 0.00035 mfd. three-gang condenser. Oscillator coil has pickup winding. Intermediate frequency intended, 175 kc. Price includes padding condenser, 700-1000 mfd. $1.80

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Tuning Coils for 365-465 kc Receivers

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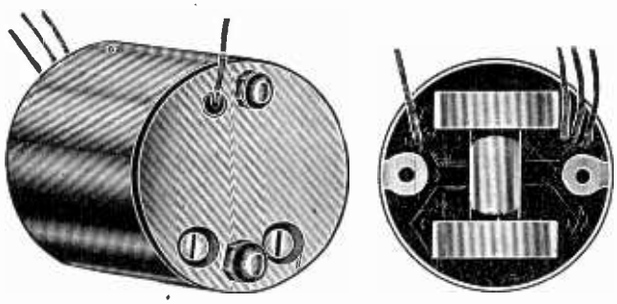

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The primary consists of the yellow and red leads, yellow to plate, red to B plus. The secondary consists of the green and black leads. Green emerges through a protected small opening in the top of the shield and goes to grid cap of a screen grid tube. Black is the return for the secondary, usually to ground. Both primary and secondary are tuned, and thus the coils are for screen grid tubes exclusively, except the second detector may be any type tube. The condensers for tuning the coils are Hammarlund's compression type, on an Isolantite base. The set-screws for adjusting these condensers with a screwdriver are accessible from the top of the shield.

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