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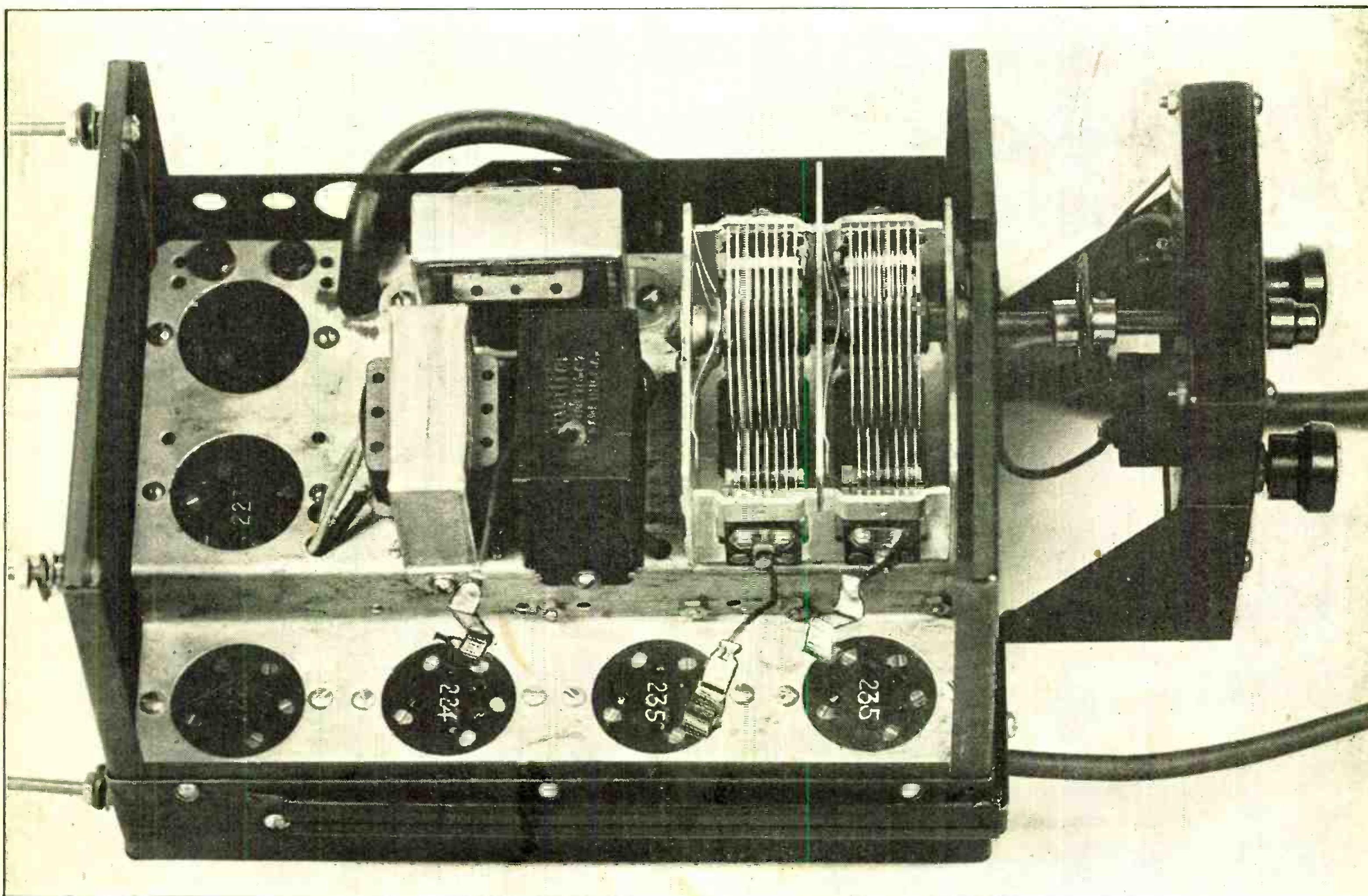


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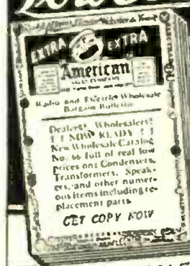


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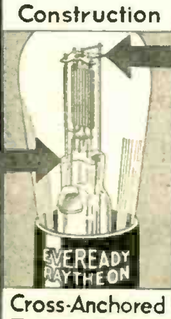


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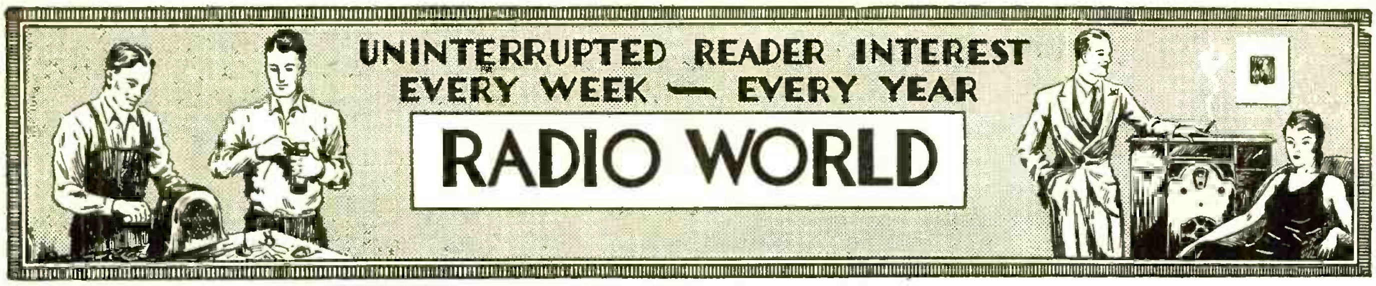


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# An Auto Receiver

## Fits in Even the Small Cars Between the Cowl and the Dash

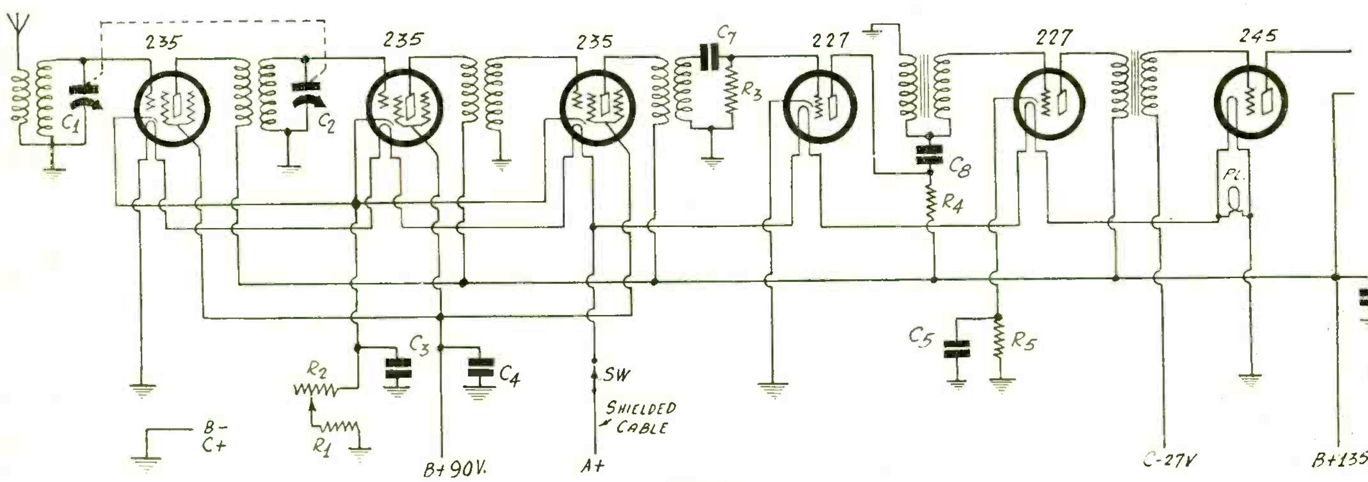



FIG. 1

IT has been stated many times that an automobile receiver must be sensitive if it is to supply entertainment while the car is in motion and when no other antenna or ground than that possible in a car is used. We wish to emphasize the need for sensitivity. If the set is not very sensitive it might just as well be left at home, for it will not bring in satisfactory signals under the extremely unfavorable conditions obtaining in a car. Certainly we need three stages of radio frequency amplification, a sensitive detector, and on top of this, two stages of audio frequency amplification. Will this make a set that is sensitive enough? It depends on where the car is taken and how unfavorable the conditions are. The circuit diagrammed in Fig. 1 has been installed in many cars and it has given satisfaction in every instance.

Let us examine the set, therefore, to see where the sensitivity comes in. In the first place it has three stages of radio frequency amplification with a variable mu type screen grid tube in each stage. These are first rate amplifiers. The first two couplers are tuned with a single control. The question may arise as to whether these two tuners provide adequate selectivity. There are two factors which are favorable. In the first place the antenna is small and does not exert much damping on the first tuned circuit so that this is even more selective than the one that follows the first tube. Then there are only two tuners on the single control, and it is easier to adjust two so that each contributes all its selectivity than to adjust more than two. When more are used on the same control the selectivity may be greater at some setting, where adjustment has been made, but the combined receiver may be quite broad at other settings. Besides, in an automobile receiver it is not necessary to have nearly as great selectivity as in a receiver that is to be used permanently in the vicinity of high power broadcasting stations.

### Untuned Stage

In order to boost the amplification with more tubes without the use of extra tuners the second two couplers are untuned radio frequency transformers peaked broadly so as to cover the entire broadcast band effectively.

Following the radio frequency amplifier is a grid leak, grid condenser type of detector, with the grid leak connected between the grid and ground, or grid and cathode, since the cathode is grounded. The stopping condenser C7 has the value 0.00035 mfd.

The coupling between this detector and the first tube is somewhat unusual. It is a combination of resistance-capacity and autotransformer coupler. The plate is fed through resistance R4, which goes to the B supply. The value recommended for this coupling resistance is 20,000 ohms.

The autotransformer is essentially an ordinary audio frequency transformer with the two windings connected in series, the connection being made so that the primary and secondary voltages add up on the grid on the tube after the coupler. The terminal ordinarily connected to the plate is connected to ground, and

*(Continued on next page)*

### LIST OF PARTS

*Coils*

**Two radio frequency tuning transformers for 0.00035 mfd. condensers.**

**Two untuned radio frequency transformers.**

**Two audio frequency transformers, one connected as autotransformer.**

*Condensers*

**C1, C2—Two 0.00035 mfd. tuning condensers with one dial.**

**C3, C4, C5, C6—Four one microfarad condensers.**

**C7—One 0.00035 mfd. fixed mica condenser.**

**C8—One 0.1 mfd. fixed condenser.**

*Resistors*

**R1—One 0.25 ohm resistor.**

**R2—One 800 ohm variable resistor for volume control.**

**R3—One 2 megohm grid leak.**

**R4—One 20,000 ohm resistor.**

**R5—One 2,000 ohm resistor.**

*Other Parts*

**One 2.5 volt, 0.25 ampere pilot lamp.**

**One filament switch.**

**One four-lead shielded and rubber covered cable.**

**Four UY sockets.**

**One UY socket.**

**Special metal chassis.**

# An Easily-Accommodated Set

## Receiver Has Adjustable Dial Distance for All Cars

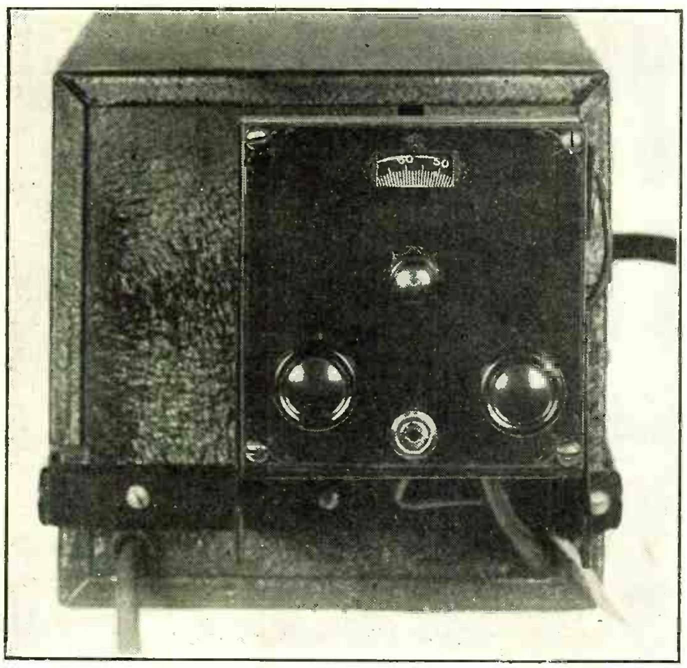


FIG. 2

(*Continued from preceding page*)

the plate is connected to the junction of the two windings, through a condenser C8 of 0.1 mfd. The junction is made by connecting the B plus and F terminals of the two windings.

This method of connecting the audio transformer produces a high step-up of the voltage since it combines direct and transformer voltage. Not only is the voltage that would be impressed on the tube with direct coupling put on the tube that follows but also the voltage that is induced in the secondary by the current in the primary. The sensitivity of the set is in no small measure due to this form of coupling in the circuit. The coupling between the first audio frequency amplifier, a 227, and the output tube is by ordinary audio frequency transformer.

The volume in the circuit is controlled by varying the grid bias on the three variable mu tubes, all of which are put on the same control. There is first a fixed resistance R1, of 0.25 ohm in the common cathode lead. This is used to prevent the bias from going to zero. The main part of the bias is obtained from the variable resistance R2, which has a maximum value of 800 ohms. A 2,000 ohm bias resistor R5 is used for the 227 audio frequency amplifier. This is a standard value for this tube.

The two tuning condensers C1 and C2 are 0.00035 mfd. units attached to one control. The secondaries of the coupling transformers are wound to fit these condensers and to cover the broadcast band. Condensers C3, C4, C5 and C6 are all one microfarad units.

### The Filament Circuit

The car battery, of course, supplies the filament current for the six tubes in the receiver. Since this maintains a voltage of about 6.3 volts, if three of the 2.5 volt tubes are connected in series each tube gets a voltage of 2.1 volts. While the rated voltage for these tubes is 2.5 volts, they will work satisfactorily on a voltage as low as 2 volts. But there are six tubes and only three can be connected in series across the battery. Hence two circuits of three each are made up and connected across the battery. If the voltage across each tube were 2.5 volts the total current drawn from the battery by the six tubes would be 3.5 amperes, but since the voltage is only 2.1 volts, the current will be only 2.94 amperes.

Note that the power tube filament is connected in series with the heaters of the two 227 tubes. The 245 power tube requires a current of only 1.5 amperes. Since this is less by 0.25 ampere than the amount required by the heater tubes, a pilot light PL requiring a quarter ampere at 2.5 volts is connected across the 245 filament. Thus the current is equalized and the series connection is permissible. The 245 filament is connected next to the ground so that there will be no bias complications.

The bias for the power tube is supplied by a battery of 27 volts. The plate and screen voltages are supplied by another battery of 135 volts. It will be noted that the voltage on the screens is 90 volts rather than the usual value of 67.5 volts. Higher amplification is the reason for using the higher voltage.

### Assembly

The set is assembled in a metal box measuring 6½x6½x9 inches. This case is ground and all the leads terminating in the ground symbol should be connected to it. The negative of the A battery is also connected to this case, which connects the grounded side of the circuit to the chassis of the car, for this is connected to the negative side of the battery. Thus the only ground available in the car is automatically obtained by making the connection to the battery.

The negative of the plate battery and the positive of the grid bias battery are also connected to the shield or to the car chassis. If the batteries are placed far away from the set in the car it is not necessary to run the B minus and the C plus leads to the set. It will be enough to connect them to the nearest point on car chassis.

The filament switch is placed in the positive lead to the storage battery, since this is the only practical lead where the circuit may be broken.

A long cable is provided for the positive line from the storage battery, the 90 and 135 volt leads from the plate battery, and the negative lead of the grid battery. The leads are covered with a heavy serving of rubber and metal braid, which is connected to ground. Thus the leads are shielded from undesired pick-up.

### Mounts on Instrument Board

The receiver is so assembled and designed that it mounts easily on the right of instrument panel in the car. It is not necessary to deface the panel to mount the set, as the mounting bolts are attached to the "dash board" back of the instrument panel. The separation between the set chassis and the set control panel is adjustable so that the control panel may be adjusted flush with the instrument panel. The extension feature makes the set adjustable to any car.

Fig. 2 shows the control panel of the receiver. The dial is at the top and at the bottom are three knobs, one for the volume control, at the left, another for the tuning control, in the center, and a third for the switch at the right. The apparent knob in the center is the shaft of the condensers. To make the extension of the shaft, a rod of suitable length is measured off and put into the dial drive. Then this is coupled by means of a flexible coupler to the condenser shaft. Necessary leads connecting the control panel and the set are flexible and sufficiently long to accommodate any car.

