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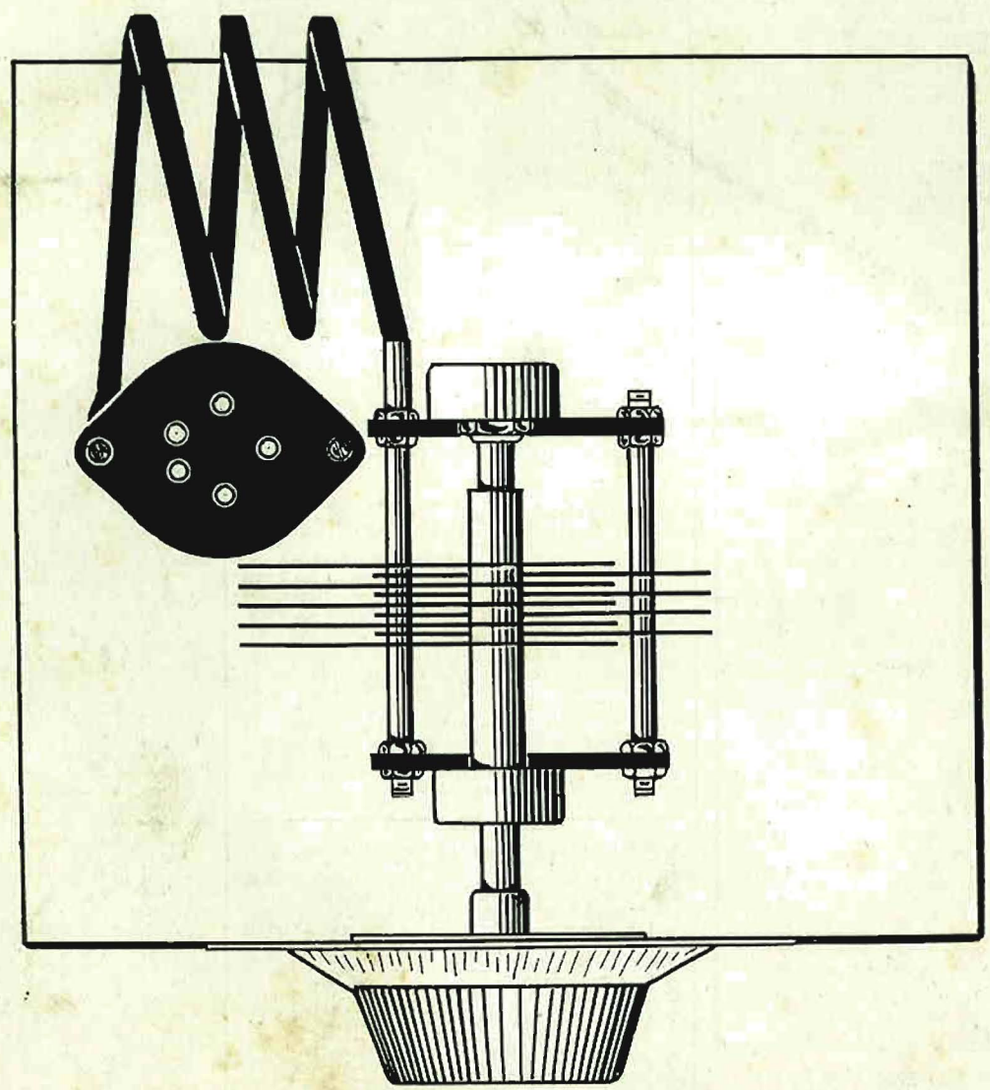

Much interest attaches to an oscillator that will oscillate to 40,000 kc or so. This layout is of such an oscillator. See page 8.

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ELEVENTH YEAR

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Padding Simplified

Calibrated Oscillator Reduces Work

By J. E. Anderson

ADJUSTMENT of superheterodynes still offers difficulties to both amateur and some professional set builders. This is true even though oscillators are available with which to do the adjustment. It is still more difficult when no oscillators are available.

The trouble is not so much that the work is inherently difficult, for it is not, but rather that the builder does not know the procedure to follow, or perhaps that he does not know the principles of the superheterodyne and of padding particularly.

Although it is of great help to understand the subject thoroughly, it is not essential in order to do a good job of adjustment. We speak here of adjustment rather than of padding because the padding essentials are supposed to have been worked out beforehand by somebody who has a thorough grasp of the problem, and when the circuit gets to the builder it is only a matter of adjusting a number of condensers.

Requirements

There are several requirements which must be met before any superheterodyne will work correctly. First, all the intermediate frequency circuits must be tuned to the same intermediate frequency, and this should be as close as possible to the frequency for which the oscillating circuit in the receiver was designed. Second, all the r-f tuners must be alike in the characteristics so that no matter what the setting of the gang condenser the r-f tuned circuits, if two or more, must be tuned to the same frequency. Third, the oscillator must be adjusted so that the frequency of oscillation at any setting of the gang condenser is higher than the natural frequency of the r-f circuits by the amount of the intermediate frequency. In case of lining up the intermediate circuits there may be an exception when we are ultra-particular, but for practical purposes there is not. The exception is that each tuned circuit should be in resonance with the same frequency when one is not in the presence of the other. But this is a fine point that need not worry any one, for it is of relatively little importance. It is sufficient to tune each i-f circuit to the same frequency, or until the signal is loudest, for loudest signal is most desired.

Building the I-F Amplifier

The first thing that should be done is to tune the intermediate amplifier to the desired frequency. The question now is to get the desired frequency and to be sure that it is that and no other. For this we need an oscillator, preferably one that is modulated. It does not matter much what the modulation is, just so it is audible. Many utilize nothing but the circuit noise that is present in most instances.

Let us assume that no oscillator covering the intermediate frequency is available. Then one can be constructed temporarily in a short time. To be sure that this oscillator will cover the intermediate frequency desired start with a transformer exactly like the transformers used in the intermediate amplifier, including the tuning condensers. Hook up this transformer in a circuit like that in Fig. 1, using a 237 or a 227 tube. If a-c is used on the heater there will be a slight modulation, especially if no part of the heater circuit is grounded. It is enough to apply 45 volts on the plate, although both higher and lower voltages can be used if desired.

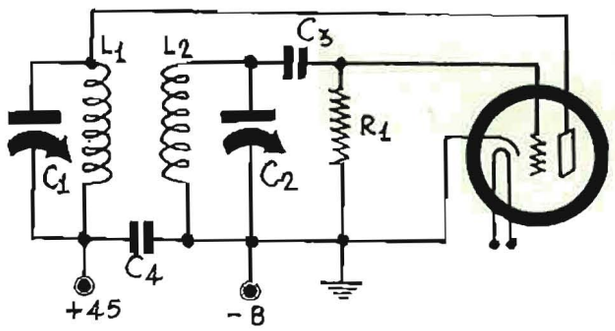

FIG. 1

A simple intermediate frequency oscillator built of an intermediate frequency transformer and using a heater type tube.

Tuning the I-F Oscillator

Now we have to tune the i-f oscillator to the desired frequency. Since we have selected a transformer which covers only a small band of frequencies about the desired frequency, this part of the work is comparatively easy. Suppose, for example, that we have a 175 kc oscillator. The fourth harmonic of this frequency is 700 kc. Let us tune a broadcast set to 700 kc or to the nearest broadcast station that can be tuned in. Fortunately, in this case, 700 kc is used by a high power station centrally located in the country so that most receivers of fair sensitivity can be tuned to it.

When this station has been tuned in, adjust the two condensers C1 and C2 in Fig. 1 until the heterodyne squeal is loudest. The object of making the squeal loudest is only to insure that both the tuned circuits in Fig. 1 are tuned to the same frequency. Then turn both condensers in the same direction until zero beat is obtained. The frequency of the oscillator is then 175 kc.

If 700 kc cannot be tuned in, tune in 690 or 710 and adjust as before. In this case adjust until the beat frequency is near the upper audible limit, that is, about 10,000 cycles per second, but detune by this amount in the direction of 700 kc. This is easily done if we first tune to zero beat and then detune. If we are dealing with 690 kc we have to detune by turning the adjusting screws to the left so as to increase the beat by 10,000

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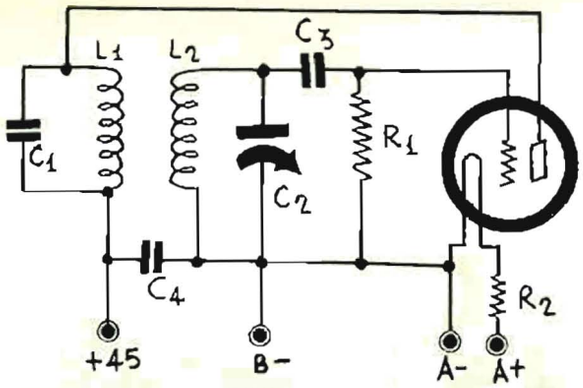

FIG. 2

The same oscillator as in Fig. 1 but using a small battery tube that may be heated by a dry cell.

(*Continued from preceding page*)

cycles. If we are dealing with 710 kc we have to detune by turning the screws to the right in order to make the fourth harmonic about equal to 700 kc. Even if we tune to zero beat in either case, we are off only 2,500 cycles from 175 kc. Hence we cannot make much of an error, and that error would not make any difference. However, since we have the means of avoiding even that error if only we have signals of 690 or 710 kc available we might as well apply it. The means is detuning in the proper direction by an amount equal to 10,000 cycles, or until the beat ceases to be heard.

Using the Oscillator

Now we have to make use of the oscillator. Hook the set up ready to play. Set the oscillator going. Between the plate of the oscillator and the grid cap of the first detector connect a very small condenser. Tune each i-f circuit until the noise in the loudspeaker is greatest. If there should be blocking of the grid, connect a grid leak between the cap of the first detector and the chassis of the set under test. If no noise can be heard it may be that the coupling is too weak. It can be increased by increasing the coupling condenser.

Let us assume that we got a noise the first time and that we have increased its intensity to a maximum by each one of the trimmer condensers in the i-f amplifier. As soon as this has been done the tuning of the amplifier is completed and we should not touch the intermediate tuning condensers again. When the oscillator is coupled to the grid cap of the first detector the clip normally belonging to that cap should not be connected.

If there is no noise in the speaker due to a complete lack of modulation, we have to introduce some noise. It is possible to adjust the grid leak R1 in the oscillator so that the circuit becomes self-modulating, that is, so the oscillator blocks at a high rate. The best way in insuring this is to use a very high leak resistance. It may be that a modulation will be obtained when no leak is used at all. Nearly always, however, there is noise in the amplifier that can be used as a guide. It may be only a hiss.

We have now tuned the intermediate amplifier to the desired intermediate and we had to construct an oscillator to do it. We now proceed with the next essential step.

Tuning the R-F Circuit

The r-f circuits must be tuned so that they are always in resonance with the same frequency. We have assumed that the tuning coils have been made for us and that the tuning condensers are all in one gang. When this is the case we have only to worry about the tuning at the high frequency end of the tuner, that is, we have only to adjust the trimmer condensers at the high frequency end. However, we must make sure that we do not miss out on the highest frequency, that is, 1,500 kc. We want this to come in at about 5 on the dial, assuming a 100 legree dial.

If we have a 1,500 kc signal handy we have no trouble. We only have to set the main dial at 5 and then tune the trimmers of the r-f condensers until this signal is loudest. It does not matter whether the signal comes from a modulated laboratory oscillator or from a broadcast station. If we have neither an oscillator nor a 1,500 kc signal from a station, we can use the next best, a signal from a station on 1,490 kc. In that case we would have to set the condenser a little higher, say at 5.5. And if we are compelled to use a still lower frequency before we can get a station, we advance the dial just a little more. Remember that the stations are crowded at this end and we cannot set the dial too far up.

Calibrating the R-F Circuit

Well, let us assume that we have succeeded in trimming the circuit to a station between 1,450 and 1,500 kc. We are then reasonably sure that it is trimmed at the high frequency end and that 1,500 kc will come in above zero on the dial. The trimming at the low frequency end will be good if the tuning coils are right, and we have depended on the manufacturer of the coils for that.

