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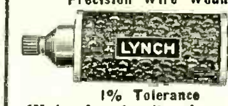

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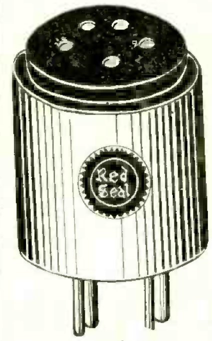

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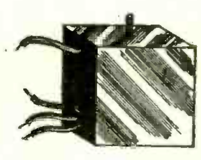

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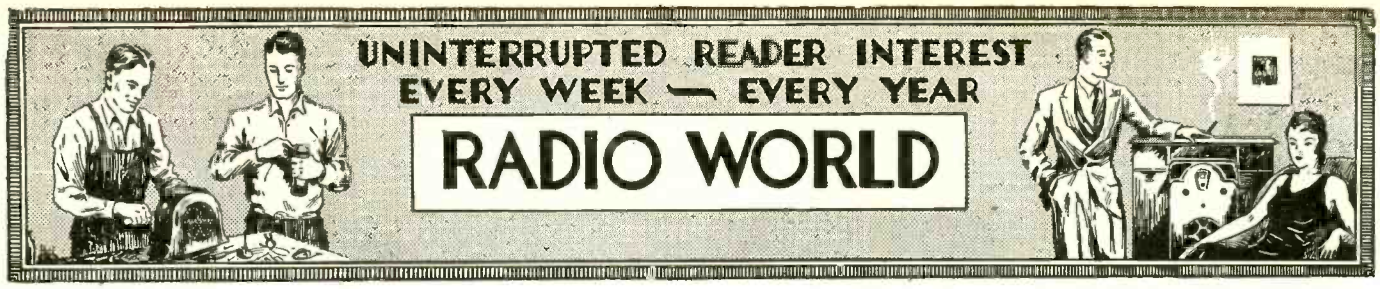

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T-R-F With Converter Built In; Same Dial Used on All Bands

Entirely New Method Is Presented for the First Time Anywhere

By Herman Bernard

IN the construction of tuned radio frequency sets for broadcast reception, or for short waves where only one band is to be covered, equal to the frequency range of the coil-condenser combination (no switching), there is no particular requirement for ingenuity or hard thinking. If a tuned radio frequency broadcast set is also to be used for short wave reception, from 30 meters to 200 meters, without plug in coils, then the system has to be changed to a superheterodyne for short waves (remaining a t-r-f set for broadcasts), and switching is necessary.

There are several problems. One is that the leads should not be too long, as they may be if the switch decks are close together, and the coils are necessarily distant from the switch points. Another consideration is that the apparatus should not become too bulky, as first efforts usually result in the at least theoretical requirement of a small arsenal of radio equipment. Still one more advantage is that the system used should not be too complicated, which does not mean it should be as easy as a, b, c, for there is a vast difference between a simple t-r-f set and one with a converter built in. The converter model needs many more leads, and these in a wiring diagram seem to make the picture confusing, so it should be accepted that some study must be given to the circuit, the method of switching and the layout.

Desire is to Use Same Dial

It has long been the desire of those working on the built in converter to use the same dial for tuning the short waves as for the broadcast waves. That means the same condenser, of course. But all built in converter models use a separate condenser, or two separate condensers, and it is pertinent to inquire whether a little ingenuity will not provide a satisfactory solution. It is advantageous also to avoid a complicated switch. Let us see what can be done.

First, let us consider what we have in the t-r-f set. There are two stages of t-r-f, a detector with tuned input, suitable audio, a power supply, and a tuning arrangement for covering the broadcast band with single dial. There are a volume control and a-c switch besides. The tuning condenser has three sections, and each carries a trimmer. Now, the trimmer may be built into the condenser permanently, but if necessary we may override this permanency by isolating the trimmer stator from the main condenser stator.

So we have a set with which to work, and the mechanical requirements are present for the converter use, with the exception of the switch. How many decks must this have? How many points per deck? When it is remembered that the antenna has to be shifted from one point to another, an a-c line to filaments made or broken, and two or three tuned circuits must be switched, we seem to be confronted with quite a problem.

Use of High Intermediate

However, let us do a little reconstructing. Instead of connecting the aerial to the usual primary, we can achieve the same coupling, in effect, by using a series condenser. This is C1 in the aerial circuit, 0.0001 mfd. Now, as aerial always will go to grid, it may be connected to the stator of the first tuning condenser, so that whatever the stator goes, the aerial goes along.

Do we want to move the stator to any other place than across to the grid coil it ordinarily tunes? If so, why?

As stated before, we have a set with a three gang condenser, and either the stators of the trimmers are separate from the tuning condenser stators, or can be made so, or can be left as found and additional trimmers put in. There was a reason for that suggestion—an important reason. Since there is no law against using a high intermediate frequency, and indeed since such a one is desirable for short wave reception, why not use it, if it can be readily attained? Why go to low frequency end of the broadcast set, where t-r-f receivers are notoriously insensitive, as a rule, to get the intermediate frequency, when we may select one around 1,600 kc, get high sensitivity indeed, and have a most suitable channel for the intermediate amplification?

No doubt the reader has guessed the answer from the foregoing hints. Since we have a coil-condenser system that tunes up to 1,500 kc, even with the trimmers and the three gang in circuit, why not remove the three gang, trimmers alone serving as the capacities for peaking at 1,600?

How complicated a switching device would be necessary, how many extra tubes would be needed, and what circuit arrangement should be followed, to capitalize on the brand new idea of thus using 1,600 kc in the simplest imaginable fashion?

Entirely New and Different

The switch is simply a three deck, three point device, also known as a triple pole, triple throw, or a switch to change three circuits to three different positions for each. Electrically, somewhat less than that is required, as two points on one of the decks are left blank. A single shaft will take care of all switching, provided the shaft is insulated, the three moving arms or indices being represented by extra lugs on each deck, so a three point switch has four lugs on each tier.

We can readily imagine the circuit without the tuning condenser across it.

The fact is obvious that this system is different from all others, in that you do not have to turn the tuning condenser to get an intermediate frequency, and no frequency in the broadcast band is used, which gets rid of a lot of possible direct

(*Continued on next page*)

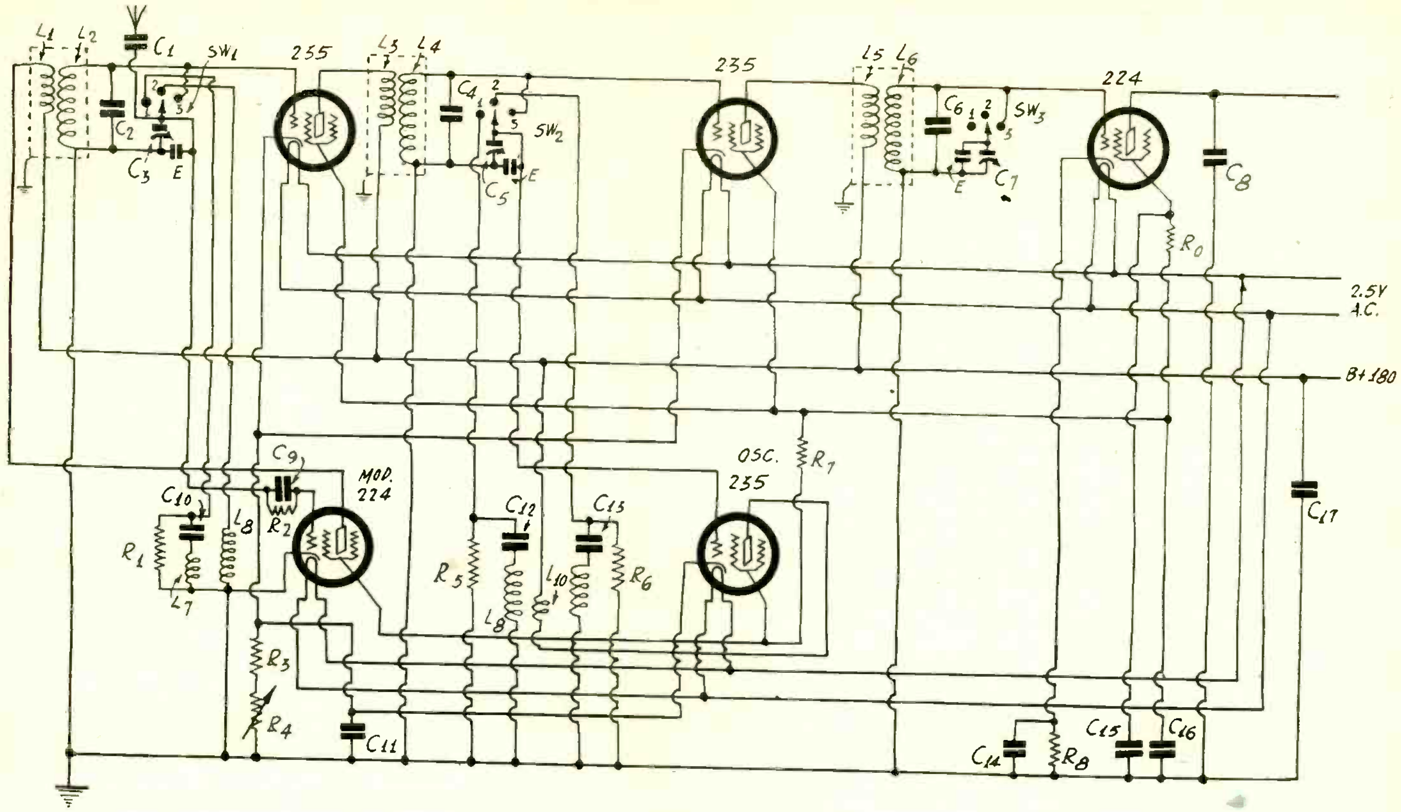

FIG. 1

Here for the first time is shown a tuned radio frequency tuner with converter built in, using a high intermediate frequency, and using the same dial and condensers to tune in both short and broadcast waves, an invention of the author.

(*Continued from preceding page*)

interference from broadcasting stations. But if we have a three gang condenser we may as well use it, or, if not the full three gangs, then two of them. Why not use the condenser for tuning the mixer?

Well, if we do that we will have arrived at last at the solution for which so many have been seeking, that of using the same tuning condenser and same dial for the short waves as for the broadcast waves, in a t-r-f set with converter built in.

As previously suggested, there is a difference between plain t-r-f and the additional feature of converter built in, so many who would have no hesitancy about following the one diagram, that looks simple, would balk at the other one, that looks complicated. It is admitted that Fig. 1, representing the complete solution of the tuning section (audio and B supply omitted), does look complicated, but it is confidently asserted that it really isn't so in fact, and an attempt will be made right now to prove that assertion.

Let us summarize what we have considered so far:

(1) That a t-r-f set with suitable audio and B supply is taken for granted, using a three gang condenser.

(2) That a switch will be used to remove the variable tuning condensers from the tuned circuits of the t-r-f set, and these condensers, or some of them, are to be used for short wave tuning.

Switching Explained

Therefore what still must be accomplished and explained is how to constitute a mixing circuit, so that the aforesaid condensers will tune it.

Certainly we need an oscillator. That is the circuit that will generate different frequencies so that when these frequencies are mixed with incoming frequencies the result will be the intermediate frequency. It is preferable, although not imperative, to have a separate modulator, and to tune it, so we shall include that. Two tubes are needed therefore for the mixer. If the t-r-f set as such has six tubes, with converter it will have eight tubes, six used for t-r-f, eight for short waves.

The operation of the tuned radio frequency set for broadcast waves is standard. When the two tubes of the mixer are heated, the switch transfers the antenna input from the first tube of the t-r-f chain to the modulator, and puts the otherwise unused section of the tuning condenser across a short wave coil in the modulator grid circuit.

The switch SW-1 also throws the second section of the tuning condenser to another and corresponding position, so that the condenser stator picks up a short wave coil in the oscillator grid circuit. A series condenser is necessary, to reduce the capacity of the tuning condenser, because the intermediate frequency is high (say 1,600 kc), hence the oscillator has to tune to a frequency that much higher than the modulator frequency. The series condenser is C13, and may be a 20-100 mmfd. equalizing condenser, set at near maximum capacity. To establish a conductive grid return a resistor R6 is used in parallel with the series circuit composed of coil L10 and condenser C13.

There is a common plate winding, and this will produce oscillation. The modulator and oscillator frequencies have to be mixed, that is, the two circuits have to be united to a small degree. A resistor (R7) will perform this function. The value may be small, around a few thousand ohms. Even a few hundred ohms will afford some coupling.

Now we have the mixer working as a unit, the modulator tuning in the short wave frequencies desired, the oscillator striking a frequency difference equal to the intermediate frequency, and the erstwhile t-r-f channel comprising an intermediate channel or amplifier. The modulator may be called the first detector, and the erstwhile detector (demodulator) may be called the second detector.

Completion of Circuit

We have still to hook up the ouput of the mixer to the input of the intermediate channel. Since the antenna coil will have a primary winding, we may put this in the plate circuit of the modulator tube, and return the winding to 180 volts. Then the circuit is complete.

Let us now analyze the switching system, especially since it takes care of antenna switching as well as condenser and coil switching.

The three deck switch is represented by the symbols SW1, SW2 and SW3, governing the stages in that order. Extreme right hand position (3) is for broadcast coverage, and requires that another switch be thrown, independently, to cut off the two mixer tubes' heater supply.

The pointers of SW1 and SW2 are connected to the stators of the respective tuning condensers, C2 and C4, and to the grids of the modulator and oscillator tubes respectively. For broadcast reception this connection has no effect, as the two mixer tubes are not functioning, but the connection will be essential for short wave work.

When the switches, by one operation, are thrown to the next position, designated as No. 2, the three condensers are removed from the secondaries in the t-r-f chain, and in the two instances under immediate discussion the larger of two coils are picked up, one for the modulator grid and the other for the oscillator grid circuit. In the case of SW3, the only function performed is to remove the main tuning condenser, so points 2 and 1 are blanks.

For position 1 of the two switch sections, SW1 and SW2, the smaller coils are picked up, for shorter waves.

Since the aerial is connected through a series condenser to the stator of the first tuning condenser, C3, and since for broad-

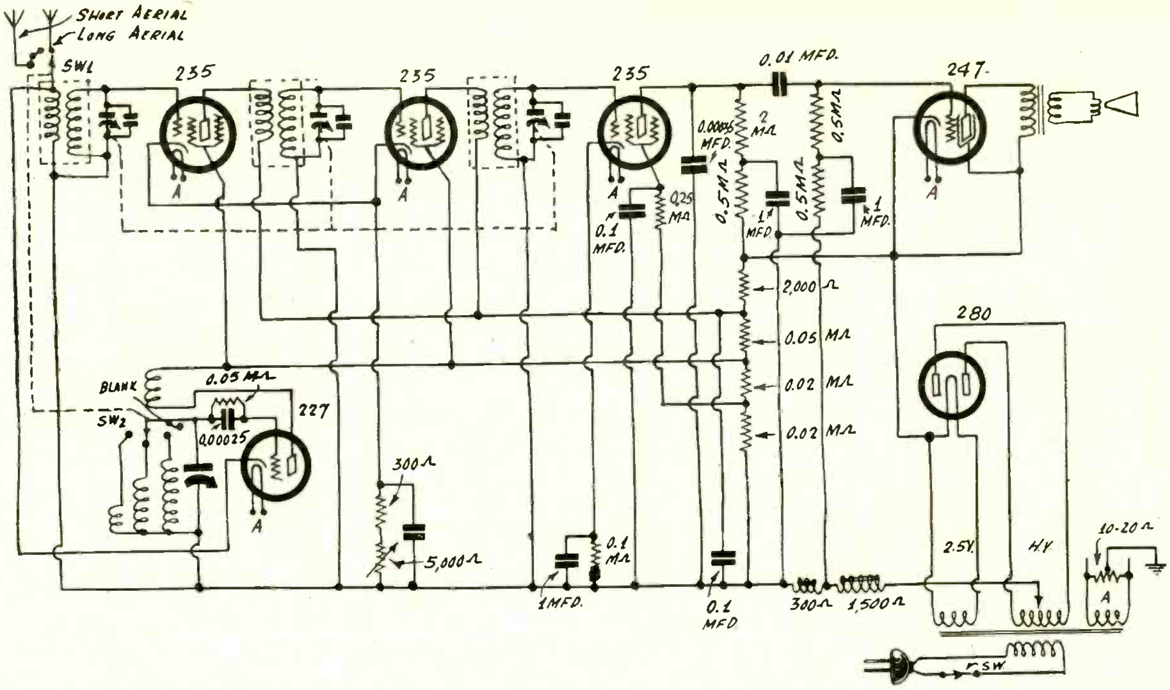

FIG. 2

Here is a practical way to get short waves simply, shown for the benefit of those who desire to give short waves an easy and inexpensive trial.

casts this input is to go to the first stage of t-r-f, and for short waves to be removed therefrom and to go instead to the modulator grid, attachment of the antenna connection to the stator, which serves for tuning both circuits, results in the antenna being moved to the required positions.

There remains a consideration of the coil problems. It is necessary to get the modulator and oscillator circuits to tune somewhere nearly alike (although strict synchronism is not vital), and for the lowest frequencies of short waves this is a problem.

Starting at, say, 1,700 kc, with tuning capacity of 0.00046 mfd., ratio, maximum to minimum, of 9-to-1, or a frequency ratio of 3-to-1, we will reach 5,100 kc. The oscillator will start at 3,300 kc, and unless special precautions are taken, would wind up at 9,900 kc, where, for the two circuits to keep abreast, the windup should be at 1,600 kc higher than the windup for the modulator, or at 6,700 kc. So the oscillator should tune from 3,300 to 6,700 kc, a frequency ratio of about 2-to-1, and if a series condenser is inserted, as stated, the minimum will be around 20 mmfd. and the maximum will be 82 mmfd., a ratio of about 4-to-1 for capacity, or about 2-to-1 for frequency.

The Case of the Smaller Coils

For the second set of coils, both tuned windings may have about the same number of turns, because the percentage of frequency difference is small, even though the absolute frequency difference is the same. This, the modulator would tune from 5,000 to 15,000 kc, while the oscillator would time from 6,500 to 19,500 kc, with full capacity (0.00046 mfd.) in use in each instance. This would not be quite right as to frequencies, nor would the idea of using larger capacity for tuning the higher frequencies, to 15,000 kc, be successful, so series condensers are used in both these circuits for the second band, and the frequency limit becomes 10,000 kc (30 meters) as a 2-to-1 frequency ratio prevails for both, and if higher frequencies are desired, an extra pair of grid coils would be necessary.