[Other Illustration on Front Cover]

# A Typical Midget
## 235 R. F. and Pentode Output

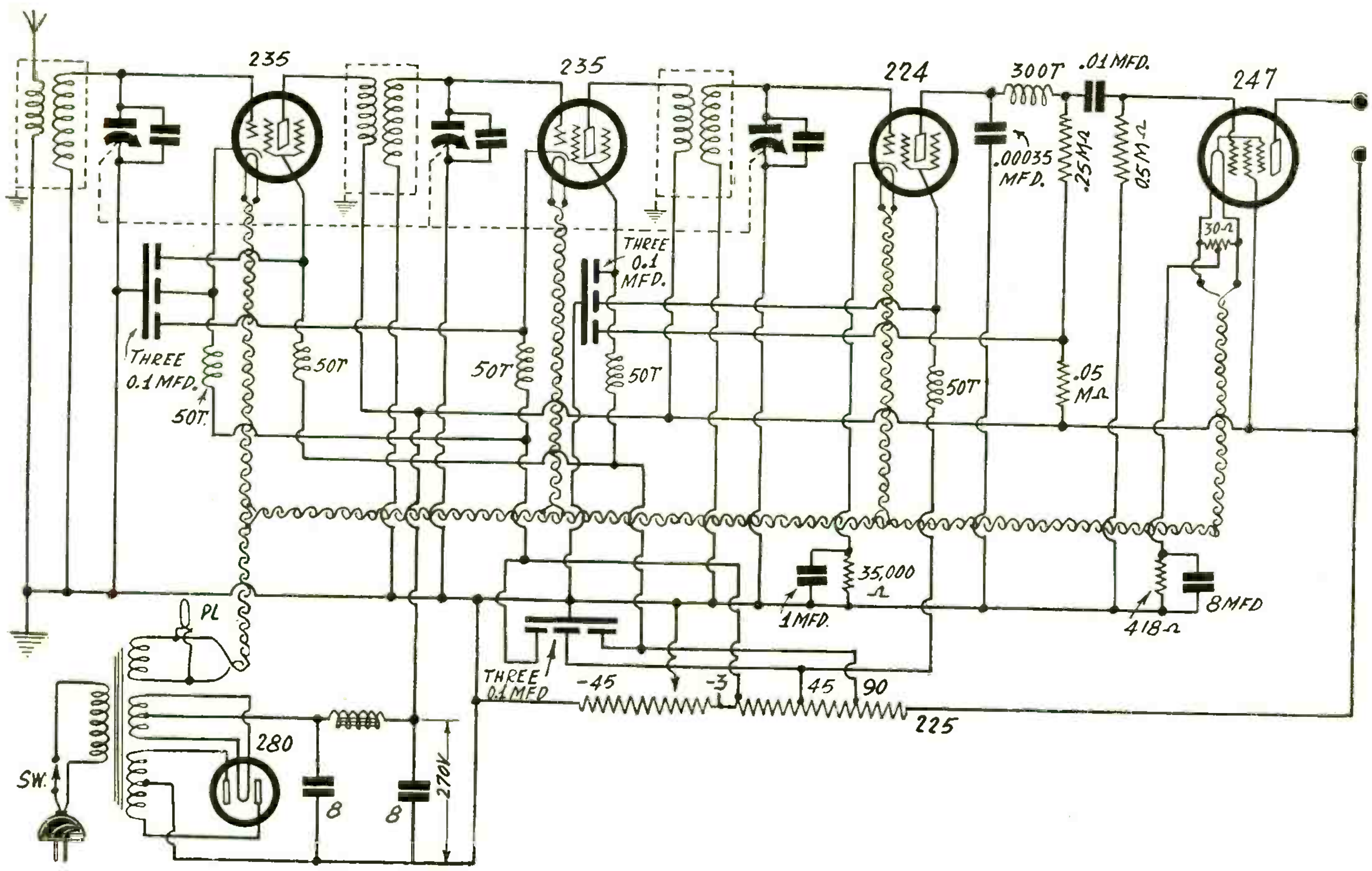



FIG. 1

**Typical circuit illustrating commercial types of midget receiver designs, using tuned radio frequency amplification and having a pentode output.**

MIDGET receivers are the rage of the day in radio. There are midgets of all kinds, and some of these midgets are about as sensitive and selective as the large console models. At least, they are sensitive enough for normal enjoyment of radio programs. That is to say, they are capable of bridging in all the stations which one ordinarily tunes in for the purpose of program enjoyment. And they usually have as much output as the larger sets.

The small size is obtained by using miniature parts where smallness does not detract from the efficiency of the circuit. They are also made small by crowding the parts together where crowding is electrically permissible. Much space is saved in the loudspeaker, for this, too, is made on a miniature scale. Here, perhaps, is the greatest sacrifice to the god of miniature.

But even here the sacrifice is only in respect to the size of the baffle board for the small electro-dynamic or magnetic unit is quite capable of giving enough volume for any home.

A circuit such as that given in Fig 1 is quite suitable for a midget set, midget in size but not in sensitivity, selectivity, or volume. It comprises only five tubes, including the 280 rectifier. The first two, which are radio frequency amplifiers, are 235 variable mu tubes. They insure a high amplification when it is needed and a low amplification, without detection effects when only low amplification is needed.

The detector is a 224 screen grid tube operating as a grid bias detector, that is, a power detector. We don't want to avoid distortion of the radio wave here, but we want all we can, and therefore the 224 tube is superior to the 235.

A 224 screen grid tubes operates effectively only into a high impedance, and the best way to get an impedance that is high enough is to use a resistance. A 250,000 ohm resistor is about right. If the radio frequency voltage impressed on the grid of the detector is high enough the rectified output voltage of the detector is ample to load up the 247 pentode tube used in the last stage of the circuit. The peak of the audio voltage need only be 16.5 volts to load this tube up and to insure 2.5 watts of undistorted output power.

The fifth tube in the circuit is the 280 rectifier which supplies ample current for the plates and the voltage divider.

Adequate selectivity is provided, by three tuners, all ganged and controlled by the same knob. A trimmer condenser is necessary across each of the tuning condenser sections. Without these trimmers the selectivity cannot be made high enough. But they are not enough, for the coils too must be adjusted to equality.

The adjustment of the coils and the trimmer condensers is especially important when the coils are placed in shields, which is necessary if uncontrollable oscillation is not to upset the workings of the circuit. Better selectivity is obtained when the coils are small compared with the shields. For a given size shield it is better to use small coils than coils that fit snugly into the shields. But it is still better to use large coils and still larger shields. Coils having a diameter of 1.75 inches have been found to work out well in shields not less than 3 inches in diameter. Such coils and shields are available both for .00035 mfd. and .0005 mfd. condensers.

The use of RF chokes in the supply leads to the various tubes and of by-pass condensers as shown is highly desirable in a compact set such as a midget necessarily must be. They help to localize the radio frequency circuits to the stages where they belong and hence to stabilize the receiver.

The volume is controlled by controlling the bias on the two 235 amplifier tubes. This bias is obtained from two resistances in the common cathode lead, the two connected in series. One is fixed in value and so chosen as to make the bias 3 volts. The other resistor is variable and is used to increase the bias on the two radio frequency tubes. If the second resistance is about 1,000 ohms there will be ample variation to suppress the amplification when this is necessary. The small resistance should be about 60 ohms in this circuit.

The design as illustrated is typical of tuned radio frequency midgets using 235 radio frequency amplification and pentode output.

The volume on locals is plentiful. DX can be heard, too.

# The All-Wave 233

## Two Volt Tubes Used Throughout

By Herman

### *Standard Circuit Improved with Use of Up-to-Date Tube Types*

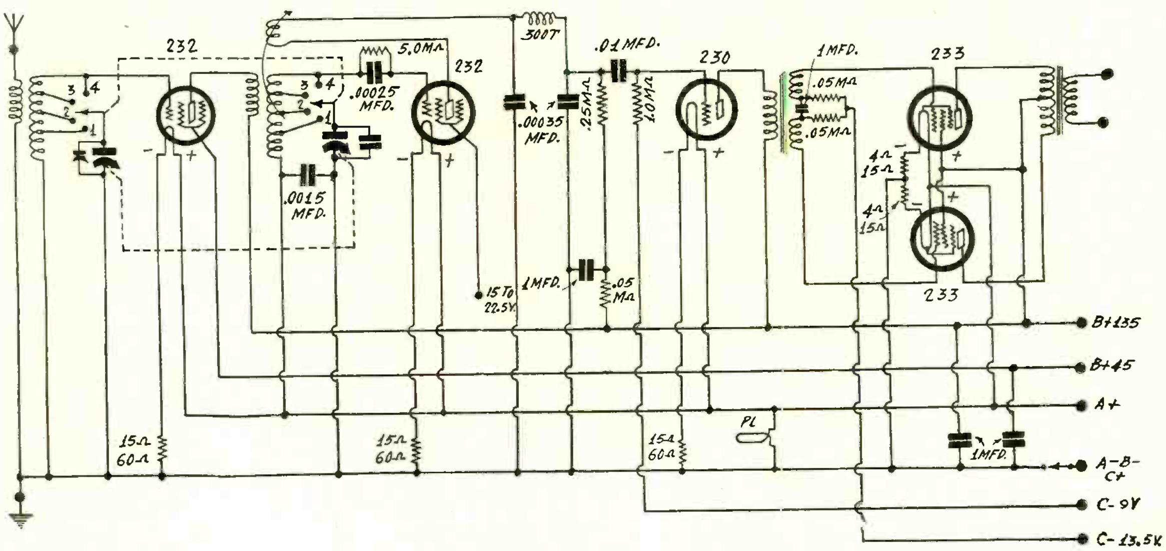



Fig. 1
The new battery-operated pentode tube, the 233, is used in push-pull in the output of the 233 Diamond of the Air. How the selectivity is improved over that of other models is explained in the text.

EVERY one with any acquaintance with radio circuits knows well the standard stage of tuned radio frequency amplification and regenerative detector. The circuit first became popular before there were any power tubes for the output, and many thousands of builders got much enjoyment from the four-tube design, which included two single-sided stages of transformer-coupled audio frequency amplification, with 201A tubes throughout.

Using the basic circuit, and introducing such improvements as modern facilities permit, we can build an all-wave battery - operated circuit, with screen grid radio frequency amplification and detection, a general purpose tube for the first audio, and pentode tubes in push-pull for the output. Not only can we attain a higher order of performance with the basic circuit than was heretofore possible, but we can include the popular advantage of all-wave coverage, 15 to 550 meters.

Fig. 1 shows the circuit of the 233 Diamond of the Air that accomplishes these objects. The designation arises from the number assigned to the pentode tube for battery operation at 2 volts.

All the tubes take 2 volts on the filament. However, the 232's and the 230 pass a current of 60 milliamperes at that voltage, while the 233's pass a current of 260 milliamperes. These values in amperes are .06 and .26. So the total filament current drain is $3 \times .06 + (2 \times .26)$, or .7 ampere.

The plate current drain of the entire circuit is about 45 milliamperes and requires the use of heavy-duty B batteries, three 45-volt units being necessary. The relatively high current is due principally to the use of the pentodes in push-pull, as each 233 draws 14 milliamperes of plate current and 3 milliamperes of screen current. The pentode is, of course, a screen grid tube.

If a 6-volt storage battery is used, the 238 tubes may be used in push-pull, battery connected directly to the heater, a resistor of 1,200 ohms on the cathode circuit, bypassed by 4 mfd. Each 238 draws 10.5 ma B current, each 233 draws 17 ma.

As for the source of A voltage, either dry cells or a storage battery may be used. If dry cells are selected, six No. 6 cells are required, three pairs connected in series and the individual pairs in parallel.

For series connection of these 1.5 volt cells, run a wire from the binding post at the circumference (negative) of one cell to the binding post in the center (positive) of another cell. Then the two remaining posts of the combination are positive and negative, according to the previously stated positions, but the voltage is 3 volts.

Because a single No. 6 dry cell for 1.5 volts or two such cells in series for 3 volts should be taxed at no more than .25 ampere drain, the extra series pairs for parallel connection are required. Thus, the A battery will stand .75 ampere.

The resistance values in the negative legs of the filaments are for 3-volt and 6-volt sources. The smaller values of resistance are for 3 volt source, while the larger are for a 6-volt source, which would be a storage battery.

The selectivity is better than with the older models of the basic circuit, because with the screen grid tube the amplification of the radio frequency stage may be retarded a little, with amplification still ahead of that of a general purpose tube, by using a smaller primary than is usually recommended for screen grid tubes, and this looser coupling improves the selectivity greatly. Moreover, the use of the pentode as output tube, with its amplification factor of several times that of any other power tube worked from batteries in other days, leaves the net volume greater than in older systems.

There is, of course, a definite relationship between selectivity and amplification, even if the amplification is obtained at audio frequencies. While the relationship to audio amplification is indirect, it is nevertheless present, since the object is to attain satisfactory speaker volume, and when more than that degree of volume is readily obtainable, the selectivity of the tuner may be increased by looser coupling methods.

All-wave coverage is attained by using tapped coils, with a dual selector switch to pick up pairs of taps. The stators of the two-section gang condenser connect to the two switch arms, and the condenser stators are connected to the coils through the switch taps. The switch should have its shaft insulated from everything.

The connections from switch to stators is made from one of the lugs on each side of the switch, that is, there are two lugs for this purpose. Inspection of the switch will reveal the continuation of these lugs to the switch arms.

#### Resonance Assured

Use of a gang condenser requires that precautions be taken against mistuning, particularly in a circuit that has two tuned stages. This requirement is readily met by putting a manual trimming condenser across the first tuned stage and an equalizer across the detector's tuned stage. The reason for requiring the equalizer (which you can permanently adjust to suitable value) is that it must be certain that the detector stage always has more capacity than the other when the manual trimmer in the radio frequency stage is set at minimum. Then the manual trimmer is always effective, as it is required always to add capacity to the circuit. Were it not for the equalizer the antenna stage might always have more capacity than the other, indeed probably would have, due to the antenna-ground capacity in the

# Diamond of the Air

## with Push-Pull Pentode Power Tubes

Bernard

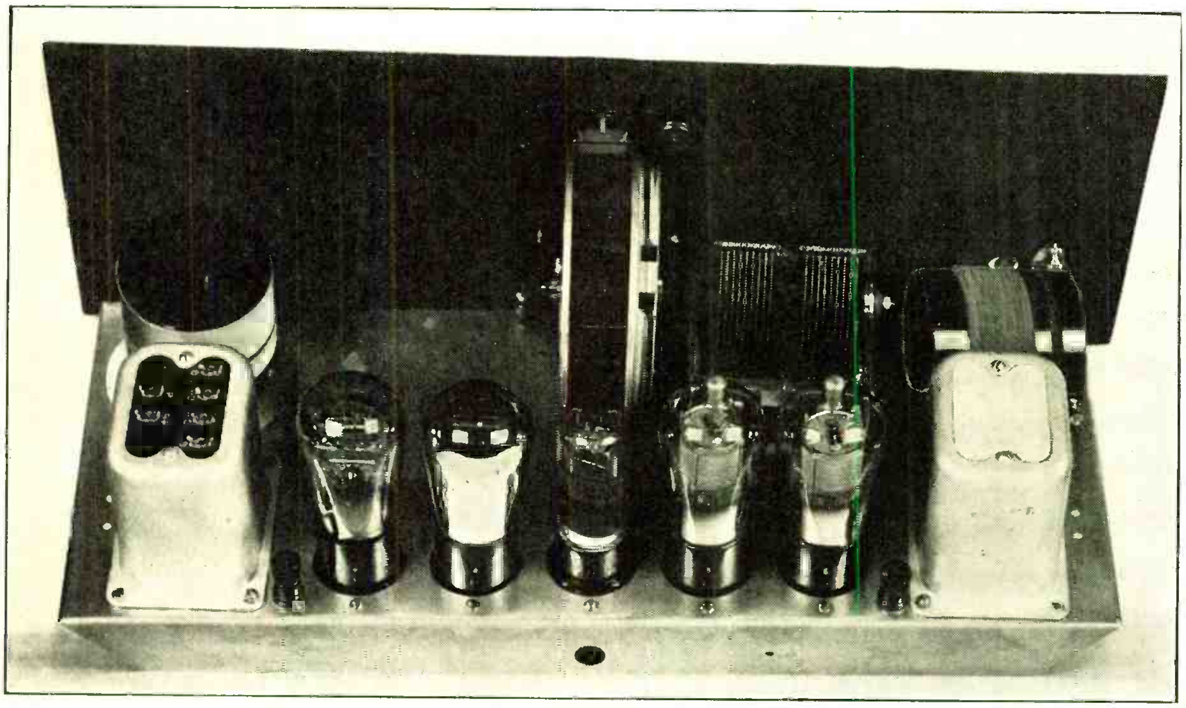


Fig. 2

### LIST OF PARTS

For Fig. 1

*Coils*

One antenna coil, on 2.5 inch diameter tubing; secondary, 62 turns, tapped at the 42d, 54th and 60th turns.
One three-circuit tuner, main diameter 2.5 inches; secondary, 62 turns, tapped at the 42d, 54th and 60th turns.
One 300-turn honeycomb radio frequency choke coil.
One Amertran push-pull input transformer, No. 151.
One push-pull output transformer or center-tapped impedance for speaker coupling (not needed if speaker has a center-tapped winding).

*Condensers*

One two-gang .00035 mfd. condenser.
One 20-100 mmfd. equalizing condenser.
One 60 mmfd. manual trimming condenser.
Two .00035 mfd. fixed condensers.
Three 1.0 mfd. bypass condensers.
One .00025 mfd. grid condenser with clips.
One .01 mfd. mica fixed condenser.
One .0015 mfd. fixed condenser.

*Resistors*

Three 15 ohm and two 4 ohm filament resistors (if source is 3 volts); or three 60 ohm and two 15 ohm (if source is 6 volts). *Pairs not needed for 238 push-pull but 1,200 ohm and 4 mfd. instead.*
One 5.0 meg. tubular grid leak (not pigtail).
One 0.25 meg. pigtail resistor.
One 1.0 meg. pigtail resistor.
Two 0.05 meg. pigtail resistors.

*Other Parts*

One dual selector switch, double throw, four point.
One steel subpanel, 7x17.5x1.5 inches (drilled).
One front panel, 7x18 inches (drilled).
One National drum dial, modernistic escutcheon, color wheel, pilot light.
Two grid clips.
Two brass bushings, ⅝ inch high, threaded 6/32 for antenna coil elevation.
Two binding posts (antenna and ground).
One roll of hookup wire.
Two brackets for tuning condenser.
One seven-lead battery cable.
One switch.
One dozen 6/32 machine screws and one dozen nuts.

*Note: Power tube biasing battery not needed for 238 tubes.*

primary of the antenna coil, which capacity is reflected in the tuned secondary.

The leak-condenser type of detection works well with the 232 tube, and is used because of its increased sensitivity over the negative grid bias method applied to this tube.