The next step is to calibrate the r-f circuit, which is really a part of the adjustment of the oscillator, or it is preliminary to that adjustment. We are not particularly interested in the entire calibration curve but only at two points near the ends of the dial. For example, we want to know where on the r-f tuner 1,450 kc comes in and also where 570 comes in. These two points are about the best but it is all right to select any frequency between 1,500 and 1,400 kc and also any frequency between 550 and 600 kc. The point is that whichever two we select we want to know where they come in on the r-f tuner. If we have a calibrated oscillator we can choose any two we like, but if we have not, we have to use the best broadcast frequencies that we can pick up.

We next convert the receiver to a t-r-f set by connecting the grid clip, G1, Fig. 3, that normally goes to the cap of the first detector to the cap of the second, using the shortest lead that will make the connection. The grid clip that normally goes on the second detector should be removed and kept away from the cap. That is, we eliminate the intermediate frequency amplifier and the first detector entirely by moving a grid clip. The oscillator might be killed by short-circuiting the tuning condenser, but it is not necessary. Now tune in a station near each end of the dial and note exactly where each comes. Let us assume for the sake of illustration that the two stations come in at 6 and 92 on the dial of the r-f tuner.

Trimming at Low Wave End

Restore the circuit to a superheterodyne by connecting a clips where they belong and by starting the oscillator if it had been stopped. Now set the main dial of C, Fig. 3, at 6. Very likely nothing will come in. Now tune in the same signal as was received on 6 when the circuit was a t-r-f set, using only the trimmer, C1, Fig. 3, on the oscillator condenser, and make the signal as loud as possible. If it becomes too loud in the process make use of the volume control to cut it down and after that tune for maximum with the trimmer on the oscillator. Do not touch the trimmers on the r-f condensers at this point of the adjustment. If you do, you have to start all over again, except tuning the intermediate. And don't touch the intermediate trimmers for if you do you are back at the very beginning.

Trimming at High Wave End

Now set the dial, of C, Fig. 3, at 92. Then adjust the series condenser, C2, Fig. 3, that is, the adjustable condenser in series with the oscillator section of the gang condenser, until the station that came in at 92 when the circuit was a t-r-f set is again as loud as possible. Reduce the amplification with the volume control if necessary. Nothing at all but the series condenser should be touched during this adjustment, except, when necessary, the volume control. If any condenser other than the series condenser is readjusted at this point it is necessary to start at the beginning and do the work over again.

It may be that this adjustment at 92 slightly throws out the adjustment at 6. Hence the dial should be returned to 6 and the adjustment made there again. Only a slight touch on the trimmer condenser should be needed, if any at all. This readjustment at 6 will have a negligible effect on the adjustment at 92 so that it is not necessary to readjust there. The circuit is now adjusted and the tracking should be good throughout the dial. As a test, turn the dial slowly from one end to the other and note the sensitivity, the selectivity, and particularly the heterodynes. If the padding is not good the heterodyne squeals at some points will be strong. If the padding is good they will hardly be audible at the worst points.

Adjustment Procedure

In the preceding paragraphs it was made clear that the adjustment of a superheterodyne for good tracking must be done in a certain order and that there are several essential steps in the process. In order to set the process down more definitely let us call the intermediate frequency f, the high signal test frequency F1, and the low signal test frequency F2. Then we can set down the following procedure:

(A)—Tune each of the tuned circuits in the intermediate amplifier to f. For this purpose the signal of frequency f should be put into the circuit at the grid of the first detector, first removing the grid clip normally on that grid.

(B)—Convert the circuit to a t-r-f receiver by moving the grid clip belonging to the first detector to the cap of the second detector, using as short a wire as possible and leaving nothing else on the second detector grid.

(C)—Set the dial on about 6 and with the trimmers of the r-f tuning condensers tune in F1 as accurately as possible.

(D)—Turn the dial until F2 comes in loudest. Note carefully what the dial reading is. Let us assume here that it is 92.

(E)—Restore the circuit to a superheterodyne by connecting the grid clips where they normally belong.

(F)—Set the dial on 6. With the trimmer C1, Fig. 3, on the oscillator condenser alone tune in F1 very carefully.

(G)—Set the dial on 92. With the series condenser, C2, Fig. 3, alone tune in F2 until this signal comes in as loud as possible.

(H)—Return the dial to 6 and with the trimmer on the oscillater alone readjust for F1 until this signal is as loud as possible.

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Where to Make Super Adjustments

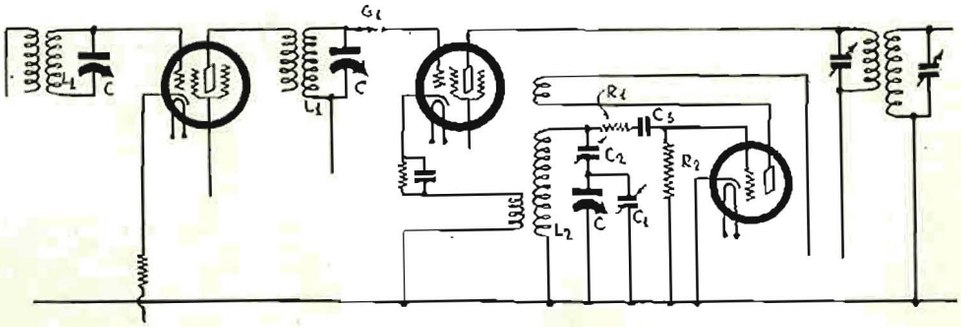


FIG. 3

This sketch shows a part of a superheterodyne to illustrate the various adjustments to be done. The trimmers across the first two are adjusted for r-f. C1 is adjusted for low waves and C2 for long waves.

(Continued from preceding page)

(I)—Check the padding throughout the range of the dial, noting sensitivity, selectivity, and the intensity of heterodyne squeals. Also check coverage at both ends of the dial. That is, make sure that 1,500 kc comes in above zero on the dial and that 550 kc comes in below 100.

Retrimming the Circuit

In C, F, and H we have assumed that the test frequency F1 comes in at 6 on the dial. It may not be possible to make it come in at that setting or it may be that frequencies higher than F1 will not come in above zero on the dial if 6 is chosen. Hence F1 should be tuned in with the trimmers at such a point as will insure that all frequencies higher than F1 will tune in properly. Depending on the value of F1 chosen, the low setting may be either less or greater than 6 by a small amount.

In D and G we assumed that the signal F2 came in at 92 on the dial. Just where it comes in will depend on the value of F2 and also to some extent on the adjustment at F1.

In case the check-up suggested in (I) shows that the coverage is not satisfactory at either end, and if there is room at the other, a resetting of the trimmers of the r-f condensers will help, particularly at the high frequency end. It should be remembered that there is very little change in the capacity of the variable condenser between 5 and zero so that for practical purposes it may be assumed that zero and 4 are about the same. But between 4 and 6 many channels can come in. In retrimming all the work should be repeated except the tuning of the intermediate amplifier.

Use of Calibrated Oscillator

While the adjustment can be made without a calibrated and modulated oscillator covering the broadcast band, it can be done much more simply with the aid of one. For example, if we can provide a signal of 1,500 kc we can always set the main tuning control, C Fig. 3, at a low value, say 4 or 5, and then adjust the trimmers on the r-f condensers until the 1,500 kc signal comes in loudest. This done we can set the calibrated oscillator at 1,450 kc and then find out by turning the main condenser where this comes in. This would be F1. Again, we can also set the modulated oscillator at 570 kc and then turn the dial to find out where this comes in loudest. This would be F2. During the work the receiver should be connected as a t-r-f set.

When we are ready to adjust the oscillator the modulated and calibrated oscillator is equally useful. We convert the circuit to a superheterodyne and set the main condenser where 1,450 kc came in. Then we set the oscillator at this frequency and tune it in with the trimmer on the receiver oscillator, that is, C1 Fig 3. This done we turn the dial to where 570 kc came in and also set the calibrated oscillator at this point. Then with the series condenser, C2 in Fig. 3, we tune to maximum signal. There is no guesswork in this and if the tuners do not cover the band we know it right away.

D-C Intermediate Oscillator

In Fig. 2 we have a battery operated intermediate frequency oscillator of exactly the same type as the oscillator in Fig. 1. This can be used in cases where no alternating current is available or where it is not convenient to use the circuit in Fig. 1. The coils and condensers both oscillators may be the same. If the tube in Fig. 2 is a 230, the filament voltage may be obtained from two No. 6 dry cells connected in series. The ballast resistance R2 in this case should be either 15 or 20 ohms. If the intermediate transformer is available this oscillator can be hooked up in a few minutes and the time required to build it is more than saved in tuning the intermediate oscillator, and then we have the certainty of the intermediate frequency as a net profit for the work.

There is no provision for modulating the circuit in Fig. 2, but it may be modulated by using a grid leak of excessive value. If unfiltered direct voltage is applied to the plate of the tube the modulation can be obtained that way. It is well worth while to build one of these oscillators for it requires only an additional intermediate transformer with a few extra small parts which are usually lying around.

Philco Gives Converter Advice

Philco in its Service Bulletin No. 127, "Operating the Short-Wave Converter," says in part:

"With a good aerial and ground, reception of foreign stations is obtained not on rare occasions only, but with a considerable degree of regularity. Such reception, however, cannot be had simply by turning the dial. It is necessary to use one of the various short wave station logs to know where to find the stations, and it is necessary to know when the stations are on the air. In the eastern part of the United States, for example, it is almost impossible to hear any European stations after seven o'clock in the evening because practically all of them are off the air. It is midnight in London and 1 a. m. in most of continental Europe. A fair aerial, used in conjunction with a powerful broadcast receiver, may give wonderful distance reception on broadcast, but may give poor results on short waves. Investigation will usually show in such cases that the aerial or lead-in is too near the ground or too near large metal surfaces or other grounded objects. Short waves are far more susceptible to such unfavorable conditions than standard broadcast waves. A good aerial out in the open will always give the best possible results.

It is suggested that every distributor's serviceman make a demonstration and a detailed explanation to his salesmen so that they, too, can become convinced of the remarkable possibilities of short wave reception and can go out and sell dealers on performance. The following points should be brought out forcibly, for it is only by their careful observation that successful short wave reception can be obtained.

1. A good aerial and ground are absolutely essential.

2. A knowledge of the station frequency in kilocycles or megacycles is necessary so as to avoid "hunting."

3. Time differences should be borne in mind; the set should not be condemned for lack of reception when there are no stations on the air.

4 Tuning is extremely sharp; it is easily possible, even when turning the dial slowly, to pass over a number of stations without knowing of their presence. The comparatively small distance on the dial between 10 and 11 megacycles, for example, covers a greater tuning range in kilocycles than the entire distance from top to the bottom of the scale on the broadcast receiver.

5 Divide tuning time in the following manner: 19 to 15 megacycles from day break until about 2 p. m.; little can be heard in this range after darkness falls between the transmitter and the receiver. From 15 to 9 megacycles, stations to the east are heard from noon until about 10 p.m.; stations to the west are heard from 10 p. m. to shortly after daybreak. From 9 to 4 megacycles, darkness is required to give the signal carrying power; tuning should be done after darkness falls. The above applies to distant stations only; many local and nearby stations will be heard at all hours.

Short wave DX reception is largely a matter of tuning.

A Simplified Oscillator and a Neu Detector Tube Ser

By Thomas .