Values suggested are: L1L2, L3L4, L5L6, for 0.00046 mfd., secondaries 100 turns of No. 31 enamel, primaries 25 turns of any fine wire wound over secondaries. E; C1, 2, 4, 6, 10, 12, 13, each 0.0001 mfd., or 20-100 mmfd. equalizers; C3, C5, C7, already stated; C8, 0.00035 mfd.; C11, 0.1 mfd.; C14, 1 mfd.; C15, 0.1 mfd.; C16, C17, 0.1 mfd.

Ro, 0.25 meg.; R1, R2, R3, R6, 0.02 meg. (20,000 ohms); R3, 600 ohms; R4, 5,000 ohms rheostat or potentiometer; R7, 2,000 ohms.

The accomplishment may be summed up as follows: both short waves and broadcasts in a t-r-f set with converter built in; wave band switching, without plug in coils; same dial and substantially the same condensers used for tuning all bands; coverage, with two grid coils in the mixer circuit, 30 to 200 meters; elimination of direct interference from broadcast stations by use of a high intermediate frequency; short wave performance at an extremely high sensitivity level; extra advantage of short waves is provided by two extra tubes, extinguished when set is used for broadcasts only; converter of the superheterodyne type.

A Simpler Method, But Not As Effective

On a different basis is the circuit diagrammed in Fig. 2, which is a very simple way to bring in short waves on a t-r-f set, using the superheterodyne converter principle. The performance is not so good as by the method shown in Fig. 1, and the intermediate frequency is in the broadcast band, as is usual with converters, or, if outside, is just a little so, as enabled by the extension of tuning by the set itself. It is suggested that the device be worked at the highest possible intermediate frequency by turning the tuning condensers until the plates are disengaged.

This diagram is printed to show an easy method of getting results, and may appeal to those who would not want to try a more elaborate affair, and particularly by those who have t-r-f sets where there is room for an extra socket and a coil form (four windings on the one form).

The t-r-f part is standard and needs no particular explanation. The short wave adjunct consists of a 227 tube used as combined modulator and oscillator. It works because the incoming signals are of all frequencies, while the oscillator's generation is of a single frequency at a time, so for a fixed intermediate frequency the tuning of the oscillator will result in the same intermediate frequency output for different short wave frequencies.

The primary of the antenna coupler is connected to 227 cathode and picks a long or a very short aerial, by switching. The end of the winding goes to ground, which is also B minus, so that the cathode is grounded that way, save for the slight voltage drop in the winding. Therefore the oscillator-modulator is cathode-coupled to input of the t-r-f part of the setup.

Since the aerial goes right into the t-r-f section, of course the broadcast stations may be tuned in as usual with the receiver, but the very short aerial cuts down the broadcast pickup severely, while not offering any impediment to short waves. The oscillator-modulator, which is tuned by a separate condenser, will then give you short wave reception.

The 227 is a modulator because of the leak and condenser. The coil may be wound on one form, 1.75 inch diameter, 3 inches or so axial length. The plate coil is wound in the center and consists of 12 turns of No. 28 enamel wire. Leaving 1/8 inch space, wind 17 turns of No. 28 enamel for L9. Then, next to the plate winding, on the other side, wind 7 turns of No. 18 wire, beginning 1/4 inch away. The third coil is put on the other side of the 14 turn winding and consists of 3 turns of No. 18.

Connect plate and B plus, then see that the grid connections face the plate (not B plus) connection, to insure oscillation. This presupposes all windings in the same direction.

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The Diode as Detector and

Load Put in Negative Leg, Cathode

By Herman

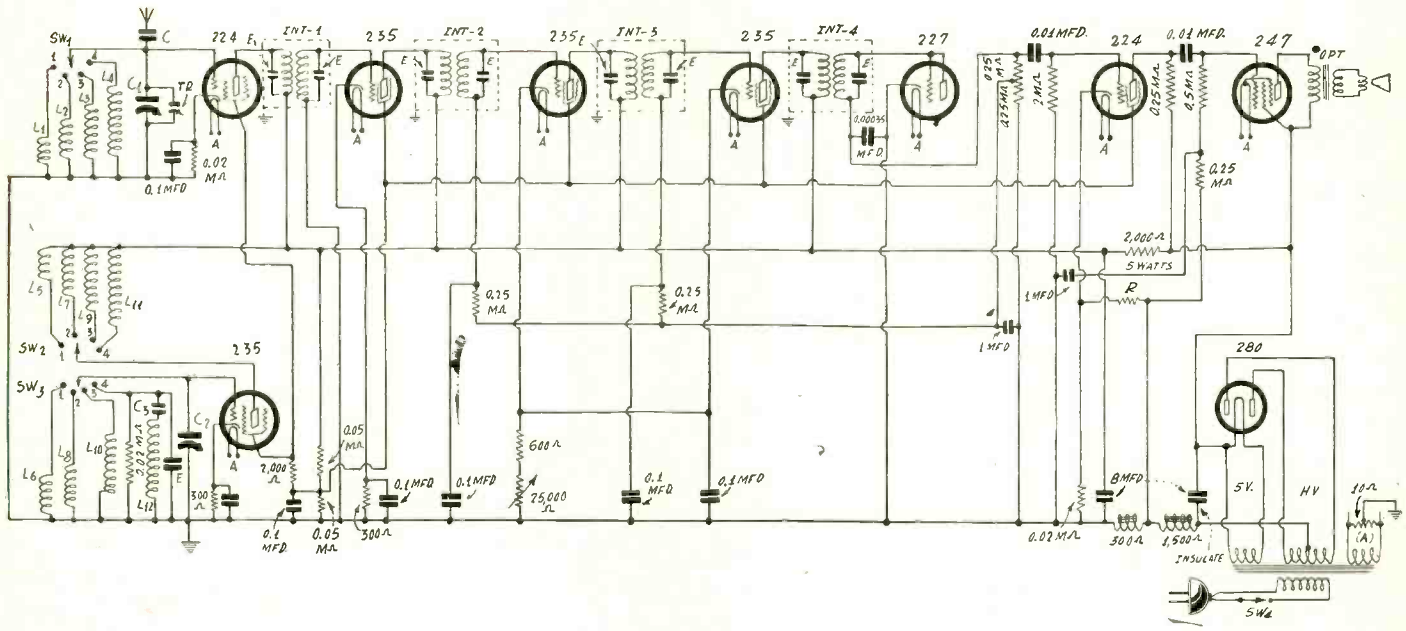

FIG. 1

A complete circuit, illustrating particularly the use of a diode as detector, where the load on the diode are two resistors in series, affording a midtap that prior grids may be returned to for automatic volume control.

MUCH interest exists in automatic volume control, especially in connection with short wave reception, since the control acts as a corrective, but not as a cure, for fading. Often the desire is to use no extra tube.

In considering automatic volume controls theoretically it frequently happens that what seems to be a correct solution turns out to be no solution whatever, because analysis of the circuit discloses that the plate current of the controlled tubes is made to pass through a resistor that is to serve as automatic bias control. Then the augmenting current is many times greater than the control current, and the effect of the control is proportionate. As the control circuit may carry 1 milliampere and the intended controlled circuits 10 or 15 milliamperes, it can be seen that nothing is accomplished.

The other difficulty is that the control does work, but in the wrong direction. How many engineers have thought up what seemed to be a good solution, only to realize on reconsideration that the bias becomes lower the louder the signal, therefore loud signals tend to become louder and faint ones fainter, will never be known.

One Tube Serves Two Purposes

These theorized solutions do not even find their way into print, as the engineers check up on themselves, and at luncheon will even tell jokes on themselves about these near but yet so far solutions.

In Fig. 1 is shown a complete circuit for an all wave superheterodyne, for a-c operation, the intention being, however, to focus interest on the detector that serves also as an automatic volume control. So much of the circuit would have to be drawn in to illustrate this point that the complete circuit is given, though this is not intended to be an article detailing the constructional work.

The detector is a 227, used as a diode. The two previous issues contained articles on diode detection and modulation, and the present one deals with the diode as detector and automatic volume control tube. Let us see how the tube works, why the control is effective, or, if it turns out that the plate current of r-f tubes has been passed through the control tube unconsciously, or the control works in the wrong direction, apologies will be in order.

How Detector Works

We have a mixer, with switching arrangement for wide wave coverage, say, 15 to 550 meters, with modulator at top left and oscillator at lower left, the two tubes, coupled by a 2,000 ohm resistor in the common screen circuits. There are three stages of intermediate frequency amplification at 175 kc.

A high amplitude voltage will be fed into the detector. The secondary of the detector-feeding coupler (Int.-4) has one terminal connected to the joined grid-plate terminals of the 227, which joinder constitutes the tube a simple rectifier, when the circuit is completed. Such completion is established by eventual return to ground. Therefore the other secondary terminals must go to ground eventually.

The radio frequency fed into the detector therefore has the 227 in parallel with it, and as a tube handles only direct current (whether modulated or pulsating or not), the path for the resultant direct current is from cathode to anode. The plate-grid juncture is the anode, always negative.

So we have a complete circuit for input and also for output. We need not tie the low end of the secondary to ground, but may connect it instead to a resistor, which eventually goes to ground. Then we have radio frequency in this resistor also, but can remove that with a condenser. The resistor then may be regarded from audio frequency aspects only. We can make the filtration as complete for radio frequencies as we desire, but a condenser will serve our purpose well enough.

Now, suppose instead of using a single resistor we use two resistors, as in Fig. 1. These are 0.25 meg. each, in the negative side of the diode. We will then have a midpoint that will give us exactly half of the d-c voltage dropped in this series combination of two resistors.

Works in Right Direction

We therefore have the beginning of an automatic volume control, because we have a resistor across which the voltage is changing according to the change of current produced by the signal, and the change is in the same direction. When the signal amplitude is higher the voltage across this resistor is higher.

But we would not want to rely solely on this for bias. Suppose there were no signal. The bias would be zero, the plate current excessive, and tube life shortened. Therefore we apply a starting bias, in the usual manner, and include the volume control in that circuit.

The automatic control is a series biasing device, so that it augments the other, but the effect would be disproportionate indeed if the bias always had to be higher than the starting bias before the addition would take place. Moreover, we would desire a manual volume control as well, and if this too were a bias alterer, then we certainly would have few occasions to enjoy a higher bias by virtue of the control effect. That is, there would be a highly restricted and seldom effective control.

So we return the anode circuit of the rectifier to ground and not to the cathodes of the controlled tubes, which are the second and third intermediate amplifiers.

Now, the drop in the manual control, the 25,000 ohm rheostat, may be from 0 to 30 volts, whereas the drop in the limiting re-

Automatic Volume Control

Grounded, So Signal Increases the Bias

Bernard

sistor of 600 ohm may be from 6 to .8 volt, so the bias may be varied manually from 6 to 29.2 volts. But, no matter how much it is biased, the automatic control will add to that bias (except when there is no signal), because the grid returns of the two controlled tubes are to the center of the anode load on the resistive load on the detector's anode.

The following points regarding the detector and the intended automatic volume control or automatic bias adjuster should be noted carefully:

(1) The negative line of the diode detector carries the output load.

(2) The cathode (positive) of the diode is grounded.

(3) The grid returns of the controlled tubes are connected, after r-f filtering by capacity-resistor circuits, to the midpoint of the detector load.

Midpoint Negative in Respect to Ground

From the foregoing it can be seen that the positive side of the rectifier is grounded, and therefore grid returns if made to midpoint of the resistors are made to a point negative in respect to cathodes of the controlled tubes. But if these two grids were returned to ground, the grid bias would be negative only to the fixed extent determined by the manual control and the limiting resistor associated with it (25,000 ohms and 600 ohms respectively), while when the return is made, as in Fig. 1, to the midpoint of the two resistors (0.25 meg.) in the diode circuit, the bias is still more negative, since the signal causes the midpoint itself to be *negative in respect to ground*.

So this is a device that works in the right direction, because the higher the signal amplitude, the greater the voltage difference across the two resistors in the detector's anode circuit, while the automatic bias increases as the signal amplitude increases, because the automatic bias is always negative in respect to cathodes of the controlled tubes and even in respect to ground, and any change must then be in the only possible direction, and that is the signal direction.

Modulation

Some automatic volume control circuits need special attention because of the modulation. These circuits use an impedance that will handle the audio frequencies, and if the modulation is not removed there will be a serious decrease in amplification, due to negative feedback. In the present circuit all the modulation can be removed, as the remaining or upper 0.25 meg. resistor would be a suitable load on the diode circuit. The 1 mfd. condenser takes care of the modulation problem satisfactorily.

No plate current of any tube is passed through the control resistor in the diode circuit, nor is there any other plate current anywhere in the diode. The tube itself has no plate voltage, except signal.

Audio Circuit

The circuit shows no condenser across the 224 first audio biasing resistor, as to be of any use it would have to be of audio frequency proportions (say, 8 mfd. or more capacity), and instead audio regeneration is used. There is some regeneration present anyway, due to the use of the 300 ohm section of the dynamic field coil (which is also part of the B supply choke) for pentode bias. But more may be added, by including R, for which no value of printed on the diagram, because the amount of feedback needed will depend on many factors, including the impedance of parts. Starting with 100,000 ohms, lower values may be tried for R until motorboating appears, when the next lowest value, that does not produce motorboating, is inserted. However, if values as low as 10,000 ohms are used, the biasing resistor should be halved (made 0.01 meg. also). Then the circuit may be left as it is.

THE following is a list of some of the new members of the Short Wave Club. Virtually every week new names are published. There are no repetitions.

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Short Wave Club

ARE you interested in short waves? Receivers, transmitters, converters, station lists, trouble shooting, logging, circuits, calibration, coil winding—what not? If so become a member of Radio World's Short Wave Club, which you can do simply by filling in and mailing attached coupon. Or, if you prefer,, send in your enrolment on a separate sheet or postal card. As many names and addresses as practical will be published in this department, so that short wave fans can correspond with one another. Also letters of general interest on short wave work will be published. Besides, manufacturers of short wave apparatus will let you know the latest commercial developments. Included under the scope of this department is television, which is spurting forward nicely.

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Short Wave Editor, RADIO WORLD, 145 *West 45th St., New York.*

Please enroll me as a member of Radio World's Short Wave Club. This does not commit me to any obligation whatever.

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A Six Tube Air-

Pentodes Used to Get

By J. E.

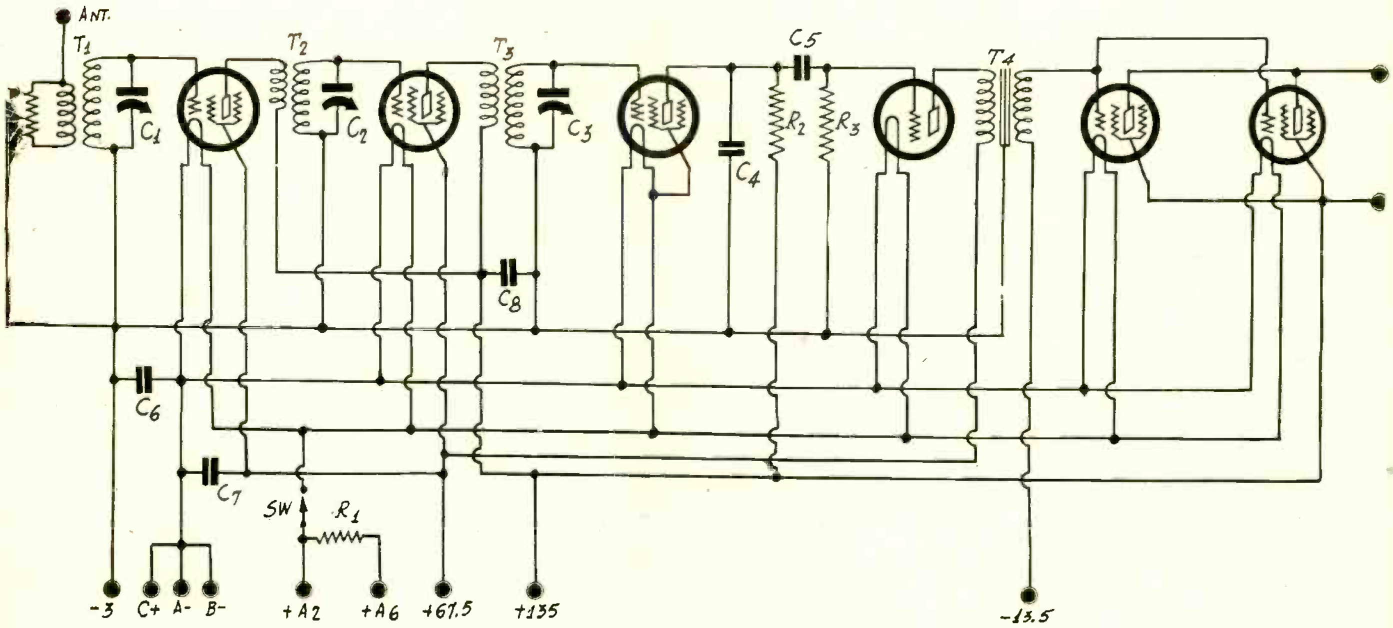

FIG. 1
The circuit diagram of a six tube air-cell radio receiver, which can be used also on a 6 volt battery.

WHERE no electric power is available battery receivers must be used, and the most economical tubes are those of the 2-volt series comprising the 230, the 231, the 232, and the 233. The first of these is a three element general purpose tube, the second a three element power tube, the third a screen radio frequency amplifier and detector, and the fourth tube is a power pentode, which has taken the place of the 231.

A satisfactory battery receiver can be constructed of three 232 tubes, one 230, and two 233 tubes, one of the screen grid tubes being used as detector. The circuit diagram of such a receiver is given in Fig. 1.

This set is called an air-cell receiver because it was designed to be used on a 2 volt air cell. However, provision was also made for using it on a six volt battery. The use of a two volt battery imposes certain restrictions on the design in that compromises have to be made in the screen, grid, and plate voltages in order to limit the number of terminal leads or binding posts.

Requirements

The plate voltage on the screen grid radio frequency amplifiers should be 135 volts and the screen voltage should be 67.5 volts. These are easily provided. The grid bias on these tubes under these conditions should be three volts, which is also easily provided.