The push-pull stage uses a transformer that has a primary like that of other push-pull transformers (except that the inductance is much higher) while the secondary is different from that of most other transformers, on account of the split winding. In fact, the secondary consists of two different windings.

### Secondary Connections

Nos. 1 and 4 of the secondary terminals go to the respective grids, while 2 and 3 are connected to individual resistors of a value of 0.05 meg. (50,000 ohms), their other terminals to the negative C bias for the pentode, which in this case is 13.5 volts. (The latest model transformer (illustrated) has the connections identified by letters: P. B. C.) Across terminals 2 and 3 is placed a 1 mfd. condenser. This value may be increased to 2 mfd. if desired.

This special treatment is in the interest of stability, but if you have a push-pull transformer (input type) with continuous secondary, simply connect in the usual fashion, with extremes to grids and center-tap to the biasing voltage.

### 233 Connections

The connections for the 233 tube are as follows: grid, plate and filament are standard. The filament has a screen attached to it, inside the tube, but this requires no external connection save the one made for the filament itself.

What would be the cathode terminal of the indirectly heated type tubes is here the suppressor screen, the mainspring of the tube, and its purpose is to reduce greatly the secondary emission due to electrons that bombard the plate being bounced off the plate, back into the space stream and even through the grid to the filament. The retardation effect of this secondary emission has caused the low mu of previous power tubes and its removal accounts for the high mu of the pentode, which has a working mu in this case of around 50. This fifth prong, for the cathode in other type tubes, goes to the maximum B plus voltage of 135 volts, the same as does the plate return of the tube.

For the 238, if used, the plate control grid and heater connections are standard as for screen grid RF tubes, cathode goes to a 1,200 ohm resistor to B minus, bypassed by 4 mfd., while the screen, G post of socket, goes to maximum B plus. The circuit will be published next week.

### Coil Winding Directions

The coils are wound on a 2.5 inch diameter bakelite tubing, except for the small form for the tickler to rotate inside one of the larger diameter forms. The tickler may be wound on any diameter that serves the purpose, about 1.5 inches being common, requiring 30 turns of any kind of insulated wire.

The secondary turns for both coils, for .00035 mfd. tuning, total 62. The wire is No. 24 silk covered, either single or double. The taps, from the grid end, are at the 42d, 54th and 60th turns. As the total is 62 turns, the smallest tuned winding consists of

(Continued on next page)

# An All-Wave AC Model

## How to Check Oscillation—Winding Directions for Coils

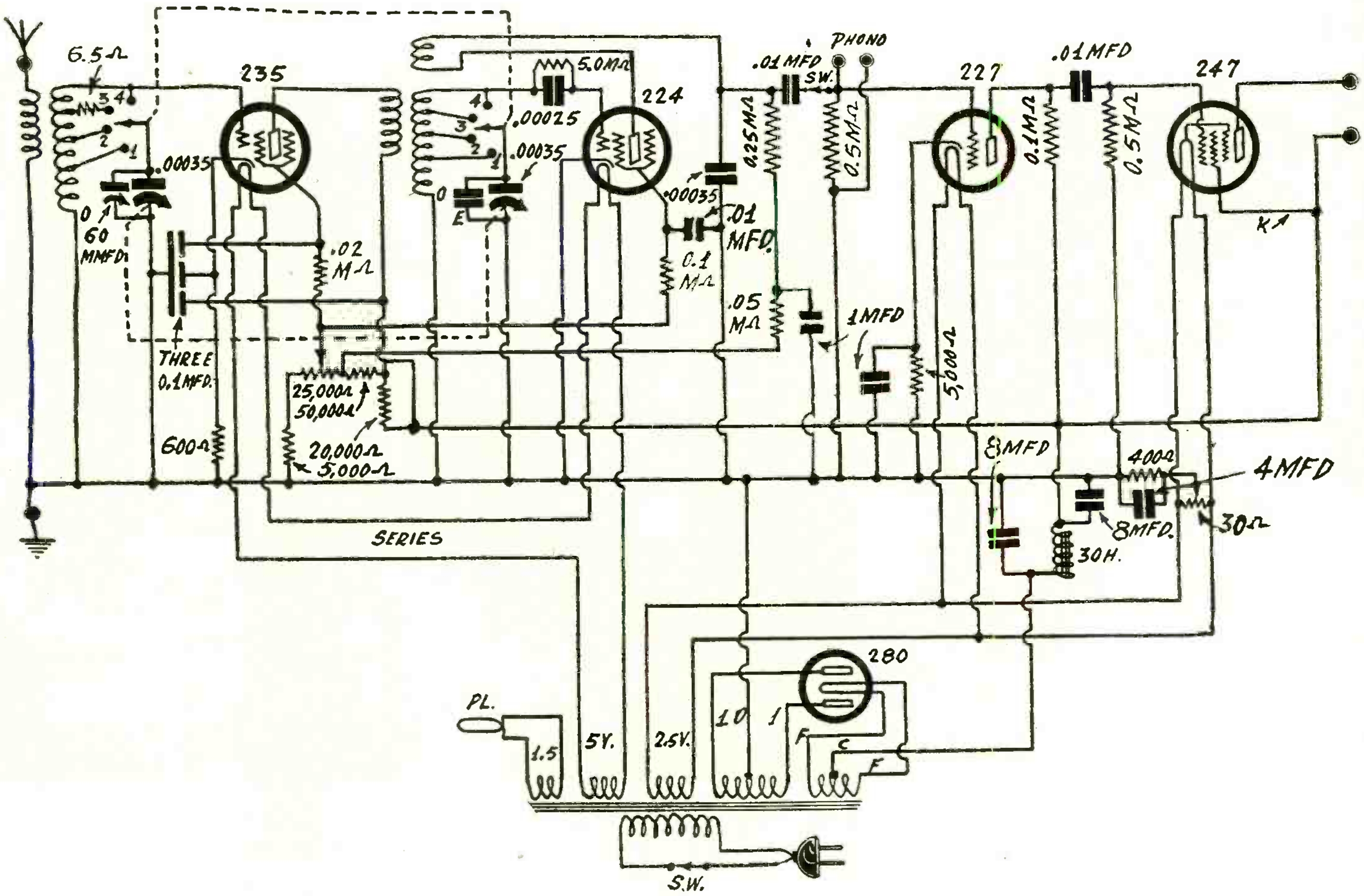



FIG. 3

*(Continued from preceding page)*

two turns. The winding in relation to the taps is: 4th to 3d, 42 turns; 3d to 2d, 12 turns; 2d to 1st, 6 turns; 1st to 0, 2 turns.

The primary of the antenna coil is separated from the secondary by 1/8 inch and consists of 10 turns.

The plate winding for the 232 tube consists of 15 turns of any kind of fine wire, provided it is insulated, and it may as well be enamel covered, if you have that. The space between this winding and the secondary is 1/4 inch. It is well to know that the direction of winding and of connections as to the foregoing is not important. However, the tickler winding in the plate circuit of the detector, while it may be of any kind of wire as the other plate coil, must be connected in a given way to produce regeneration, unless the tickler can rotate 180 degrees, when you need not concern yourself about the direction of con-

*(Continued on next page)*

### LIST OF PARTS
For Fig. 3

*Coils*

**One antenna coil for .00035 mfd. tuning, 93-turn secondary tapped at the 60th, 82nd and 90th turns (AW-5-AL).**
**One interstage coil for .00035 mfd. tuning, 93-turn secondary tapped at the 60th, 82nd and 90th turns (AW-5-IL).**
**One type K power transformer (2.5 volt winding, two 5 volt windings, 1½ volt winding, and high voltage secondary to afford 300 volts DC output).**
**One 30 henry B supply choke coil.**

*Condensers*

**One two-gang .00035 mfd. tuning condenser with straight frequency line plates.**
**One block of three 0.1 mfd. condensers in one case (common black lead to grounded B minus).**
**One 60 mmfd. manual trimming condenser.**
**One equalizing condenser, 20-100 mmfd. (E).**
**One .00025 mfd. grid condenser with clips.**
**Two .01 mfd. mica fixed condensers.**
**One .00035 mfd. fixed condenser.**
**Two 1.0 mfd. bypass condensers.**
**One 8 and two 4 mfd. electrolytic condensers, with three brackets.**

*Resistors*

**One 600 ohm Electrad flexible biasing resistor.**
**One 25,000 ohm potentiometer with AC switch attached.**
**Two 20,000 ohm pigtail resistors.**
**Two 5,000 ohm pigtail resistors.**
**One 50,000 ohm pigtail resistor.**
**One 0.05 meg. pigtail resistor.**
**One 0.1 meg. pigtail resistor.**
**One 5.0 meg. cartridge type grid leak (not pigtail).**
**One 0.25 meg. pigtail resistor.**
**One 0.1 meg. pigtail resistor.**
**Two 0.5 meg. pigtail resistors.**
**One 400 ohm 5 watt biasing resistor.**
**One 30 ohm center tapped resistor.**

*Other Parts*

**One antenna binding post. One ground binding post.**
**One twin jack speaker assembly.**
**One twin jack phonograph assembly.**
**One modernistic disc dial with pilot light and socket.**
**One dual selector switch, double pole, four point, with insulated shaft.**
**Two insulators for potentiometer, if metal chassis is used.**
**Two extra knobs for manual trimmed and potentiometer ¼-inch shaft (switch and dial have own knobs).**
**One metal chassis, with one UX (four-prong), and four UY (five-prong) sockets.**
**Two dozen 6/32 nickel plated machine screws and two dozen nuts.**
**One roll of slideback hookup wire. Two grid clips.**
**Four right angle brass brackets, ⅝-inch, for mounting coil forms.**
**One phonograph switch.**

# The Double S Makes Its Bow

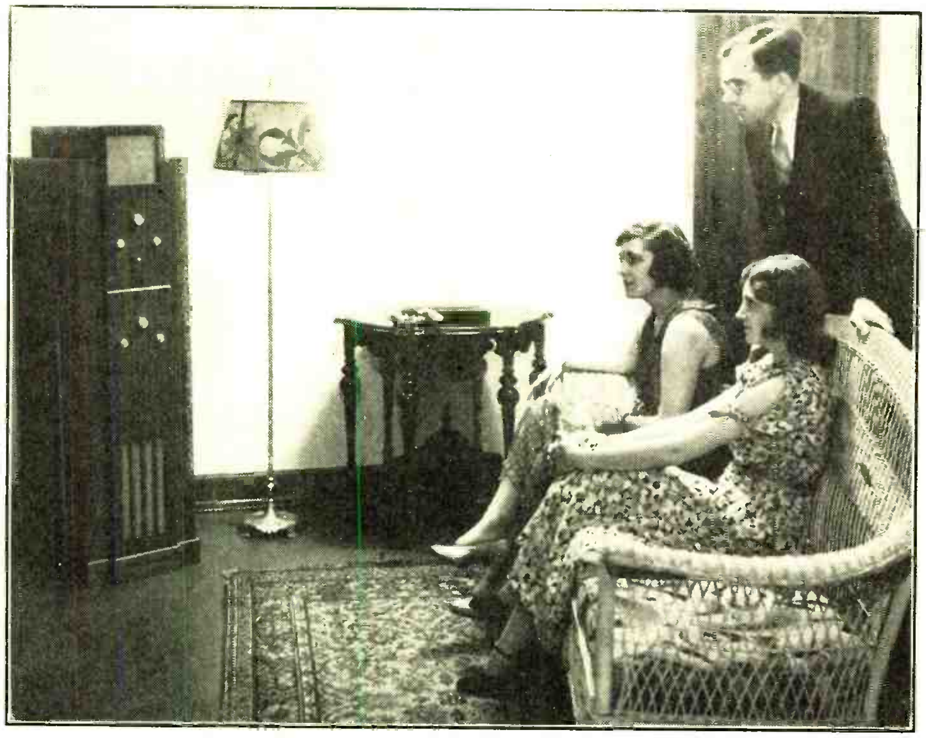
## Sound and Sight Synchronized Reception

THE first Double S receiver—meaning one that affords reception of both sight and sound to constitute home radio talkies—has come out of the mid-West, in modernistic exterior garb, and making a highly presentable appearance. It is not a peep-hole huckster, but a purveyor of the projected view on a screen. The relative size of the screen can be judged from the photograph, and the distance at which one may sit and still see something is likewise indicated.

The system includes a television tuner and special audio amplifier, which feeds the neon lamp with pulsating direct current that varies according to the current emanations from photo-electric cell at the sending station. The scanning device is right behind the screen of the home set. Below can be seen what appears to be a loudspeaker grille, and so indeed it is. The rest of the system therefore consists of a broadcast tuner with its own audio amplifier, whereby the sound accompaniment As some sound accompaniment is sent on can be picked up in the broadcast band. short waves, there may be special provision for this advantage likewise.

The set-up is most remarkable as proveceivers are not going to be cumbersome ing that the first home radio talkie redevices that will put even an irate housewife in worse humor. The cabinet is nothing the henpecked televising homesteader need be ashamed of.

With the advent of a serious compound assembly in good-looking housing it is expected that other manufacturers who have had the same idea in mind, but have been bashfully waiting for some one to break the ice, soon will emerge with their original ideas, after having closely examined the illustrated model, both as to exterior and interior.



**Double S is slang for Sight and Sound Receiver, just as Double O is slang for something else. So give this Double S the Double O.**

# Construction of an AC Model

*(Continued from preceding page)*

nection. But for 90-degree ticklers, reverse the connections if regeneration fails. Reversal consists of removing the plate and B plus connections, and putting them to opposite terminals than the ones that they previously occupied.

The output of the pentodes may be taken from an output transformer or center-tapped choke. If the speaker has a center-tapped coil, such as the Farrand inductor for pentodes, no extra output device is needed.

### A Somewhat Similar Circuit for AC

The battery model Diamond for all-wave reception uses five tubes, because the output is in push-pull. However, if an AC-operated circuit is desired, it can be built, consisting of only five tubes, including the rectifier. This is the AW-5, of which there has been some discussion in these columns.

The output is single-sided, but the 247 pentode permits a good power output, while the higher voltages on the plates account for the volume of an integral four-tube receiver for AC operation equalling the volume of a battery-operated five-tube design.

In the AC model the winding form is 1.75 inch diameter bakelite, and two coils are used. These may be placed under the chassis. The wire for the secondaries is No. 28 enamel, while the antenna primary may have the same diameter wire, and the two plate windings either the same or may consist of finer wire, so long as it is insulated.

### Coils for AW-5

The winding data for the 1.75 inch diameter are:

Antenna coil: 20-turn primary, leave 1/8 inch space; 93-turn secondary. Tap at the 60th, 82d and 90th turns from the grid end.

Interstage coil: primary, in plate circuit of 235 variable mu tube, 20 turns of any kind of fine wire; secondary, 1/8 inch away, 93 turns, No. 28 enamel, tapped at the 60th, 82d and 90th turns. Tickler, 20 turns, 1/8 inch away from opposite end of the secondary, any kind of fine wire.

For the equal secondaries the number of turns between taps is: 4th to 3d, 60 turns; 3d to 2d, 22 turns; 2d to 1st, 8 turns; 1st to end, 3 turns. Total, $60 + 22 + 8 + 3 = 93$ turns.

This circuit, using a different method of regeneration control, also regenerates over the entire span, 15 to 545 meters, but on the setting of the switch for tap 3, the radio frequency gain is a little too high, and that tube may oscillate, so to remedy this a small resistor is placed in series with the switch tap and the coil tap. Hence this resistor is out of the circuit except when tap 3 is used. The value, as specified in Fig. 3, is 6.5 ohms. If this does not correct the condition a larger value of resistance may be used.

There is no objection to placing a resistor in a circuit if the circuit oscillates without it, since an oscillating circuit is one with a negative resistance, and there must be some resistance present for stability. A normal resistance for a non-oscillating circuit would be 10 ohms at 300 meters, but of course the effective value is greater at the higher frequencies.

Certain minor changes have been introduced in the circuit since its publication in the June 20th issue, and the present diagram may be followed, likewise the list of parts. The circuit is given now so that those who want all-wave coverage from a circuit something like that of the 233 Diamond, but for AC operation, will have the essential data at hand.

If the coils are placed close to the metal panel the data are as given, 93 turns, etc. But if they are put on top and elevated, the total number of secondary turns need be only 70, tapped at the 47th, 62d and 67th turns. The other windings need not be reduced. [*Next week the Fig. 1 circuit will be shown for 238 push-pull.*]

# A Receiver Especially

## Radio and Audio Treated So As To

By H. G.

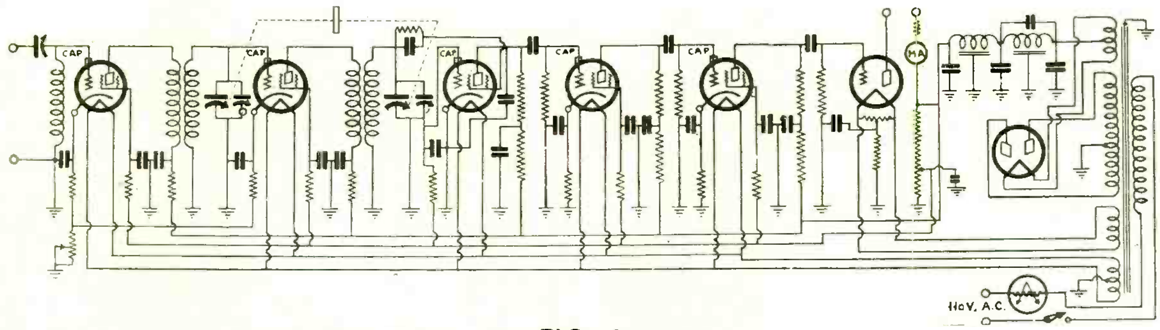



**FIG. 1**
**The circuit diagram of a six-tube television receiver designed to amplify frequencies up to 40,000 cycles.**

TELEVISION reception requires special receivers if the full value of the visual signal is to be accepted. Receivers designed for broadcast reception, or for code, are entirely too selective for television purposes. While any good receiver may be used for receiving television signals only a specially designed set will bring in all of the signal. Extremely selective receivers, such as are required for broadcast and code reception, tune out all the detail in the picture.