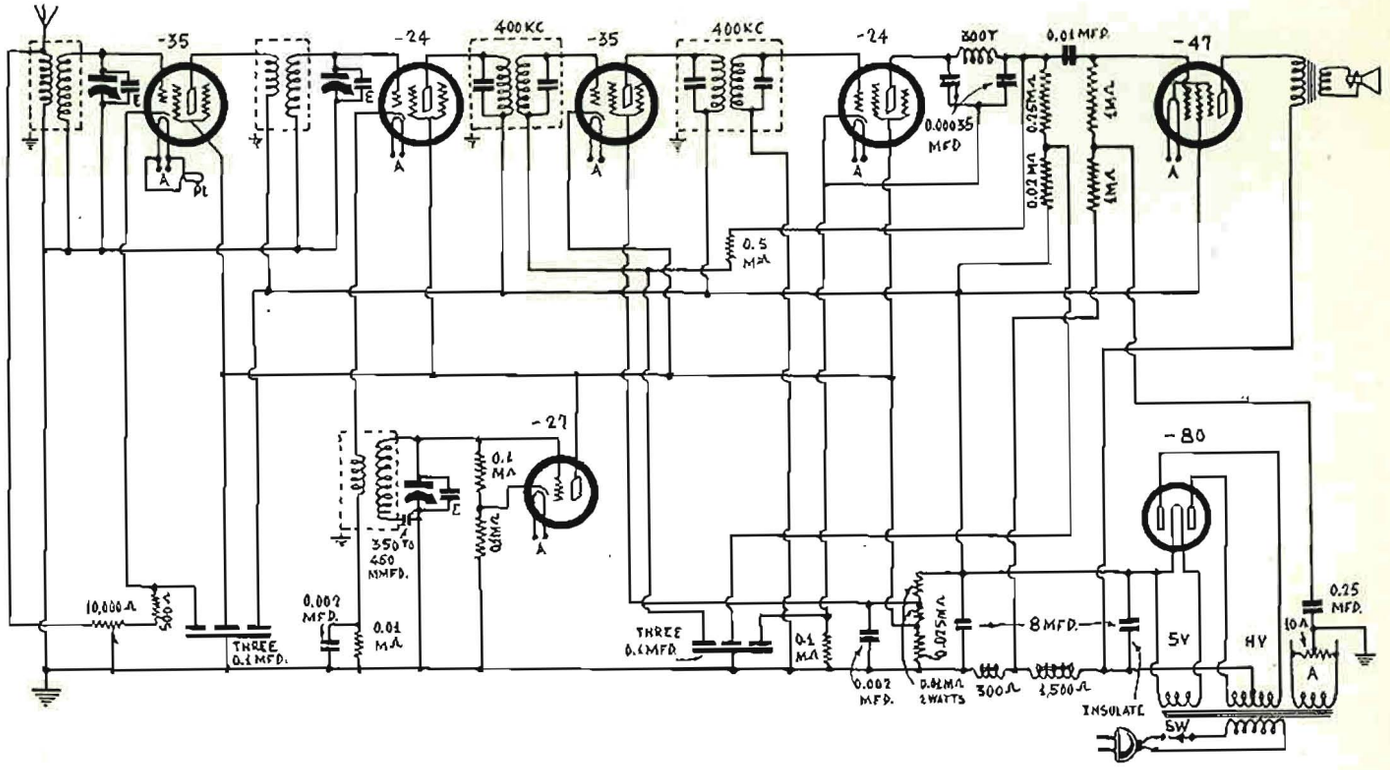


FIG. 1

THE two circuits, Figs. 1 and 2 herewith, include some unusual features, have some points in common, others that differ considerably, but in general meet to the ends they are intended to serve.

Considering first Fig. 1, we have a broadcast receiver, 200 to 545 meters, consisting of a superheterodyne with one stage of t-r-f, separate modulator and oscillator, one stage of 400 kc intermediate frequency, detector, one stage of resistance coupled audio feeding a pentode output tube, and a rectifier circuit.

The t-r-f stage increases amplification, hence sensitivity, but it also increases selectivity, which is its principal purpose. The reason is suppression of image interference. Even with 400 kc the possibility of image interference is considerable. The limits can be obtained by adding twice the intermediate frequency to the lowest signal frequency, or 800 + 550 kc = 1,350 kc, and by subtracting 800 from the highest frequency, or 1,500 — 800 = 700 kc. So between 700 kc and 1,350 kc one must safeguard against trouble. The extra selectivity as obtained from the t-r-f stage will suffice as a solution.

Slightly Negative Bias

In the oscillation circuit we find a suggestion for obtaining oscillation without a coil in the plate circuit, in fact the plate circuit is grounded to radio frequencies. Two equal resistors are put from grid to ground and the joint or center is connected to cathode. The bias is theoretically zero, since the grid and cathode are at the same d-c potential. However, grid current will flow, and as it does the bias on the grid will be a little negative, due to the drop in the resistor between cathode and grid.

Oscillation should result if the resistors are of equal value. There will be oscillation over at least some of the band, but to increase the tendency to oscillation the lower resistor, from cathode to ground, may be increased in value.

Plate current is flowing in the cathode circuit, and with any values of resistance, all the plate current will flow through the lower section, as the padding condenser is so placed that it stops d-c from flowing to ground in its direction.

The cathode of the intermediate amplifier (—35) is tied to the screens of other tubes. All voltages must be reckoned from the cathode. So, if the screens of other tubes are at 90 volts positive, and the total voltage is 250 volts, then 160 volts are available for bias and plate voltages for the intermediate amplifier.

The control grid of the —35 therefore must be returned to a point negative in respect to cathode. This should be negative by the amount of the steady bias for the —35 tube. Suppose this is taken as 3 volts. With no signal in the receiver, the plate of the detector is established at 3 volts lower than the screen of the detector and cathode of the intermediate amplifier. The resistor marked 0.02 meg. in the detector plate circuit can be of such value as to accomplish this, or the load resistor may be increased or decreased to serve the purpose, or the detector biasing resistor changed accordingly. Some practical data on the solution of this problem will be given presently.

The grid of the intermediate tube has a resistor in series with it, and a bypass condenser to ground the grid return, this filter circuit being advisable to reduce greatly the effect of audio-frequency fluctuations on the feedback, that is, to cut out the modulation from the feedback.

Since the cathode of the controlled tube is at a d-c voltage 90 volts above ground, if the screen of that tube is to have a

Peeking into

The Limiting Filament Resistor for Air-Cell Battery Sets

LITTLE HAS BEEN PRINTED in the radio press about the technical requirements for use of the air-cell or "breathing" battery, and when letters are sent to the National Carbon Company, manufacturers of these devices, asking for information for the purpose of printing it, the letters are not always answered.

It so happens there has been a good deal of grief in connection with the conversion of sets to use the air-cell battery.

However, "Service," John F. Rider's magazine for service men, in its March issue the first instalment of an article by G. M. Reed that goes into the problem carefully. The information is of extreme value because the air-cell batteries are obtainable by service men, some use them for sets they build or convert, and the reason for failure has not been clear to them. It is true that the manufacturer discountenances such conversion and tries to restrict the sale of the cell to authorized purposes, but the life of the cell is limited, replacement is required, this is a service man's job, and the cells are readily obtainable, as almost everything in radio has been, despite restrictions.

The ampere-hour rating is about 600. The air cell is to be used with 2-volt tubes. The discharge rate should not ex-

Automatic Volume Control; es Dual Function in Clever Circuit

Ruddimore

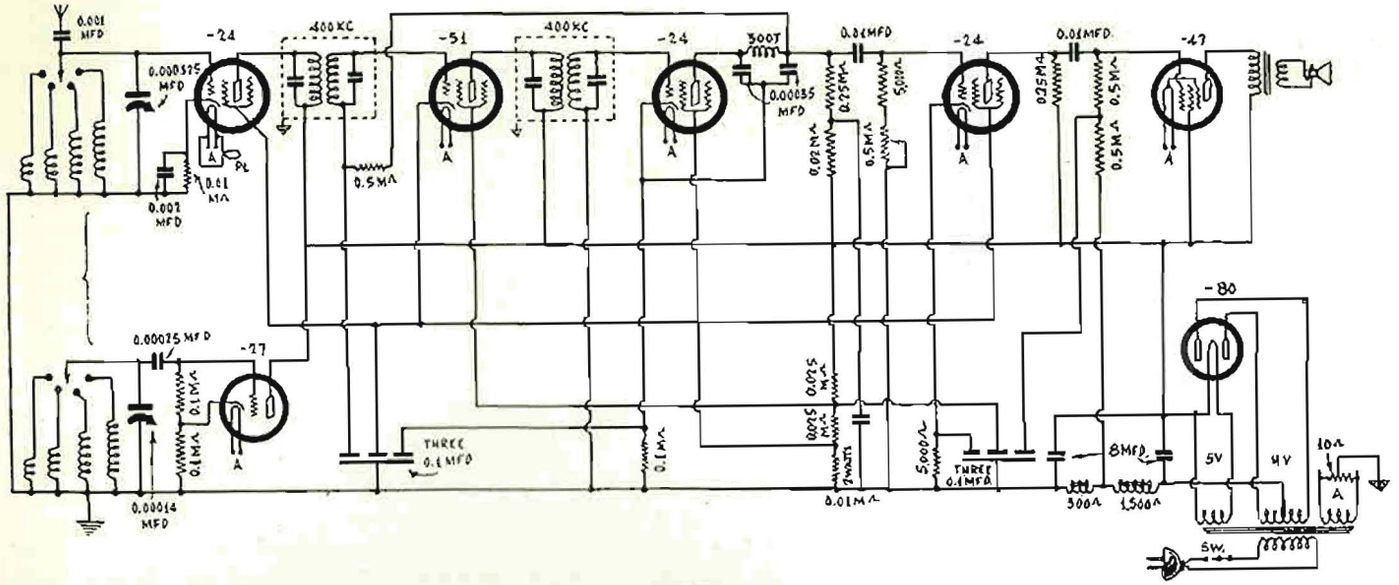


FIG. 2
Coverage of 15 to 545 meters is provided by this superheterodyne, with greatly simplified coil system in the mixer circuit.

positive voltage a special voltage must be taken off for that purpose. Hence the screen is lifted to about 170 volts above ground, giving an effective screen voltage of 80 volts.

The oscillator hookup and the automatic volume control are the only novelties of the circuit.

As for the seemingly difficult task of establishing in the detector plate circuit so small a steady bias as 3 volts negative, previously referred to, the grid return of the intermediate amplifier may be connected provisionally to ground, the cathode provisionally to the cathode of the r-f amplifier, the screen to other screens, and a plate voltage of about 160 volts applied. Then this tube may be measured as to bias, with any voltmeter of suitable range across the cathode to ground circuit, and the volume control adjusted until it reads 3 volts. The plate current reading of the —35 should be taken next, and written down. Then when the circuit is restored to the Fig. 1 formation, the detector biasing resistor may be subjected to substitution until the plate current through the —35 reads as it did when the test was made with the automatic volume control out.

All-Wave Receiver

Fig. 2 affords wide frequency range, and therefore it is not practical to have switching and still include a stage of t-r-f. Twelve coils would be required, and surely eight are enough to worry about. If the modulator and oscillator coils are inductively coupled, four forms will suffice.

Selectivity has to be increased even though there is not another or third tuned circuit ahead of the intermediate channel. Fortunately, there is a way out. If the coupling between antenna and first tube is decreased the selectivity is increased. However, the pickup is reduced sharply. A series condenser of 0.0001 mfd. is shown. It may be a 20-100 mmfd. equalizer, set at maximum.

To atone for the drop in pickup, more amplification must be provided. It is dangerous to try this at the intermediate level, for in terms of intermediate frequency this is pretty high, and oscillation trouble woud be almost certain, and hard to cure. So it is better to use an extra stage of audio. This would produce considerable hum, were not the condenser in the detector plate circuit's resistor-capacity filter of 1 mfd., which will get rid of the resistor-capacity filter in the pentode grid circuit also is included. As an extra precaution, try reversing the connections to the primary of the output transformer as a means of hum reduction. This is in lieu of reversing the field coil connections, which cannot be done in the present circuit, because the field coil is also the B supply choke coil and pentode bias impedance.

Simplified Coil System

With the series condenser, and no primary, there is only one winding required in the antenna circuit, and with the type of oscillator shown, again only one winding, the coil situation is greatly simplified. Separate antenna primaries and separate feedback windings need not be picked up, and thus there is avoidance of a conglomeration of wires leading to and from the coil switch.

The all-wave set is shown with two separate tuning devices—a knob for the modulator, a vernier dial for the oscillator. There is no critical tuning in the modulator circuit except on extremely weak signals. The oscillator alone is calibrated, and therefore one can tune by frequencies, set the oscillator properly, and rotate the modulator knob at random until the signal comes in loudest. On some stations signals are heard no matter where the modulator knob is set, although of course they are loudest at resonance.