The detector should have a voltage of 135 volts in the plate circuit in series with a 250,000 ohm coupling resistance. We already have 135 volts in the circuit, but the screen and grid voltage should not be the same as the corresponding voltage on the radio frequency tubes. We may if we wish apply 3 volts on the control grid provided that we select the proper screen voltage. Since it is convenient to apply a grid bias of 3 volts, that is the way the circuit has been arranged. This leaves the screen voltage to be determined. In the figure, the screen has been connected to the positive side of the filament circuit, which makes the screen voltage two volts. This is not the best operating voltage, but just the same the tube detects very well. If a little higher voltage is desired the detector screen lead

LIST OF PARTS

Coils
T1, T2, T3—Three shielded midget radio frequency transformers.
T4—One audio frequency transformer, 3-to-1 ratio.
Condensers
C1, C2, C3—One gang of three 0.00035 mfd. tuning condensers with trimmers.
C4—One 0.00035 mfd. fixed condenser.
C5—One 0.1 mfd. fixed condenser.
C6—One 0.25 mfd. condenser.
C7, C8—Two one mfd. condensers.
Resistors
P—One 25,000 ohm wire wound potentiometer.
R1—One 6 ohm fixed resistance.
R2—One 250,000 ohm resistance.
R3—One 1 megohm grid leak.
Miscellaneous Parts
Sw—One filament switch.
One tuning dial.
Four UX tube sockets.
Two UY tube sockets.
One midget receiver chassis.
Three grid clips.
One magnetic or inductor loudspeaker.
Thirteen binding posts.
One grid battery, maximum not less than 13.5 volts (Two 7.5 volt units).
Three 45 volt B batteries.
One 2 volt (or 6 volt) filament battery.
Three 236 type screen grid tubes
One 230 type tube.
Two 233 type pentode tubes.

New Wire Phone

Good Response from 30 to 8,000 Cycles,

WHILE the average radio listener has probably not realized it, there has been a distinct improvement in the tonal quality of programs being transmitted by stations in the big nationwide broadcasting networks, radio engineers and tone experts declare.

The reason for this improvement, they explain, has been the recent installation of a new type of cable for the telephone lines linking the various stations on the main hook-ups connecting most of the cities between New York and Chicago. Further extensions of the new type facilities to other points are contemplated in accordance with the requirements for them.

Meets Exacting Demands

Heretofore practically all of the program transmission service to cities in the networks has been furnished over open wire telephone circuits. But for some time increasing use has been made of long distance cables to provide the necessary growth and to supplement the open wire facilities.

Cell Receiver

Great Output Volume

Anderson

may be connected to a suitable voltage on the B battery. The lowest is 22.5 volts, but this is too high and the detecting efficiency is better with the two volt screen. Connecting a high resistance in the screen lead when 22.5 volts are used does not alter the case because at the detecting point there is practically no screen current and therefore no drop. Hence the effective value of the screen voltage remains at 22.5 volts, or very nearly that.

Adjustment of Amplifier

The recommended plate voltage for the 230 amplifier is 90 volts on the plate and 4.5 volts on the grid. If these were used two extra leads or binding posts would have to be provided. Hence the tube is operated with 67.5 volts on the plate and 3 volts on the grid. Thus the grid voltage used on the radio frequency tubes may be used and also the screen voltage on these tubes may be used on the plate of the 230 tube. This simplifies the circuit a great deal, yet it does not decrease the efficiency. The undistorted output of the 230 under these conditions is ample to give the power stage its full output voltage.

The two 233 pentodes are operated in parallel, with 13.5 volts on the grids and 135 volts on the plates and the screens. These tubes, therefore, are operated under recommended conditions. The maximum undistorted output of this power stage is ample to operate any loudspeaker.

Since there is no way of exciting the field of a dynamic speaker without connecting it across the B battery, another type of speaker must be used, for to connect the field across the B battery would be very uneconomical. Perhaps the best speaker is an inductor, but an ordinary magnetic can also be used. There is a magnetic-dynamic loudspeaker extant although it is not easily obtainable. This could also be used. This speaker is a dynamic speaker with a permanent magnet field. If means were available for exciting the field of a dynamic speaker, it would not be necessary to use a battery tube receiver.

Radio Frequency Transformers

The radio frequency transformers in the circuit are the same as those used in most modern midget receivers. They are wound for 0.00035 mfd. tuning condensers and they are alike so that a triple gang condenser may be used for tuning with only the trimming condensers provided on the tuning condensers. Each coil is placed in a zinc can which shields it completely. These shields are 2 and 5/8 inches high and 2 inches in diameter. The secondaries are wound on a diameter of one inch with No. 36 enameled wire. The primaries are wound over the secondaries, being separated from them by several layers of empire cloth. No. 40 silk covered wire is used in the primaries. These coils come assembled in compact units and are not easy to duplicate due to the thinness of the wire.

The by-pass condenser C4 in the plate circuit of the detector has a value of 0.00035 mfd., the stopping condenser C5 a value of 0.1 mfd., and the grid leak R3, one megohm.

Following the 230 audio frequency amplifier there is an audio frequency transformer T4, which should have a ratio of three to one.

In battery receivers it is customary to control the volume by controlling the filament current. While this works it is not a satisfactory method. A good way of controlling the volume is to control the input voltage. For this purpose a high resistance potentiometer P is connected across the primary of the first radio frequency transformer. The antenna is connected to the top of the coil as usual, but the ground is connected to the slider. When the slider is all the way to the bottom of the potentiometer the input to the set is maximum and when it is all the way to the top it is zero, the antenna being grounded. A value of 25,000 ohms for this potentiometer is all right, although a higher resistance may be used. A lower resistance is not recommended.

This type of volume control would not control the output satisfactorily unless the tuning coils were shielded, because if they were not they would pick up signals directly. With shielded coils, however, it is quite satisfactory.

The Filament Circuit

It will be noticed that the filament circuit is not connected to the metal chassis. It is customary to connect the negative side to it. This is done to permit mounting the tuning condensers on chassis without insulating them, or to return the grids to one point and the condensers to another. To the chassis are connected the ground, the slider of the volume control potentiometer, the secondaries of the tuning coils, the rotors of the tuning condensers, the by-pass condenser C4, the grid leak R3, the frame and core of the audio frequency transformer, and the 3 volt point on the grid bias condenser.

To the negative side of the filaments are connected the positive of the grid bias battery, the negative of the plate battery, and of course, the negative of the filament battery. The grids of the two power tubes are connected to a point 10.5 volts negative with respect to the grounded point on the battery, making the grid bias on the power tubes 13.5 volts.

The filament switch Sw is put in the positive leg of the filament battery where it controls all the tubes.

The circuit is designed for operation on either a two volt or a six volt battery without any rheostat. For this reason two binding posts are provided for the positive battery lead. When the battery used has a voltage of 2 volts, terminal A2 should be used. Then the battery is connected directly across the filaments without any ballast resistor. When the battery voltage is 6 volts, terminal A6 should be used. Then a ballast resistance R1 is connected in series with the filament circuit.

The value of this resistance depends on the number and type of tubes used in the circuit. For this particular set, which has four tubes each drawing 60 milliamperes and two each of which draws 260 milliamperes. Thus the total filament current is 0.76 ampere. The drop in the resistance should be the difference between the voltage of the storage battery and the voltage required by the tubes. That is, if the battery voltage is 6.3 volts, the drop should be 4.3 volts. Hence R1 should have a value of 5.65 ohms. It is permissible to use a 6 ohm fixed resistance. This will make the tubes operate at slightly less than two volts.

Precautions

Since it is very easy to make a mistake and connect a six volt battery to the A2 binding post, this post should be clearly marked so that a mistake is not likely to be made. Moreover, it is well to put it where it is not as easily accessible as the A6 post. The mistake of connecting a six volt battery to the 2 volt binding post will cost a set of tubes, for they will blow out almost instantly. It is also well to check the correctness of the resistance R1 before full voltage is applied. At first, connect a two volt battery to A6. If the tubes light up it is not safe to connect six volts until the error has been rectified.

Since all the tubes are on the resistance R1 when a six volt battery is used, all contribute to cutting the voltage down to the required 2 volts. It is not safe to remove a tube while the filament battery is on. When any changes of tubes, or switching of tubes, are to be done, turn the filament switch to the off position, and do not turn it on again until all the tubes are in the circuit in their proper places. Occasion often arises while testing with a circuit tester of switching a tube from the set to the tester. This switching should never be done except when the filament switch is off. These precautions do not apply when the battery voltage is 2 volts.

Cable Announced

Compared to 150 to 5,000 Cycles

Anticipating future improvements in such broadcasting equipment as radio transmitters, receivers and microphones, it was thought that the ordinary telephone cable would not be sufficient. Consequently to meet the more exacting requirements the new type of cable with special broadcasting circuits was developed by the Bell System engineers.

Extends Frequency Carriage

This new cable enables the radio circuit to carry a wider frequency or tone range than has hitherto been possible over the ordinary telephone circuit. It permits a frequency range from 30 to 8,000 cycles instead of the ordinary telephone wire range from 160 to 5,000. Thus many of the lower and higher notes which previously could not be reproduced with any high degree of perfection are now brought to the radio listener almost perfectly, provided, of course, that his receiving set is in good working order. Today the piano's low C, at 32 cycles, should be heard as well as squeaks and chirps above 5,000 cycles.

Why I Enjoy Television

Home Pictures Provide Experimenter with Real Attraction

By Roland Tookle

THE war of words about television pivots about commercialization, but the fact that some television stations are on the air should at least be an assurance that it is possible to receive some kind of television. Likewise, it must not be forgotten that a great number of persons, experimentally inclined, or interested in the experimental progress of the science, are eager to see what is being sent. They may be classed along with amateurs, and amateurs are antonymical to professionalism or commercialization.

That television as it stands to-day is not good enough for the general public may be taken for granted, and the most enthusiastic denials of this assertion come from the worst enemies of television's progress. The trite phrase is that television is in an experimental stage. But while this is true, who ever said that experiments are uninteresting, and that a man who knows in advance how little he is going to receive, in the way of perfection, hasn't the right to go ahead and receive it?

Likes To See What's What

I am in the class of those who like to see what's going on, even though what's going on isn't much to brag about. Also, I note from time to time improvements are being made. I make a few myself. Now I see that a lamp has been developed that affords black and white pictures, instead of the pink ones. Television was said to have a pink eye. Some want to give it a black eye. But a television engineer has given it a white eye. More power to him and his station!

Anyone who desires to view the television of to-day may do so. The expense is not prohibitive, if one builds as much of the apparatus as a few tools, some knowledge and some skill permit. A television receiver is nothing but a tuned radio frequency set, that covers the television band, and has a good audio channel. It is practical to revamp a t-r-f set not used for broadcasts any more, and make it suitable for television. Use screen grid tubes, shield well, and try things out for yourself. Use a pentode tube, if you like. I get pretty good pictures using a pentode, third harmonics and all!

The reason why a t-r-f set is advisable is that it is not regenerative and not too selective to injure or blur the details of the picture. The audio should consist of two or three stages of resistance coupling. I use the two stage regenerated audio system described recently in Radio World and it is very satisfactory.

Some Inside Tips

Very careful shielding is necessary, or, if that can't be accomplished, then skinnier primaries have to be used. The requirements for complete shielding are not readily met, as most shields are aluminum or zinc composition or the like, and of thin walls, so are what may be termed incomplete shields. So primary reduction may be resorted to without qualm. Thick walled copper shields will sustain larger primaries and such primaries will make for lessened selectivity. Of course the gain is greater with large primaries, due to the increased coupling.

Tuning the plate circuit of screen grid r-f amplifiers sounds good, but don't waste much time on it.

The detector may be of the power type. A screen grid tube, with low screen voltage, high plate resistor and high applied plate voltage, gives good results, working into a resistance coupler. I use 0.5 meg. in the plate circuit, applying the full B voltage of 270 volts, which is divided, 265 for plate and 5 for negative bias of the detector, through the drop in a 20,000 ohm biasing resistor. Across this resistor, and across a 1 meg. resistor that goes from detector screen to the r-f screen voltage, radio frequency bypass condensers must be put—so 0.1 mfd. fulfills the purpose. The point to stress is that the screen voltage for the detector in such a circuit must be low. Around 10 volts would be a good suggestion. I do not know the exact voltage, as my meters are not electro-static instruments, and I can't read accurately the voltage across circuits that draw so little current.

A Visit to the Studio

I also tried out some superhet circuits for television, and, being built for just that, they worked out all right, too. The point against supers is that if they are gaited to broadcast selectivity they won't do very well for television. However, suitable resistors across the grid circuits reduced the selectivity of a selective set that served broadcast purposes, until television came in, pretty well.

Like many other experimenters, I settle down to work on one station only. It is the station I receive best.

I have seen a great deal of their transmissions, and managed to get invited to the studio and plant to see how the other end of it was worked. This invitation can be obtained from almost any station, if one is really interested, and the visit certainly repays the pains.

In recognition of this courtesy I took measurements of the output of my set over a period of weeks and submitted a careful report to the station engineer. My output meter was all I used. Then sensitivity variation was compared with changes that had been made from time to time in the transmitting plant and antenna direction.

When one has a set, all else that one requires are the motor, scanning disc and lamp. It has become popular to include a magnifying glass in front of the frame for better apparent size of the image. The impression gained is that the picture is a few inches square. Only one person can look at my pictures at a time. Projection, or the casting of the picture on a larger screen, will come along, so several can see it at once, but up to now I can't get enough illumination to make projection worth while, except at abnormal expense. I am talking about apparatus that costs only little money. Mine cost me, all told, $64 to date, and some labor, which I did myself.

Synchronization Bothers Him

When one connects the output of the set it is to the loudspeaker first. Then the television signals can be heard. An adjustment or two lines up the tuned circuits, maximum volume is attained, and the switchover is made to the lamp. An uneven glow may appear. Reverse the connection to the output posts. Then the disc is set in motion. It is driven by the motor, and may be out of phase with the transmitting disc, but if so, careful rheostat adjustment, an irksome procedure, may correct for this in part, but in the main the synchronism has to be there or it is absent. Often enough the synchronism is good, even though my motor is not on the same line as that of the transmitting station. I have no phonic wheel or other device of a self-correcting nature, but such inventions are coming forward nicely, and may be obtained by those who care to pay the price, which is not very high.

Even if the picture has good definition it may be split either horizontally or vertically, so a shift of the scanning disc will correct for this deframing, and some scanners have a device for making this shift readily. I built up a device of my own. In fact, I even made my own disc, which is quite a job.

Stops Some Interference

Sometimes reception is marred by natural static, but on the whole the static is more ruinous to voice and music than to pictures, I think. There isn't much that can be done about that. Unnatural static can be treated with various remedies, one of them a filter at the set, so that vibrators, heating pads and other such apparatus will cause little trouble. Even the phone dial can be killed off as an interferer.

Drifting is my chief trouble. This of course has to do with lack of synchronism. I check up with other stations to ascertain whether the drift applies to only one or to all four I can get.

I said that I have a favorite station and that it is not on the same a-c line as my set, yet there is a station on the same a-c line, and I have no trouble with synchronization there. The reason I prefer the other station is that the pictures are more varied and interesting, and when all else is O. K., are clearer. Besides, there is the synchronization problem. I am interested in that, for I am working on an invention of my own which has to do with self-synchronization.

Drifting means that the picture moves off the screen. Flashes of light mean natural or unnatural static; I can readily tell which by a sound test. Black lines are due to my little brother having played with the scanning wheel and filled its precious pores with some of the emanations from his own pores. The holes must be kept clean, and when they must be cleaned great care should be taken not to injure the hole in the cleaning process. Do not use a screwdriver, awl, wire brush or pipe cleaner. Wash the holes clean with soapy water. A vacuum cleaner helps.

Interference from Other Stations

Sometimes interchannel interference causes trouble, such as wavy, wobbling pink or dark streaked lines, and sometimes I will see the same picture twice, but I know that the lines are due to another wave interfering, and that the doubling up is due to the duality of the reception. The sky wave and the ground wave come in at different times, because the sky wave

(Continued on next page)

Ripe Field for Ultra Waves

New Tube Prophesied as Enabling T-R-F Sets

By Hollis Baird

Chief Engineer, Short Wave & Television Corporation

HISTORY promises to repeat itself in the ultra short or quasi optical waves, logical channels for general television service, in their rapid development and use.

It is primarily tube improvement which has dictated the successful campaign in short waves, and tubes once again appear as the key points on which the conquering of ultra-short waves will depend. Successful radio reception demands radio frequency amplification.

Only about eight years ago our most potent broadcast receivers were a regenerative detector with two stages of audio. Of course, radio frequency was seen as a theoretical possibility, but practically all attempts to harness it had failed.

Neutralization Successful

It was then that neutralization was first successfully applied and we had neutralized r-f circuits. Once this had been conquered and engineers found themselves more familiar with radio frequency, various other ways of stabilizing r-f amplifiers were found.

Finally came the screen grid tube, which gave a much higher gain in amplification and at the same time required no neutralization, only careful shielding. Broadcast t-r-f then went into its present era of high efficiency.

In the meantime short waves had been coming into general use. Like broadcast waves, short waves were found to only be satisfactory with the use of a regenerative detector and two stages of audio. All attempts at r-f were rather futile until the screen grid tube came along. This tube succeeded where short wave neutralized stage attempts had failed and the use of the t-r-f in short wave reception became general. Today two stage r-f amplifiers are used in production of commercial receivers giving exceptionally good sensitivity.

Coming now to the ultra shorts, these new waves that behave like light waves, we find the same story repeated. No one has been successful in using anything but a regenerative detector and a good audio amplifier for reception of ultra short waves unless it may have been a few spasmodic attempts at superregeneration.

To assume that this is a reason for being discouraged about ultra short waves is a faint-hearted engineering attitude which the previous history of radio should refute. It does appear, however, that the answer to ultra short wave success may lie in a new type of tube as in the case of the screen grid tube and short waves.

It is just this unknown part of ultra short waves and the fascination of solving their challenge which promises to bring back the old school of experimenters who did so much in broadcast and short wave development. This will be a case quite different from broadcast and short wave reception when distance meant anything. Short waves have circled the globe completely and distance between points on this earth don't exist from a radio viewpoint.

The ultra short waves with their characteristics of traveling straight out like a beam of light rather than following the curvature of the earth, the fact that neither darkness nor fog affects them, unlike solid objects, and that static and facing are never experienced, offer intriguing possibilities.

Since these waves do travel straight out, their maximum range is not likely to be far, only the distance from the antenna to the furthest visible horizon's edge.

Behavior of Ultra Frequencies

One interesting angle is the question of solid objects obstructing the passage of the wave. Thus, if a transmitter were located on a high building and the receiving antenna was on the roof of a house down between two other high buildings, it might be assumed that this antenna would not receive the waves from the transmitter, but the fact is that these waves, like light, do all kinds of tricks in reflecting and the chances are that the wave would strike the tall building on one side and reflect between the two buildings working downward until it finally reached the hidden antenna.