Not only does the broadcast receiver tune out the detail but it also discriminates against the larger contrasts which are carried by the extremely low frequencies. There is too much frequency discrimination in the broadcast set for television purposes. This is true even if the broadcast set as such is excellent from the quality point of view. The eye is keener than the ear and a visual signal must be almost perfect before it is acceptable.

### High Sensitivity Essential

A television receiver must also be sensitive, for a strong output is necessary and the television signals transmitted at this time are not as strong as broadcast signals. Regeneration is not permissible in a television receiver because regeneration almost invariably increases the selectivity beyond the allowable limit. Therefore it is necessary to get the sensitivity by straight radio frequency amplification or audio frequency amplification, or both. Since the visual signal consists of a very wide band of frequencies it is essential that the audio frequency amplifier be able to handle the entire band. As the television set-up now is the band allowed is 100 kc. In this band there must be two side bands so that only 50 kc is available for each one. This is just ten times wider than the width allowed a side band in broadcast transmission. Ordinarily part of the television band is utilized for some other purpose, such as a sound channel or a synchronizing channel, so that the width of a television side band is about 40 kc. Therefore the audio frequency amplifier must be able to amplify equally all frequencies from about 10 cycles per second to 40 kc per second.

It may be questioned why it is necessary to amplify a frequency as low as 10 cycles per second when the scanning rate is not faster than 20 per second, or even 15 per second. The reason is that there is a strong sub-harmonic of the frequency of scanning and this sub-harmonic must be amplified together with the rest. In case the scanning is at the rate of 15 frames per second, the audio amplifier should really be effective as low as 7.5 cycles per second.

### Resistance Audio

The only audio frequency amplifier that will amplify as low as 10 cycles per second is a resistance coupled circuit, and this must be specially designed in order to go as low as 10 cycles per second. This type of amplifier is also the only one that will go as high as 40 kc, retaining the uniformity of the amplification

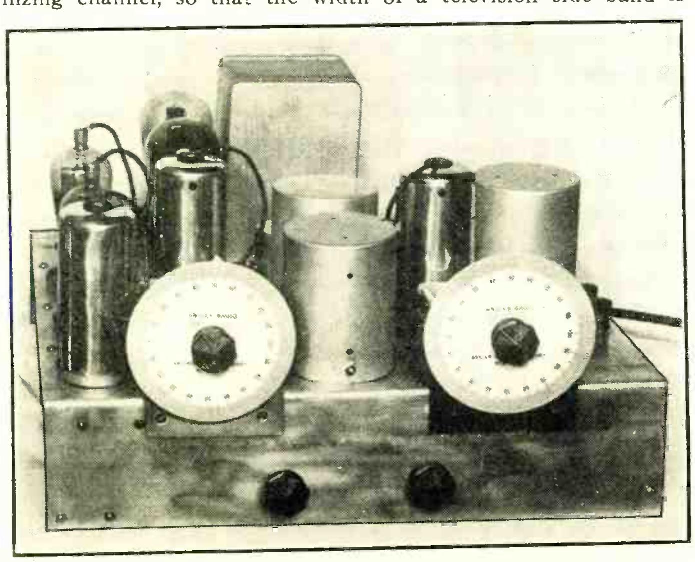


**FIG. 2**
**Inside view of the assembled television receiver.**

### LIST OF PARTS

**One 0.000465 "Midway" variable condenser (Cardwell type 407-C)**
**One 0.0002 dual "Midway" variable condenser (capacity of each section 0.0002) (Cardwell type "C")**
**Two 140 mfd. variable condensers**
**One Electrad volume control, type RI-202**
**One Electrad Truvolt fixed resistor, type B-15**
**One Electrad Truvolt fixed resistor, type B-30**
**Four 1,000 ohm wirewound grid resistors**
**One Electrad Voltage divider, type C-200**
**One Electrad Voltage divider, type C-200**
**One Electrad type V-20 center-tapped resistor**
**One power switch**
**One 0.0001 mfd. fixed condenser**
**One 0.1 mfd. fixed condenser**
**One 0.001 mfd. fixed condenser**
**Three 0.25 mfd. fixed condensers**
**One 1 mfd. fixed condenser**
**Six 2 mfd. fixed by-pass condensers**
**Two triple section condensers, 0.1 mfd. each section**
**Two 8 mfd. electrolytic condensers**
**One 16 mfd. electrolytic condenser**
**Three 4 mfd. by-pass condensers**
**Eight 50,000 ohm Lynch metallized resistors**
**Three 25,000 ohm Lynch metallized resistors**
**One 50,000 ohm Lynch metallized grid leak**
**Two 75,000 ohm Lynch metallized resistors**
**Three 250,000 ohm Lynch metallized resistors**
**One Find-All shielded television antenna coil**
**Two Find-All shielded television RF transformers**
**One power transformer**
**One double filter choke, each section 30 henries, 80 milliampere capacity**
**Five five-prong sockets**
**Three four-prong sockets**
**One self-adjusting line voltage regulator**
**Four binding posts**
**Three tube shields**
**One aluminum chassis**
**Two vernier dials**

# Designed for Television

## Avoid Frequency Discrimination

Cisin

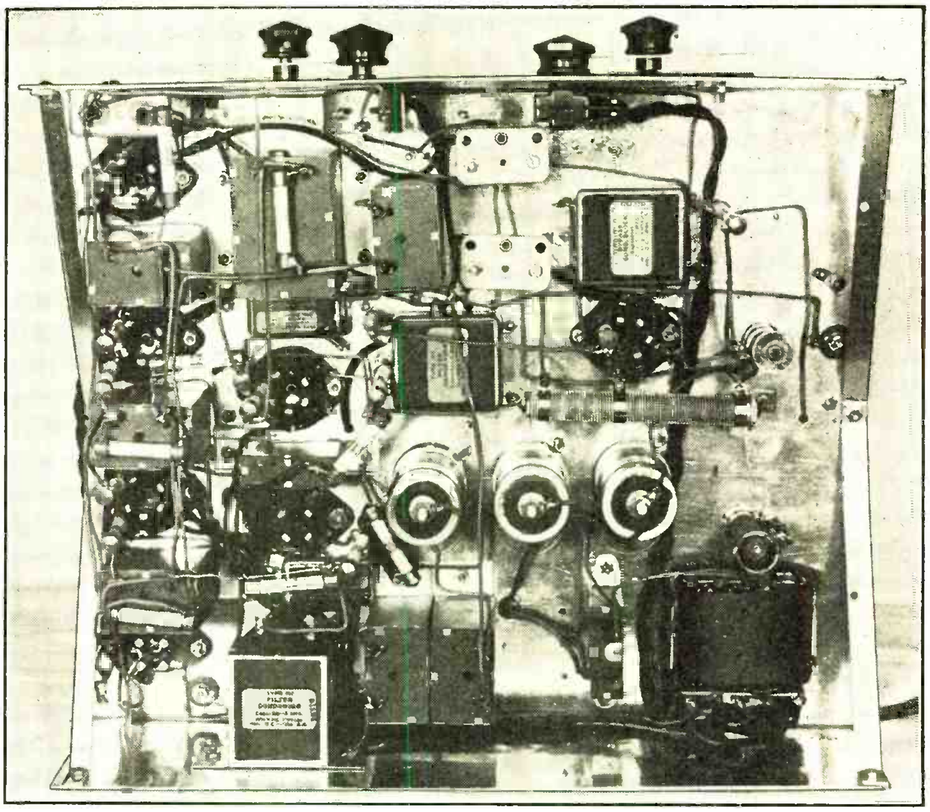


FIG. 3
Bottom view of the assembled Find-All television receiver

in between the two extremes. And in order to go as high as 40 kc it is necessary to take precautions against suppression of the highs by shunt capacities in the grid and plate circuits. The use of screen grid tubes help in this regard.

The Find-All television receiver is a six-tube set embodying the features necessary in a circuit that is to cover such a wide band of frequencies. It has a stage of untuned screen grid tube radio frequency amplification. This adds virtually nothing to the frequency discrimination but it does add considerably to the sensitivity, which is so needed. The untuned amplifier is followed by a tuner and another screen grid tube amplifier, after which there is a second tuner, which precedes the space charge detector. The detector is followed by three stages of resistance coupled audio, two of which contain screen grid tubes and one a power tube.

### Stability Important

Frequency stability is essential both in the radio frequency and audio frequency amplifiers. Instability means regeneration and that is not permissible, as was pointed out. If there is instability in the audio frequency amplifier that part of the circuit is likely to oscillate, or regenerate strongly at some frequency. If there is oscillation the amplifier is inoperative. If there is only strong regeneration, but not outright oscillation, there will be one frequency at which the amplification may be several times as great as at other frequencies.

Instability of this nature in the audio frequency amplifier also means, in most instances, that there will be a frequency region in which there is degeneration, and that, too, is ruinous to the quality. However, degeneration is not as serious as regeneration, but since we are likely to have both at the same time the combined effect will ruin the quality.

Degeneration is nothing but over stability. If this is equal throughout the frequency range to be covered by the amplifier no harm results, for the only effect is a slightly lower amplification. That is a cheap price to pay for all-around excellence.

As a means of preventing instability in the amplifiers there is a resistance-capacity filter in each low potential lead to every tube. That is, there is a resistance in each lead and a capacity to ground for each. In the cathode lead the resistance is that of the grid bias resistor and the capacity is that of the regular by-pass condenser across the resistor. There is one of these for every tube.

There is also a high resistance in each screen lead with a condenser from the screen to ground. Likewise there is a resistance in series with each plate return and a condenser from the junction of this and the load resistance to ground. Thus every circuit is filtered so that there can virtually be neither regeneration nor degeneration at any frequency. If chokes were used instead of resistances in the filters there is the possibility that at some frequency there would be a resonance effect which would upset the stability at that frequency.

### Shielded Coils

In order further to guard against regeneration effects in the radio frequency amplifier the coils are shielded. This prevents coupling by mutual inductance and direct capacity between the coils.

The two condensers are separately tuned in order to get more accurate tuning. While this complicates the receiver it makes it more satisfactory because for short waves ganging is not successful.

It was stated previously that the first stage was not tuned. This is only partly correct, for the antenna is tuned by means of a variable condenser. By tuning the antenna a very much stronger signal can be obtained than by using an entirely aperiodic circuit.

The volume is controlled by means of a variable resistance placed in the common cathode lead of the first two tubes. This resistance is in addition to the regular individual grid bias resistances for these tubes. Since it is additional it can only be used for increasing the bias and thus reduce the amplification when this becomes necessary or desirable.

### Self-Adjusting Line Voltage Feature

The voltage supplied to the circuit is held constant by means of a self-adjusting line voltage control amperite, which is an important feature in a set of this type, the output of which should remain constant after it has once been adjusted to the desired value.

The filtering of the rectified voltage must be thorough, for if there is ripple present this will show up on the picture. There are two sections in the B supply filter. The choke of one of these is shunted by a condenser which tunes the circuit to 120 cycles per second, the frequency of the principal ripple in a full wave rectifier operating on a 60-cycle line. This tuned circuit traps out the 120 cycle ripple and prevents it from being impressed on the elements of the tubes.

# A Plebiscite on an All-

## Tentative Circuit Printed to Evoke Suggest

By Henry

REVERSING the usual procedure of first building a circuit and then discussing it, we shall first discuss it, invite suggestions and then build it, reporting on whatever troubles are encountered and how they are remedied.

Before any circuit is built the designer considers the requirements and then draws a circuit intended to meet them. Therefore a list of requirements is in order:

(1)—The circuit should provide all-wave coverage, with band selection made from the front panel.
(2)—The sensitivity should be 10 microvolts per meter or better.
(3)—The selectivity should be of a high order, without any serious sideband suppression.
(4)—The radio frequency amplification should be so high that, if possible, no audio amplification whatever is required, or at least there should be direct coupling of detector to the output tube.

### A Tentative Circuit

The tentative circuit, Fig. 1, meets all these requirements. The first of the listed demands, that of all-wave coverage without plug-in coils, is met by using the tapped coil system, with a selector switch that simultaneously operates on the inductance in both tuned circuits. Since there is a stage of radio frequency amplification ahead of the modulator, required for broadcast service to be tuned, a system has to be provided to get rid of the tuning in this stage for short-wave use, otherwise three stages would have to be tuned for short waves, and the switching would become complicated.

The solution suggested is that a single pole double pole switch be connected to the first grid, to pick up either the aerial (for short-wave use) or the tuning condenser stator (for broadcast use). Simultaneously, this switch, when thrown for short-wave use, puts the primary of the antenna coupler in parallel with the secondary, while cutting out the tuning condenser. Therefore the effective input device is a radio frequency choke coil, having an inductance a little less than that of the primary of the transformer alone. This will be around 20 microhenries, which is sufficient for short-wave purposes, and also reduces the peril of broadcast frequency interference on short waves, because the small untuned inductance when in the grid circuit presents a low impedance to those frequencies.

The sensitivity arises principally from the high amplification in the intermediate channel, even though only two stages are used. The third coupler in this channel simply links the detector to the second intermediate amplifying tube, for there is always one more coupler than the total number of stages in the amplifier.

### Variable Mu Tubes Suggested

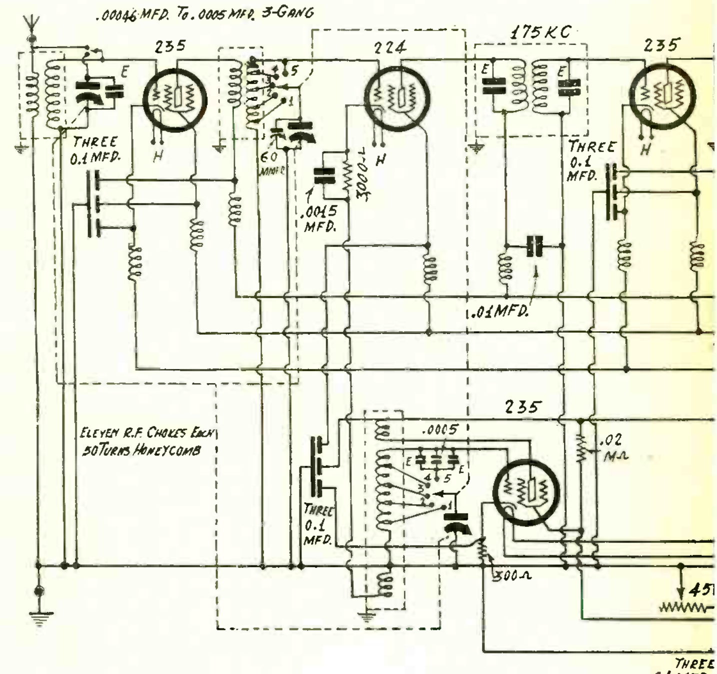
The band pass filter present in the intermediate channel because of the loose coupling of the primary and secondary of the 175 kc intermediate transformers permits sideband integrity at high selectivity. The selectivity is aided by the use of 235 tubes in the stage at the radio frequency level and the two stages at the intermediate level, since the variation of the bias voltage affords high amplification at low bias to bring up the sensitivity for weak signals, and low amplification for high bias, to check the over-loudness of strong locals while making for greater selectivity to prevent other stations from being heard at the same time. The tube is essentially a non-detecting amplifier, therefore the troubles arising from stray detection, as by shock excitation, are avoided, and there is no cross-modulation or cross-talk.

The sensitivity, therefore, may be 10 microvolts per meter under the conditions of low bias, but some means must be provided for avoiding zero bias, therefore a 3-volt minimum is established through proper connection to the voltage divider.

The sensitivity and selectivity are inter-related, more so than in receivers that do not use the variable mu or exponential tube. The 235 is called exponential because its characteristic curve (plate current platted against grid voltage) has a general exponential contour.

### Power Compared

The requirement that there should be a minimum of audio frequency amplification, and if possible none whatever, is a rather difficult one, not because it is impossible to attain suitable volume when a detector tube is used also as the output tube, but principally because a tube highly suitable is not commercially obtainable.




FIG

A tentative circuit presented for discussion by readers as a superhete

Assume that a 227 tube is used for output. This tube may be compared to the 112A, which is rated as a semi-power tube. If used as a negative bias detector, or power detector other than of the grid leak type, the characteristics are altered, so that the comparison even to the 112A, which does not rate high these days as an output tube, is less favorable to the 227. The power in the plate circuit isn't great enough. The plate current may be only 2 milliamperes, and even if the voltage is 300 volts the direct current power would be only .6 watt. The maximum undistorted power output, a dynamic term, applying to alternating current power, would be less.

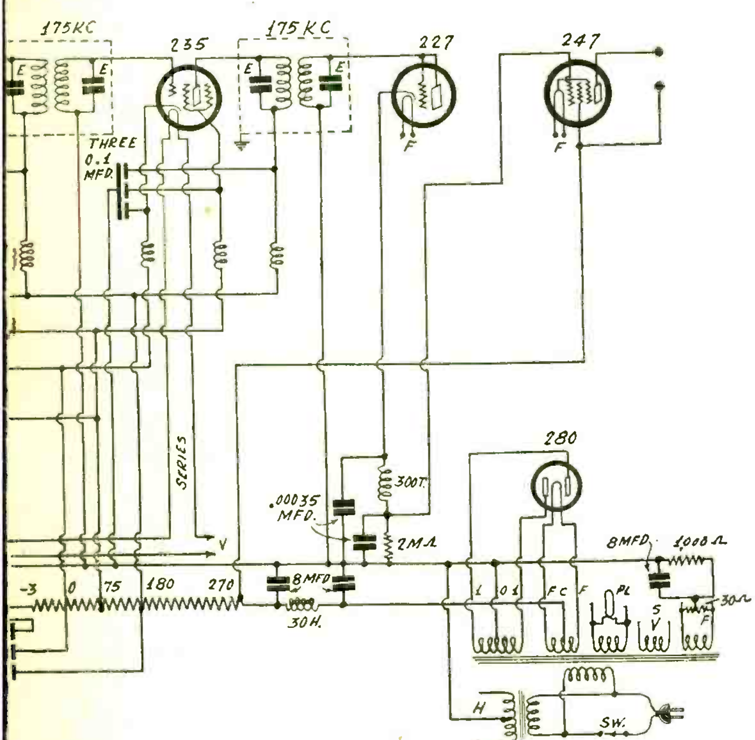
There isn't any present practical necessity for totally eliminating audio amplification, in fact, in a strict sense, complete elimination at present is hardly practical. Fig. 1 shows a true rectifier used as the second detector, that is, a 227 tube with grid and plate tied together, constituting the tube a diode, which of necessity means that there is no amplification whatever in this type of detector. However, there is good rectification, the radio frequencies being filtered out of the pulsating direct current by the pi-filter consisting of the two .00035 mfd. condensers and the 300-turn honeycomb choke coil.