There is no tracking problem, particularly as the modulator condenser is large enough to keep pace with the oscillator, which for the lower signal frequencies (broadcast band) otherwise would considerably outrun the modulator otherwise.

For frequency coverage, 0.00014 mfd. in the oscillator circuit will provide the range with four coils, only if the minimum capacities do not exceed 22 mmfd. This is quite practical with a good condenser. The total frequency ratio, maximum to minimum, is almost 37-to-1, so for each coil 2.5 to 1 is required of the condenser, affording 38.2625.

Periodicals

ceed 650 milliamperes. The discharge rate may be a little higher, but the battery life is shortened. Also it is lengthened as the drain is lessened. At 0.6 ampere drain the life is about 1,000 hours. At 0.3 ampere it is about 2,000 hours. The voltage of the fresh battery is about 2.53 volts, the voltage during the normal span of the cell is 2.48 volts, 2.49 or 2.5 volts.

With these facts stated the author goes on to show that not only must the drain be kept within limits for battery life, but that the tubes should be operated at a selected voltage, the "ideal" being 2 to 2.1 volts, although the safe limits are 1.9 and 2.2 volts. The mere application of Ohm's law to a state of facts as determined from a tube chart will not do, the author points out, because the actual current consumption may be greater than 60 ma for the low-drain tubes of this series, and greater than 0.13 ampere for the power tube. If the limiting resistor, in one case cited as 0.673 ohm, is too high, the filament voltage will be too low, and if the limiting resistor is too low the filament voltage will be too high. Around the selection of the correct filament resistor the first instalment pivots, and it turns out to be an interesting problem, in which the resistance of the wire leads, contacts, switches, etc., has to be included. Some manufacturers use uncoiled resistance wire and cut it to proper length for each set.

Mystery Circuit is Solved Theore

20,000 to 40,000 kc Suggested

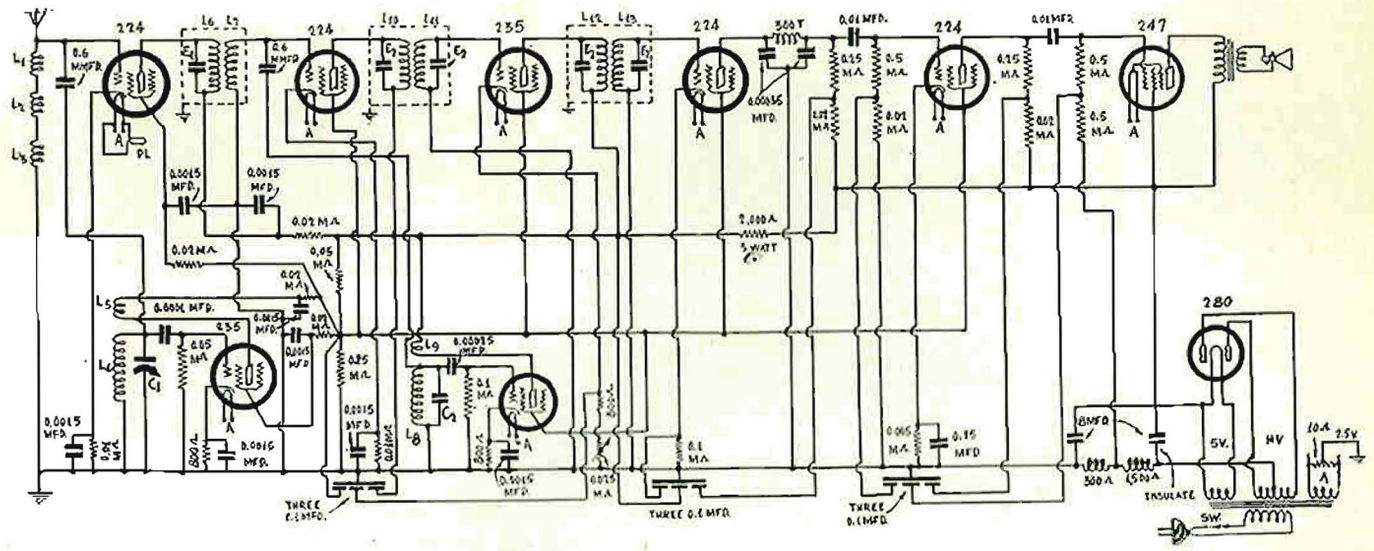


FIG. 1

After having shown a penetration and understanding that left very little to be explained about the mystery superheterodyne, readers have come forward with the final piece of information necessary to complete the theoretical solution. That is the choice of the first intermediate frequency at about 20,000 kc and the tuning range of the manually selected oscillator circuit from higher than 20,000 kc to higher than 40,000 kc.

THE mystery superheterodyne, which has been shown diagrammatically and which readers have been speculating on, now has reached the stage of theoretical solution by readers. Many very shrewd observations were made, and in general the idea was grasped remarkably well. It is to tune in a very wide range of frequencies, say 20,000 to 550 kc, with a single tuning condenser, no repeat points, no switching or plugging-in. The remaining task is to work out the circuit practically.

It can be seen that some very fine work has to be done. The only manually tuned oscillator might have a frequency range of from a little higher than 20,000 kc to a little higher than 40,000 kc, and would produce with incoming frequencies a suitable beat frequency to pass through a 20,000 kc coupler to the second detector.

Some work has been done on such an oscillator, using No. 18 enamel, but oscillation stopped at 30,000 kc. Perhaps the wire produced this effect, for only the higher capacity settings of the condenser produced oscillation, so it is assumed that losses stopped the oscillation at higher frequencies. The trouble was cured with larger wire diameter and other remedies.

It is thus established, however, that an oscillator can be set up readily enough at 20,000 kc, and if the oscillation is removed then we have a suitable coupler to the second detector (second 224 tube from upper left). A third oscillator will have to beat with the first intermediate frequency to produce the second intermediate frequency. In terms of comparative frequencies this difference will be almost microscopic, and it is a problem indeed how to maintain it, for it may be 400 kc out of 20,400 kc. Any variation of its frequency would have a serious detuning effect, or produce response varying from one signal frequency to another. This trouble would not arise in the first instance, that of the manually tuned oscillator, because the transmission band looking into the second detector is wide enough to take care of variations. A band of nearly 1,000 kc is expected. The selectivity will be derived from the second intermediate level.

The mystery circuit has aroused widespread attention and interest, and it is beyond question that when it is worked out properly it will meet a real requirement. Who would have thought of covering so great a band without any kind of switching or plugging-in? Never before has the idea been presented.

It was a pleasure to intrigue our readers with this theoretical masterpiece, and it would be a double delight to be able to present a constructional article, with a performance record, as it is hoped we shall be able to do some day. It will take several months, at least, to engineer such a circuit, we believe, but meanwhile our readers know that something really important is in the air, and they too may address themselves to the solution of the problems involved, for their personal pleasure.—EDITOR.

Frequencies Correctly Chosen

THE FIRST DETECTOR receives all frequencies. To insure an equally high response throughout a wide band this inductance is divided into three parts. Each unit would have a natural resonance different from the other two. The overall inductance would be the sum of the three and the combination would be sufficiently high to give a better response curve than a single inductance would.

Likewise, the distributed capacity, being composed of three

Answers to P

Basic Patent Defined

WHAT is a basic patent? Does this differ from an ordinary mechanical patent?—A. C. Coughlin, Erie, Pa.

A basic patent is properly one which dominates an entire series of patents. For instance the Selden patent, which was later declared invalid, might be called a basic patent on the ground that it covered every present-day automobile in claiming merely the combination of a road vehicle driven by a gasoline engine. All other automobile patents are necessarily subservient to it because requiring its use to make possible their value. The term "basic patent," however, is often used improperly to mean a very broad patent and there are actually but very few true basic patents. An ordinary mechanical patent is in the majority and may be directed to claim very broad and necessary combinations of elements not quite basic but still of possible great value in an art.

* * *

How Long It Takes to Get Patent

IS OBTAINING a patent a matter of months or of years?—A. O. F., Chicago, Ill.

It is difficult to get a patent in much less than a year or two since the various divisions of the Patent Office are from five to ten months behind in their work and each case must come up in its turn for examination. Usually at least two amendments are necessary, each requiring such an examination with its delay. Thus the average time of getting through a simple patent at present is around two years, although the inventor is protected as to priority, since his case is filed, and need not wait for the issue of the patent to exploit it. However, if the prospective patent right is being infringed, it is sometimes possible to have the application made "special" and get it set ahead of its turn for examination, in which case it would be possible to get the patent out in a few months or certainly in less than a year.

ically as Readers "Catch On"; for the Manually Tuned Oscillator

separate units all connected in series, would create a total distributed capacity of rather a low value, adding to the greater efficiency of the pick-up value of the antenna inductance.

The transformer coupling the first and second detectors (two 224's at upper left) is tuned to a predetermined frequency. This frequency naturally will be the result of the frequency of the first oscillator and some signal impressed on the grid of the first detector tube. As the first oscillator is the only tunable circuit in this combination frequency to which the above transformer is responsive it should be of such a value that no interference can occur within the tuning range of the oscillator. As the first detector is not tuned we can assume that all frequencies are present at all times. Therefore the intermediate frequency above mentioned must be of such a value that no repeats can occur. Therefore to cover from 20,000 to 550 kc. this frequency must be above 20,000 kc.

This frequency is the beat resulting from the mixing of the oscillating frequency and some frequency in the first detector tube. To arrive at the oscillating band of this first oscillator we can arrive at the low end of this frequency by adding the low end of the broadcast band, namely, 550 kc. to 20,000 kc., giving us 20,550 kc.

The other end of this band will be the sum of the intermediate frequency of 20,000 kc. and the high end of the broadcast band, namely 1500 + 20,000 kc., or 21,500 kc. Therefore any setting of the oscillating frequency between its low and high point will create the intermediate frequency beat by mixing with some frequency present in the first detector.

The first oscillator with its tuning range from 20,550 kc. to 21,500 kc., provides a band that will be relatively sharp in tuning throughout and therefore it is necessary to include the tuning condenser provided with very positively controlled tuning mechanism so as to spread out the channels. This is best achieved by providing 360 degree tuning dial and a dial readable to about one part in 10,000.

The second oscillator is fixedly tuned and the frequency at which it will operate must strike a difference with the first intermediate frequency equal to the second intermediate frequency. Thus at 400 kc. second i-f, the second oscillator would be at 20,400 kc.

As the second detector has no tuning range, the inductance value incorporated within this circuit can be designed for this particular frequency and to include the minimum amount of external capacity, thereby providing efficiency in this circuit very much higher than would occur in an oscillator having a greater range of frequency, such as occurs in the first one. The second detector turn picks up the intermediate frequency from the first detector and also has impressed on it the fixed frequency of the second oscillator.

When the first oscillator is tuned from its low frequency end to its high frequency end, it would progressively pick up signals from the high end to the low end and on account of the values used there would be no repeats or doubles. Hence the first oscillator would have to tune in respect to a 20,000 kc. intermediate frequency so as to generate from 40,000 to almost 20,000 kc., for gaining response from 15 to 545 meters.

Actually the first intermediate frequency could be a little higher than 20,000 kc., to allow for signal response of 20,000 kc. There would be no repeat points, on account of the high first i-f and the preselected second i-f.

GUSTAV F. BAUER
JAMES A. JOHNSON
781 Ellicott Square, Buffalo, N. Y.

The explanation of the mystery circuit as given by Messrs. Bauer and Johnson states the case correctly. The frequencies are selected correctly, which is the new contribution to the solution. Others have suggested a high first i-f, but few high enough to prevent repeat points. If repeats may be endured at the high frequencies, a lower first i-f could be used, but there could be no signal reception at this i-f, due to the signal and intermediate frequencies crossing. Messrs. Bauer and Johnson are to be complimented on their excellent choice of frequencies.