Here indeed is a fascinating subject. With their many characteristics to be discovered, with the vast possibilities of widespread use when they are conquered and the possibilities for inventors to solve the problems of reception at these frequencies, a very ripe field indeed opens up to the experimenter in which he can contribute materially to the increased use of radio by mankind.

Gets His Money's Worth, Says Experimenter In Television

(*Continued from preceding page*)

is a reflection from the Heaviside layer. The station should use an antenna that suppresses the sky wave, as the ground wave is strong enough, and besides, if the ground wave doesn't travel far, it is also true that no kind of results are obtained from television signals of any kind on any frequency that do travel far.

I should like to emphasize again the fact that many have the preliminary makings of a television set, and can readily buy the other parts. I do not recommend spending much money. I admit the entertainment value is not there, but the interest is enough to hold me, and I have been at this for seven months. I get just as big a kick seeing television results in my own home as I did the night I saw my first picture there, and as soon as things pick up (you know what I mean) I intend to invest a little more heavily. Already I've got my money's worth, and, while admitting that television is still highly experimental, I would like to say that so am I.

Ouster of Stations in Large Cities Inevitable, Says Lafount

Washington.

Fewer radio broadcasting stations in and near the largest cities was forecast by Commissioner Harold J. Lafount, of the Federal Radio Commission. He said:

"It seems inevitable that the number of stations in and near cities such as Chicago and New York will have to be reduced, for with channels crowded as they are in these regions, even splitting of broadcasting time and stabilization of frequencies probably will not eliminate interference."

In line with this policy the following six stations were deleted: WJAZ, Zenith Radio Corp., Chicago; WCHI, People's Pulpit Association, Chicago; WIOB, Nelson Brothers, Chicago; WPCC, North States Church; WNJ, Newark, N. J.; WKBO, Jersey City, N. J.

The Effect of Selectivity On Definition of Pictures

Selectivity has been at a premium in broadcast reception. Selectivity means getting the full response from a broadcast station with as sharp a cut off as possible after this so as not to get interference from another broadcast station on an adjacent channel 10 kilocycles away. The superheterodyne receiver has found its greatest value in its ability to cut off sharply at 10 kilocycles.

Suppose we put a television signal requiring a width of 80 kilocycles through a superheterodyne receiver designed to cut off sharply at 10 kilocycles. Practically 70 of our 80 kilocycles are lost in the process. Take any picture and eliminate 90 percent of its detail or clarity and the result is easy to imagine.

The possibility of building a superheterodyne which will be ceive 80 kilocycles exists, but if this was used for broadcasting four stations would be received at the same time. For this reason television should be received on a tuned radio frequency short wave receiver if broadcast reception is also planned. Regeneration should not be used since this also tends to cut off sidebands.

This points to the development of special television receivers which is going to be necessary anyway as television develops, since our broadcast sets will have to be operating at the same time in order to get the sound for our home television talkies.

The detail of a picture or the quality of received music is directly dependent upon how faithfully these sidebands are amplified in our receivers. A transmitting station sends out a carrier wave and superimposed on this are thousands of little vibrations which carry the music or pictures. The more of these there are the wider space on either side of the carrier do they take up.

In ordinary broadcast work a width of 10 kilocycles is considered sufficient to transmit good quality, but in television we must face the fact that four times as wide a band is required or a band of 80 kilocycles. Getting even amplification at 10 kilocycles has been a problem in broadcast receiver design. It is easy to imagine the difficulties of designing a television amplifier with even amplification at 80 kilocycles.

Methods of Modulatio

Advantages and Disadvantages o

By Bruns

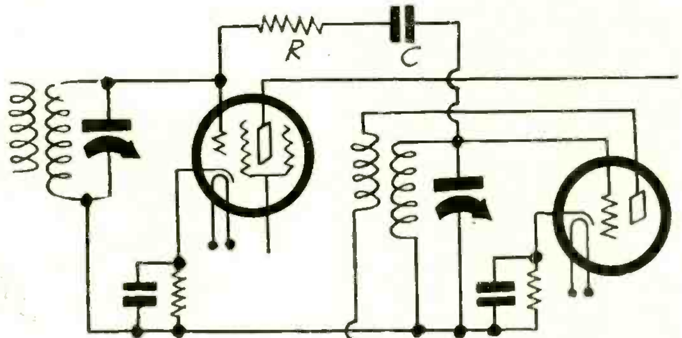

FIG. 1

A method of modulation in a superheterodyne in which the grids of the oscillator and modulator are connected with a high resistance R. The condenser C is used only to allow the use if different bias values in the case of filament tubes. For heater tubes it is not necessary.

IN every superheterodyne receiver there is an oscillator, and this oscillator is coupled in some manner to the modulator, or first detector. There are many different methods of effecting the coupling. Not all are equally good, although all may be made equally effective quantitatively. They differ in respect to quality. Not all the methods are applicable to all the different tubes because some of them apply only to one particular type of tube.

In Fig. 1 we have the circuit of one of the earliest methods of modulation. The grid of the modulator is connected to the grid of the oscillator by means of a high resistance R. Thus the oscillating voltage across the oscillator tuned circuit is impressed on the grid of the modulator, or at least what is left after the oscillating current has passed the resistance R. Condenser C is of large value and does not affect the amount of coupling and it is used only because the bias voltages on the two tubes are different.

One advantage of this method of coupling is that it is almost independent of the radio frequency. However, it has its drawbacks. If the intermediate frequency of the circuit is high the two tuned circuits are tuned to widely different frequencies and the oscillating voltage developed across the tuning coil or the tuning condenser of the modulator is very low because the frequency of the oscillator is so far off resonance that the impedance is low. That is, most of the drop occurs in the resistance R and very little is left for the grid circuit of the modulator. When the intermediate frequncy is low this objection is not serious. But the method is objectionable on the ground that the degree of coupling between the two circuits varies in the opposite from what it should. When the intermediate frequency is low the coupling should be loose but then it is close.

A variation of this method of coupling is to join the plate of the oscillator with the grid of the modulator. This, however, is open to the objection that the feed back contains harmonics which are plentiful in the plate circuit of the oscillator. Of course, the harmonics are farther off resonance in respect to the radio frequency circuit than the fundamental so that they are eliminated to some extent by the modulator tuner. Still another variation is to connect the grid of the oscillator to the plate of the modulator by the resistance and the condenser. This is not so good though, because if the intermediate transformer following the modulator is tuned in the primary, and it should be for most effective modulation, the coupling is extremely loose on account of the low impedance offered by the IF tuned circuit to the oscillating current. Of the four possible variations of this method the one shown in Fig. 1 is the best.

In Fig. 2 is shown a method of modulation which is now used extensively in midget superheterodynes. Perhaps it is used because it is so simple once the proper coupling has been found between the two tuned coils. In practice the modulator input coil and the oscillator coil are wound on the same form. This coupling must be very loose when the intermediate frequency is low or the two circuits will pull together. This method is particularly applicable to the case when the oscillator is a dynatron, for which many of the other methods are not suitable. The degree of coupling increases with the frequency, and this is an objection, for the higher the signal frequency the looser should the coupling be, for a fixed intermediate frequency. One advantage is that very little harmonic distortion is impressed on the modulator tube by the oscillator, for harmonics are well filtered out by the oscillator tuned circuit.

When the modulator is a heater tube the oscillator voltage is introduced into the modulator circuit by way of the cathode, as in Fig. 3. The pick-up coil, wound around the oscillator coil form, is connected in series with the cathode lead above the grid leak and the by-pass condenser. This is a good method and is used extensively in better class of superheterodynes. Since the coil is coupled to the resonant circuit of the oscillator the voltage impressed on the modulator is comparatively free of harmonics. As in all cases where mutual inductance is depended on, the degree of coupling between the two tubes increases with the frequency, an undesirable feature, but one that can be compensated for.

In Fig. 4 is illustrated a method of coupling that is applicable to all cases where the modulator is a screen grid tube. The pick-up coil is simply connected in the screen lead in place of the cathode lead. It possesses the same advantage as the method illustrated in Fig. 3 and nearly the same disadvantage. One advantage of this not possessed by the preceding circuit is that the voltage is introduced only in the screen circuit and not in the plate and grid circuits together. The method depends essentially on the fact that there are two control grids in the tube, and one voltage is introduced into each circuit. For equal coupling the pick-up coil in this case should be a little greater than that in the preceding circuit.

In Fig. 5 the pick-up coil is connected in the grid lead of the modulator, a method applicable to all tubes. This is one of the earliest methods of coupling and it is an effective one. In fact, its main disadvantage is its effectiveness. It is so easy to interlock the two circuits by using too close coupling between the pick-up and the oscillator. It only takes a few turns, loosely coupled to the oscillator, to get the required degree of coupling. Of course, since mutual inductance is used, the degree increases with the frequency, and if the pick-up is just right at 550 kc it is likely to be greatly excessive at 1,500 kc. Or if it is just right at 1,500 kc it is likely to be so loose at 550 kc that the set has little sensitivity. These observations apply to the other methods in which mutual inductance is used.

Ten of the National Broadcasting Company field engineering force, attending the Peacock Ball at the Hotel Waldorf-Astoria, New York, recently, wore dinner jackets on official business. The engineers had previously set up and tested their equipment in the hotel's public rooms for an early morning broadcast.

* * *

Since anouncing his presidential aspirations, Eddie Cantor, guest artist of the Chase and Sanborn programs, has received letters suggesting the election campaign slogan: "Cantor to the White House with Eddie."

* * *

Paul Whiteman now uses a long baton. It is two and three-quarters feet in length and was presented to him by William Dewey, managing director of the Edgewater Beach Hotel, Chicago.

* * *

John Philip Sousa, who recently celebrated his seventy-seventh birthday by leading his band, has conducted the playing of "Stars and Stripes Forever," his famous march, more than 5,000 times in thirty-five years.

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the Different Circuits Pointed Out

ten Brunn

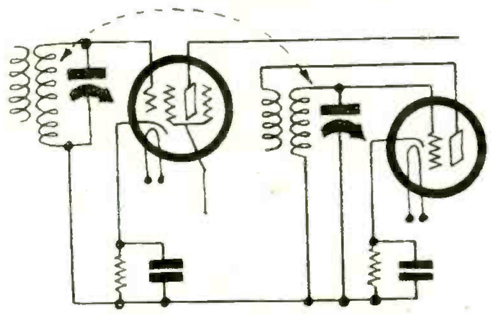
Read the diagrams from left to right. Top, Figs. 2 nad 3; bottom, Figs. 4 and 5

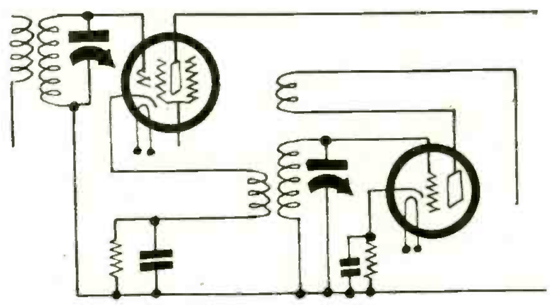
FIG. 2
A common method of modulation in midget superhets.

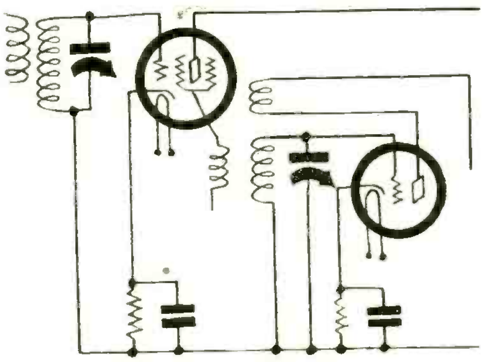
FIG. 3
This is a common method of modulation in big sets.

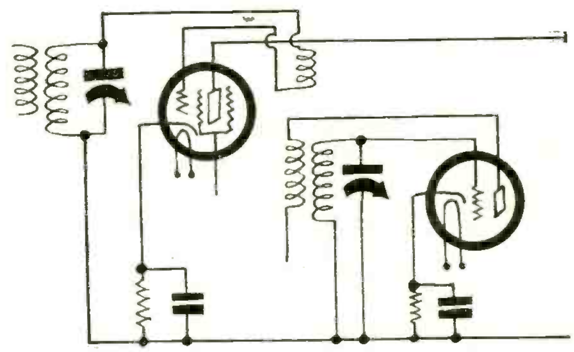
FIG. 4
In this case the pick-up coil is connected in the screen lead of the modulator, a good method applicable to all types of screen grid tubes.

FIG. 5
In this case the pick-up coil is connected in series with the control grid leak of the modulator.





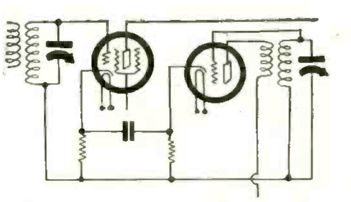




In Fig. 6 is a method not depending on mutual inductance and for that reason is more effective at low frequencies than at high. However, it is nearly independent of frequency. This method depends on the coupling of the two cathodes, and for that reason can be used only on heater tubes. The bias resistance in the modulator tube has a high value, suitable for detection, and the grid bias resistance in the oscillator has a value suitable for amplification. That is, the one in the modulator may be from 3,000 to 10,000 ohms for a screen grid modulator and the one in the oscillator may be 2,000 ohms, assuming that the tube is a 227. This method, with a condenser of 0.01 mfd., has proved quite effective on short waves. Due to its practical independence of frequency it can be used over a wide band.

In Fig. 7 is a case of introducing the oscillator voltage in the plate circuit of the modulator by means of mutual inductance. The pick-up coil is connected in series with the plate lead and then placed on the form of the oscillator coil. For equal coupling the volatge introduced in the pick-up coil should be much larger than those introduced into the screen circuit, the cathode circuit, or the grid circuit. There is not likely to be any overloading in this case as long as the amplitude of the voltage introduced into the pick-up coil does not exceed the direct voltage in the plate circuit. This will not happen. But this simply suggests that the method is not nearly so effective as some of the other methods.

This plate circuit coupling is applicable to all types of tube, for every tube has a plate circuit.



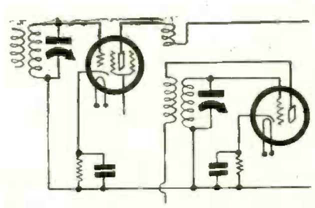


FIG. 6 (left)
In this case the oscillator and the modulator are tied together by a condenser between their cathodes.

FIG. 7 (right)
In this circuit the pick-up coil is connected in the plate circuit of the modulator and varies the plate voltage.

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* * *

Guy Robertson, baritone heard over an NBC network, and Vincent Youmans, popular composer, used to play on the same prep school football team.

* * *

An American woman who is a member of the only white family in the village of Russian Mission, on the Yukon River, is one of the most enthusiastic followers of NBC's Associated Spotlight Revue.

"While listening to the Revue tonight, I heard an announcement that a wire had just been received from Honolulu saying that the program was coming in splendidly there," she writes. "I listen to your programs every night, and the reception is grand; I can even hear the studio applause. KGO comes in better than any other station.

"No one unless he has lived up here can realize what a boon radio is to us. It is our only contact with the outside world. In this village there is not another white person, and radio brings my own language back to me."

Two Tube Modula

Both Broadcast and Intermediate Fre

By Burton

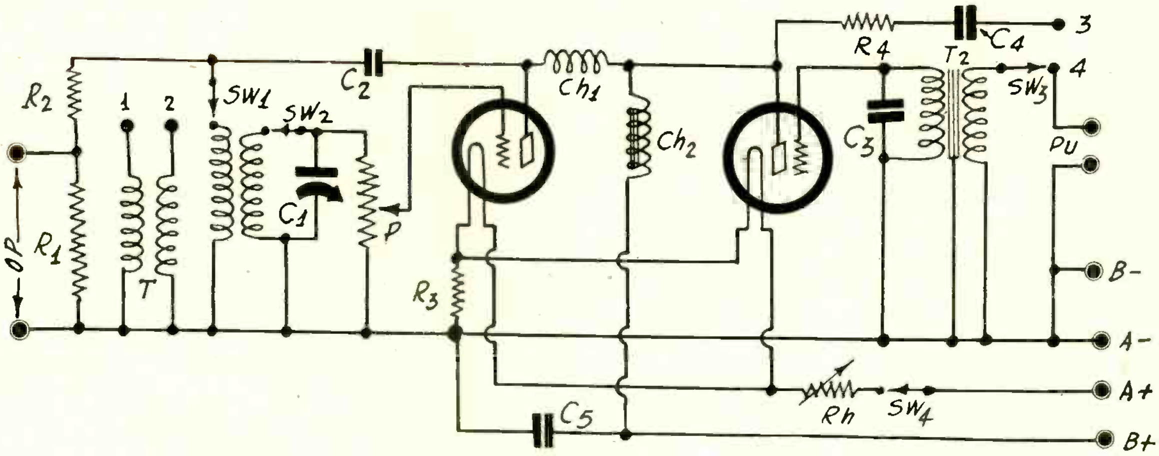


FIG. I
The circuit diagram of a two tube modulated broadcast and intermediate frequency oscillator using 230 tubes.

TEST oscillators are in constant demand by service men, manufacturers of receivers, and radio experimenters. These devices must be convenient to use as well as inexpensive, and they must cover not only the broadcast band, but also the band of frequencies used in intermediate frequency amplifiers and superheterodynes. The generated radio frequency must also be modulated with a tone, preferably the standard test frequency of 400 cycles per second.

A modulated oscillator consists of two separate oscillators, one operating at radio frequency and the other at audio frequency. The radio frequency is variable by means of a tuning condenser, but the oscillator frequency remains fixed unless provision is made for varying when it is so desired.

Controlling Intensity

The output of the audio frequency oscillator feeds into the radio frequency oscillator and modulates the radio frequency output. In the test oscillator shown in Fig. 1 the two tubes are coupled according to the Heising system of modulation.

In order to get a pure note from the audio oscillator it is necessary to limit the intensity of oscillation. The less the amplitude of the audio oscillation, as a rule, the purer the note generated. For this reason it is necessary to cut down the feed back to a level where oscillation is just sustained with normal voltages on the plate and the filament. The controlling element is the resistance R4 in the feed back lead. This might be a variable resistance of 50,000 ohms, or more. The circuit will probably oscillate with any value of R4 from zero to 100,000 ohms, but it depends on many factors which are not controllable. For example, it depends on the kind of transformer that is used in the oscillator, that is, T2. R4 should be adjusted until a pure tone is obtained when listening in with a headset connected in series with the plate battery, or when only one side of the headset is connected to the plate of the audio oscillator tube.