Instead of the 2.0 meg. grid leak a high impedance winding of a speaker or output transformer might be used in the cathode circuit, but of course the power would be insignificant. So nonreactive coupling is used to a regular power tube, the 247 pentode, and audio amplification becomes available, because the mu of the 247 is rated at 95. Therefore we do not fill the requirement of total absence of audio amplification, or, rather, do not actually put forth that severe requirement, only aiming to come as near to meeting it as practical.

# Wave Superheterodyne

## ons—Readers' Votes to Decide Final Model

B. Herman

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**basis of registering their preference for a particular type of rodyne.**

### Why No Audio Amplification?

The reason for making such a to-do about the elimination of audio amplification as far as possible is wholly in the interest of quality. It can be argued with soundness that the audio amplification obtained from resistance coupling will be so good that there is no acoustical reason for not using that form. Nevertheless, the less audio used, the fewer troubles of the almost insurmountable sort that arise from use of substantial amount of audio coupling of any form, particularly direct coupling, and including non-reactive coupling, which is a form of coupling using no coils and no condensers.

There are peculiarities in the behavior of condensers and coils in relation to frequencies, and these peculiarities constitute the reactance. Therefor one may say that the desire to omit reactance is the desire to avoid eccentricities.

But there is another consideration, a theoretical goal, if you like, and it relates to television. If it is imperative to have only the finest wave form and truest frequency amplification for television, it should not be amiss to have a circuit that will reproduce with the faithful requirements of television, even if the use is to be in conjunction with sound reproduction alone, and even though the obstacle one strikes inevitably is the characteristic of the speaker, which is of a lower order of merit than is the characteristic of the tuning and audio amplifying system. Besides, the receiver tunes in the television band, therefore the outfit should be of such excellence as to permit proper driving of a neon lamp.

It is quite obvious that the trend is toward less and less audio amplification, and it is somewhat intriguing to omit the audio amplification, if practical, perhaps to anticipate the receiver of the future. Then the problem will rest only with the speaker manufacturers, and they have always been able to follow fairly closely improvements in receiver and amplifier design, as exampled by the dynamic speaker's rise to almost universal accord.

### Condenser Speaker Prophesied

Moreover, some day some one may offer a really workable and long-life condenser speaker, and then the purity of the receiver's output will be doubly vindicated. Especially is this possible if the amplification is made extremely large—much larger than in the present receiver—to atone for the lack of sensitivity of the condenser speaker.

The problem of the high voltage necessary for this type of speaker need not prove troublesome. We can have as high voltage as we like. The direct current is zero. Means of safeguarding the high voltage from prying or careless hands are easily provided. Some day the condenser speaker will be permanently in our midst.

The discussion now brings us to a point that has been in mind for several weeks, and which, like the other considerations set forth, is thrown open to discussion by readers, who are invited to criticize in any way any of the remarks made herein, and perhaps will make suggestions that will call for a change in the intended receiver, causing one to be built perhaps considerably different than the one diagrammed in Fig. 1.

The day will come when a true power detector tube will be on the market, that is, a tube that, though used as a detector, will have a relatively high maximum undistorted power output, but meanwhile we must use the tools we have. The best opportunity at the moment seems to be afforded by the 238 pentode. This is one of the automotive series that takes 6.3 volts on the heater and draws 0.3 ampere at that voltage. It is a heater type tube, please note, and it is the only heater type pentode.

As we intended to use AC we must have as a detector tube one that uses the heater type of construction, whereby the heater radiates the heat to the cathode that emits the electrons. The filament tube would introduce intolerable hum.

The specifications for the 238 are: heater voltage, 6.3 volts; heater current, 0.3 ampere; plate voltage recommended, 135 volts; screen voltage recommended, 135 volts; grid voltage (for amplification), 13.5 volts negative; plate current, 8 milliamperes; screen current, 2.5 milliamperes; plate resistance, 110,000 ohms; amplification factor, 100; mutual conductance, 900 micromhos; load resistance, 15,000 ohms; undistorted power output, 0.375 watts.

These specifications are not adamant. The heater is not delicate and its applied voltage may be as high as 8 volts, therefore we would be safe indeed in using 7.5 volts AC, as obtainable from commercial transformers, since the 210, 250 and 281 filaments take that voltage. As the negative bias would be much higher for detection, the plate current would be much less. But it would be practical to compensate somewhat for these factors by increasing the plate voltage considerably above 135 volts.

### Lower Amplification Factor

What voltage the tube will stand with long life would have to be determined by experiment. At 135 volts on the plate the detection is good between 20 and 25 volts negative bias, but assuming 180 volts, the negative grid bias for detection might be around 30 volts.

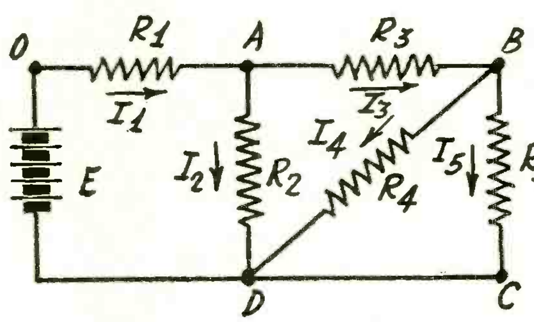
Of course if the 238 tube is used in that way it will not have an amplification factor of anything like 100, but it probably will amplify some. This can be assumed from the fact that all other tubes under like conditions of detection do amplify, because they can be regenerated, even as power detectors. Without amplification there could be no regeneration. The thing to do, then, is to apply the regeneration test after the other conditions are satisfied.

*[The circuit shown in Fig. 1 is merely suggestive, and not a final selection. It is a superheterodyne, embodying all-wave coverage, and providing high gain. However, suggestions from readers on circuit alteration are welcome and should be addressed to the author, Henry B. Herman, care of* RADIO WORLD, *145 West 45th street, New York, N. Y. Some of these comments and criticisms will be published, as well as other data on the circuit in its theoretical stages, in following issues. It will be several weeks before the selected circuit actually is built, and therafter, if results warrant, full constructional details will be printed. This is an opportunity for readers to vote on the kind of superheterodyne they want. Please send in your letters as promptly as possible.*—EDITOR.]

# Solution of Resistor

## Application of Kirchhoff's Laws to Voltage Div

By J. E.



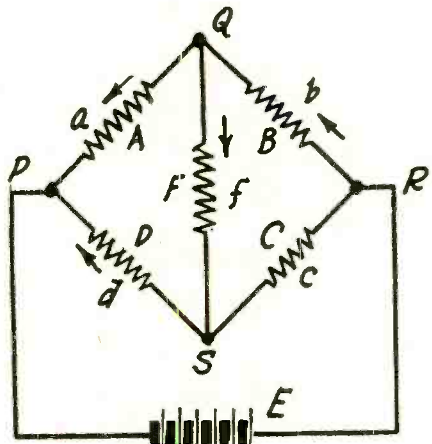
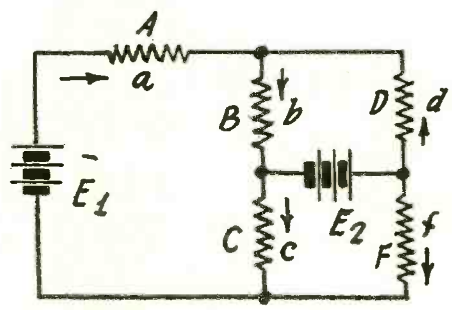




FIG. 1 (left) A network of five different resistances and one source of e. m. f.

FIG. 2 (right) The Wheatstone bridge is another network which may be solved easily by use of Kirchhoff's laws.



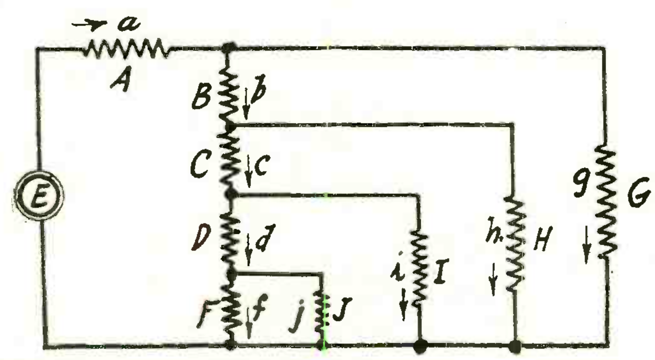




FIG. 3 (left) Another network in which there are five conductors and two sources of e. m. f.

FIG. 4 (right) The voltage divider in a B supply and the plate and screen circuits served form a network which may be solved by means of Kirchhoff's laws provided the required data are available.

WHEN the electric circuit is very simple the current can be obtained by an application of Ohm's law, provided that the voltage and the resistance are known. Also, the voltage drop in any particular resistance, if there are more than one connected in series, can be obtained if the resistance and the current are known.

It is not often one encounters simple circuits of this type in radio. Most of them are networks containing many circuits, or meshes. Ohm's law is not adequate for the solution of such complex circuits. It is then necessary to employ Kirchhoff's laws, which are extensions or generalizations of Ohm's laws. An article by J. A. Dowie explaining these laws was published in last week's issue of Radio World. These laws are so important that it is thought timely to give additional examples of the application of them.

Kirchhoff's first law is an expression of the fact that electricity cannot accumulate at any point in a circuit. The simple way of stating it is that at any point just as much current flows away from a point as to it. This is obvious if we consider any point in a conductor but it is not quite so obvious when the point is a junction of three or more conductors. When the point is a junction of many conductors the law states that the sum of all the currents flowing to the junction is equal to the sum of all the currents that flow away from it. Stated algebraically it says that the algebraic sum of all the currents flowing to any point is zero. There is no inconsistency between the arithmetic and the algebraic statements of the law because if a current is flowing away from a point it is negative if it is considered to flow to the point.

Kirchhoff's first law becomes obvious when we consider a hydraulic analogy. Suppose we have a large number of water pipes meeting at a point and that there is a certain pressure. Water will flow in all the pipes, unless one is closed by a valve. Obviously the water will flow toward the junction in one or more of the pipes and it will flow away from the point in the other pipes. Water cannot accumulate at the junction and therefore it is obvious that just as much water flows toward the junction as away from it. If we add up the flow away from the junction and also that toward it, we find that the two are exactly equal. The analogy as far as the flow is concerned is exact.

Consider Fig. 1. Here we have a complex network of resistances connected to a source of e.m.f. or a battery E. Currents will flow in all the resistances. At point A we have a junction of three resistors and Kirchhoff's first law states that $I_1 = I_2 + I_3$. Writing this down according to the algebraic statement we have $I_1 - I_2 - I_3 = O$, all currents assumed to flow toward the junction. Clearly the two equations are equal so that we do not have to distinguish between the two points of view.

At point B we have another junction of three conductors and by Kirchhoff's first law we have $I_3 = I_4 + I_5$. D is a junction of four conductors and by Kirchhoff's first law we have $I_1 = I_2 + I_4 + I_5$.

### Voltage Summation

Kirchhoff's second law states that in any circuit, or mesh, of a complex network the sum of all the voltage drops is equal to the e.m.f. in that mesh. This statement must be taken algebraically. That is to say: If we go around the mesh in any direction and we encounter a current flowing against the direction of summation the voltage drop must be taken as negative. Take the mesh ABD, for example. If we start at A and sum up in the direction of ABD we first come to $R_3$. The current $I_3$ is in the direction of summation. Hence the drop $I_3R_3$ is positive. The drop between B and D is also positive because current $I_4$ is in the direction of summation. But when we come to DA the current $I_2$ is against us and hence the corresponding voltage drop is negative. There is no battery or any other source of e.m.f. in the mesh ABD and therefore the algebraic sum of the three voltage drops is zero. If we go around the mesh BCD we encounter two voltage drops, one positive and one negative no matter in which direction we go around the mesh. This simply means that the drop BD is equal to the drop BCD. The two resistances are in parallel.

If we go around the first mesh EAD and sum up the voltage drops in the clockwise direction we have two voltage drops, OA and AD, both positive because both currents are with us. According to Kirchhoff's second law we have for this mesh $E = R_1I_1 + R_2I_2$, for the e.m.f. in the mesh is equal to the sum of the voltage drops.

Solving the circuit requires that all the currents be determined in terms of E and the five resistances. In order to get the values it is necessary to have five equations, one for each current. These equations must be independent. We have only three independent meshes, AOD, ABD, and BCD. We can get one equation from each by Kirchoff's second law as indicated. The other two equations must be obtained by applying Kirchhoff's first law by summing the currents flowing to any two junctions. We may choose from junctions A, B, D. We cannot use three junctions and two meshes for one of the junctions is not independent and if we take three junctions we might leave out one of the resistances. Having obtained the five equations it is only a matter of algebraic manipulation to get the value of each current.

If E is six volts; R1, 20 ohms; R2, 10 ohms; R3, 15 ohms, R4,

# Network Problems

## ider, Wheatstone Bridge and Battery Circuits

### Anderson

40 ohms, and R5, 25 ohms, the currents are $I_1$, 218; $I_2$, 168.2; $I_3$, 49.8; $I_4$, 16.6; $I_5$, 33.2 milliamperes.

In this example the direction of the currents was obvious but in some instances it is not possible to predict. In such cases any direction may be assumed for any current. If it turns out later that the assumed direction was wrong the value obtained will have a negative sign. No error will be committed if the assumed direction is wrong, but the result must be interpreted according to the sign.

### Wheatstone Bridge

The Wheatstone bridge is an example of a complex network of many meshes in which the direction of the current in the bridge cannot be determined by knowing the direction of the e.m.f., because the direction of the bridge current depends on the relative values of the four resistances. In Fig. 2 is a Wheatstone bridge in which E is the source of e.m.f. and F is the bridge conductor.

When the bridge is balanced no current flows through F but when it is unbalanced current flows in one direction or the other, depending on the values of the four resistances A, B, C and D. In this network there are, in general, five different currents. To solve it we have to have five equations, obtained by the application of Kirchhoff's two laws. These should be three voltage drop equations and two current summation equations. One of the current summations may be taken at S and the other at Q. The three voltage drop equations may be RSP, RQP and RSQP, or they may be RSP, RSQ and PSQ. If the capital letters represent resistances and the corresponding lower case letters the currents we have the three voltage drop equations $E = Cc + Dd$, $Bb + Ff - Cc = 0$, and $Ff + Dd - Aa = 0$. The two current summations are $b = a + f$, and $d = f + c$.

From the two voltage drop equations involving f and the two current equations we can get the condition for balance. The condition is that f be zero. Hence we have $Bb = Cc$ and $Dd = Aa$. From the current summations we have, setting f zero, $b = a$ and $d = c$. Dividing we have $Bb/Aa = Cc/Dd$, and since b equals a and d equals c, the condition for balance is $B/A = C/D$. This condition for balance in the bridge was obtained by use of Kirchhoff's two laws.

In some instances it is desired to read the value of one of the resistances in the bridge in terms of the current through F. That is, it is desired to put a milliammeter in the bridge and read the resistance of one of the arms by the deflection due to the current f. This method of measuring resistance is employed when a small difference is to be determined. For example, suppose the bridge is balanced when A has a given value. Then a small unknown resistance x is connected in series with A. The value of x can then be determined by the deflection, or the value of f, provided x is small compared with A. It is possible to use the method even when x is large but then the milliammeter has to be calibrated beforehand, calibrated in terms of resistance.

In Fig. 3 is a network with two sources of e.m.f. in different positions. This circuit, too, can be resolved by the application of Kirchhoff's two laws. There are again five different resistances designated by the capital letters and the corresponding currents designated by the small letters. The direction of the currents has been assumed to be as indicated by the arrows. The true direction of any current may not be as indicated but if it is not that will show up as a negative sign. In this case we have $E1 = Aa + Bb + Cc$, $E2 = Dd + Bb$, and $E2 = Ff - Cc$ for the voltage drop equations and $a + d = b$ and $a = c + f$ for the current equations. If we know the values of the voltages and the resistances we can easily obtain all the currents.

### Problem of Voltage Divider

The problem of the voltage divider is soluble by means of Kirchhoff's laws under certain conditions but here it is rather a question of knowing the currents than the resistances and computing the resistances. The problem is complex because some of the currents are not known and some of the resistances are likewise unknown. In Fig. 4 is a simplified circuit of a voltage divider and the circuit to which it is connected. The problem usually is to determine the values of resistances B, C, D and F so as to give the proper voltages across them. Here the voltage drops are known but neither the currents nor the resistances are known.

The resistances G, H, I and J represent the load resistances across the voltage taps and they are made up of resistances in the tubes, such as screen and plate resistances, as well as coupling resistances of various tubes. These resistances are unknown in most cases. They depend not only on the plate and screen voltages and external load resistances but they also depend on the operating grid bias on the various tubes. In order to solve the problem completely it is necessary to know the currents g, h, i and j. Current f can usually be taken arbitrarily, but it must be known just the same. On the choice of this current depends the values of the resistances in the voltage divider.