* * *

Another Sharp Observer

AFTER LOOKING OVER your mystery circuit I thought I might as well join the the Mystic Knights of the Sea, so here goes:

In the hookup if the first detector is aperiodic, first manually tuned oscillator tuned with a small variable condenser and covered from 20,300 to 39,000 kc., your second detector tuned to 20,000 kc. fixed, the second oscillator oscillating on a fixed frequency of 20,175 kc., amplifier and third detector tuned to 175 kc., this feeding a head phone, speaker or other audio, you would hear all the signals on the air from about 16 meters to 1,000 meters by merely turning the first oscillator dial without repeat points.

Well, here's hoping you pass on my membership and best wishes from a reader ever since I started playing with crystals.

F. H. FRIDENSTINE
570 West Twenty-Fourth Street, Ogden, Utah.

Mr. Fridenstine succinctly states the case. He has the frequencies in the right region, too. orrect selection of these seems to be epidemic. The object of the mystery circuit is to tune in the wide wave band without switching or use of plug-in coils, and simply by tuning manually with one condenser. The reason for the high first i-f and the first oscillator's range starting higher than this i-f is to avoid repeats.

* * *

Others Who Made Their Mark

Other letters making valuable contributions to the solution of the mystery circuit were received from:

L. L. Wheaton, 1019 Jefferson Avenue, Moundsville, West Virginia.

Cal Brainard, 79 East Highland, Sierra Madre, Calif.

T. W. Farley, 136 Seventh Street, Jersey City, N. J. (c/o Autocoil Co.).

Gilbert R. Bushong, 4615 Chestnut Street, Philadelphia, Pa.

ent Questions

Is a Working Model Necessary?

MUST the application for patent be accompanied by a model of the device exactly as it will appear in the manufactured state, or will a fairly accurate working model suffice?—F. M. Braun, Detroit, Mich.

No model whatever need accompany the application, the use of models generally having been done away with years ago. Only in exceptional cases may the examiner call for a model, as when the application is not clear as to its workability. The writer has filed more than 1,000 patent applications and only in one or two stray instances was a model submitted, and then they were volunteered.

* * *

Drawings as Patent Basis

IS IT POSSIBLE to patent a mechanical device merely from a complete set of drawings?—James J. Thompson, New York, N. Y.

A complete set of drawings is amply sufficient from which to patent a mechanical device; in fact, rough sketches showing the general idea, accompanied by a description in the inventor's own words, are all that are usually given.

* * *

What Field Offers Biggest Opportunity?

WHAT IS the most profitable field of invention for an inventor to work in?—Richard O'Brien, Chicago, Ill.

Your own. If you cannot improve the tools and methods and products in your own business, in which years of effort have made you skilled, your chance of success in a new and unknown field is infinitely less. There are striking exceptions to this rule, of course, but remember they are *exceptions*, and a policy based upon averages, not exceptions, is surer and safer.

Address questions to Ray Belmont Whitman, Patent Editor.

An Ultra-Frequency Oscillator

Bypass Condensers Prevent Feedback Stoppage

By Herman Bernard

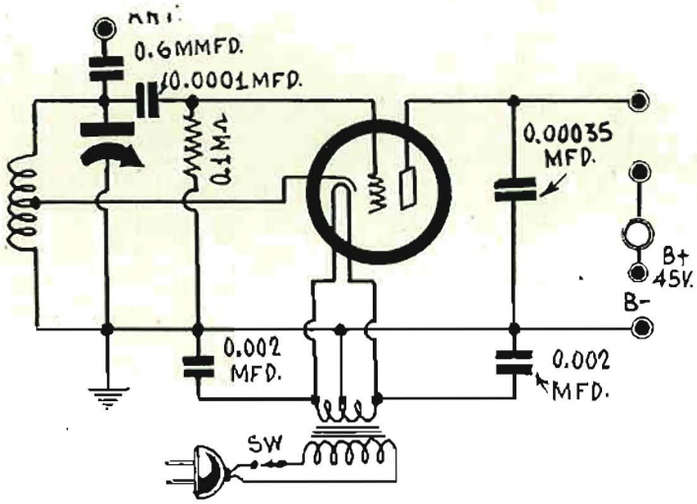


FIG. 1

An oscillator for frequencies in the "ultra" region. The three bypass condensers are necessary. One (0.000375 mfd.) removes the impedance of the phones from the r-f circuit, the two others (0.002 mfd.) prevent choking effect in the secondary of the filament transformer.

THE necessity for having a suitable oscillator circuit for the ultra frequencies is growing, since not only are amateurs engaged on experiments in transmission and reception but some experimental television is in this region, and besides, there are special uses, as in the mystery superheterodyne.

For establishing a suitable oscillator for the mystery circuit various hookups were tried and finally the modified Hartley oscillator was used as shown in Fig. 1, because it worked on the highest frequency to which the condenser would tune with the coil used. At first it didn't do that, either, but stopped oscillating when the condenser was set at about half its total capacity, leaving the other half of the dial dead.

What Bypass Condensers Did

The circuit as set up at first consisted of a National Equicycle condenser of 0.00015 mfd. capacity, 270 degree rotation, a National true vernier dial (reading accurately to one-tenth of one division), and the hookup as shown, but with the 0.00035 mfd. plate bypass condenser and also the 0.002 mfd. condensers omitted. Then the plate bypass condenser was inserted, whereupon oscillation was present at higher frequencies, although not much higher. Next the 0.002 mfd. condensers were connected from each side of the filament winding (heater of tube) to ground, and there was oscillation at any and all dial settings. Moreover, the oscillation was of constant value from one end of the dial to the other, as indicated by the unchanged reading of the 0-5 milliammeter. It so happens this oscillator is of the detecting type, and therefore the milliammeter reading may be used for resonance indication to excellent purpose. As the intensity of the oscillation increases (supposing there were a change and it was in that direction) the current through the meter decreases. To put it differently, if the circuit's oscillation is stopped by putting a short across the tuning condenser, the plate current increases. It goes beyond the full-scale mark on a 0-5 milliammeter. When oscillation is present the reading is 3 ma.

The circuit therefore modulates downward. Signal is comparable to oscillation in this respect. The greater the signal strength the less plate current. This is consistent with the results obtained from all types of grid leak detection, but contrasted to all types of plate bend rectification, where the modulation is upward (greater signal intensity, greater plate current).

The reason for the downward modulation of the circuit is found in the presence of the grid leak, 0.1 meg. This is connected from grid to grounded B minus. Assuming no oscillation, there will be no grid current, hence no d-c through the resistor. When oscillation starts there will be grid current, and this current will produce a voltage drop in the resistor.

The grid is maintained at an average negative value because of this grid current. This is the statement usually made, and the meter readings bear it out, but the explanation is not at all clear. It would seem that the grid should be positive. In fact it isn't.

The grid condenser and the grid leak work together to effectuate this result of negative bias. The explanation given is that there is a voltage drop in the leak, that the grid condenser is charged, that that it discharges through the leak slowly, hence the side of the condenser toward the grid return is negative and the grid return is negative, hence the grid

Question of Calibration

The coil finally used consisted of hollow copper tubing, 3/16 inch outside diameter, total 2 turns, with cathode to center tap. The diameter of the coil was 3 inches. No form was used. The spacing between turns was equal to twice the diameter of the wire and was accomplished by pulling the turns away from each other by pressure at the ends after tighter winding in the first instance.

The leak was a pigtail connected from the grid of the socket to a lug on the grounded frame of the tuning condenser. An equalizing condenser of 20-100 mmfd. was set at maximum and soldered to the stator lug of the tuning condenser, other side to the grid end of the resistor. The coil was terminated at the other end on the aluminum chassis used. This termination was to the left as you regarded the assembly from the front panel. The tube socket was between the coil and the moving plates of the condenser. The grid lead was about 1⅛ inches long.

It is difficult to calibrate an oscillator that covers such high frequencies. From general experience it is known that, with minimum capacities carefully kept down, and with the coil data as given, the circuit will reach 30,000 kc or higher, and the question is, how much higher, and what are some of the points along the tuning curve.

As a test a 4-turn coil was used and the strongest local tuned in on a radio set (WABC, 860 kc). An effort was made to get a beat between that and the high frequency oscillator. But even so it was impossible to hear anything when the earphones were connected as shown, and the 0.6 mmfd. condenser had its otherwise free side connected to aerial that fed the broadcast receiver.

So another oscillator was put into action to beat with WABC's wave, and the oscillator's modulation was introduced. The combined racket of not-quite zero beat between the test oscillator and WABC's wave, plus the modulation in the set oscillator, about 2,000 cycles, plus tighter coupling between the test oscillator's output and the high frequency oscillator (Fig. 1) yielded a very faint squeal at a point about midway on the dial, and this was assumed to be the tenth harmonic of 860 kc, or 8,600 kc.

As the tuning ratio would be 2-to-1 or better, other harmonics were to be expected, but could not be traced.

A Lecher wire aerial with slider will be set up, and in that way another attempt made to find the frequencies on the present two-turn set-up. Besides, a secondary standard oscillator at 5,000 kc will be built, and tested against the weekly 5,000 kc transmissions from the Bureau of Standards (2 to 4 p.m. and 10 p.m. to midnight, EST) in an attempt to pick out the fourth, fifth, sixth, seventh and eighth harmonics, as the circuit should tune from 20,000 to 40,000 kc (approximately 15 to 7.5 meters) for the purposes of the mystery superheterodyne.

The tube used was a 227. The B voltage was obtained from an a-c rectifier in the test oscillator previously referred to, while a center-tapped 2.5 volt filament transformer was used for the heater. The necessity of maintaining the extremes of the secondary winding of the filament transformer at ground potential, so the secondary does not act as an r-f choke and stop oscillation at lower capacity settings of the condenser, has been stated.

Short Wave Club

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

J. A. Adams, 7735 Haskins Ave., Chicago, Ill.
Nathan Prail, 1841 Peshine Ave., Newark, N. J.
C. M. Thompson, 4064 Wilson Ave., NDG, Montreal, Que., Canada.
Frank J. Gillen, 574 Dewey Ave., Rochester, N. Y.
George Blackburn, Jr., 234 Bonham St., Paris, Texas.
Eugene Hayman, 3203 West 92nd St., Cleveland, Ohio.
Carl W. Smith, 941 Moore Ave., Williamsport, Penna.

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.

Name .....

Address .....

City ..... **State** .....

Short-Wave Construction

Its Application to 4-Tube Battery Set

By Capt. Peter V. O'Rourke

IN line with the recently instituted policy of renewing the use of old-time circuits, adapted to better performance with new tubes, the four-tube battery-operated short-wave receiver was given a preliminary description last week, issue of April 9th. The list of parts and the coil data also were given.

This week the full-scale picture diagram is printed (on following two pages), and the schematic diagram is printed again, for exact conformity with the picture diagram. It is the same schematic as was given last week, but the 1.3 and 1 ohm resistors are reversed, to correspond to the picture diagram. This represents no electical difference.

How to Insure Regeneration

The radio frequency and detector coils are of the plug-in type, wound on tube base diameters, which are about 1.25 inches. The designations imprinted on Fig. 1 for the coil connections refer to the tube base prongs (UX). There is no relationship between the designations as the plate, grid or filament of tubes. For instance, in the case of the antenna coil, G goes to grid, a coincidence, but in the interstage example G goes to plate of the r-f tube.

The polarities of the interstage coil in particular must be observed, otherwise there will be no regeneration, and sensitivity and selectivity will be of a low order.

If the coils are wound as directed last week, or commercial coils made for this receiver are used, the regenerative effect will be present in its full value.

In the layout one of the 0.00014 mfd. tuning condensers is at center, actuated by the vernier dial. To the left is the other 0.00014 mfd. tuning condenser, but this is actuated by a knob.

Condensers Discussed

If a two-gang condenser with a 0.00014 mfd. or 0.00015 mfd. in each section is used by any who have one and who want to modify the circuit accordingly, a manual trimmer should be included nevertheless, about 35 mmfd. capacity. This would be across the antenna condenser. Then a small fixed trimmer would be put across the plate tuning condenser, and the first stage lined up with it on the basis of half the capacity of the manual trimmer in circuit. Also, since the rotor of the second section then goes to ground, a bypass condenser of 1 mfd. should be connected between the B plus end of the plate winding of the r-f tube to ground.