Any roughness or harshness in the tone indicates that the feed back is too intense and that the tube is badly overloading. Increase R4. If R4 is increased beyond a certain value, oscillation will cease. Select a value of R4 just under that. If the resistor R4 is variable it should not be touched after the proper value has been found. The variable may be replaced by a fixed resistance of the same value. It should be remembered that some tubes will not oscillate as readily as others, and it may be that if a value of R4 is selected for a very good tube the circuit will not oscillate when a tube not so good is put in the circuit.

If the transformer T2 is not good for oscillation it may be that the circuit will not oscillate even when R4 is zero. A suitable transformer is an audio output transformer having a ratio of one to one and designed for coupling between a power tube and a magnetic speaker. There are many of these transformers available and one may be had for very little money.

Tuning Audio Oscillator

The audio oscillator is tuned with condenser C3, which is connected across the grid winding. The frequency obtained with any given condenser depends on many things, but mainly on the inductance of the grid winding of the transformer. As this is not known, the value of the condenser to give 400 cycles cannot be given. Moreover, there are several minor factors which affect the frequency. This circuit will undoubtedly oscillate without C3, but the frequency will be shrill, assuming an average output transformer is used for T2. To lower the frequency it is only necessary to add capacity across the grid winding. Try first a small fixed condenser, say 0.00025 mfd. If the resulting tone is right, leave it that way. If it is too shrill, add more capacity. If it is too low, use a smaller condenser. It is possible to adjust the frequency fairly accurately by connecting suitable condensers across the fixed winding. If it is necessary to approximate the 400 cycle frequency, the generated tone may be compared with A above middle C on a piano, which has a frequency of 435 cycles per second.

Condenser C4 is merely a stopping condenser to permit grounding one side of each winding of the audio oscillator transformer.

LIST OF PARTS

Coils

T—One intermediate frequency transformer as described.
T1—One broadcast frequency transformer as described.
T2—One 1-to-1 output transformer as used between power tube and magnetic speaker.
Ch1—One 10 millihenry or larger radio frequency choke coil.
Ch2—One 30 henry audio frequency choke coil.

Condensers

C1—One 0.0005 mfd. tuning condenser, with good vernier dial and large scale.
C2—One 0.01 mfd. condenser.
C3—One condenser to be determined by trial (between 0.00025 and 0.1 mfd.).
C4, C5—Two 1 mfd. condensers.

Resistors

R1, R2—Two 50,000 ohm resistors, or two adding up to 100,000 ohms.
R3—One 8 ohm ballast resistor.
R4—One resistor between zero and 100,000 ohms to be determined by trial.
P—One 100,000 ohm potentiometer.
Rh—One 6 ohm rheostat.

Miscellaneous

Two UX sockets.
S1, S2—One double pole, double throw switches.
S3—One single pole, double throw switch.
S4—One single pole, single throw switch.
Four binding posts (or eight if external batteries are used).
One 3 volt A battery, preferably two No. 6 dry cells in series.
One Small 22.5 or 45 volt dry cell battery.
Two 230 type tubes.
One metal box for housing entire oscillator.

ted Test Oscillator

quencies, Modulated With Pure Tone

Williams

The capacity should be about one microfarad, although a smaller condenser will work well if no lower frequency than 400 is to be generated. It should be pointed out here that the value of R4 depends on the value of C3 finally used. When C3 is large, R4 must be smaller than when C3 is small or oscillation will not occur.

The Modulation Choke

The choke Ch2 may be called the modulation choke. It is the voltage across this choke, set up by the audio oscillator, which varies the effective plate voltage of the radio frequency oscillator. An ordinary filter choke of small size may be used, or even one of the windings of an old audio frequency transformer. If the audio frequency generated is no lower than 400 cycles per second, the primary winding is ample, but if frequency is to be much lower it would be preferable to use the secondary. However, the value of the inductance of this choke is not at all critical. If it is low the degree of modulation is less, and that may be a desirable feature. Values from 1 to 100 henries have been used and they all work.

At the right of the circuit are two binding posts indicated by PU. These are for use in case it is desired to obtain the modulating frequency or frequencies from an external source. For example, a phonograph pick-up unit or a microphone may be connected to these terminals. When this is done switch S3 is set on point (4), as in the drawing. The tube that was an audio oscillator then becomes an audio amplifier. When the tube is to be used as audio oscillator S3 is set on point (3).

The Radio Frequency Oscillator

The radio frequency amplifier is almost the same as the audio frequency amplifier, except for the values of the component parts. In this case the stopping condenser C2 need not be larger than 0.01 mfd. and may be as small as 0.001 mfd. The choke Ch1, which serves to prevent radio frequency current from escaping through the distributed capacity of Ch2 and through the audio frequency feed back circuit, should have an inductance of about 10 millihenries, or a higher value. An 800 duolateral coil used for intermediate frequency transformers is suitable, but a regular radio frequency choke of from 60 to 125 millihenries may be used just as well.

As in the case of the audio frequency oscillator, it is desirable to limit the intensity of the oscillation so as to prevent harmonics in a high degree. In this case the oscillation is limited by means of a potentiometer P connected across the tuned circuit, the slider being connected to the grid. The oscillation is most intense when the slider is at the top and somewhere along the resistance oscillation stops. The proper setting is just above that point, but just how far above depends on the intensity desired. Once the setting has been decided it should be left alone, because any change in the position of the slider will alter the frequency generated and will thus change the calibration.

Tuning System

The radio frequency oscillator is tuned with a 0.0005 mfd. condenser C1. This size is used because it easily covers more than the broadcast band and covers a fairly wide band on the intermediate frequency range. There are two radio frequency transformers, one for the broadcast band and the other for the intermediate band. A double switch, S1, S2, is used to switch from one to the other. S1 connects the feed back circuit to either the broadcast coil primary, as in the drawing, or to the intermediate frequency coil primary, point (1). S2 either picks up the broadcast coil secondary, as in the drawing, or the intermediate coil secondary, point (2).

The secondary winding of the broadcast coil should contain 71 turns of No. 24 enameled wire on a 1.75 inch diameter, no spacing between turns other than that determined by the diameter of the wire. The tickler winding of this coil may consist of 50 turns of the same size wire. No spacing is necessary between the two windings. Indeed, a single winding of 121 turns may be put on the form, putting a tap at the 50th turn from one end. The tap should be grounded. This method of making the coil eliminates the possibility of getting the leads reversed. If the tap is ground and the terminals are connected to the switch points, the coil is connected right for oscillation.

The Intermediate Transformer

The intermediate transformer may consist of two 800 turn duolateral wound coils such as are used for intermediate frequency transformers. The coupling between the two coils should be as close as possible and it may be necessary to remove the ends of the wooden forms on which these coils are wound so that the windings may be put together. Of course the coils are obtainable without the cores. In that case they should be placed about ⅛ apart. Two of the terminals, one of each, are joined together and grounded. The other terminals are connected to (1) and (2).

It may be that first attempt will not yield an oscillator because of reversal of leads. In that case the terminals of one of the coils should be reversed. It is possible by inspection to make the right connection in the first place. Each coil has an inner terminal and an outer terminal. The inner of one should be connected with the outer of the other, and the junction grounded. Then the two coils should be placed end to end in such manner that turns wind around in the same direction. If one coil is turned around so that the windings are in opposition direction there will be no oscillation.

It is suggested that of the two terminals left after the two have been joined and grounded that the outer be connected to (2) and the inner to (1).

It will be observed that the audio frequency transformer T2 is connected in the same manner as the two radio frequency transformers. Two terminals are connected together and grounded. The test for oscillation here is simple, because it is audible if a headset is connected to the circuit, or if only one terminal of the headset is connected to the plate of the oscillator tube. If there is no sound, reverse one pair of leads, either of the grid or the plate winding.

The Output

Only a small part of the radio frequency output of the circuit is utilized, and it is divided by means of a potentiometer consisting of R1 and R2. The sum of these two resistances should be approximately 100,000 ohms, but it is not critical. The more of this resistance is used for R1 the greater the output. For half output the two resistances should be equal.

The binding post connected to the junction of R1 and R2 may be connected to the grid circuit of a radio frequency amplifier. This is recommended, for it disturbs the calibration of the oscillator very little. A radiating wire could be connected to the tap of R2 for radiating a signal directly, but this will affect the calibration, and it is not very effective on the intermediate frequency band.

The Filament Circuit

Both tubes are 230 type, which requires a filament voltage of 2 volts. This is supplied by a small 3 volt dry cell battery, the total current being 120 milliamperes. Since the voltage is one volt in excess of requirements a ballast resistance R3 is connected in the common negative leg. This should have a value of 8 ohms. The drop in this is used for bias on the grids of the tubes. This resistance is intentionally low in order to make it possible to adjust the circuit for drop in the voltage of the battery. A rheostat Rh is connected in the positive side of the circuit to take up the difference. This need not have a resistance greater than 6 ohms. The filament switch is also connected in the positive lead.

The plate voltage need not exceed 22.5 volts, but it may be 45 volts. The circuits will oscillate on either voltage. A by-pass condenser C5 of one microfarad is connected across the battery to insure oscillation when the battery has been used for some time.

Calibration of Oscillator

The calibration of the broadcast oscillator can be done against broadcast stations, with the aid of a radio receiver. Tune in the broadcast receiver to a station of known frequency. Set the oscillator for zero beat with this station and one point has been found on the calibration curve. Repeat for other stations until points have been found at many points throughout the dial.

The calibration of the intermediate oscillator is not so simple, because there are no standard frequencies directly available. However, it can be done by the use of harmonics. The fourth harmonic of 175 kc, for example, is 700 kc, and this is a broadcast frequency. Using fourth harmonics of the IF oscillator and beating them against broadcast frequencies it is possible to go from 375 kc to 137.5 kc. The range of the IF oscillator will be between these limits.

The entire circuit, including the batteries, should be kept in a metal box, with only the controls and the PU and the OP leads available from the outside.

Star Circuit for a Midget

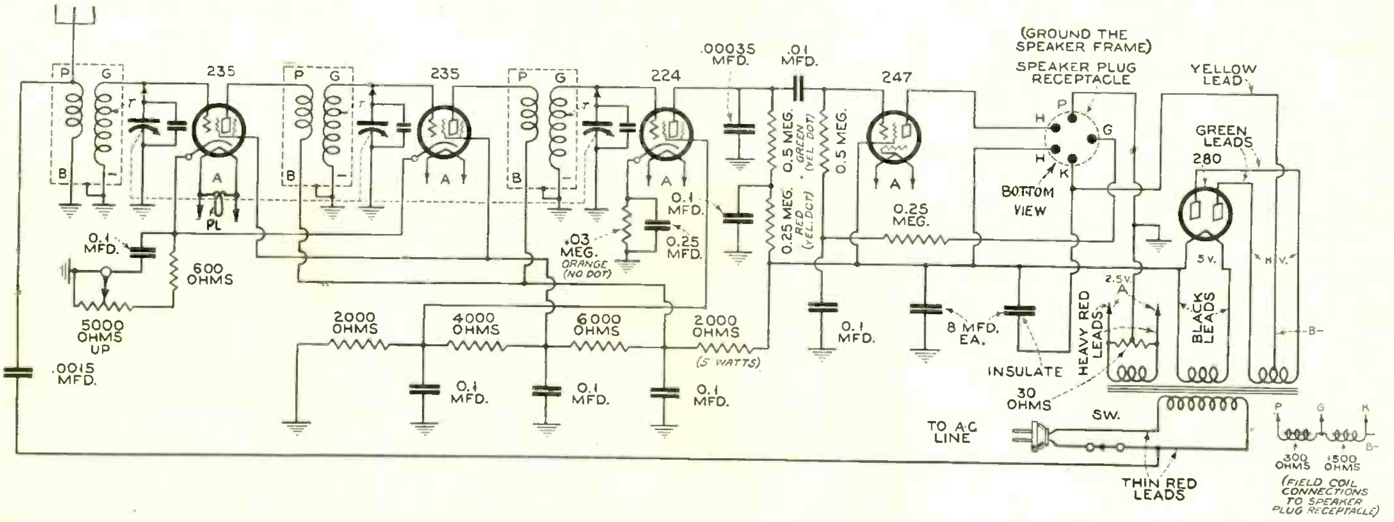


FIG. 1—The schematic diagram of one of the most remarkably sensitive and selective 5 tube circuits ever produced, the result of seven months of intense experimenting. The tubes used are: two 235 variable mu; one 224; one 247 and one 280. A switch may be included so that besides coverage of the broadcast band, waves from 80 to 200 meters may be heard, by throwing the wave switch.

Glorious Attainment by a 5 Tube Model

By Randolph Roosevelt

PERFORMANCE unsurpassed by any other five tube a-c operated tuned radio frequency set, sensitivity of the incredible order of 15 microvolts per meter, and fully satisfactory selectivity (a factor not expressible numerically) are achieved by the circuit diagrammed as Fig. 1.

The vast difference in performance of five tube sets is readily appreciated when one makes comparisons of finished products, measuring them on accurate instruments, as to selectivity, sensitivity and tone. It takes many months of patient experimenting to find out what is exactly best, and these pains have been bestowed on the circuit shown in Fig. 1, so that all trouble is removed, and one can rely on the most amazing performance that five tubes ever afforded.

It is well known that the greatest radio frequency sensitivity is developed when tubes are operated just under the oscillation point. And yet the tubes must not spill over, for if they do, squeals and squawks are heard, and reception is impossible or intolerable. By building up the primaries to exactly the right number of turns for the tubes and voltages used, and considering the proximity of the coils to one another (even though the coils are shielded) it is possible to bring the set to just below the point of oscillation for the highest broadcast frequency, while the number of primary turns, their d-c resistance and the correct degree of coupling between primary and secondary make for a fairly even response or amplification over the broadcast band of frequencies.

Tunes in Distance Well

Now the set is perfectly stable all over broadcast band, and it will tune in distant stations, plenty of them, often a few thousand miles away, clearly, sweetly, loudly.

There is provided, for those who would like to receive some short waves as well, without going to the expense of a short wave converter or a separate short wave set, a tap on the secondaries. By using a switch that has three decks, or layers, with pointer movable to either of two positions for each deck, the G terminal of the secondary may be picked up by the tuning condenser (full secondary used), or the condenser may be connected to the top on the coil (marked T on the diagram) and tuning may be enjoyed from 80 to 200 meters. This includes the television band.

In this short wave band, however, the circuit has to have a wide sensitivity, controlled, and the hightened frequencies of reception prove self-sensitizing, while the volume control (marked 5,000 ohms up) completely governs the wide sensitivity range.

Thus a dual purpose receiver may be built, if desired, or if only the broadcast band is of interest the wave switching feature may be omitted simply by connecting the tuning condenser stators directly to G of the coils and caps of three tubes.

For tuning, a shielded three gang condenser is used. The capacity may be 0.00035 or 0.00046 mfd., which does not include the capacity of the built-in trimmers.

The detector is of the power type, and, like the r-f tubes, is a screen grid tube. However, the r-f tubes are of the variable mu type, because of the sharp resultant reduction in crosstalk and crossmodulation (their virtual elimination, in fact), while the detector is a 224, because it has a higher gain. Nevertheless, a 235 works in the detector socket.

Audio Regeneration Used

The bypass condensers in the detector stage screen and cathode are of radio frequency values. It is not suggested that either 0.25 mfd. or 0.1 mfd. have any worth-mentioning effect here on audio frequencies. As the signal current through the 0.03 meg. (30,000 ohm) biasing resistor and, to a smaller extent, through the 2,000 ohm resistor on the ground side of the horizontally depicted voltage divider, are negative in phase, there is reverse feedback through them, and such feedback would be injurious to volume, sensitivity and tone. In former days large bypass capacities were used, but the new capitalized audio frequency regeneration is much more effective and incomparably more economical.

The audio system must be regarded as a whole or a unit, and each tube circuit therefore must not be treated as a something wholly independent.

Since the detector tube has an audio frequency output, the one and the only utilized output, since the radio frequencies are purposely bypassed to keep them out of the a-f amplifier, the detector is an audio tube. The output tube is a pentode.

Notice that there is a socket shown, with five black dots in a circle, to the right of the pentode socket. This is the socket used for the so-called speaker plug. A dynamic speaker is used, with field coil and output transformer built in. The field coil has a total resistance of 1,800 ohms, with a tap at 300 ohms. Connecting the primary of the output transformer to the heater (H) terminals interchangeably, plate (P) to ground, grid (G) to the tap on the field coil, and cathode (K) to B minus, the resultant field coil connections are shown at lower right in Fig. 1. B minus is not grounded, but connected to

CIRCUIT NO. 627

The diagram, Fig. 1, on this page, is covered by Blueprint No. 627.

Two stages of variable mu tuned radio frequency amplification, tuned detector input, one stage of resistance coupled audio, pentode output and rectifier.

Tubes: two 235 variable mu (r-f); one 224 (detector); one 247 (pentode output), and one 280 (rectifier). Total, five tubes.

Wavelengths: Broadcast band, plus 80 to 200 meters, by throwing a switch.

Built-in lamp socket antenna, full dynamic speaker, regenerated audio, high selectivity, great sensitivity; excellent tone; no hum; resistor-capacity filters in both the detector plate and power tube grid circuits; r-f coils, three-gang tuning condenser and r-f tubes shielded; vernier dial, traveling light type; full power dynamic speaker; ac operation, 110 v, 50-60 c.

one terminal of the dynamic field coil, the grid return of the pentode goes to the tap, while the terminal 300 ohms removed from tap goes to ground. Thus the field coil is used also as the B supply choke coil, a distinct economy and also making for compactness, while the coil is unusually placed in the negative leg of the rectifier.

Polarities Defined

B minus is the negative, so all points removed therefrom are positive, hence if the 2.5 volt winding's center (or using a center tapped resistor) is connected to ground, and since ground is positive in respect to B minus, a connection to any other point with be negative. Hence the pentode's negative bias results. The total current through the field coil is 55 milliamperes, so the negative bias for the pentode is 16.5 volts, which is exactly right.

Besides the advantages of this system as already outlined, there is the fact, merely suggested heretofore, that regeneration is present at audio frequencies. Since there would be abundant negative feedback, the object is to introduce sufficient positive feedback to make the positive predominate a little. This can be attained with striking accuracy. The 0.5 meg. (500,000 ohm) resistor in the grid circuit of the pentode is of the standard value used in many receivers, but experimenters, if they like, may use somewhat higher values here. until motorboating appears, and then reduce the value to such that that causes the motorboating to disappear. The motorboating is proof of excess positive feedback, and the suggested solution is a scientific and infallible one.