In a practical problem the circuit may be simplified a little. It may be assumed that the voltage across BCDF remains constant. With that assumption we need no longer consider the value of A, the DC resistance in the rectifier tube and the filter. Likewise G and g drop out of the problem. But the other currents must be known if the resistances between taps on the voltage divider are to be computed so as to give the desired drops.

The process of solving this problem is straightforward. First we assume a reasonable value for f. Knowing the voltage drop in F we know the resistance value of F. Suppose, for example, that the drop in F is to be 45 volts. Let us assume that the current through F is 10 milliamperes. Now we apply Ohm's law to get the resistance F. $F = 45/.01$, or $F = 4{,}500$ ohms.

The next resistance, D, we cannot get without knowing the current j through the load resistance J. If we know the circuit which is to be served by this circuit we can estimate the current j, but if we don't know the circuit nor the current, we have gone as far as we can. Let us assume that an examination of the circuit shows that the effective value of J is such that a current of one milliampere will flow into J. We now apply Kirchhoff's first law for finding the current d in D. If 10 milliamperes flow into F and one flows into J, it is clear that 11 milliamperes come up to the junction through D.

Now, then, assume that the voltage drop in I is to be 75 volts. This is equal to the drop in D and F. Hence the drop in D is $75 - 45$ volts. That is, the drop in D is 30 volts. To get the value of D we divide 30 volts by d, which we found to be 11 milliamperes. That is, $D = 30/.011$, or 2,730 ohms, very nearly.

Let us now assume that the voltage drop in H is to be 180 volts. That is, the voltage between the second tap from the top of the resistance to B minus should be 180 volts. We can't proceed without knowing how much current flows in C. Since we know the current in D we require to know the current in I. If we have the circuit which is to be served we can estimate this current from the number and types of tubes connected to the tap in question, and from the grid bias on the tubes. If we don't have the circuit it is necessary to assume a value, or we cannot proceed.

### Assuming Screen Current

Let us suppose, for illustration, that four screens are connected to the tap above D and one plate circuit. Now it is reasonable to assume that the four screens take 4 milliamperes and that the plate takes 5 milliamperes. Hence we assume that a current of 9 milliamperes flows into I. Now we have sufficient data to compute C. The current c is the sum of the currents that flow into D and I, that is, it is 20 milliamperes, since 11 milliamperes flow into D and 9 into I. The voltage at the top of C is to be 180 volts and that at the bottom is 75 volts. Hence the drop in C is 105 volts. Hence $C = 105/.02$, or 5,250 ohms.

The next step is the determination of B. First let us assume that the voltage drop across G is to be 300 volts. Then the voltage drop across the entire voltage divider is 300 volts and the drop in B is 300 less 180 volts, or 120 volts. We cannot proceed without knowing the current b through B, which means that we must know the current h through H for we already know the current through C. In the absence of the circuit which is to be served we can only guess. But we can guess reasonably and consistently. We previously assumed that there were four screen grid tubes. The plate current of each is about 4 milliamperes, so at the start we have 16 milliamperes. Undoubtedly, there is something else connected to the 180-volt tap. Let us assume it is a power detector taking one milliampere, but no other tube or conductor. Then we have a total of 17 milliamperes flowing into H and a total of 20 milliamperes into C. Hence by Kirchhoff's first law the current in B is 37 milliamperes. Therefore $B = 120/.037$, or 3,240 ohms. That completes the solution. It rests on assumptions because in no instance was the current diverted from the voltage divider known.

This illustration covers one of the most frequent questions asked of the technical department. Where should the taps be placed on the voltage divider to give specified voltages, and what should the total resistance be? There is no answer, for the solution cannot even be guessed at without some data concerning the circuit to which the B supply is to be connected. The answer will be different for different sets. It is extremely simple to give the position of the taps to give specified voltages if no current is drawn from the taps. But such a case does not arise except in connection with grid bias voltage dividers.

# Tests Made

## Solution Found for All Tro

**By Brunsten**

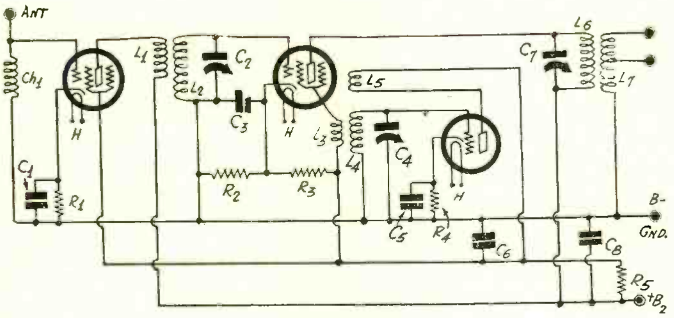



FIG. 1

**The circuit of a short wave converter used in experimenting for finding the best values. One of the most important things is to get the bias on the modulator correct.**

IT cannot be denied that short-wave converters are tricky. Sometimes they work wonderfully well and sometimes they don't work at all. There must be good reasons for this unreliability. Many experiments have been conducted with the object of finding out why the performance of a converter is so uncertain, and many reasons have been found, the main one being coupling trouble between the converter and the broadcast receiver.

There are also many types of trouble encountered. For example, there is interference from broadcast stations, there is lack of sensitivity on some wave bands while the sensitivity is good on others, and there are heterodyne troubles. One of the difficulties is that the converter acts as an antenna to the broadcast receiver so that broadcast signals are brought in regardless of the setting of the tuners on the converter. Fortunately, there is a remedy for every type of trouble.

The circuit depicted in Fig. 1 was used as a test in determining the cause of some of the troubles met. At first this set had about all the defects to which converters are subject. After it had been adjusted it worked satisfactorily in all respects.

### Trouble Exploration

At first a 0.25 megohm resistance was used between the antenna and ground. This worked well. But a resistance does not discriminate among frequencies at all. It is just as effective at zero cycles per second as at 30,000 kc per second. Therefore if there are any noises on the low frequencies these will get into the circuit and come through as a modulation on the signal. Then a choke Ch1 was substituted, a choke of 800 turns and an inductance of approximately 8 millihenries. This size choke was used because it was desired to make the circuit effective in the broadcast band as well as in the short wave region.

A choke of this size is practically a dead short circuit to low frequencies so that if there is low frequency noise it will be shunted to ground right away. It did improve the circuit noticeably. If the broadcast band is not desired this choke need not be larger than one millihenry, that is, if the lowest frequency to be received is 1,500 kc.

### Radio Frequency Tuner

The radio frequency tuner L1L2C2 had a great effect on the selectivity of the circuit, but nothing was found about it that does not apply to any other tuner.

Having chosen the tuning condenser C2 the inductance of L2 is determined by the frequency that is to be tuned in. Hence there is nothing to vary except the primary L1. But this may be varied as to the number of turns and degree of coupling. If there are many turns and the coupling to the secondary is close the amplification of the circuit, that is, of the first tube, is high, but the selectivity is not good. That is a general proposition. Conversely, if the coupling is loose and the turns few, the amplification is not so good and the selectivity is very good, provided the selectivity of L2 is good. No general rule as to the number of turns on the primary and the closeness of coupling can be given.

One coil that gave a good compromise between selectivity and sensitivity had a ratio of turns one-to-two and a separation of one-fourth inch between the windings. The coil L1L2 was wound on a diameter of 1.25 inches with No. 32 silk-covered wire.

Experiments were made on C1 and R1 to see the effect of varying the bias and the by-passing of the bias resistor, the tube being a 224. Neither was critical and the usual value of 300 ohms for this tube was retained. There was no noticeable gain in the output when the by-pass condenser was made higher than 0.1 mfd.

Two by-pass condensers, each of 0.1 mfd., were associated with the first tube, neither of which is shown in the diagram. One was connected to the screen and the other to the plate return. There was a slight gain due to these condensers but not enough to justify their use when condensers C6 and C8 also are used. The common side of these two 0.1 mfd. condensers were alternately connected to ground and to the cathode of the first tube. One connection was just as good as the other as far as the sensitivity of the test could determine. Since the two large condensers C6 and C8, each of 2 mfd., were in the circuit the two 0.1 mfd. condensers were omitted.

### Detecting Efficiency

The sensitivity of the converter may be made good or indifferent by adjustment of the modulator tube. In this particular case the oscillation is impressed on the screen circuit and the grid bias method of detection is used. Holding the input to the tube constant both from the first tube and the oscillator the resistance values of R2 and R3 were varied. The voltage applied to the screen was 67.5 volts and that applied to the plate was 135 volts, both applied directly with batteries.

R2 and R3 at first was a potentiometer of 200,000 ohms with the slider connected to the cathode. A definite setting was found which gave the best detecting efficiency, that is, greatest output. The value of R2 was then measured. Several measurements were made and they varied from 2,200 to 3,000 ohms. The tube was a 224. The optimum value is nearer 3,000 ohms than the lower value but it was not critical in this range.

The detecting efficiency was also studied by leaving out R3 and varying R2 alone, that is, using R2 as an ordinary grid bias resistor. Approximately the same value was found to give the best results, showing that R3 did not contribute much. The reason for this, of course, was that the resistance of R3 was too high so that comparatively little current flowed through it. There seems to be no good reason for using a potentiometer except for the purpose of varying the volume. The arrangement forms an excellent volume control when the cathode is moved over the potentiometer resistance. If the volume control is not desired it seems best to use a 3,000 ohm grid bias resistor. This recommendation applies even though the voltages on the two elements are increased proportionately.

### Condenser Necessary

The circuit was tried both with and without condenser C3 across R2. Without the condenser the detecting efficiency was only fair but with it it was excellent. There was little increase in the detecting efficiency after the condenser was made larger than 0.1 mfd. This was for a frequency near 550 kc and therefore there is no need of making it larger for any higher frequency.

A condenser was also connected across R3, when this was used.

# The Background

In television, background is the flat surface hung behind a person being televised, who in this case is called the subject.

A white surface, usually a sheet, is hung behind. A natural question would be:

"Why not a black background, which would make the person stand forth due to his complexion being much lighter?"

In actual practice it proves to be the nicest way for a person to seem to lose all his hair, and, in fact, the top of his head. The hair, usually dark, merely blends in with the dark background, and the person seems to end where his hair begins. This means that the top and upperside of his head seems to shrink into a small, bald object. Thus a white screen must be used.

Recently, the Shortwave and Television Corporation intro-

# on Converter

## ubles Encountered in Circuit

Brunn

There was no appreciable change in the output. Hence this condenser was omitted. C6 and C3 combined serve as by-pass across R3 when this resistance is used.

The detecting efficiency depends a great deal on the type of load on the modulator tube. In this case a parallel tuned circuit is used, composed of a variable condenser C7 and the inductance L6. This circuit not only puts a high impedance load on the tube at the intermediate frequency but it also provides a by-pass condenser for the higher frequencies involved.

This tuned circuit is well worth while from this point of view. Then it also serves to eliminate interference from the antenna effect of the converter circuit. All frequencies higher than the frequency to which this circuit is tuned are by-passed to ground and are thus prevented from passing into the broadcast set. Frequencies lower than the resonant frequency are also by-passed through L6 just as any tuner suppresses frequencies on the low side.

### The Oscillator

A 227 tube is used for oscillator because this works just as well as any other and the circuit is simpler than when a screen grid tube is used for this purpose. The tube is biased as an amplifier but R4 had a value of only 1,000 ohms, which is a satisfactory value when the plate voltage is only 67.5 volts. The bias condenser C5 across it had a capacity of 0.1 mfd. Nothing is gained by making it larger.

The oscillator circuit is a simple tuned grid hook-up with a tickler. This type works satisfactorily and is simple to connect up and it permits grounding the rotor of the tuning condenser C4, which is an important feature when tuning in short wave signals.

The functioning of the circuit depends to a great extent on the pick-up coil L3. If this coil is large and is closely coupled to the oscillation coil L4 the signals will be very strong, but there will be danger of overloading the modulator tube even when no signals are coming in. But up to the point of overloading the output is directly proportional to the voltage induced in L3. Even before there is serious overloading if the voltage induced in L3 is high there will be too many repeat points and squeals. Hence it is best to sacrifice sensitivity for purity of output, and for greater selectivity. On a coil on which L4 had seven turns a single turn was found to be about right for L3. On a coil having 16 turns for L4, 2 to 5 turns work all right. There was no separation between the L4 and L3 windings in these cases, but when there is, the number of turns may be increased a little.

### Plug-in Coils Used

The coils used in this circuit have been described many times. L1L2 fits a 4-prong socket and L3L4L5 a 5-prong socket and both are wound on 1.25 inch bakelite molded forms provided with the proper bases. Of course, larger and more efficient coils may be used if desired. If three-inch diameter coils are used more room should be allowed for each coil and the two should be mounted at right angles so that there is no direct coupling between them, for this coupling would introduce a voltage in the grid circuit of the modulator tube, which would either decrease or increase the pick-up voltage. In one case this would result in decreased sensitivity and in the other probable overloading of the modulator tube. When small coils, mounted with their axes parallel, are used it is good practice to put a shield between the two coils to minimize the direct coupling.

### Output Coupler

Many broadcast receivers are sensitive at one end of the broadcast band while others are sensitive at the other. Some are sensitive throughout. If the broadcast receiver is sensitive to all frequencies in the band, it makes little difference what the values of C7 and L7 are, for good short wave sensitivity can be obtained for any intermediate frequency. But if the broadcast set is sensitive in a certain region of the band C7 and L6 must be chosen so that they will resonate at a frequency where the broadcast set is sensitive. If C7 is a regular broadcast tuning condenser and L6 is a regular broadcast coil, C7 may be set at any frequency.

If the broadcast set is not very sensitive, and many are not, it is necessary to add a tube to the converter after coil L7. This coil is then connected in the grid circuit. The tube to be added should be of the 227 type because this has a low output impedance and will match the input to the set fairly well. The coupling between this tube and the broadcast set should be by means of a radio frequency coil from the plate to B plus and a condenser from the plate to the antenna post on the broadcast set.

If the sensitivity of the broadcast set is good L7 may be connected directly to the antenna and ground post of the set. L7 should have as many turns as L6 and the coupling should be close, but there should be a tap on the coil from 10 to 20 turns from the ground end. In case the antenna input impedance to the set is a high resistance or radio frequency choke the entire winding should be used, but if the input is a small primary winding on a tuned transformer the tap should be connected to the antenna post. In any case, both connections should be tried and that used which gives the greater sensitivity.

The resistance R5 is used to drop the voltage from 135 to 67.5 volts. Its value should be 10,000 ohms or somewhat less.

### Voltage Divider Tapping

A B supply which I have has a rated voltage of 300 volts and a rated current of 85 milliamperes. There is no voltage divider in it so that I can only get the one voltage. Will you kindly supply the values of resistance necessary to give voltages of 180, 75 and 15 volts?—W.A.B.

You can use almost any resistance you want, but 15,000 ohms is a suitable value for the entire voltage divider. This will make the bleeder current 20 milliamperes. If this current flows through the entire resistance, the resistance between B minus and the 15 volt taps should be 750 ohms, the resistance between the 15 and 75 volt taps 3,000 ohms, and the resistance between the 75 and 180 volt taps 5,250 ohms, and the resistance between the 180 and the 300 volt taps 6,000 ohms, making a total of 15,000 ohms. If you draw any current from any of the taps below 300 you don't have the same voltage distribution any longer. If you draw current, you have another problem. But you did not ask that!

# in Television

duced a departure in background screens by using a beaded type of screen such as is now being put out for home motion pictures. This type of screen reflects most of the light played upon it and its effect from a light viewpoint is extreme whiteness. As soon as this background was used, a marked improvement in the detail of the subject's face and head was noticed.

Another point in considering background is the fact that synchronization of the receiver with the sending station is much more difficult, since it is the impulse which is transmitted when the subject has been scanned once and the second scanning starts which is used to keep the receiver "in step" with the transmitter. A white background with a square area gives this impulse nicely.

### Short Waves Fascinate Him

I CERTAINLY am glad you started Radio World's Short-Wave Club and I am more than grateful to have the privilege of joining it. I buy the magazine constantly and I always read it thoroughly, and I am glad to say I enjoy it.

I am a short-wave experimenter. Although I am a beginner, I have already logged foreign stations, numerous amateurs on the phone band, and quite a number of short-wave broadcasting stations. I also have picked up transatlantic phone messages and police reports.

I think radio is a fascinating hobby, especially short-waves. It just seems to take one's mind off of the everyday commonplace things of life and elevate it to higher planes of thought. It helps to inspire one to greater ideals and achievement in the scientific realm.

Simon H. Sasser, Jr.,
Route 1, Box 54,

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

# Radio University

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

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

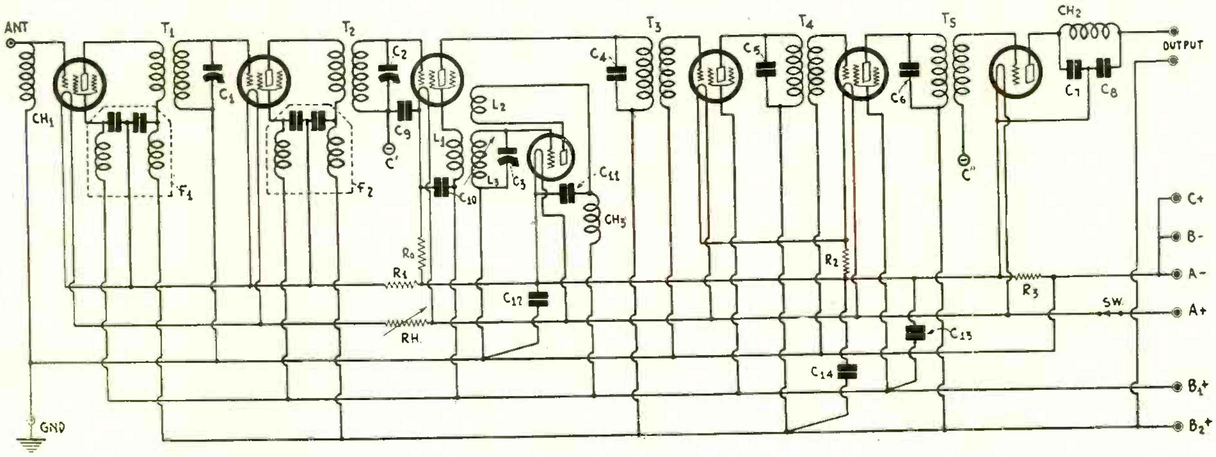



Fig. 932
The circuit of a superheterodyne tuner designed for battery tubes. Properly constructed, this is an extremely sensitive circuit.