The larger variable condenser is 0.0002 mfd. capacity, and it is the feedback condenser. Those having 0.00025 mfd. may use that capacity. For all coils as described this is sufficient capacity to produce feedback, but in some instances due to too low voltages and other conditions, the smallest coil alone may not produce oscillation, in which event double the number of turns on the plate winding.

The circuit is so engineered as to develop the utmost sensitivity consistent with what selectivity requirements the short waves from 15 to 200 meters impose.

How Bias Results

It is not advisable to have as much selectivity as in the broadcast band, although by pressing regeneration even this may be attained, for those occasional instances where some desired distant station is close in frequency to some strong station that is geographically near, the result may be readily achieved.

By using transformer coupling the audio gain is established at a high level without any danger of motorboating, at least until the B batteries reach such a condition that some put-put sound occurs, which is a sign that these batteries need replacing.

Audio Bias

The danger of having too high negative grid bias values when the B battery effective voltage declines is avoided by using the voltage distribution method that is an automatic corrector of such fault. The negative bias for the first tube is the drop in the filament resistors, equal to about 1 volt, the detector has a positive bias, the first audio tube has the bias resulting from the drop in 200 ohms while the last audio tube is biased by the drop in 500 ohms (sum of 200 and 300 ohms). These bias

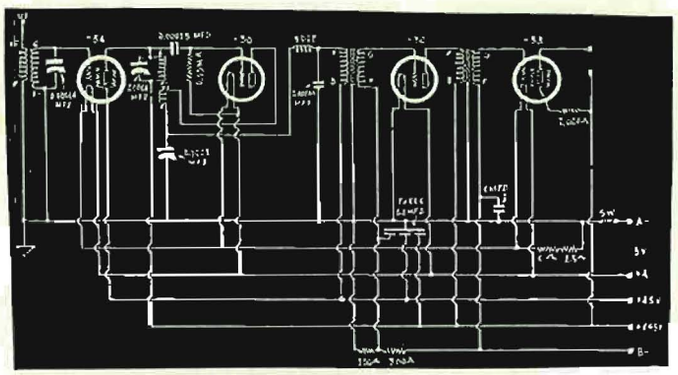


FIG. 1

The four-tube circuit, using the new —34 tube as radio frequency amplifier. This is a variable mu pentode. The other pentode is the output tube, a —33. Note how bias for audio is obtained.

voltages may be read directly across these resistors with even a low-priced voltmeter, as the current in the measured circuits easily is high enough.

The bias for the —30 tube, which is worked at a somewhat higher plate voltage than normally, should be around 7 volts and for the —33 pentode around 11 or 12 volts. The actual applied plate voltage is not the full battery voltage in either instance, otherwise the figures would be 7.5 and 13.5 volts negative bias.

The output tube is not the only pentode in the set, for the —34 is an r-f pentode, the extra screen being at center of the filament, hence not requiring external connection beyond what normally would be made for the filament. And besides this tube is of the variable mu type, meaning that its plate current does not cut off until a remote negative bias is impressed. Thus crosstalk and crossmodulation are reduced. In other words, selectivity is increased.

The r-f pentode-variable mu tube is represented by the second socket from left in Fig. 2, while the detector socket adjoins it.

Socket Arrangement

Hence the sockets are as follows, the total being six because two are used as coil receptacles:

Extreme left: antenna coil receptacle.
Second from left: radio frequency amplifier tube.
Third from left: detector tube.
Third from right: interstage coil receptacle.
Second from right: first audio tube.
Extreme right: power output tube.

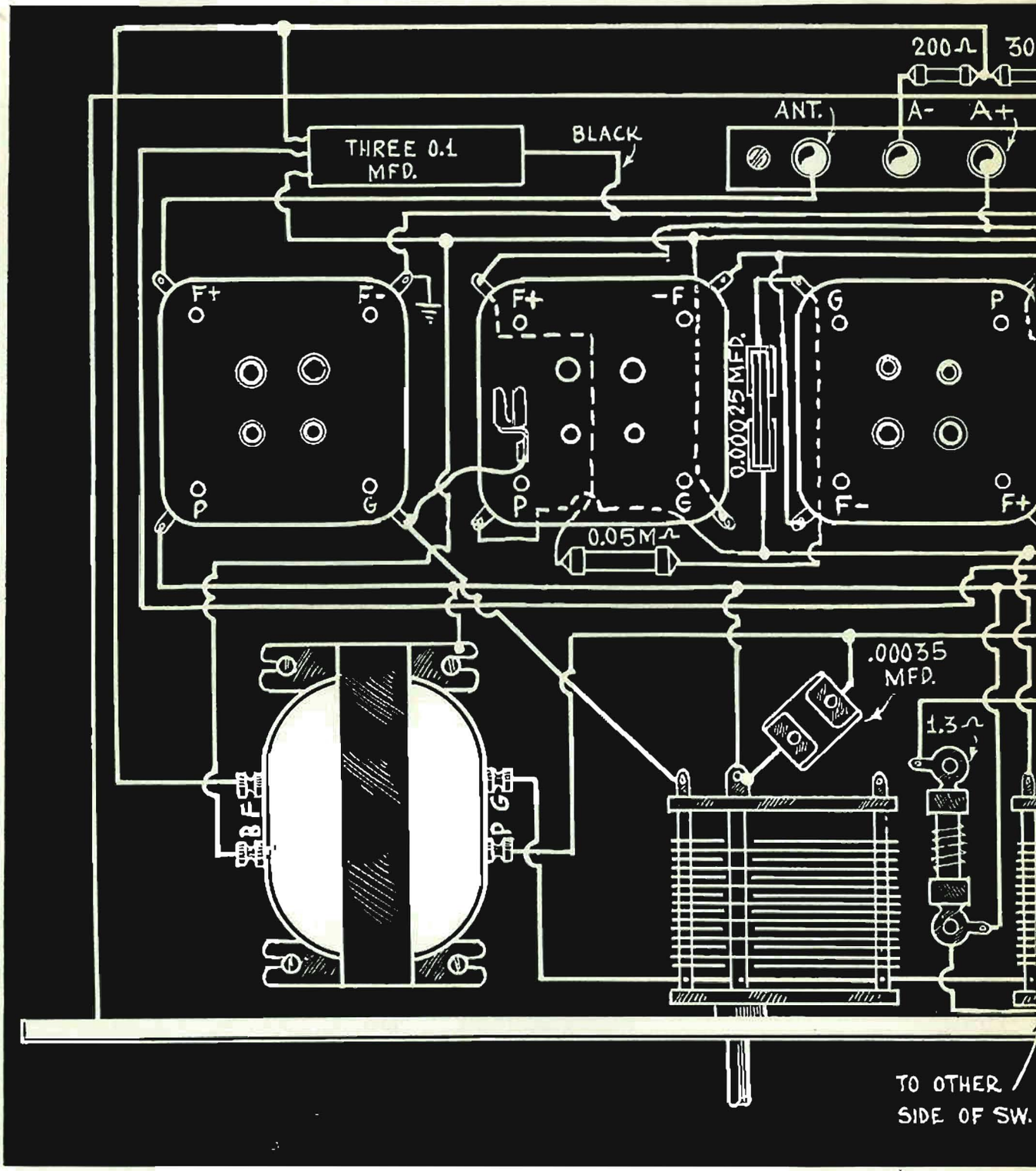
The reason for separating the two coils by one socket (detector tube) is to establish a suitable separation in the interests of stability. It is expressly stated in many treatises that coils for such circuits should avoid intercoupling as much as possible, and this separation presents a satisfactory solution.

The leads to the grids of tubes are relatively short. One lead is shown running at an angle of 45 degrees from the nearest stator lug to the G post of the antenna coil socket, from which point it goes upward to a grid clip for connection to cap of tube. The other grid lead is represented by a resistor of 0.05 meg. (50,000 ohms) from detector socket to any suitable F plus point, here taken from the r-f socket.

The Audio Leads

The long audio leads are of no consequence. The radio frequencies have been bypassed, and the length of the audio lead had no harmful effect on the circuit. Particular reference is made to the lead to plate of the first audio transformer (left) and the lead back to grid of the first audio tube (second from right). The arrangement is not only symmetrical but it encompasses the entire assembly in small space and produces good results.

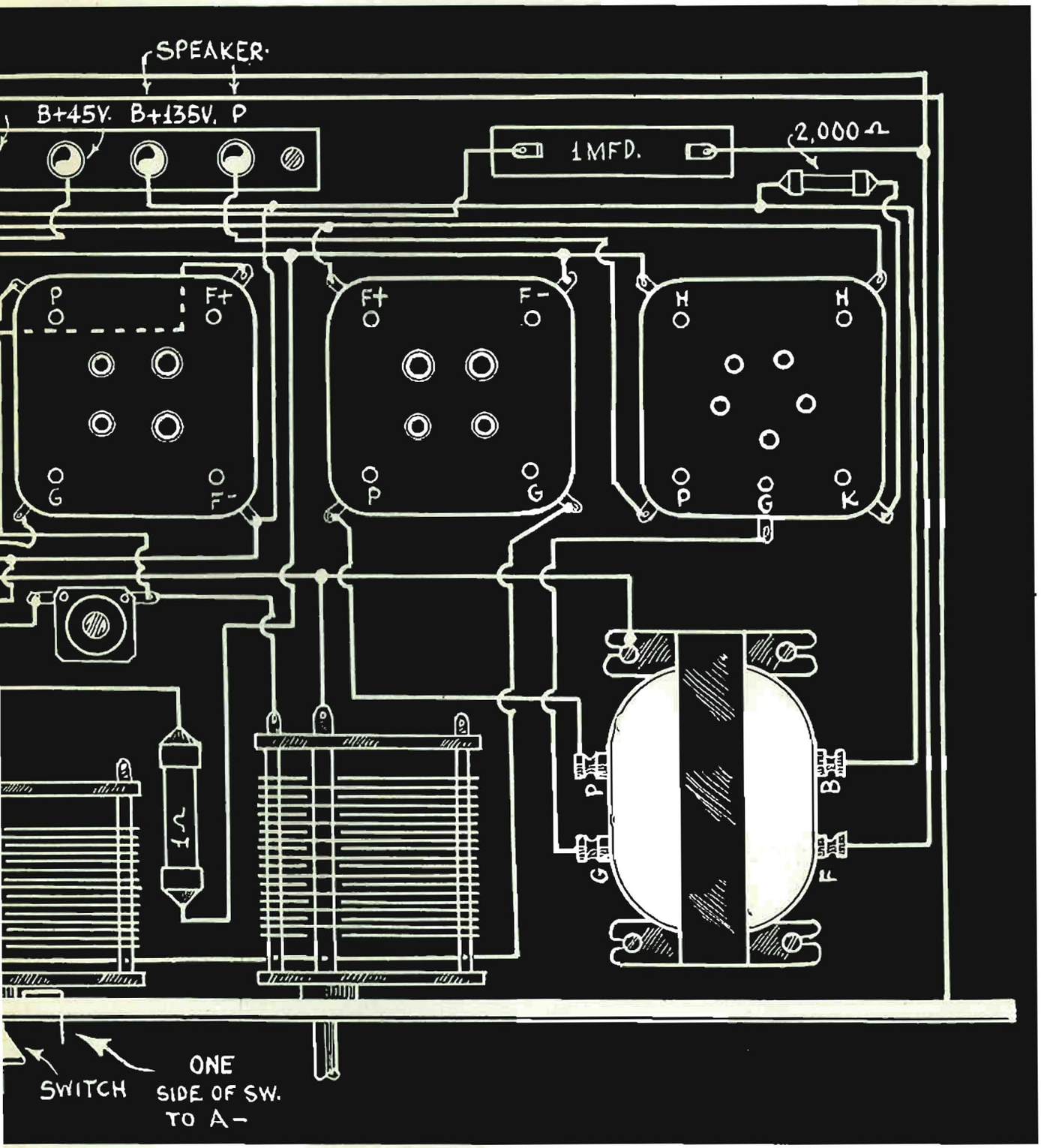
FULL-SCALE PICTURE DIAGRAM OF 4-



The parts for the four-tube short-wave receiver are laidout on a 7x14-inch fro
This wiring corresponds in all particulars to that i

An Excellent Circuit T

UBE SHORT-WAVE BATTERY RECEIVER



el and a baseboard 13x6½ inches front to back, the wiring being done as shown.
schematic diagram printed on the preceding page.