16 mfd. in Filter

Therefore no large bypass condensers, of audio frequency proportions, are necessary.

The filter condensers are 8 mfd. electrolytics, one of which must have its case insulated if the chasis is metal. The diagram carries this warning.

The tone is most remarkable. Engineers who have made a life study of acoustics say that the circuit's tone leaves nothing to be desired, and while much depends on the speaker, the circuit itself should introduce no discrimination, and this one does not. The speaker is therefore recommended by name: either the Rola or the Magnavox. For installations in a midget cabinet, use the 7 inch cone; for console installations use the 10.5 inch cone.

Blueprint No. 627

Figure 1 is covered by our full-scale blue print, No. 627, which gives the complete picture diagram, with wave switching details, as well as the itemized and classified list of parts. This blue print may be obtained by ordering BP-627 and sending 25 cents in coin, stamps, money order or check, to RADIO WORLD, 145 *West 45th Street, New York, N. Y.*

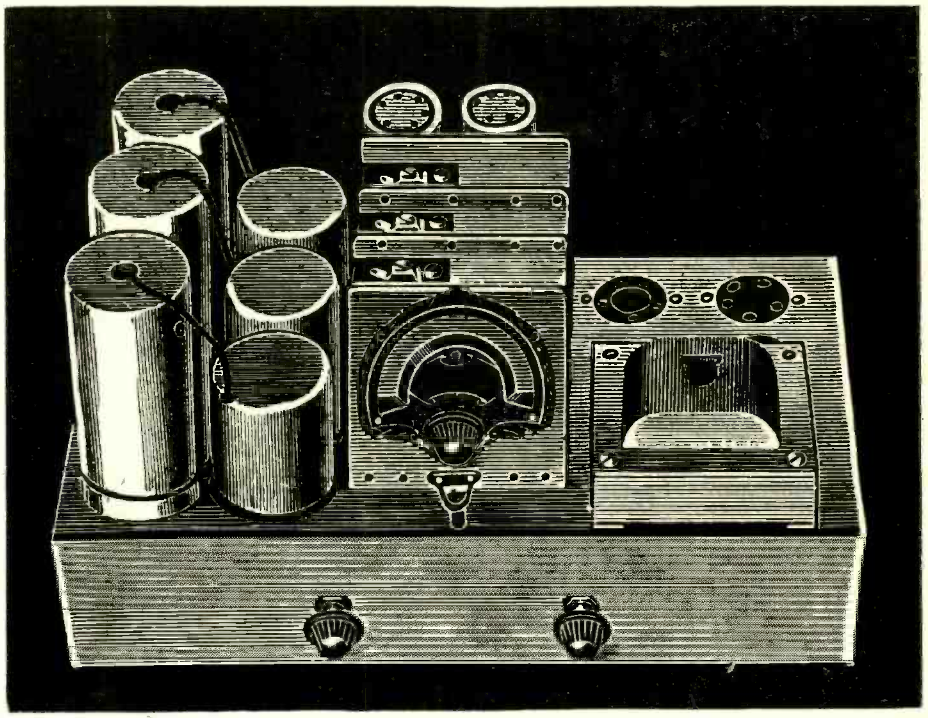


FIG. 2—View of the assembly from the top. The first r-f stage is at left front, so the detector will be more handily coupled to the pentode tube (second from left rear). The rectifier socket is barely visible as a crescent, since the other socket (right rear) serves as recpeptacle for the speaker plug. The volume control is at left the switch at right.

The set is not only a wonderful one, expertly engineered, and of astonishing performance, but it also exceeds the broadcast band coverage without switching, that is, there is positively no missout, a disagreeable disadvantage of some small sets, and besides there is the optional advantage of some short wave coverage.

The circuit, moreover, does not hum, as hum is another serious distraction in hastily prepared a-c circuits. Seven months were spent on the design and per-build it will have one of the finest small sets in the world.

fection of this receiver, so that any who

Chassis size is 13 1-2 inches wide by 7½ inches front to back, while at front and rear are 3 inch high elevating flaps. Shielded coils are used, tube shields for the r-f tubes, shield for the tuning condenser, a neat shelf to hold the resistors under the r-f sockets, while the power transformer is located at right front.

Built-in Antenna

The built-in antenna consists of a fixed condenser connected to one side of the a-c line. In some locations there is more volume when the a-c plug is connected to the convenience outlet in one direction than in the other. The built-in antenna is handy for apartment dwellers and others, but is not to be compared to a good outdoor aerial. Such aerial may be connected additionally to the set.

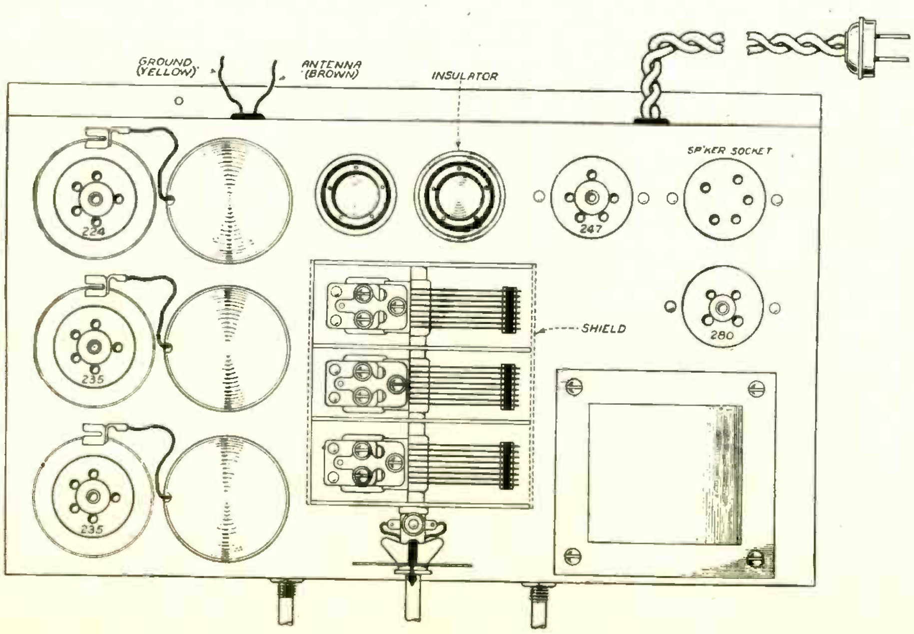


FIG. 1A—The plan of the broadcast set that provides option of coverage to 80 meters. The condenser shield is shown as removed, to reveal condenser details.

Dixon Gets Queries on Care of Children

Because Peter Dixon writes "Raising Junior," and because he is known to have read extensively on the subject of babies and their care, and also because he's got two youngsters of his own, he is beginning to get a new kind of fan mail. In one week Dixon received fifteen letters asking questions about the care of babies. And one young wife wrote and asked him to please submit an estimate on the cost of having a baby.

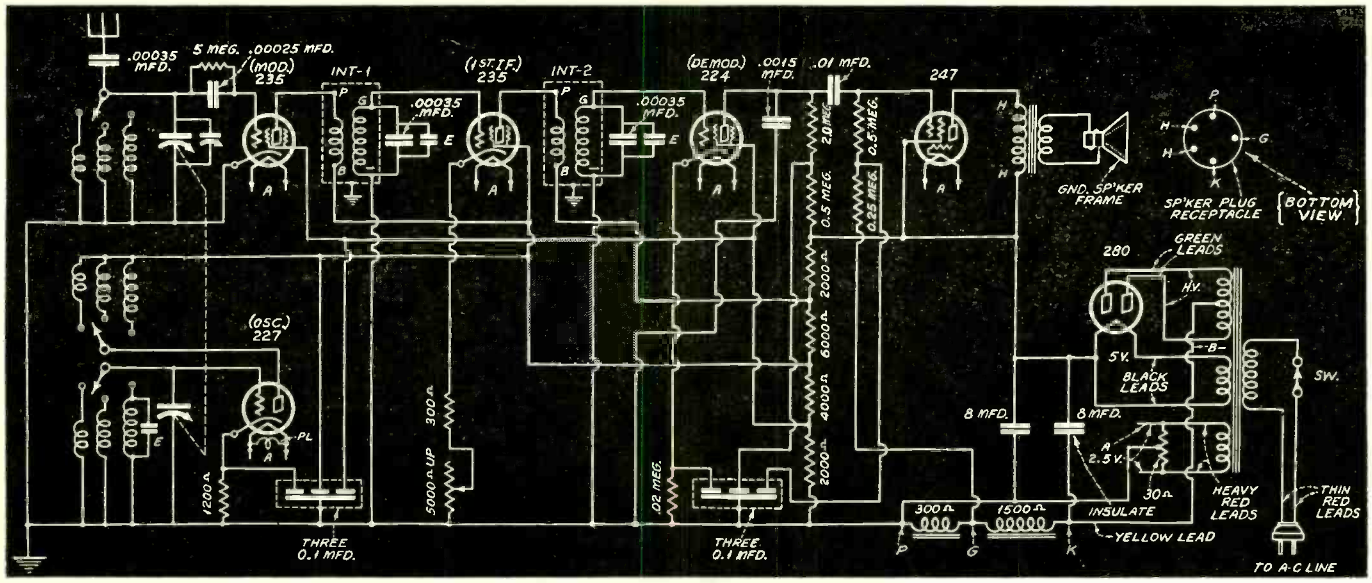


FIG. 3—A set for short waves, 15 to 200 meters, using no plug-in coils, and affording extreme simplicity and ease of tuning.

15 to 200 Meters On a Midget Set

By Martin Mansfield

A SHORT wave set, to tune from 15 to 200 meters, may be built on a chassis 13½ by 7½ by 3 inches, accommodating six tubes and the socket for the speaker plug, and may be housed either in the same midget cabinet as the tuned radio frequency set (see pages 16 and 17), or may be put in a console. For the midget model the dynamic speaker should have a 7 inch cone and for the console model a 10.5 inch cone, as in the case of the t-r-f set.

The exclusively short wave set, Fig. 3, is made because performance is usually much better than with sets designed to cover both the broadcast band and the short wave bands. Besides, the model will be attractive to those who already have a broadcast set, but are interested in an independent installation for receiving short waves.

Circuit Composition

The circuit has a mixer, comprising a 227 oscillator and a 235 modulator, using the grid leak method of modulation. There are also stage of intermediate frequency amplification, a power detector (demodulator), one stage of resistance coupled audio frequency amplification, and a pentode output, with rectifier. The set is for a-c operation.

Switching from one band to the other is accomplished by actuating a single knob on the front panel. The switch has three decks, and three coil connections are used on each deck, besides a fourth connection in each case for the pointers. The lugs for pointers can be easily identified, as they are removed an unequal distance from the others. The shaft is insulated from everything, so that no grounding results from connection of the bushing to a metal front.

Lug Connections

As for the switch, one deck is connected with pointer to grid leak and condenser in the modulator circuit, and three lugs on the same deck go to the secondary terminals, so that as the switch is moved, one coil after another is picked up for tuning. It is handy to decide on a particular rotation, so it is recommended that the larger coils be picked up as the switch knob is turned to the right. That means the extreme right-hand position of the pointer knob on the switch would cause tuning to begin at 199.9 meters, or 1,500 kc.

Each of the two other decks picks up, respectively, a plate coil and a grid coil for the oscillator. Any given position of the switch knob therefore results in automatic connection to three windings to serve the synchronized purpose, and no plug-in coils are used.

Data on Coil Construction

The intermediate frequency is around 450 kc. It is not vital that exactly that frequency be used, the only point being that the resonance should be somewhere around that, and will be provided by two coils with large primaries and with secondaries intended for 0.00035 mfd. t-r-f tuning. Then if a fixed condenser of 0.00035 mfd. is placed across the secondary, the frequency will be around 500 kc., while if an equalizing condenser (E) of 20-100 mmfd. capacity, is added in parallel, the intermediate frequency may be lowered, and the two intermediate coils, Int.-1 and Int.-2, may be peaked. Loudest response discloses correct peaking.

By consulting the diagram, Fig. 3, it will be seen that three windings are in perpendicular alignment, and that suggests the fact that the three are on one form. Therefore the modulator and oscillator coils are coupled inductively, and, as suggested in the diagram, the plate winding should be between the two.

The coil data can be determined by considering the frequencies to be covered and the capacities used for tuning. The condensers are two 0.00035 mfd. on one shaft, a dual straight frequency line type, and the minimum capacity in each circuit, counting condenser minimum and the effect of wiring, is 39 mmfd. We may determine the coil data from round numbers, so the minimum is taken as 40, the maximum is therefore 390 mmfd., therefore the capacity ratio is about 9.7 to 1, and the frequency ratio is a trifle more than 3 to 1, since it is the square root of the capacity ratio.

Taking a tubing of 1⅛ inch diameter, and winding 40 turns of No. 31 enamel wire, will bring us slightly below 1,500 kc, and that number of turns is put at the end of the form, which is about 2.25 inches long. The coil will be used in the modulator grid circuit. At the other extreme put on 30 turns. Then, beginning close to the oscillator grid winding, put on the tickler, consisting of 12 turns. The wire

CIRCUIT NO. 628

The diagram, Fig. 3, on this page, is covered by Blueprint No. 628.

Mixing circuit, for tuning, consisting of two tubes; intermediate frequency amplification; second detector (demodulator) of the power type, pentode output and rectifier.

Tubes: one 227 (oscillator); two 235 variable mu (modulator and intermediate stage); one 224 (second detector or demodulator); one 247 (pentode output), and one 280 rectifier). Total, six tubes.

Wavelengths: 200 to 15 meters. Three wave bands, highest, 200 to 67 meters; next, 68 to 25 meters; next, 26 to 15 meters or lower. Switch control of wave band by single front panel knob. No plug-in coils.

Full dynamic speaker, regenerated audio, ease and simplicity of tuning; set may be logged, so same stations come in at same points all the time; virtual absence of repeat points in tuning; single tuning control, with manual trimmer for extra sensitivity on weak signals; good sensitivity and selectivity; excellent tone; no hum; resistor-capacity filters in both the detector plate and power tube grid circuits; intermediate coils, two gang condenser and radio frequency tubes shielded; vernier dial, traveling light type; a-c operation, 110 v, 50-60 c.

is the same. The plate and modulator grid windings are separated by the remaining space.

Tuning Characteristics

The frequency covered by the modulator, disregarding the manual trimmer in that circuit that extends the frequency range, would be, say, 1,500 to 4,500 kc. The intermediate frequency is 450 kc. Therefore, the oscillator should begin to tune at 1,950 kc., and would wind up three times that, or 5,850 kc, that is, 1,350 kc detuned from the modulator, were not some compensation provided. So the number of turns for the oscillator grid coil is made less (30 instead of 40), and an equalizing condenser of 20-100 mmfd. is adjusted so that somewhere around the middle of the dial the two circuits are made perfectly resonant. Then they will track almost exactly, but any discrepancies, being small, can be taken up by the manual trimmer in the modulator circuit.

The modulator tuning does not seem very effective unless the signal is weak, when the heightened amplitude becomes enjoyably obvious.

Modulator Tuning Effect

The oscillator should tune from 1,950 kc to 4,950 kc. The equalizer across the winding reduces the capacity ratio. The frequency ratio is about 2.5 to 1, so slight reduction of ratio is necessary, compared to 3-to-1, hence the trimmer will be set at or near minimum capacity (20 mmfd.) That would make the effective capacity 60 mmfd. at one extreme and 410 mmfd. at the other, a capacity ratio of about 6.8-to-1, or a frequency ratio of about 2.6-to-1. This is quite close enough to the 2.5-to-1 theoretical requirement, as any disparity should be on the side of increased ratio.

In the next band the modulator will tune from about 4,500 kc to about 13,500 kc, while the oscillator will tune from about 4,950 kc to about 14,850. At the high frequency extreme, therefore, with equal coils and condensers, the difference is only 1,350 kc out of 13.500 kc, or 10 per cent., which the manual trimmer will take up perfectly. So that coils are wound with No. 28 enamel wire, on the same diameter and axial length tubing, and consist of 16 turns at the extremes of the form. The plate coil is put on 1/8 inch away from the oscillator grid winding and consists of 10 turns of the same size wire.

Third Form

The third form has four turns each of No. 18 enamel for the grid windings, and they are put on in the same relative positions as formerly, the distance being greatest between plate coil and modulator grid coil in this instance. The plate coil has 10 turns of No. 28 wire.

Blueprint No. 628

A full scale blueprint is obtainable, showing the layout of parts, coil construction, the pictorial wiring, schematic diagram, as well as giving the itemized classified list of parts, for the short-wave set, 15 to 200 meters (Fig. 3). Order Cat. BP-628, and send 25 cents in coin, stamps, check or Post Office money order, to RADIO WORLD, *145 West 45th Street, New York, N. Y.*

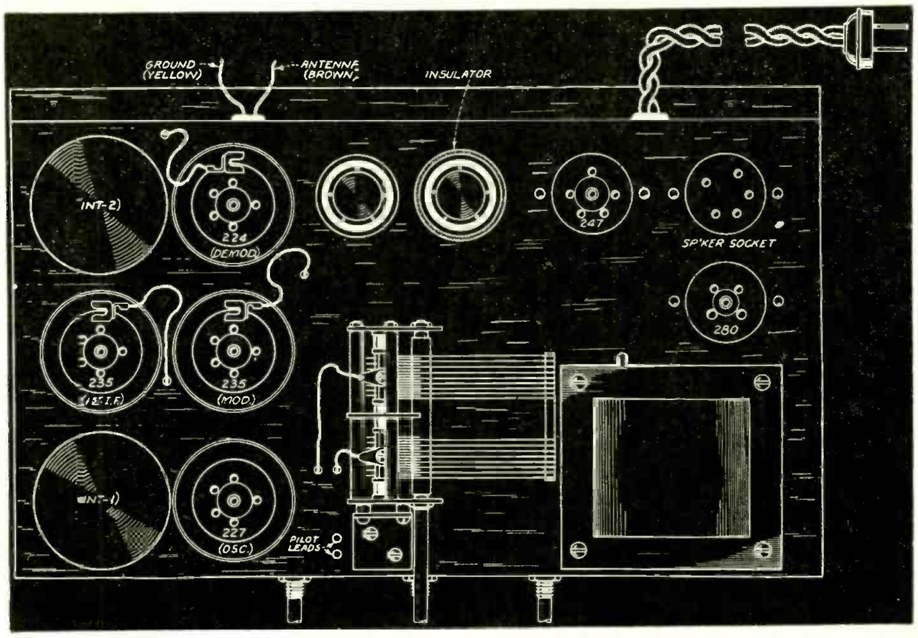


FIG 5—Sequence of tubes is: oscillator at lower left, modulator directly behind it, intermediate off center, at left, and demodulator at rear. The electrolytic condenser to insulate is designated.