## DC. Superheterodyne Tuner

WILL qou kindly show a circuit of a superheterodyne tuner up to the second detector. The circuit should be designed for battery operation although I intend to use a B supply that I have. I also have a heavy duty A battery eliminator to take the plate of the storage battery. I have used this A supply and it furnishes plenty of current but it produces more hum than it ought to produce. How can I eliminate this hum?—B.N.W.

In Fig. 932 is a diagram of a super just such as you request. It has two radio frequency tuners in addition to the oscillator tuner. It also has three intermediate frequency tuners. The hum from the A supply can be eliminated by means of a filter consisting of two 1,000 mfd. electrolytic condensers and a choke of about 0.1 henry. This choke should be wound with heavy wire.

* * *

## Pentode as Power Detector

THE highest voltage I have available is approximately 135 volts and I want to use this on a 247 power detector. Is it practical and if so, what grid voltage should I impress on the tube? About how much will the amplitude of the plate current be when the amplitude of the signal is equal to the bias?—R.B.

This is quite feasible and the grid bias should be 20 volts. If the amplitude of the signal voltage is 20 volts, the current in the plate circuit will rise to 34 milliamperes. Of course, this is not equal to the audio frequency current amplitude, which will be considerably less.

* * *

## High Impedance of Tuned Circuit

WHEN tuned impedance coupling is used between stages it is always stated that the impedance of such a circuit is extremely high. But when the same circuit is used as a secondary of a coupling transformer it is said that the impedance is very low. How can the impedance of the same circuit be so widely different when used in slightly different settings? Is it not a case of simply claiming the properties of the circuit that happen to be most desirable?—W.H.L.

What you call a slight difference in the setting of the tuned circuit makes all the difference, and the difference is that of a parallel and a series tuned circuit. A parallel resonant circuit has a very high impedance and a series tuned circuit a very low impedance. The lower the resistance in the circuit the lower is its series impedance and the higher its parallel impedance. In each case at resonance, the impedance is a pure resistance and the current is in phase with the voltage.

* * *

## Reduction of Inductance

WHY is it that the inductance of a coil is smaller when it is surrounded by a shield than when it is free of shielding? Is there any relationship between the shielding and the reduction in the inductance?—W.R.C.

The best way to look at it is that the field of the coil induces currents in the shielding and that this current is such that its magnetic field is opposed to the field of the coil. In effect this is the same as taking a few of the turns on the coil and winding them on in the opposite direction. No doubt there is a relationship between the reduction in the inductance and the shielding, but it is not a simple one. If the shielding were a simple metal cylinder concentric with and surrounding the coil a comparatively simple relation could be worked out, but for more complex shielding it would be necessary to measure the change. The amount of reduction depends on the dimensions of the shielding as compared with the dimensions of the coil. To some extent it would also depend on the electrical conductivity of the shielding material.

* * *

## Connecting Condensers in Series

IF two condensers are connected in series is the resulting capacity ever larger than either of the condensers alone? If more than two condensers are connected in series, which has the greatest effect in determining the capacity of the series?—S.G.F.

When two or more condensers are connected in series the resulting capacity is always smaller than the smallest unit. The smallest condenser is more effective in determining the resultant capacity than any of the other, and the smaller it is the more effect it has. For example, suppose we connect two condensers, one of .0001 and another of .001 mfd., in series, the resulting capacity is .0000909 mfd., which is only about 10 per cent. smaller than the smaller of the two condensers. Again, if the larger of the two condensers is 0.1 mfd. the resulting capacity is only about 1/10 per cent. smaller than the smaller of the two condensers.

* * *

## Heating Filaments with RF

COULD filaments of 2 volt tubes be heated with radio frequency current if this current were effectively equal to the DC current for which these tubes have been designed? Would it be necessary to balance the filaments against hum?—F.W.Y.

Certainly, the filaments may be heated with radio frequency current if this current is equal to the DC current required. There is little need for balancing the filaments for the hum cannot be heard, being at radio frequency. However, if the radio frequency current is modulated with a ripple of audio frequency, such as 120 cycles, it is quite likely that this modulation will be heard. The RF current might be modulated if the oscillator generating the RF is supplied plate voltage from an inadequately filtered B supply.

* * *

## Screen Circuit Modulation

WILL you kindly explain how the screen grid circuit modulator operates? I understand how a grid circuit or a plate circuit modulator works but am not sufficiently familiar with the operation of screen grid tubes. I should like to see a simple circuit of a screen grid modulator.—W.C.L.

There is a simple screen grid modulator in Fig. 933. There is no essential difference between the screen circuit modulator and other types. The plate current can be varied by varying the control grid voltage, the plate voltage, and the screen voltage. If there were any more electrodes the plate current could be varied by varying the voltage on any one. If the plate current responded rapidly to the filament current, it would even be possible to modulate by modulating the filament or cathode voltage. If the grid, screen and plate voltages are adjusted so that the plate current curve is bent at the operating point, modulation or detection will result if any one of the voltages is varied, provided two signal voltages of different frequencies are impressed at the same time. The effect of a given voltage from the oscillator depends on the position the pick-up coil is given. In the grid circuit it has the greatest effect. The next effective position is the screen, and the least is the plate. This does not mean that a circuit in which the pick-up coil is connected in the grid circuit is superior to one in which it is connected in one of the other circuits. All can be made equally effective by adjusting the coupling between the pick-up coil and the oscillator coil, or by varying the number of turns on the pick-up coil. When the pick-up coil is put in the control grid circuit there is danger of overloading the modulator by the oscillator. This danger is not so great when the pick-up coil is connected in the other circuits. Moreover, when the pick-up coil is in the grid circuit the tuned circuits are likely to pull together and not act independently.

* * *

### Suppression of Audio by RF Filter

IN your June 20th issue, on page 3, you have a diode type detector and across the 2 megohm coupling resistance you have a .00035 mfd. condenser. About how much does this condenser reduce the input at 10,000 cycles as compared with the output at low frequencies?—V.M.C.

At 10,000 cycles the impedance of the 2 megohm resistance and the .00035 mfd. condenser is 45,500 ohms. Thus the ratio of output at 10,000 and say 10 cycles is .02275. At 10,000 cycles therefore, the output is only about 2 per cent. as great as it is at 10 cycles. The output is one-half at 393 cycles per second.

* * *

### High Note Suppression in Talkies

IT IS well known that certain talkies suppress the high notes while they bring out the low notes very well. Will you kindly explain the reason in non-technical language?—N.I.J.

Sound on film is reproduced by scanning the wavy line on the film representing the sound. A high note is represented by a very short wavelength while low notes are represented by a very long wavelength. The scanner is a narrow slit, about .001 inch wide, through which light passes from an intense source of light to a photoelectric cell. If the width of the slit is comparable to the length of the wave on the film there is no variation in the amount of light that passes through as the slit moves along the film. When the slit is very small compared with the wavelength the variation follows closely the variation in the film. It is the variation in the light that passes through that determines the volume. We might illustrate this by means of a mechanical model. Take a saw to represent the sound variation on the film. The distance from one tooth to the next is a wavelength. Now suppose we move a flat stick one-eighth inch wide over the teeth with the flat side always parallel to the line through the points of the teeth. If the distance between the teeth is large, say one inch, the stick will move up and down. This movement up and down represents the audio output. Now suppose the teeth are very close together, say 1/16 inch. Now the stick will remain in the same line all the time because it will slide over the tips of the teeth. There will be no output, that is, movement up and down at right angles to the saw. The mathematical theory of the small flat stick moving over the saw teeth and that of the scanning slit moving over the wave on the film are exactly the same, at least as long as the width of the slit or the stick in the direction of motion is not greater than one-half wavelength.

* * *

### Connecting Phonograph Pick-Up

IN my receiver I have two stages of resistance coupled audio. I want to connect a phonograph pick-up unit to this amplifier so that I can use the amplifier when I play the phonograph. How can I make the connection?—W.G.H.

You can connect it between the grid and the cathode of the detector, between the plate of the detector and B plus for the detector, that is, across the plate coupling resistor, or it may be connected across the grid leak of the stage following the detector. In all these connections the phonograph pick-up unit should be opened on the high voltage side when the radio set is to be played, or it should be removed entirely.

* * *

### Inversion of Speech

WHEN speech is inverted by means of an oscillator and a detector do the harmonics remain in the proper ratio to the fundamental? That is, if a 100 cycle tone is converted into 10,000 will the harmonics of the 100 cycle tone be converted to 20,000, 30,000 and so on?—B. M. L.

No, it does not work out that way. Inversion is effected by subtracting a definite number of cycles from each frequency. Suppose we subtract 10,000 cycles from each frequency. The 100 cycle tone becomes 100—10,000 cycles, which is equivalent to 9,900 cycles. The second harmonic of 100 becomes 9,800 cycles. These two converted frequencies are not in harmonic relation. In all cases when a tone is converted into another by subtracting or adding a fixed amount the true relationship between the fundamental and the harmonics is upset.

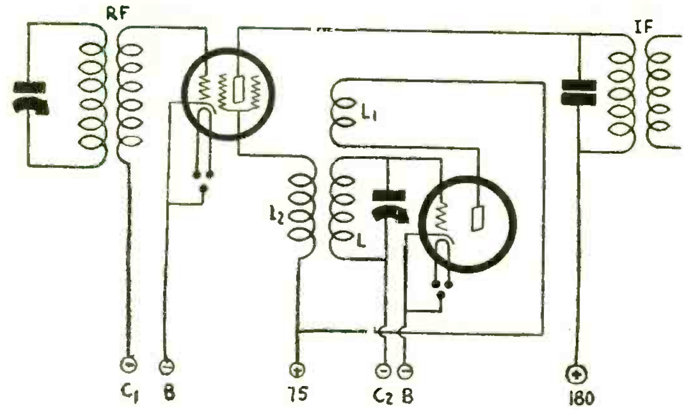



**Fig. 933**

**The essential circuit of a screen grid modulator in which the oscillation voltage from the oscillator is impressed on the screen circuit.**

* * *

### Sensitizing Short Wave Converter

I PLAN to build a short wave converter with a stage of intermediate frequency built in. Would it be advisable to tune the intermediate coupler with a variable condenser so that any desired frequency to which the broadcast set tunes can be used?—W.H.J.

It would be desirable but it is not necessary to make the coupler cover the same range as the broadcast set. It is sufficient to use a small variable condenser by means of which the intermediate frequency may be changed so as to avoid frequencies on which there are local stations operating.

* * *

### Loss of High Notes in Resistance Circuits

IS it a fact that the high audio notes are suppressed by a resistance coupled amplifier, and if so, how great is the suppression? Is the suppression greater or less with screen grid tubes than with triodes?—S.W.

It is true all right and the suppression may be quite great. It depends largely on the value of coupling resistances and on the inter-electrode capacities, as well as on other capacities introduced into the circuit for by-passing the carrier. It is usually larger for screen grid tubes than for triodes, but is not true under all conditions. In fact, the high notes are suppressed by many parts of the circuit. First we have the tuner which cuts sidebands. Then we have the filter which cuts out the carrier from the audio. This reduces the volume on the high notes. Then we have grid to cathode, grid to plate, and plate to cathode capacities, all of which shunt out some of the high notes. The output at 10,000 cycles is often extremely low as a result of these losses. On top of this suppression many manufacturers insert a device for cutting out still more of the high and call the device a tone control.

* * *

### Correcting Voltmeter

I HAVE a 0-150 volt voltmeter with a total resistance of 10,000 ohms. When I measure the voltage at the plate of a tube the meter reads only 24 volts, yet the applied voltage is 180 volts, being supplied by four heavy duty batteries of 45 volts each. When the voltmeter is connected to any two of these it reads 90 volts. Why is the voltage reading at the plate so low? If this is normal behavior what conclusion should be obtained from it?—F.W.R.

The behavior is normal all right and the only conclusion that can be reached is that there is a high resistance between the battery and the plate, possibly a plate coupling resistance. Since the meter resistance and the drop in voltage is known we can compute the value of this resistance. That is, we can, provided that the tube is not in the socket when the voltage is measured at the plate, or provided that the filament of the tube is not hot at the time. We know that the resistance of the meter is 10,000 ohms. Let the unknown resistance be R. Then the total resistance in the circuit in series with the 180 volts is $10{,}000 + R$. The current is therefore $180/(10{,}000 + R)$ ampere. When the meter is reading full scale, 150 volts, the current is 150/10,000 ampere, and when the meter reads 24 volts the current through it is 24/150 of the full scale current. That is, when the meter reads 24 volts the current is 24/10,000 ampere. Therefore we have the relation $180/(10{,}000 + R)$ equals 24/10,000. From thi equation we can get R. It is 65,000 ohms.

### A THOUGHT FOR THE WEEK

*THE New Jersey Press Association has gone on record as opposed to the idea that political candidates should be afforded an opportunity to express their views over the air. It should be noted, in fairness to the more open-minded of the N.J.P.A. members, that many publishers in that State oppose the ban which their journalistic brethren would impose. Surely if the ether is to be regarded as every man's arena, and newspapers, partisan or independent, print the speeches of candidates, why shouldn't broadcasting stations be accorded the privilege of free speech to those seeking public support? It's all pretty silly on the part of the New Jersey publishers—especially as the broadcasting stations foot their own bills, without expecting newspaper publishers to sit in the game and contribute to the dear old kitty.*

RADIO WORLD

**The First and Only National Radio Weekly**
***Tenth Year***

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

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

## Rapee New Director Of National's Music

Erno Rapee, 40, is the new general musical director of the National Broadcasting Company. As an Hungarian immigrant youth he played for his meal ticket in a cafe in New York City. For more than thirteen years Rapee was associated with Roxy (S. L. Rothafel).

Rapee became a leading influence in the synchronizing of standard music and modern compositions for motion pictures. He scored and composed theme songs for many picture successes, including "Charmaine" of "What Price Glory," "Diane" of "Seventh Heaven," and "Angela Mia" of "Street Angel."

## Trade-in Sets Asked As Gift to the Blind

How to accomplish the most good with an obsolete receiver was suggested to radio listeners of the nation, when a plea from the New York Association for the Blind for discarded trade-in radios was broadcast during the weekly concert of the Philco Symphony Orchestra.

The appeal for old sets, made on behalf of institutions for the blind throughout the country, was made at the suggestion of the New York Association, which requested time during the regular Philco broadcast for its plea.

## William Dubilier Back With Dubilier Corp.

After an absence of several years from the organization which he created and developed, William Dubilier has resumed the presidency of the Dubilier Condenser Company of New York City.

# World Voice Needs Many Tongues

Schenectady, N. Y.

World broadcasting has difficulties outside the technical field. Until a universal language is adopted and becomes widely known, any one broadcaster who attempts to reach all nations is in an impossible position.

This was brought home recently to W2XAF, one of the short-wave stations of WGY. Radiograms were received from Italy and three Latin-American countries requesting the Schenectady station to broadcast a ringside story of the Sharkey-Carnera boxing match. The Italian correspondent wanted the fight described in Italian and the Latin-Americans, who are interested in the progress of Carnera, want the story served up in Spanish.

A compromise was reached—a blow-by-blow story in Italian, and a summary in Spanish during the one-minute interval between rounds. The compromise plan is held up pending the removal of legal obstacles to the fight.

### Want Broadcasts in Own Tongue

W2XAF ranks today among the best-known short-wave stations on the air. The 40-kilowatt station is known wherever there are short-wave receivers. Musical programs are enjoyed in every country, but when an understanding of English is required, as in the case of descriptions of sporting events, the Spanish, German, Frenchman or Italian wants the narrative in his own tongue.

Every effort has been made by the management of WGY to make the short-wave stations perform maximum service. Since W2XAF is essentially a night-time transmitter—that is, its wavelength is best suited for transmission during periods of darkness—its greatest audience is in South and Central America. Due to the five hours difference in time between the British Isles and the Eastern Standard Time zone, there are comparatively few British listeners after 7 p.m., E.S.T., or midnight Greenwich Meridian time.

Listeners, after that hour, are dyed-in-the-wool fans and amateurs who are active particularly Saturday night and Sunday morning.

Because the South American audience is in the majority, W2XAF frequently carries special programs for the Latin-American, a Spanish-speaking announcer being used. If, as has been the case several times in the past year, a native of a South American country is trying out his skill in the boxing ring, the fight is carried to the delighted listeners south of the equator.

For these broadcasts a special antenna which has the effect of multiplying the 40 kilowatt output directionally by twenty, is put into service and reception is practically guaranteed, except where code stations are working to the broadcast wavelength.

Another service of W2XAF is the reading of the closing prices on the New York Stock Exchange. In South America are thousands of engineers employed in mines, on oil concessions, on plantations, etc. Many of these men are a week or more away from a daily newspaper. The radio is relied on to keep them in touch with the news of the day and the progress of their investments. Several Latin-American newspapers pick up WGY's market quotations from the air and run them with a credit line.

This service also finds favor among ships' officers. W2XAF can be heard practically around the world, as several ship radio operators have attested.

### Film Record Run Off

By means of a film recording machine developed in the research laboratory of the General Electric Company and in use only at WGY, the Schenectady station has a device on which outstanding broadcasts may be permanently recorded and, should occasion arise, may be rebroadcast.