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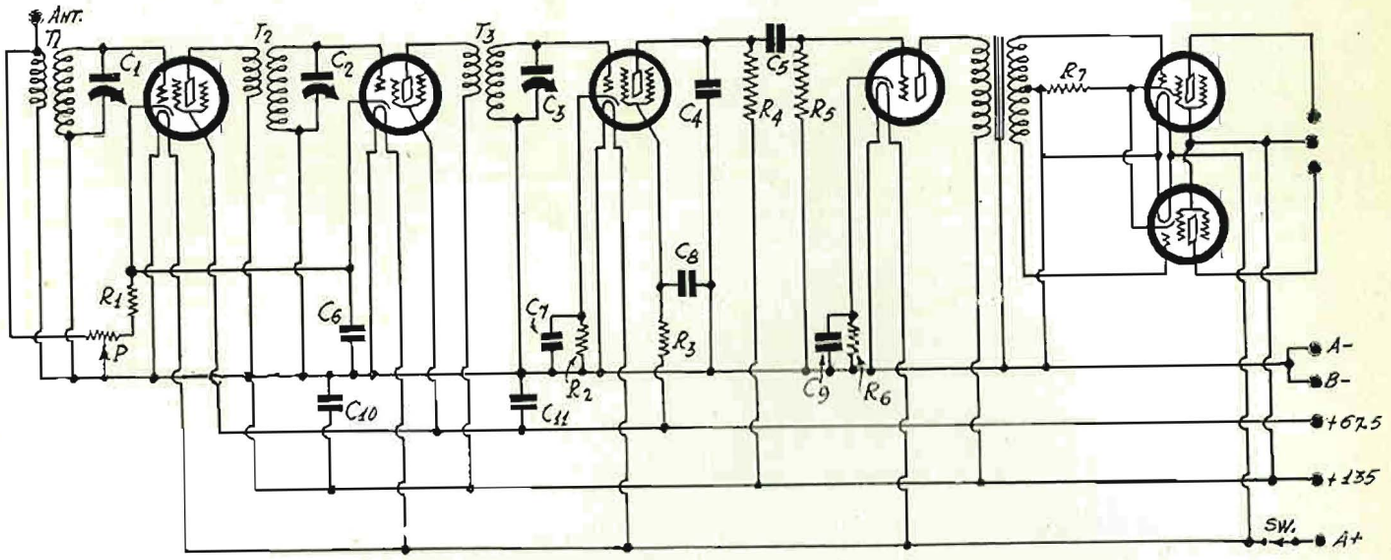

FIG. 1,001

This t-r-f automobile receiver can be used on cars whether the positive or the negative of the storage battery is grounded. B minus should always be connected to the chassis.

A t-r-f Auto Set

WILL YOU KINDLY publish a circuit diagram of a six tube t-r-f automobile receiver in which all the tubes are self biased and in which the filament circuit may be grounded on either side? The tubes I wish to use are 236 (2), 237 (1), 238 (2), and 239 (2). Please give values of resistances and by-pass condensers.—F. W. R., Paterson, N. J.

In Fig. 1,001 is such a circuit. The following values may be used for the condensers: C4, 0.00025 mfd.; C5, 0.01 mfd.; C6, C7, C8, 0.1 mfd. each; C9, 0.5 mfd.; C10, C11, 0.25 mfd. each. The resistors may have the follownig values: R1, 300 ohms, R2, 30,000 ohms; R3, half megohm; R4, quarter megohm; R5, one megohm; R6, 1,250 ohms; R7, 600 ohms. A one microfarad condenser can also be connected across R7 to good effect.

* * *

Super Fails to Work

WHAT can be the matter with my automobile superheterodyne which I built according to your diagram when everything seems to be in first class condition except that I do not get any signals? I have hooked it up as a t-r-f set according to your instructions and then I get signals. I have also tested and tuned the intermediate frequency oscillator and that too works very well. But when I try to receive signals with it as a superheterodyne I don't get a thing. Please come to my rescue.—W. H. T., San Diego, Calif.

You have tested everything in the circuit except the most important thing, the oscillator. Everything may be in first class condition in an automobile, but the car will not run unless the engine is going. Same thing here. The oscillator may not work because the tickler is reversed, which by the way, is a common error which is not the fault of the builder. Reverse the plate and the B plus leads to the oscillator coil and see what happens. You ought to get some signals right away, especially near zero on the dial. Then it is just a matter of padding the circuit, or adjusting the shunt and series condensers.

* * *

How Much Must the Inventor Spend?

CAN YOU GIVE me a general idea of the fee which might be charged by a patent attorney, or does this depend entirely upon circumstances? Are there other fees involved?—J. T. Miller, Scranton, Pa.

A charge of $150 for filing a patent application on a comparatively simple invention involving but one sheet of drawing, thus including the cost of the drawing as well as the Government filing fee of $25, is made by many patent lawyers of standing. There would be no further expense for upwards of a year when an amendment would have to be prepared in answer to the first action and this amendment would cost $25. A second amendment of $25 and in some cases possibly a third or fourth would also come along six or eight months apart, depending on the case. Then the applicant at last would have to pay the final Government fee of $25 to have his patent issued to him.

* * *

Failure of Neon Tube Oscillator

I HAVE constructed a neon tube oscillator such as you described in conjunction with an all-wave oscillator, but so far I have been unable to get the oscillator working. What do you suppose is wrong with it? Please suggest remedies.—T. R. G., Atlantic City, N. J.

The voltage on the tube has to be just so or it will not oscillate. If the glow strikes reduce the voltage gradually until the glow disappears. Just before this occurs the tube should oscillate. That is, oscillation occurs when the voltage on the tube is just over the striking voltage. You may have to reduce the resistance in series in order to get a glow.

* * *

Types of Searches Differentiated

IS THE "infringement search" a part of the routine of the Patent Office, or is this the responsibility of the person applying for a patent?—L. M. P., St. Louis, Mo.

The Patent Office makes no infringement search but only patentability searches. The infringement searches are directed to determine whether the claims are infringed and the patentability researches to whether the patents as publications prove the subject-matter of the invention to be old and therefore unpatentable to the applicant. Hence an infringement search is always the responsibility of the person applying for a patent and should be made before active steps to market the patent are taken, to be safe against possible litigation. Much of the needless and expensive patent suits now pending would have been eliminated if this precautionary step had been taken first.

* * *

Microphonic Noises

WHAT is the reason a receiver howls when the loudspeaker is near it and behaves all right when the speaker is at a distance? Do you think that the antenna is too long?—W. J. Y., Omaha, Neb.

Vibrations from the speaker get to the tubes of the set and start the howl. The coupling is either through the support of the speaker or through the air. Mount the speaker on sponge rubber, felt, or some other vibration killing material. If this does not help, the coupling must be through the air, that is, the sound waves may hit a particularly sensitive tube and start its elements vibrating. If putting in a new tube will not help, mount the tube on a shock absorbing socket and protect it from the direct sound waves by a lead shield.

* * *

Construction of Converter

I AM planning to build a short wave superheterodyne, for which I have the r-f coils and condensers. I am undecided

what to use for the intermediate amplifier. What frequency would you suggest?—W. H. C., Pueblo, Colo.

What intermediate frequency you select does not matter a great deal just so you select one outside the band of frequencies you want to receive. If you don't want to receive broadcasting stations on this set you can select any frequency up to about 1,400 kc as the intermediate. If you also want to receive the broadcast stations you can go as high as 475 kc as the intermediate.

* * *

Hissing Sounds

THERE is a most disagreeable hissing noise in my set. I have tried everything but so far have not hit on anything that did any good at all. Can you suggest something?—F. K. A., Buffalo, N. Y.

You might connect a resistance of about 100,000 ohms, or a little more, across the secondary of the audio transformer that feeds the last tube, if the set has one.

* * *

Matter of Terminology

WHAT is the difference between a choke coil and a tuning coil? Both are wound in about the same way except that, as a rule, the choke coil has more wire.—G. A. T., New York, N. Y.

Both are inductance coils, and their differentiation is only in the matter of use. A choke is an inductance coil used to choke out current, or to prevent current from flowing in a certain branch of a circuit. A tuning coil is an inductance coil that is used in a resonant circuit. The same coil may be both a tuning coil and a choke at the same time under certain conditions.

* * *

Storage Battery is Inefficient

MY storage battery is rated at 100 ampere-hours but the rating does not seem to have anything to do with the capacity. I can leave it on charge for a week, charging at the rate of 0.75 ampere, which ought to give it a charge of 126 ampere-hours. In other words, charging it for a week at this rate should give it a good overcharge. But when I turn it on a set that draws less than 5 amperes, it discharges in about two hours. There is something radically wrong there, and I don't know what to do. Can you suggest what should be done and why the battery will not take a charge?—P. C., Brooklyn, N. Y.

The plates are probably sulphated so that the battery will not take much charge. Instead of charging it you are probably only boiling out the water in the electrolyte. You can take the battery to a service station specializing in the kind of battery you have, and it will either be fixed up or you will be told that there is nothing to be done except to get a new battery. Batteries do not cost much now.

* * *

C Batteries Versus Self Bias

DISREGARDING the greater convenience of self bias, are C batteries sufficiently better than self bias to warrant their use in an a-c receiver? I have heard that self bias causes a reduction in the amplification. Is that correct?—W. H. G., St. Louis, Mo.

There is not enough difference between grid batteries and self bias to warrant the use of batteries in an a-c set. It is true that the bias resistance causes a reduction in the amplification, but this is largely an academic matter. When there is a condenser across the bias resistance there is little reduction in the gain. In the radio and intermediate frequency stages a comparatively small condenser so reduces the effect that we can say there is no reduction in the gain. In the audio amplifier it is different. There the reduction is appreciable because we cannot get a condenser large enough to prevent the reduction in the amplification on the very low audio notes. But it is not necessary to amplify all the low notes at full value, and in most cases it is not even desirable. A condenser of 1 mfd. across a bias resistance of 1,000 or 2,000 ohms is usually sufficient. And we now can get large electrolytic condensers which are more than ample.

* * *

Noise in D-C Sets

WHY are d-c sets noisier than other receivers? I have noticed that they produce a great deal more hiss than a-c sets and battery sets.—M. T. E., Camden, N. J.

There are many reasons for this. In the first place the power line is directly connected to the vital parts of the circuit and and any noises that are on the line will be transferred to the receiver. In an a-c set the power transformer is interposed between the set and the line and noise can only be transmitted by induction. The noise is usually composed of very high frequencies which do not get through the transformer. Noise is often due to shocks or to surges which are always present in the line. The hiss can usually be eliminated or at least greatly reduced by connecting a resistance of from 100,000 to 250,000 ohms across the secondary of an audio transformer. In the case of push-pull, connect one across each half of the secondary.

* * *

Double Peak Oscillator

IN oscillators of the modulated type that I have constructed I have noticed a double peak in the output. This is very annoying because I cannot tune a set accurately and be sure what I have. I have noticed that this effect does not occur when I use the oscillator as a zero beat indicator. What causes the double peak and how can it be eliminated?—W. G. M., Racine, Wis.

The difficulty may be due to a type of overloading somewhere. In that case anything that would reduce the output of the oscillator, or the input to the device that is overloading, would help. Sometimes the effect is noticed when the coupling between the tickler coil and the tuned winding is too close. In that case reducing the number of turns on the tickler would help, or loosening the coupling by moving the tickler farther way from the tickler, or interposing a high resistance in the plate lead. Sometimes the effect is due to interlocking of two tuned circuits, of which that of the oscillator is one. The interlocking may not be complete. When the two peaks are distinct the symptoms do not point strongly to interlocking.

* * *

Tuning an Intermediate Oscillator

I HAVE occasion to adjust many superheterodynes with various intermediate frequencies, particularly 175 kc. Will you kindly tell how I can construct a simple oscillator and adjust it to the intermediate frequency?—B. W. J., St. Joseph, Mo.