Avoidance of Dead Spots

The only precaution necessary is in respect to polarity of connections. If the windings are put on in the same direction, oscillation will result only if the terminals of the plate coil and oscillator grid coil, where they adjoin, go respectively to B plus and grounded B minus, or to plate and grid.

Dead spots are avoided by preventing coupling between coils on respective forms, as such coupling results in absorption of the signal, so two coils are mounted at right angles to the central form. Thus the central form, holding the smallest coil, juts back from the front panel, behind the coil switch, while the coil for highest waves may be at right and the second band coil at left, these at right angles to the central coil. To avoid coupling between the parallel coils (even though they are well distant), a 2 inch square piece of aluminum may be mounted at the bases, or the smallest coil put into a shield and the two other coils attached to the sides of the shield.

Rating of Resistors

All the resistors (except the center tap resistor for the heater secondary) may be of 1 watt type, for in this case the 2,000 ohm resistor to reduce the B voltage for plate purposes need not be of 5 watts rating, because only one tube is served.

The short wave signals will come in clearly and without hum, as the B supply filtration, with 16 mfd. of capacity, and the resistor-capacity filters in the detector plate and pentode grid circuits, eliminate the hum. Tuning is extremely easy and simple, and stations may be logged.

There is requirement for considerable sensitivity, and this is attained by making the primaries of the interstage transformers large. The ratio should be about 3-to-1, so that if there are 120 secondary turns there would be 40 primary turns, wound over the secondary, or, if preferred, radio frequency choke coils, of the small honeycomb type, to fit inside the secondary, may be used. These would have 200 to 300 turns. Coils having 800 turns or so should not be used.

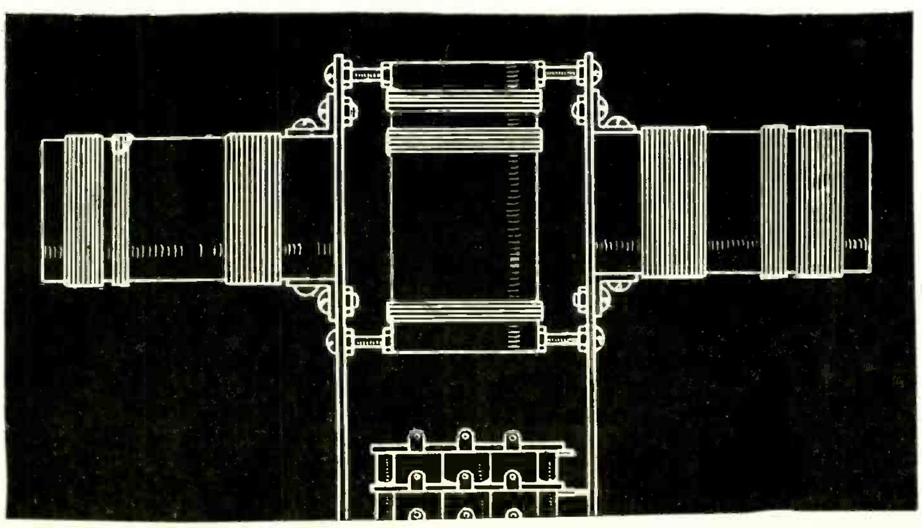


FIG. 4—View of the coil assembly, to show the relative positions. Below is the wave band switch. Aligned with it, secured to side brackets or a shield, is the coil with smallest windings. Note that the two other coils are at right angles.

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

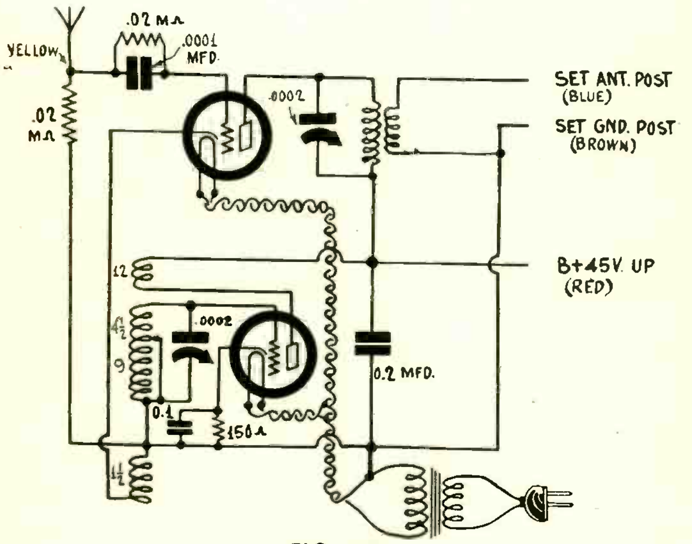


FIG. 968

In a short wave converter without intermediate stage built in the coupling of modulator to the set really couples the aerial to the set, also. Therefore broadcasts come through directly, unless a "quiet spot" is found on the set dial.

Mixer Coupling

WHEN an oscillator and a modulator are to be coupled, as in the mixer of a superheterodyne, may not the oscillator be a 227 tube and the modulator a screen grid tube, with the screen of modulator connected to the plate of the oscillator? That will give the modulator a screen voltage equal to the plate voltage of the oscillator and will put the plate winding in the common oscillator plate-modulator screen circuit. I intend to try this but would like some information first.—O. T. D.

Coupling may be effected in that manner, but it is entirely too close, even for broadcast work, and most certainly for short wave work. A resistor would have to be interposed between the screen of the modulator and the plate of the oscillator, to reduce the coupling, and this might have to be several hundred thousand ohms. It should be remembered that the modulator screen voltage will be exceedingly high, as the oscillation voltage at the plate has to be considered. Therefore the modulator screen voltage may be actually much higher than the modulator plate voltage, in which case the modulator would oscillate, being a dynatron in effect. The method has possibilities, but they must be subjected to considerable experimenting, we believe, before satisfactory results will be obtained.

* * *

Use of Untapped Field Coil

SEVERAL diagrams show the use of a dynamic speaker, with field coil tapped, the field coil also being used as the B power filter choke. I have a speaker, and it has a field coil, not tapped, yet I would like to obtain the bias for a pentode in the same manner as from a tapped choke. Please let me know how to do this.—G. M. D.

The bias may be obtained by putting the untapped choke in the negative leg of the rectifier, from B minus to ground, being careful not to ground B minus, and careful to insulate the condenser next to B minus from any metal chassis, grounding the center of the 2.5 volt pentode filament winding, and connecting the pentode grid return to the juncture of two high resistances. You will have to measure the voltage drop across the B supply choke or dynamic field coil. Suppose it is 24 volts. The bias desired is around 16 volts. Therefore the resistors may bear the ratio of 2-to-1, so 0.5 meg. and 1 meg. may be used, the larger value being connected with one side to ground, the pentode grid return to the juncture, and the other end of the smaller value resistor to B minus. Where the drop is large the relative position of resistors is reversed.

* * *

Since 1927!

MY set is an elaborate tuned radio frequency receiver in a gorgeous cabinet. I bought it at a good price about four years ago. Recently there seems to be a background swish in it at times. The tone is not as clear as it used to be. I am still using the tubes furnished when I bought the set.—H. G.

Four years are a very long time to use tubes. If you will put new tubes in your set you will find a considerable improvement, and probably the swish will disappear.

* * *

Choice of Intermediate Frequency

WHAT intermediate frequency should be used in a short wave converter? I have heard different frequencies recommended.—H. D.

If you mean that a stage of intermediate frequency is to be built into your converter, it would be advisable to select a low frequency, say, around the lowest frequency to which your receiver will tune, which may be something like 520 kc. If you refer to the selection of a spot on your dial for use as intermediate frequency with a converter that has no such built-in stage, it is usually preferable to select a high intermediate frequency, as the receiver likely will be more sensitive in that region. However, any frequency in the broadcast band opens the possibility of direct reception of broadcasts, constituting continuous interference, so a so-called quiet spot on the dial should be picked. On a sensitive set this may be hard to find, and you would then have to select the highest frequency to which the set will tune, which is assumptively a little out of the broadcast band. By making the test yourself you can determine the best frequency for your own installation. See Fig. 968.

* * *

Regeneration Stage Transposed

AFTER trying out a regenerative detector in a circuit that has a stage of radio frequency amplification ahead, I switched the regeneration over to the r-f stage, and results were better. Is it all right to leave the regeneration control in the r-f stage?—K. T.

Yes, it is all right from a reception viewpoint, but radiation may be strong, and one should avoid radiation, because it produces interference in neighbors' receivers. There is no good reason why the regenerative action should be more effective in the first stage than in the detector, unless the constants are not properly proportioned for the detector stage, and happen to fit more nicely into the r-f stage. These constants can be changed, so that the regenerative action is just as good and just as effective in the detector stage as in the other. More turns on a feedback winding would be one solution. Try to work the set to advantage with the regeneration in the detector stage.

* * *

Shielded Short Wave Coils

PLEASE let me know whether it is all right to shield short wave coils. Also tell me a good method to use in testing for this. I intend to build a short wave midget set and would like to use shielded coils if there is any advantage.—R. F.

It is all right to shield the coils, but the shield should be relatively large in respect to the coil diameter form. If the shield diameter is at least twice the coil diameter you will be pretty safe, if top and bottom of shield wall is no nearer to the winding than the sides of the shield. A test is to connect the coil as an oscillator, with shield on and shield off, and note both whether oscillation is retained and what the difference in frequency is. If oscillation is retained it is all right to use the shielded coil you have. The frequency change is simply for your information, to remind you that in calibrations you must allow for the difference between shielded and unshielded coils.

* * *

Volume Control for Intermediate Frequency

MAY I put the volume control for 235 intermediate tubes in the cathode circuit (to vary the bias), and if so, what value should be used?—F. W. C.

The variable resistor to alter the bias is a good method of volume control for the variable mu tubes. What value of resistance to use, both for volume control and for the limiting resistor, depends on the sensitivity, or, roughly, the number of stages. In sets having a sensitivity of 25 microvolts per meter, 5,000 ohms are satisfactory for the volume control, for sets with sensitivity of 15 microvolts per meter, 10,000 ohms, and for sets of higher sensitivity, 25,000 ohms, assuming two tubes are controlled. The limiting resistor should be 300 ohms for two tubes, with the exception that incipient oscillation, if present, may be corrected by increasing the value of the limiting resistor until the oscillation disappears, provided the resistor does not exceed 600 ohms. If it does, then the oscillation should be attacked at the coil, shield, bypassing and other points. If the intermediate frequency is high then the voulme control should not be a d-c voltage changing device, as described, as changing the voltage alters the frequency. This is not important where the frequency is 450 kc or lower.

DIAGNOSIS OF RADIO ILLS BY BOARD'S HEAD

By MAJ. GEN. CHARLES McK. SALTZMAN,
Chairman, Federal Radio Commission

Just as improvements are made in technical operation with better signals laid down in the service area, just so must program improvements will be made, with better entertainment laid down in the homes of the listening public. Whatever the nature of the program selected, the broadcaster must constantly strive to improve its quality. Improvements in program quality should keep pace with improvements in technical operation.

In the case of a new facility like radio, reaching into the very home life of our nation, it is inevitable that complaints will arrive. When Alexander Graham Bell's first crude telephones were installed on telephone systems, the novelty of the wonderful invention soon wore off and many complaints were received as to the service rendered.

Tax Paid in England

The telephone company of today with its wonderful equipment still receives complaints. The telephone company is constantly endeavoring to correct the practices which cause these complaints. The broadcaster, if he be wise, will do the same. Complaints are being received concerning offensive advertising in broadcasting programs. So long as our country favors the competitive broadcasting of today, as distinguished from monopolistic broadcasting, advertising must probably pay the bill and we shall listen to "sponsored" programs.

In England, for example, where broadcasting is maintained by a tax on receivers, the broadcaster does not need to precede and end each program with announcements of the virtue of any particular brand of salad dressing or the merits of any particular cigar, no matter how exceedingly mild it may be. But there are sponsored programs and sponsored programs—programs in which the advertising is palatable, and programs in which the sales talk is nauseating. Broadcasters, if they listen to the trend of public opinion, will commence to take steps to make these sales talks more palatable. Right now the problem is theirs and they should hasten to solve it.

Broadcasters in Europe not only use the 550-1,500 kilocycle band for their purposes but also may use frequencies between 160-224 kilocycles, these latter frequencies being very long waves of great value in broadcasting. There is considerable dissatisfaction in Europe concerning the present allocation of broadcasting facilities. There is no doubt but that steps will be taken by numerous countries at Madrid to broaden the band and make more frequencies available.

Effect of Frequency Changes

The frequencies above and below our broadcasting band are now assigned to marine and other commercial uses. Some nations will probably resist any move to broaden this band, as it may do violence to services in which that nation is particularly interested. It is quite certain, however, that many changes will be made in the field of frequency assignments at Madrid. These changes may include broadcasting.

Do you want any changes in the broadcast band or in the international regulations concerning broadcasting? If the 550-1,500 kilocycle band is widened it would furnish additional frequencies to provide relief for frequencies which are now overcrowded with stations in the United States, reduce interference and increase service areas.

On the other hand, it would mean that this widening would displace marine and other commercial stations from their present frequencies and that 13,000,000 receiving sets in this country would not respond to the new frequencies.

Do you want the broadcast band widened? What attitude do you want the United States to take in this matter? Next year a delegation will be appointed to represent the United States at Madrid and to safeguard the radio interests of our country. Many trying problems will be encountered by that delegation, for each nation represented at Madrid will have its own national interests in mind. What attitude do you wish this delegation to have concerning broadcasting?

Television "Highly Experimental"

The idea that you and I will be able to see radio pictures in our homes just as we hear radio programs today has aroused a remarkably widespread public interest. A great many people labor under the belief that visual broadcasting has been perfected. As friends of radio, we should all be very careful to spread no false rumors or be parties to the development of a frenzied expectation that is unwarranted.

As in all experimentation, the Radio Commission has been liberal and has encouraged research work in television with a hope that the development of this new application of radio may be hastened. But the Radio Commission still believes that the art is "highly experimental" and that it can not be commercialized at this time.

Statements made by prominent radio authorities as to the status of television vary greatly. Some say that visual broadcasting is five years in the distance, some say one year, some say it is here now. While the press contains statements that remarkable progress has been made in this new art, I do not know the address or the telephone number of any engineer who will say just when it will become a reliable, practical medium of public entertainment, or that the finished product will be along the lines of the present research.

Everyone is aware that great strides have been made, but whether television will arrive this month, next month, next year, or 1936 can not be foretold without the assistance of an astrologer or a fortune teller, and I believe that they have been ruled off the air by a press release of the Federal Radio Commission.

The Radio Census

New York

Washington.

The Director of the Census announced the results of a preliminary count of the number of families in the State of New York according to the 1930 census, with the number of families reporting radio sets. The whole number of families in the State on April 1, 1930, was 3,162,118, as compared with 2,441,125 in 1920. The population per family in 1930 was 4.0, as compared with 4.3 in 1920. The number of families reporting radio sets in 1930 was 1,829,123, or 57.8 per cent of the total.

Massachusetts

The number of families in the State of Massachusetts on April 1, 1930, was 1,024,527, as compared with 874,798 in 1920. The population per family in 1930 was 4.2, as compared with 4.4 in 1920. The number of families reporting radio sets in 1930 was 590,105, or 57.6 per cent of the total.

NEW TELEVISION LAMP AFFORDS A WHITE LIGHT

Boston.

Hollis Baird, chief engineer of the Short Wave and Television Corporation, of Boston, announced the development of a white light for television. "This," he said, "brings the long desired freedom from pink pictures and is a revolutionary advance in the television art."

He continued: "The idea that television is fundamentally a question of light sources has been forgotten in the merry discussion of mechanical versus cathode ray television. These two latter things should be considered beyond their scanning systems. If we consider the question of light itself, the possibilities of future television become more easily conceived.

Cathode Light Is Green

"In the cathode ray system an electron stream, playing upon a chemically treated end of the tube, produces the light. The possibilities of any fluorescent substance as an intense source of light which will permit its development of bigger and bigger pictures in the home is the challenge of the cathode ray system as against the mechanical system and its light sources. These sources are several but the gaseous tube used in this type of television has made steady strides forward and after the pink lights of the past we have already progressed to a powerful white light.

"There seems to be no limit to the amount of light which ultimately can be developed through the intelligent uses of gases and their ionization.

"One of the main objections to the mechanical system has been its pink eye effect. Cathode ray pictures are green. Now the mechanical system has a white light which will give as much brilliance as the best of the pink lights of the past few months, and an excellent response with a cool-looking, most agreeable picture as the result.

"This new light now gives commercial home television its first white pictures. This step was thought to be several years off. Instead it is already here.

Calls It Important Step

"Our laboratory has been engaged in research on this lamp for some time and while a white light was easily achieved, one of the same brilliance and life as the pink light seemed most elusive. Finally, through a study of new gases and much experimentation, our new lamp was perfected. It utilizes certain valuable gases in a correct combination achieving an intense white light and does this without the use of the hot cathode system previously used for any sort of successful white light work.

"This white light means television receivers for home screen projection with the white light of motion pictures. The light source is here and television takes an important step forward."

THE MONITOR RECEIVER

A seven tube a-c monitor receiver, intended to cover, with plug-in coils, 15 to 2,000 meters, was described as to broadcast band performance in last week's issue (November 14th). Next week a report on the continental band will be printed (November 28th). There is a separate dial for each of the four tuned circuits in this set.

A THOUGHT FOR THE WEEK

"ARE yer listenin'?"
When Tony Wons asks this question each evening over the air and ends with "All is well!" it's hard to believe that there's any trouble in the world and that everything isn't just as it should be.
And not a blessed mother's son of Tony's copyists comes within miles of convincing anybody that "All is well!"

RADIO WORLD
Trade Mark Reg. U.S. Pat. Off.
The First and Only National Radio Weekly
Tenth Year
Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.
Roland Burke Hennessy, editor, Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor.

Correct Time

ONE of the most difficult feats of modern life is to ascertain the correct time. The easiest recommendation to give might be, Buy a very good watch, set it by a railroad clock, and stop worrying.