One such occasion was the broadcast by Pope Pius XI from the Vatican station. His Holiness read his encyclical on labor and the entire broadcast was recorded by WGY. In the evening, ten minutes of recorded speech of Pope Pius was rebroadcast by W2XAF for the interest of South Americans and others who were unable to hear the original broadcast, either because of the unfavorable hour for general reception or because of adverse atmospheric conditions.

On the same evening, W2XAF carried a ring-side description of the Campolo-Loughran fight from New York. The description furnished by the National Broadcasting Company was in Spanish, and this story brought congratulations to the Schenectady station from fight followers throughout South America, particularly from the Argentine, the homeland of Campolo.

South Americans are most appreciative of programs from American stations and the embassies of every Latin-American country are keenly alive to the possibilities of W2XAF and W2XAD reaching into the respective countries. Ambassadors have come to Schenectady that they might join with their fellow citizens in observance of national holidays. Frequently local stations in foreign countries have rebroadcast the short-wave signals of W2XAF, enabling thousands who had only long-wave sets to hear the programs from Schenectady.

# RCA Wins! Licenses Granted

Washington.

The Federal Radio Commission has decided by a vote of three to two that the Radio Corporation of America did not violate the anti-trust laws within the meaning of the Federal Radio Act and accordingly voted to approve the applications of four RCA subsidiaries for fifteen broadcasting, commercial and experimental licenses. The majority consisted of Commissioners Robinson, Lafount, and Starbuck. Commissioners Salzmann and Sykes dissented.

This is one of the most importan decisions that the Federal Radio Commission or any court has made since radio legislation was enacted. If the decision had been adverse, not only the fifteen licenses involved in the hearing would have been denied, but the entire 1,409 licenses held by the Radio Corporation of America and its subsidiaries would have been involved. It would have resulted in the closing of some of the principal broadcasting stations on the national chains and many stations engaged in international communication.

The majority held that the Radio Act required an actual violation of the Sherman Act with respect to "communications," basing their decision on the fact that the Federal District Court in Wilmington had decided that the corporation was simply guilty of violating the Clayton Act, and that the violation consisted of practices tending to monopolize "apparatus."

# 50-CYCLE RULE IS VOTED FOR 1932 OBEDIENCE

Washington.

Action was taken by the Federal Radio Commission to reduce the allowable frequency variation from the assigned frequency to 50 cycles plus or minus, effective one year hereafter. The new low limit of deviation was set after a hearing at which only negligible opposition developed.

The object of setting the 50-cycle limit is to get rid of heterodyne interference due the unison of waves of two stations operating on adjoining channels. If the deviation is restricted to 50 cycles, the resultant beat note can not exceed 100 cycles, and in most audio amplifiers the interference hardly will come through. Many of the beats would be well below 100 cycles and would gain practically no response in the audio amplifier.

### Involves no Great Expense

An objection raised at the hearing was that the limit should not be quite so low, as the situation would be met if the allowance for deviation were put at 200 cycles, but the Commission's engineers met this with the explanation about the response characteristics of modern receivers, showing that unless 50 cycles were selected as the maximum variation, the proposal would not constitute a remedy and the present 500-cycle limit might as well be retained.

No great expense is involved to the stations, because crystal control is pretty generally used, and those stations not including it are considering so doing in the near future. The crystal would have to be ground and mounted so that the station could enjoy the advantage of the crystal in maintaining constancy of frequency.

Already 56 stations are maintaining their frequency with less than 50 cycles deviation, on the basis of the latest report of the Radio Division of the Department of Commerce. Only about half of the stations in the United States were monitored by the department, so that even among some of those not checked up the frequency adherence might have been within the stated amount.

### Deviate Less Than 50 Cycles

The department checked up 314 of the 612 stations, and reported the following as deviating under 50 cycles:

| Call Signal | *Transmitter location, studio location in parentheses* |
|---|---|
| KFDM | Beaumont, Tex. |
| KFEQ | St. Joseph, Mo. |
| KFH | Wichita, Kans. |
| KFKX / KYW | Bloomingdale Township, Ill. (Chicago) |
| KFUQ | AlmaHoly City, Calif. |
| KFRC | San Francisco, Calif. |
| KFSD | San Diego, Calif. |
| KFUO | Clayton, Mo. |
| KFVD | Culver City, Calif. |
| KFXF | Denver, Colo. |
| KFYR | Bismarck, N. Dak. |
| KGNF | North Platte, Nebr. |
| KGW | Portland, Oreg. |
| KHQ | Spokane, Wash. |
| KJR | Seattle, Wash. |
| KMMJ | Clay Center, Nebr. |
| KMO | Tacoma, Wash. |
| KRSC | |
| KUOA | Fayetteville, Ark. |
| WAAW | Omaha, Nebr. |
| WABC / WBOQ | New York, N. Y. |
| WCAH | Columbus, Ohio (Fort Hayes). |
| WCBM | Baltimore, Md. |
| WCCO | Anoka, Minn. (Minneapolis). |
| WCFL | Chicago, Ill. |
| WCSH | Scarboro, Me. (Portland). |
| WDAF | Kansas City, Mo. |
| WEAF | Bellmore, N. Y. (New York, N. Y.). |
| WEAN | Providence, R. I. |
| WEEI | Weymouth, Mass. (Boston). |
| WENR / WBCN | Downers Grove, Ill. (Chicago). |
| WFAA | Grapevine, Tex. (Dallas). |
| WFBL | Collamer, N. Y. (Syracuse). |
| WGES | Chicago, Ill. |
| WGR | Amherst, N. Y. (Buffalo). |
| WGY | Schenectady, N. Y. |
| WHAP | Carlstadt, N. J. (New York, N. Y.). |
| WHB | Kansas City, Mo. |
| WHO | Des Moines, Iowa. |
| WIBW | Topeka, Kans. |
| WILL | Urbana, Ill. |
| WJAG | Norfolk, Nebr. |
| WKBH | La Crosse, Wis. |
| WKBI | Chicago, Ill. |
| WKBN | Youngstown, Ohio. |
| WKRC | Cincinnati, Ohio. |
| WKZO | Berrien Springs, Mich. |
| WLBX | Long Island City, N. Y. |
| WLBZ | Bangor, Me. |
| WLS | Downers Grove, Ill. (Chicago). |
| WMCA | Hoboken, N. J. (New York, N. Y.). |
| WMSG | New York, N. Y. |
| WMT | Waterloo, Iowa. |
| WNAX | Yankton, S. Dak. |
| WOC | Davenport, Iowa. |
| WOR | Kearny, N. J. (Newark). |
| WOW | Omaha, Nebr. |
| WPAP / WQAO | Cliffside, N. J. (New York, N. Y.) |
| WPAW | Pawtucket, R. I. |
| WPCC | Chicago, Ill. |
| WPTF | Raleigh, N. C. |
| WRJN | Racine, Wis. |
| WRUF | Gainesville, Fla. |
| WSAR | Fall River, Mass. |
| WSB | Atlanta, Ga. |
| WSBC | Chicago, Ill. |
| WSEN | Columbus, Ohio. |
| WTAG | Worcester, Mass. |
| WTAM | Brecksville Village, Ohio (Cleveland). |
| WTIC | Avon, Conn. (Hartford). |
| WWVA | Wheeling, W. Va. |
| WXYZ | Detroit, Mich. |

The order supersedes a previous general order (No. 7) which permitted the 500 cycle deviation. Chief Examiner Ellis A. Yost, of the Commission, in his report on the hearings submitted last month, found that the proposed reduction in tolerance would result in a material increase in the service area of regional and local stations and would be of direct benefit to the stations and the listening public."

Equipment capable of maintaining the proposed tolerance is available at reasonable cost to the stations, he found, on the basis of testimony offered by representatives of several manufacturing companies. "The requirement," he said, "is consistent with the basic policy of radio regulation that equipment used in transmitting stations should be maintained abreast of technical progress in order that full and efficient use be made of the limited facilities available."

### The New Order

The new general order follows in full text:

"General Order No. 116—1. On and after the effective date of this order and until one year from said date all radio broadcasting stations operating between 550 and 1500 kilocycles shall maintain the assigned frequency between the limits of 500 cycles per second above to 500 cycles per second below the assigned frequency.

"2. On and after one year from the effective date of this order all radio broadcasting stations operating between 550 and 1500 kilocycles shall maintain the assigned frequency between the limits of 50 cycles per second above to 50 cycles per second below the assigned frequency and said stations are hereby required to make provision for the checking of the frequency of the emitted wave by means independent of the frequency control of the transmitter, said independent means having capability of the accuracy above mentioned.

"3. On and after the effective date of this order the Commission will authorize the installation of new transmitting equipment in broadcasting stations or changes in the frequency control equipment at present licensed for operation only if such equipment is so designed that there is reasonable assurance that the transmitter is capable of maintaining the assigned frequency to the accuracy set forth in paragraph 2 above.

"4. Each broadcasting station is hereby required to announce twice each day, at the beginning and end of its program, that it is broadcasting on a frequency of —— kilocycles, by authority of the Federal Radio Commission.

"5. General Order No. 7 is hereby repealed."

# HEXALINGUIST!

Announcements from PCJ, Eindhoven, Holland (31.28 meters, 9590 kc) are made in six languages: Dutch, English, French, German, Portuguese and Spanish. The same announcer wields all six tongues. He is Edward Startz.

### NEW W9XAA VISEMITTER

Chicago.

The Chicago Federation of Labor, affiliated with the American and Illinois Federation of Labor in the operation of WCFL and its shortwave auxiliary, W9XAA, announced its entrance into television in conjunction with the Shortwave and Television Corporation, of Boston, which will build the latest type television transmitter in new studios to be opened by WCFL in the Furniture Mart. Pictures of the latest type, with 60 line 20 pictures per second transmission, will be radiated.

# PCJ TRIES OUT BEAM AERIAL

Eindhoven, Holland.

Experiments are being conducted by PCJ, of this city, the experimental short-wave transmitter of Philips Radio, on the use of the new directional beam antennas. The object is to deliver a stronger signal in the selected directions of East and West and Southwest and to maintain more constant reception.

Two such antennas are now in use. One aerial, designated B, is directed East and West, while the other, designated C, is directed Southwest. The B aerial is directed sometimes to favor the East and at other times to favor the West. Improved reception of this station in the United States and Canada would be due to the direction of the radiation to the West.

The announcements are made in six different languages by the same announcer, Edward Startz.

The station operates on 31.28 meters, 9590 kc, and from reports it is received regularly and particularly well in the United States and Canada on short-wave sets, converters and adapters. The new schedule is as follows:

| | *EST* | *GMT* |
|---|---|---|
| Wednesday | 11 a.m.-3 p.m. | 16-20 |
| Thursday | 9 a.m.-1 p.m.<br>5 p.m.-9 p.m. | 14-18 22-02 |
| Friday | 1 a.m.-3 a.m. | 1-7; 18-20 or earlier |
| Saturday | 8 p.m.-2 a.m. | 1-7 |
| Sunday | 8 p.m.-2 a.m. | 1-7 |

# TELEVISION FOR PUBLIC CALLED 1932 PROSPECT

Washington.

Introduction of practical television "within a year" seems to be the consensus of the radio industry, Federal Radio Commissioner Harold A. Lafount stated.

"While it is my own personal opinion that a few years must elapse before television becomes entirely feasible, we cannot overlook the views of leaders in the industry who seem to be agreed that the visual art will make its bow during the coming year," the Commissioner asserted.

That public interest in television has been aroused to an unprecedented degree is apparent by the activities in the field, the Commissioner said. More and more applications for experimental television stations are being filed with the Commission, he brought out, while at the Radio Trade Show held in Chicago early this month, a half dozen manufacturers offered television receivers for home use.

**Projection Replaces Peephole**

"Of significance is the fact that television definitely has outgrown the peephole stage," the Commissioner declared. "No longer is it necessary for one to peer into a small opening on the receiver. The pictures now may be witnessed by the whole family circle on a screen two feet square, and to the accompaniment of regular sound programs."

The Commissioner declared that notable strides have been made in television during the past year, and that the visual art is definitely "on the right track." But this young science, he continued, "should not be burdened with the responsibilities of a full grown entertainment medium at this time."

**Still Deemed Experimental**

"I am not a pessimist," Mr. Lafount asserted, "but even with this encouraging progress it is difficult to believe that the next few months or the next year will usher in television as a practical public servant. There are some who say practical television is here today, others who say it is a matter of months, and yet others who believe that several years must elapse. I am one of the latter group."

The following additional information was made available by Mr. Lafount, based on reports from the industry, according to "The United States Daily":

While the Commission, only a few months ago, refused to lift the experimental restriction on television, it is cognizant of the material development since then. Despite this, however, visual broadcasting is still viewed as experimental, and there is no immediate plan to modify the restriction.

One important factor that has aided experimental television, has been the substantial standardization of the type of transmissions. The recognized standard now is a picture of 60 lines, with 20 pictures per second, which eliminates much of the "flicker" and may be compared to the newspaper halftone. Flashing of pictures on screens to be viewed by more than one or two individuals at a time is a decided step forward.

"Talking movies of the air," or sight synchronized with the sound transmissions of regular broadcasting stations, also are becoming more numerous, and are increasing the entertainment value of visual broadcasting.

**Two Sets Needed**

While two distinct receiving sets are essential plans are being evolved to produce combination sets, to pick up television, broadcast transmission and regular short wave broadcasting.

Television is transmitted in the short waves on bands 100 kilocycles wide, or 10 times the width of the broadcast channels and to pick up these signals a television receiver is needed. The sound accompaniment is picked up on the broadcast receiving set from the broadcasting station operating in conjunction with the television station.

Television experimenters who are urging that the experimental restriction be lifted so that remuneration may be realized from the visual broadcasts, insist that the quality of programs offered the public could be enhanced manyfold if this were done.

**Say Programs Would Be Better**

It is expensive to "stage" television, they say, and if such transmissions were commercialized, programs that would attract the public could be offered. Advertisers who now foot the bill for regular broadcasting, would defray the cost of such presentations, to gain the good will of the public for their commodities.

Just a year ago, according to one leader in the industry, television was a topic for technical dispute. Today transmission of sight by radio is a matter of accomplishment, not a speculation, he holds, and while public service is not yet practicable, experimental transmission and reception is most encouraging.

After its Summer recess the Commission unquestionably will give renewed consideration to the entire question of television.

## Literature Wanted

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

E. E. Young, Richards, Mo.
Edw. Apfelbaum, Mgr., Philadelphia Armature Works, 2711 Girard Ave., Philadelphia, Pa. (Power amplifiers, and speakers for public address systems.)
T. A. Gibson, 1233 N. Main St., Rockford, Ill.
G. L. Rowland, Rowlands Radio Service, 2623 Genesee St., Buffalo, N. Y.
Lt. Sgt. R. F. Hinek, W5BQA, 1st Balloon Co., Fort Sill, Okla. (Amateur equipment, tubes, transmitters, receivers, power supplies.)
Walter B. Rondeau, Santa Monica Salvage Co., 2002 Main St., Santa Monica, Calif.
Leigh P. White, Shand Creek P. O., via Prairie River, Sask., Canada.
J. M. Sutula, 770 Dickinson Ave., Memphis, Tenn. (Short wave sets and parts.)
Thomas Chlosta, 69 Shepherd St., Williamsett, Mass.
William J. Long, Jefferson, Md.
C. A. Payne, Payne's Hardware, Wolcott, N. Y.
Richard Dresselbause, Box 17, Galesville, Wis.
Geo. Gimera, Bradford, Pa.
Lloyd R. Deurloo, Box 68, Elko, Nev.
Fred W. Spencer, 341 Wyoming Ave., Buffalo, N. Y.
Theodore G. Shattuck, Simsbury, Conn.
J. E. Vassallo, 72 Main St., Malden, Mass.
J. Thos. Pitts, 2335 Greenway, Charlotte, N. C.
E. Murray, 1311 Commercial Drive, Vancouver, B. C., Can.
F. J. Thomas, 408 Prince St., Beaufort, N. C.
J. N. Bondurant, 212 E. Ming St., Warrensburg, Mo.
Myco Radio Service, 26 Fairfield St., Buffalo, N. Y.
Clarence J. Cook, 1716 Champaign Ave., Mattoon, Ill.
Isaac H. Shaw, Route 1, Portsmouth, Ohio.
George Mitchell, 960 E. Grand St., Elizabeth, N. J.
W. H. Edson, c/o Boeing Air Transport, Cheyenne, Wyo.
M. Yoder, 233 E. Maxwell, Lexington, Ky.
A. Robie Cogswell, 201 Arlington Ave., Daytona Beach, Fla.

# MACKAY BACKS KOLSTER SETS

Clarence H. Mackay, president of the Mackay Radio and Telegraph Company, announced that this company holds a controlling interest in Orange Securities Corporation, recent purchaser of the assets of the Kolster Radio Corporation, including the control of the Federal Telegraph Company of California.

A new company has been formed under the name of Kolster Radio, Incorporated, to carry on the exploitation of broadcast receiving sets, with offices and factory at 350 Thomas street, Newark, N. J., and an office at the International Telephone and Telegraph Building, 67 Broad street, New York City.

Mr. Mackay said: "The interest we have acquired has two important features. The Federal Telegraph Company, which manufactures radio telegraph equipment, assures to Mackay Radio an independent, patent-free position in the United States for the development and exploitation of its point-to-point and international radio telegraph. The recent decision of the United States Supreme Court in the Langmuir patent case was of great interest in this connection. That decision establishes that the further organization of Mackay Radio in 1927 was a progressive step.

"Through the affiliation of the Federal Telegraph Company, Mackay Radio and Telegraph acquires an independent manufacturing position in which it is not dependent on others for contracts or licenses."

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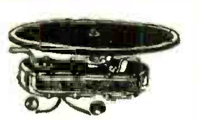

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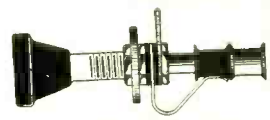

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