For ordinary purposes this might be all right, except that the railroad clock is far from infallible, being after all just a clock, and besides the very fine watch scarcely will keep accurate time. Most good watches keep time according to temperature and moisture conditions, so you would have to control meteorological mechanisms to assure fidelity from even your trusted watch. Bad timepieces are beyond discussion.

The situation would seem almost hopeless to any one who has a keen interest in absolutely accurate time. That should be time measured by astronomical observations, recorded on scientifically precise clocks, which clocks should have automatic correcters of their own errors, and time should be checked almost nightly.

Such, indeed, is what is actually done in practice, where precise time is requisite. The Naval station, NAA, at Arlington, Va., maintains such chronometric measurements, and the correct time is sent out on schedule, formerly on a fixed frequency, 5,000 kc, now on that and other frequencies. A set that has an independent oscillator is needed, as the transmission is by continuous wave, and the local oscillator supplies the frequency difference to render the dots and dashes audible.

However, few are equipped to receive these time signals, and some so equipped do not go to the trouble to ascertain the schedule of this transmitter, or of other stations sending out really correct time, but once the signals are tuned in it is certain that the listener will obtain the information on how to read them. One need not know code, as the correct time may be ascertained without being able to read the "announcements."

There is a practical interest in correct time, especially for those associated with the clock and watch industries and all necessarily punctual work, and besides travelers, even to commuters, have a high regard for punctuality, instilled in them by relentless punishment.

With science advancing in all directions, and with such fine accuracy being achieved, it is to be hoped that radio will be used more freely for finding out the correct time in the correct manner. Even those who quit the office more punctually than they reach it should be interested.

But by correct time is not meant the oral announcements prevalent as sponsored advertising from broadcast stations. Such time cannot well be correct; usually it is seriously incorrect, and has been known to be several minutes off. Even ship instruments now permit checking the chronometer to one quarter of a second, due to radio's aid. When correct time is said, it is not always meant, but the correctness should be associated with such situations as obtain on shipboard.

Jewelers throughout the country would bestow a benefit on themselves and on their communities by having window chronometers, or street clocks, absolutely correct, and made so by themselves. Of course, the jewelers should get the correct time authentically, and should have the radio equipment with which to do it. If you take your watch to a jeweler who gets his correct time from a church bell or a railroad station and communicates it to a watch or clock of his own, thus to compare with yours, no wonder so many watches and clocks keep no better time when they come back than when they went out.

There is advertising lure, no less than worth, in correct time as measured from the heavens. Jewelers should realize that it is worth money to them to be able to boast that their time is obtained directly from the Naval Observatory.

"He must be very painstaking in his work," people will say of a watchmaker who goes to such pains in practice.

The receiver with which he obtains the correct time may be put in the window for a while, on display. If the public is permitted, by a simple address system, to hear the correct time as it dashes in, maybe the jeweler will have more people in front of his store than the police will allow.

The lure of the stars once got a watch concern into trouble. It advertised over the air that it was giving correct time as measured in the starry heavens at its observatory atop a tall building in New York. Investigation proved that the time announcements actually sent out were taken largely from Western Union electric clocks (good time keepers, but not the stars), and that the "observatory" was an attic chamber not equipped for heavenly measurements. Moreover, some of the sponsored time announcements were on phonograph records, supplied to smaller stations, so the record would tell you it was exactly 11 o'clock actually any time of the day. It was hard to get the record to say "11 o'clock" just at that precise time, records being that way, and of course one had to be careful not to put the 10 o'clock record on just before 11, for then the discrepancy would be altogether too great.

The fact that people are interested in time is proved by the number of clocks and watches used. Giving "correct time" the present sponsored way is not good enough. The authentic time signals should be used, at least indirectly, for all such broadcasts, and by transportation systems, jewelers, watch makers, clock makers and Sunday drivers, so they can tell the judge just when it happened.

Lottery Ban Indorsed

THE National Association of Broadcasters agrees with the American Newspaper Publishers Association that there should be a law against broadcasting of lotteries, just as there is a law against the use of the mails for such purpose. When the Radio Law was written and enacted no thought was given to this subject, so unconsciously the broadcasting stations were favored as against the press, because the one could accept forms of advertising forbidden to the other. And the result was that a great deal of lottery advertising found its way to the microphone.

By all means the next Congress should amend Section 29 of the Radio Act of 1927, to prohibit the broadcasting of lotteries. Both associations agree as to the intended effect of such an amendment, that it prohibit to broadcasters all emanations which, if written or printed, would be subject to exclusion from the United States mails. The Postal Laws and Regulations provide as follows under the heading of unmailable matter:

"All matter concerning any lottery, so-called gift concert, or other enterprise of chance, or concerning schemes devised for the purpose of obtaining money or property under false pretenses."

The next step, in which the publishers are not interested, but in which the stations well may be, is the riddance of the air of necromancers, Nabobs, Rajahs, astrologists and the rest of the claptrapping ilk, by statutory compulsion exerted on the stations.

The newspaper publishers became incensed at the lottery discrimination, for much business flowed to stations that newspapers had to turn down, and the plea was that equality should prevail. There might have been no objection from the publishers if such equality were constituted of free-for-all dissemination of lottery advertising, as at least that would constitute division of the spoils. It was not the moral sense, so much as the pocketbook, that was outraged.

With the seers, numerologists, astrologists, and all the other devotees of profitable divinations, the newspapers may be deemed to have some sympathy, for the home and women's pages are often redolent of this hokum. The idea is that the esoteric sciences have a deep appeal for women, who are supposed to be more gullible than men, and who probably are, seeing that so many loafers persuade good women to marry them. But if the radio law is amended to conform to the postal laws, these offenders perhaps may be kept off the air as obtaining money under false pretenses.

The Federal Radio Commission, reluctant to acquire censorship in any form, and thankful it is forbidden in the Radio Law, nevertheless could find a way to rid the air of the lotteries and astrologists, in a test case under the "public interest, convenience and necessity" clause of the existing law, for it applied this to fortune telling, in some cases. But it prefers directive statutes, and may it receive them as fast as they are needed!

KALEIDOSCOPE

The filamentless radio tube is slowly taking on a coat of reality. Let's hope it won't be electronless.

* * *

Commercial broadcasters are confronted with a listener mutiny against scrambling their expensive entertainments with pleas to purchase products. Once upon a time, in 1920, the squeal created a furor, and now there's the blurb to replace it.

* * *

The Federal Radio Commission's crusade against interference will stress the obedience of broadcasting stations not to march out of step by more than 50 cycles per second either way. Punishment will follow offense. May be they'll put the monitors in the guardhouse.

A. B.

MICROPHONE NOTES

While enroute to a recent football game, Bill Munday, the Georgia drawl, and Arthur McNulty another football commentatator, picked fourteen winners out of a possible fifteen. The only game they failed to predict correctly was the contest they later announced.

* * *

Russ Columbo was christened Ruggiero, after a historical warrior of ancient Italy. The English translation of Ruggiero is Roger. In the movies Columbo was known as Roger Russel.

Station Sparks

By Alice Remsen

Arabian Fresco

(ARABESQUE, WABC, 10.30 P. M. TUESDAY)

SILHOUETTED against the Eastern sky,
A noble frieze of camels, homeward bound;
Trembling on the air there comes the cry
Of dark-robed muezzin, while all around
The faithful sink to knees in fervent prayer.

Gray swirling sands drift high about our tent;
The milch goats, tethered near, begin to bleat;
And to our hungry nostrils there is lent,
Odor of sour milk and cooking meat,
Beneath the torrid sun's now softened glare.

Preying buzzards circle overhead,
Soaring high with fearsome, outspread wings.
An Arab stallion whinnies to be fed,
As plaintively a camel driver sings,
And swiftly comes, the night with cooler air.

The gloomy desert, sullen mother, broods—
Waiting for the early coming light;
The grayish dawn that laughingly intrudes,
Driving away the drama of black night—
A laughing houri, dewdrops in her hair.

The desert wakes and starts another day.
The tents are struck, the camels rise and wait.
The stately caravan moves on its way,
Journeying slowly toward an unknown fate—
Only the desert stays forever there.

A. R.

* * *

If you are fond of romance, mixed with thrills, tune in on Arabesque. It will provide you with both. Yolande Langworthy originated this series and when she left WABC the good work was continued by Georgia Backus, who does a very fine job on both the writing and acting of this mysterious desert play.

* * *

In newspaper offices of several widely-separated American cities Peter Dixon was known as a fast rewrite man; but never did he do a faster job, and his effort was purely creative, than in writing a recent script for "Raising Junior," the domestic skit in which he and his wife had starred over the NBC networks.

An hour before the program was due on the air Dixon discovered the script had been lost. He rushed to a typewriter, typing more than twenty pages of dialogue from memory in an hour, while Raymond Knight, of station KUKU, who also is heard on the Dixon program, contributed a hastily written humorous poem.

The result: "Raising Junior" was heard without rehearsal, and was highly rated by NBC program executives.

* * *

The Gordon String Quartet, one of the best-known chamber music groups in either Europe or America, has commenced a series of five concerts on the Sunday morning musicale over an NBC-WJZ network from 11:30 a. m. to 12:30 p. m. The first concert was given on November 8. Succeeding performances will be given on November 15 and 29, and on December 6 and 13.

The Gordon String Quartet was organized ten years ago in Chicago by Jacques Gordon, then in his early twenties, and has worked together continuously since. In addition to Gordon, who plays the first violin, the organization includes Ralph Silverman, second violin, Paul Robyn, viola, and Nacum Benditzky, cello.

* * *

Elizabeth Hines, who will be remembered on Broadway as the star of "The O'Brien Girl" and "Nellie Kelly," was one of the guest artists on "Footlight Echoes" over Station WOR on November 8. She sang two numbers from the afore-mentioned shows and proved to have a sweet, melodious voice. She confessed to being rather scared of the "mike," as all professionals are when they first face that funny looking instrument; nevertheless, Miss Hines gave a very creditable account of herself. She possesses a charming personality and a lovely smile.

The second guest artist to grace the program was the distinguished baritone, Bertram Peacock, who was the original Franz Schubert in "Blossom Time" when it opened at the Ambassador Theatre, and who played the role continuously for five years. His voice is of that rich quality, so stirring to the heart; his delivery smooth, his dramatic intonation excellent. Mr. Peacock sang the Daisy duet with Maria Cardinale, and two solos from "Blossom Time," also enacting a short scene from the second act.

* * *

The "Evening in Paris" program, featuring Pierre Brugnon and Max Smolen's orchestra, recently celebrated its 150th performance on the air, and thus offers one of the oldest commercial programs still being broadcast. Considering its suspension during the summer months, it is well over three years ago that the program made its public bow. For this anniversary broadcast special features were heard, including Delphine March, who appeared on the first "Evening in Paris" program, as well as such outstanding guest artists as Del Staigers, cornetist; Lou Raderman, violinist; and Frank Banta and Milton Rettenberg, pianists.

* * *

SIDELIGHTS

LEWIS REID, program director of WOR, is a product of the Drama Department of Columbia University. . . . BEN BERNIE likes novelty numbers. . . . PRYOR'S BAND was organized by the present leader's father, Samuel D. Pryor in 1869, Arthur Pryor succeeded to the leadership in 1903. On October 31 of this year the band celebrated its 62nd anniversary. . . . LEE MORSE has opened on a tour of the R-K-O vaudeville circuit. . . . RAY PERKINS believes that "the best ten years of a woman's life is from 29 to 30". . . . THE MYSTERY CHEF is a Scotchman. . . IRENE TAYLOR was born in Cape Girardeau, Mon. . . VERNON RADCLIFFE is to be congratulated on the birth of a nine-pound son, born November 5. He has two other children. . . B. A. ROLFE is taking his first vacation in seven years. . . RAY COLLINS has played over 900 different parts on the legitimate stage. . . HARRY C. BROWN has played parts in more than 400 plays. . . KATE SMITH is an accomplished swimmer. . . MYRON NIELSEY was once the city manager of a small Kansas town. . . EARL HINES started in life as a bootblack, worked up to a barber, and then deserted it for piano playing.

* * *

Biographical Brevities

About John F. Royal

John F. Royal was born on the Fourth of July in Cambridge, Mass., and he has been in the midst of the fireworks of human life ever since—first in odd jobs for citizenry of his home town, next as a Boston newspaper man, then a showman, now a radio executive.

The broad - shouldered, genial man smiles when reminiscing; "When I was a school boy, I was the kind of kid who always wanted to put on shows," he said. "If anyone wanted showbills passed around, I would do it for nothing just to get in."

Office Boy On Newspaper

His father died when John was a boy and the gangling highschool kid "got on" as the night office boy for the Boston Post. He became a full-fledged reporter when eighteen, covering everything from opera to sports. Later he was on the city desk and was assistant city editor when B. F. Keith hired him as a vaudeville press agent.

That happened in 1910. In two years he was managing the Keith Theatre in Cincinnati, Ohio. The first time I met Mr. Royal was in 1923, when I was playing Keith's 105th St. Theatre in Cleveland and Mr. Royal was then managing the new Palace Theatre, built by E. F. Albee, in memory of his lifelong friend and associate, B. F. Keith. Mr. Royal was most gracious and showed me over the beautiful new theatre in person. I thought then what a progressive spirit he possessed, for even at that time he was very interested in radio and had receivers installed in the theatre dressing rooms. He was the first man to put vaudeville on the air from a little station in Cleveland, and Rae Samuels was his headliner on the first program.

700 Phone Calls a Day

In 1929 Mr. Royal deserted Big Time vaudeville, in which he had attained high position, and took over the directorship of WTAM, Cleveland. What he did with that station is radio history. It is known as one of the finest stations in the world. In 1931 he came to New York and assumed the position of director of National Broadcast Company programs; he has since been made a vice-president of that company.

Today John F. Royal is one of the busiest men in the world. He gets on an average of 700 telephone calls a day, grants about thirty interviews daily, and works from 9:30 in the morning to 11:30 at night.

He is a man of imagination, initiative and brain; a quick thinker, full of action, but willing to listen to two sides of a story before coming to a decision. He has gentle manners, a great knowledge of human nature, rather self-effacing for such a big man, is kind and wise, and altogether the ideal man for directing the activities of his fellow human beings.

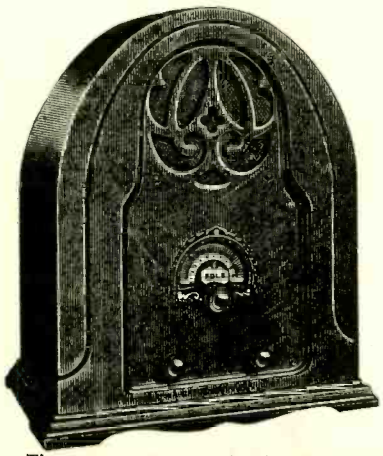
SUNDRY SUGGESTIONS FOR WEEK COMMENCING NOVEMBER 22

Sun., Nov. 22: Romances of the Sea WABC—9:30 p. m.
Sun., Nov. 22: Footlight Echoes WOR—10:30 p. m.
Mon., Nov. 23: Raising Junior..WJZ—6:00 p. m.
Mon., Nov. 23: Singing Sam...WABC—8:15 p. m.
Tues., Nov. 24: Alice Joy....WEAF—7:30 p. m.
Tues., Nov. 24: Arabesque...WABC—10:30 p. m.
Wed., Nov. 25: Bing Crosby and Carl Fenton ....WABC—7:15 p. m.
Wed., Nov. 25: Frank Parker and Quartette ....WOR—10:00 p. m.
Thurs., Nov. 26: "Sherlock Holmes" WEAF—9:30 p. m.
Thurs., Nov. 26: Weaver of Dreams WOR—10:00 p. m.
Fri., Nov. 27: March of Time WABC—8:30 p. m.
Fri., Nov. 27: Slumber Music..WJZ—11:00 p. m.
Sat., Nov. 28: Nick Lucas....WEAF—7:00 p. m.
Sat., Nov. 28: Little Symphony WOR—8:00 p. m.
Sat., Nov. 28: Civic Opera....WJZ—9:00 p. m.
Sat., Nov. 28: Ann Leaf and her organ WABC—11:45 p. m.

(If you care to know something of your favorite radio artists or announcers, drop a card to the conductor of this page. Address, Miss Alice Remsen, care Radio World, *145 West 45th St., N. Y. City.)*

TWO NEW POLO PRODUCTS

Direct from Manufacturer to Consumer



Three - gang Stator - shielded Condenser with trimmers; full vision, illuminated dial; volume and switch control; tube shields for radio frequency and detector; 16 mfd. filter capacity. Rola dynamic speaker, 8", 1932 Model. Gothic Walnut Cabinet 19" high. Tubes used (2) 235; (1) 224; (1) 247; (1) 280. For 105—120 v., 50-60 cycles. Cat. PMT....$23.00
Chassis, Speaker, Cat. PMC..$14.95
Kit of Licensed Tubes, Cat. PT $4.00

BUILT FOR ITALIANS—GETS THE ITALIAN STATION, TOGETHER WITH 50 TO 60 OTHER STATIONS EACH NIGHT IN NEW YORK AND VICINITY

POLO MIDGET

$19.00

Complete with Kit of Arcturus or National Union Tubes $23.00

For $23.00 you receive a complete guaranteed and unequalled receiver, ready to operate

BLUEPRINT NO. 627 IS BASED ON THIS CIRCUIT

Our Unqualified Guarantee

We guarantee that the Polo Midget, Cat. PMT, is absolutely leader in its class, with unequalled Sensitivity, Thrilling Tone and Real Selectivity. Buy one—try it for five days. If you find as good a set at twice the price, or for any other reason don't desire to retain the set, we will promptly refund the purchase price. No other manufacturer thinks *that much* of his set.

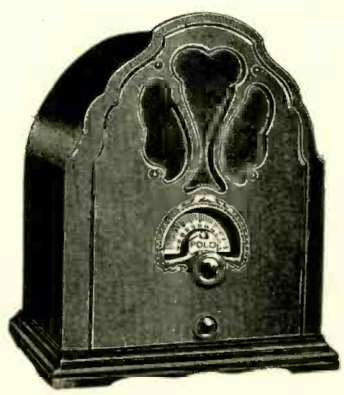
If you desire a 5-tube set at a lower price we have it.

POLO JUNIOR MIDGET

The Polo Junior Midget, Complete with Arcturus Tubes (Cat. PJMT)

$18.00

Chassis with speaker, $12.95 Cat. PJC.



Full 5-tube set with 8" power dynamic speaker. The same tubes used as in the Polo Midget, with handsome Walnut Cabinet, 15½" high, 9" deep, 11½" wide. The same guarantee as on Polo Midget.

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