In the issue of April 9th, last week, Fig. 1,000, on page 15, you will find a suitable oscillator circuit. It is absolutely necessary to use only coil L to make an oscillator. For this coil use two spools similar to those used in the transformers to be tested. Connect the condenser C across only one of them and also use the same size tuning condenser. Couple the untuned coil closely to the tuned. To adjust it to the desired frequency couple the circuit very loosely to a broadcast set and tune this set to a harmonic of the frequency you want. If you want 175 kc, tune it to 700 kc and adjust oscillator to zero beat. You will then have 175 kc because the oscillator will not cover any other harmonics. A similar method will yield any other frequency. For example, an oscillator that will tune to a narrow band around four hundred can be adjusted to 400 kc by tuning the broadcast set to 800 or 1,200 kc and then getting zero beat.

* * *

European Broadcast Frequencies

WHAT are the frequencies used in Europe for broadcasting porposes? I have been told that the bands from 150 to 300 kc and from 550 to 1,500 kc are used. Is this correct?—L. L. E., Bridgeport, Conn.

It is partly true. A list of European stations shows that there are stations from 155 kc to 428.6 kc and from 523 to 1,530 kc. There is a gap between 428.6 and 523 kc. It will be observed that the bands used in Europe are much wider than the bands used in America and that the higher frequency band is so wide that an American set would not cover it.

* * *

Ripple Free High Potential

IN AN experiment which I want to perform I need a very high, steady potential. No current is needed, only potential, but the voltage is so high that it is not practical to use batteries. Moreover, there must be no ripple. Can you suggest a method of getting the voltage? I have heard there is a way of using a high frequency oscillator and conjunction with an ordinary B battery.—W. G. F., Bronx, N. Y.

You can set up a high frequency oscillator, say one of 1,500 kc, powering this entirely with batteries. The output of that can then feed a full wave rectifier of exactly the same type as a rectifier used in a B supply. It would not be difficult to filter the output of this rectifier to eliminate all ripple, for the ripple frequency would be 3,000 kc. Even the rectifier tube should be heated with steady current. Elimination of all hum frequency is essential, for otherwise the hum would be impressed on the output of the high frequency rectifier and the filter for that would not take out the ripple. This scheme has already been used in experimentation in physics where a steady potential of 50,000 volts was needed.

* * *

Variation in Bias

IS IT not a fact that when a resistor in the cathode lead is used for obtaining bias on a tube the bias varies with the signal? What can be done to eliminate this variation?—B. W. W., Covington, Ky.

It is a fact. The higher the plate current the higher the bias and, conversely, the lower the plate current the less the bias. It is obvious that this acts to reduce the signal, or the amplification. Ordinarily referred to as reverse feed back, or degeneration. The way to eliminate it is to put a large condenser across the bias resistance. The larger the capacity the less the degeneration. When a condenser is used the variation is not nearly so great as when it is not used because the condenser charges and discharges, holding the bias practically steady as far as the signal is concerned. However, with slow changes in the signal intensity the bias varies. Hence a self-biased tube with a small condenser across it will act almost the same as an automatic volume control. On very strong signals the bias is higher than on weak signals and hence the amplification is lower. However, it tends to remove the modulation rather than reducing the amplitude of the radio signal.

WFIW, REGIONAL STATION, ASKS POWER OF 5KW

Washington.

The Federal Radio Commission is asked by WFIW, Hopkinsville, Ky., to establish a precedent in granting 5,000 watts power, while the station maintains its 940 kc regional channel. To date a "regional" channel means one on which power is limited to 1,000 watts, so that if the request is granted the channel would be effectively in the cleared channel class. Four frequencies had been set aside for higher than 1,000 watts, but this was part of the original plan to which amendment is now proposed. The power was not 5,000 watts, however.

If the Commission grants the request and establishes the precedent it is expected that many stations now in the regional class will ask for more power, and thus to be put in what amounts to the cleared channel class. The different classifications are based on the power allotments, and these are determined by geographical, frequency and other considerations.

May Favor the Grant

Since other stations would be affected by the grant, if it is made, the Commission has notified them, so that they may present their argumtnts at a hearing.

Although when such notice is given it almost invariably follows that all the stations thus notified show up with a long list of objections to the application, it is hinted that some of the stations on or near the 940 kc channel may be surprisingly in favor of the grant. The reason is that if higher power is obtainable by one station now in the regional class, other stations may look forward with hopefulness to the same concession, whereas of the grant is denied to one it is likely to be denied to all.

Stations Notified

The Commission has never given a regional station power of more than 1,000 watts, except in the case of the four high-power regional channels—1,400, 1,470, 1,480 and 1,490 kilocycles—which are specially designated to this purpose, according to Commission records.

Notification was given to WDAY, Fargo, N. Dak.; WCSH, Portland, Me.; KOIN, Portland, Oreg.; WHA, Madison, Wis.; KMBC, Kansas City, Mo.; WBRC, Birmingham, Ala., and WBCM, Bay City, Mich.

Works of Art Televised

Works of art were televised when the images of four paintings at the annual exhibit of the Society of Independent Artists were transmitted over 2WXAB recently. The artists who had painted the pictures spoke about them as they were being sent. The artists were John Sloan, president of the society, Fred Gardner, vice-president, Alfred Maurer and Norman Jeanne Bernstein.

Subsidy Plea Is Turned Down

Washington.

According to a report to the Department of Commerce from Trade Commissioner Julian B. Foster, Wellington, N. Z., the New Zealand Broadcasting Board has denied a subsidy to Class B broadcasting stations of that country which had petitioned for monetary assistance. In denying the petition the Board stated that there are no subsidies available at this time which could be turned over to them. Many of the stations in this class derive incime from advertising and sponsored programs, and recently this source has been insufficient to meet the expenses.

Class A stations are owned and operated by the Government, whereas Class B are privately owned. In all there are 36 stations in the Dominion at this time.

LOFTIN-WHITE IN NEW FIRM

Sound Engineering Corporation, Edward H. Loftin, president, has been formed, with offices at 342 Madison Avenue and laboratories at 11 West Forty-second Street, New York City. The whole field of sound recording and reproduction will be covered by the corporation's activities.

The announcement, sent out by Eric Palmer, the corporation's publicity representative, set forth:

"One of the most interesting of the many applications of sound engineering work is that of the development of a talking night letter system, the company announces. This involves telephoning your message to the central office, where it will be immediately recorded and held until the wires are not busy and then transmitted to the office of destination, where it will again be recorded, and this record is delivered in the same manner as the usual telegraphic night letter. Another interesing phase of sound development, say the engineers, is that pertaining to the automatic reception of telephone messages. A simple and cheap apparatus has been developed which will take any message coming in over the phone while you are absent from home or office, which apparatus is not attached in any way to the telephone."

S. Young White is vice-president. He worked out with Commander Loftin the Loftin-White direct-coupled audio amplifier. H. R. Van Deventer is secretary-treasurer, Arthur W. D. Harris, executive vice-president, and Edward A. Rockwell consulting engineer.

50 AMOS 'N' ANDY CHARACTERS

More than fifty characters have been introduced into their skit by Amos 'n' Andy during the past three years. Some of these characters have been on and off the scene at varying times for almost the entire period the pair have been broadcasting over NBC, while others have appeared for only a few words in a single episode.

NEW SCANNER AND MOTOR FIT INTO THE WALL

Utilizing a new type of scanning disc with a built-in synchronous motor, William Hoyt Peck has devised a complete television projecting system which can be built into the wall of a room.

This will project a nine-inch picture with a distance of only four and one-half inches between the disc and the screen. The motor and wheel combined are only one and one-half inches thick.

In the ultra-compact scanner Mr. Peck has changed his light source from the front of the wheel to the top.

Devices Central System

His reflecting lenses are mounted at an angle around the periphery of the wheel, and the light is thus reflected onto a ground glass screen, either set flush with the surface of the wall or fastened into a picture frame and hung before the opening through which the neon tube may be replaced, if necessary.

Mr. Peck is devising a central teleyision installation system so that the home or apartment building may be equipped with television in all rooms at a cost only a little greater than that of an equal number of loud speakers.

May Show Up to 6-foot Pictures

A centrally located receiver will supply energy to neon tubes with their associated scanning systems, concealed in the walls of various rooms of the building. In any of these installations, the nine-inch screen may be removed and one up to six feet tall substituted.

Station Changes

Changes in the list of stations by frequencies, made since the publication of the list in the March 26th issue, follow:

630 kc, WOS, Jefferson City, Mo. Change owner to Missouri State Marketing Bureau.

860 kc, KMO, change frequency to 1330 kc, and power to 250 w.

1010 kc, KGGF, new location, Coffeyville, Kans. (Instead of South Coffeyville, Okla.)

1010 kc, WORK, York, Pa., York Broadcasting Co. 1KW. New Station.

1120 kc, KRKD, new location, Los Angeles, Calif. (Instead of Inglewood, Calif.)

1200 kc, WABI. Change owner to Universalist Society of Bangor.

1310 kc, Delete WFDV. See 1500 kc below.

1130 kc, WJJD. Change owner to WJJD, Inc.

1330 kc, Insert KMO, Tacoma, Wash. KMO, Inc. 250 w.

1360 kc, WCSC, Charlotte, N. C. Change ownership to South Carolina B'dc'g Co., Inc.

1420 kc, KGKX, Sandpoint, Idaho. Change owner to Sandpoint B'dc'g Co.

1500 kc, WFDF, Rome Ga., Rome Broadcasting Corp., 100 w. Frequency changed from 1310 to 1500 kc.

MYSTERY YARN, DRAMAS, GAIN IN POPULARITY

Washington.

There appears to be a general shift in popular taste from music as the most popular radio program to other subjects, especially dramatic dialogues and mystery stories, according to reports received by the United States Office of Education.

Music, however, still commands the greatest popularity, Commissioner William John Cooper pointed out in citing to "The United States Daily" a large number of returns from broadcasting stations in answer to a question by the office as to the most popular program.

Dr. C. R. Koon, specialist in education by radio, stated that although more than 60 per cent of the programs consist of musical selections, the taste of the public seems to be turning towards other themes. The popular mind seeks variety, he pointed out, and there are certain programs, like dramatic dialogues, which allow the imagination considerable latitude.

Wide Variety in Taste

The following additional information was supplied at the Office of Education:

Programs involving dramatic sketches are being more successfully presented. They serve as a visual stimulus. With rapid motivation of plot, through simplicity, directness, and sustained interest of theme, they captivate attention and stimulate imagination to supply the presence of the actors.

From its inquiry, the conclusions of which will be published in a handbook for instruction by radio, the Office of Education is at present studying the answers of those stations which find the popular demand for music to outrank other program requests. Reports from about 40 stations disclose a wide variation in the tastes of the listeners.

A number of stations indicate that their musical programs are selected in accordance with the tastes of their closest listeners, and that they are given with local conditions always uppermost in the minds of those who originate the programs. One station reported that "hill billy music" was the most popular because the community preferred that type to operatic or classical forms.

Dinner Music Popular

Dinner music programs in which there is a wide range of selections, both instrumental and vocal, have a wide appeal. Other stations in reporting a preference of many listeners to classical music state that the demands are usually for the more popular classical themes. Orchestra music is quite popular.

Some sections of the country call most frequently for old-time songs, minstrel singing, fiddlers, and old melodies. The greatest demand of one station is for square dance tunes, jigs, polkas, schottisches, etc. Another states that it is called on most frequently to present ballads and semiclassical selections.

Among the variety of musical programs sought most frequently of the various stations are: Music appreciation, old familiar songs, Hawaiian misuc, fiddlers, barnstormers, piano, melodeon, varied programs of dinner music, hymns, songs and piano. Other programs include orchestra and solo, classical broadcasts of glee club ad orchestra concerts, minstrels, orchestra and classic vocal and chamber music.

Board Warns on SOS Interference

Washington.

If a broadcasting or any other radio station causes interference with a station handling distress traffic "such station must immediately cease operation upon notice directly or indirectly from the station experiencing the interference," the Federal Radio Commission has ruled.

Under the new rules of the Commission a station is no longer required to keep a continuous listening watch for distress signals. However, should undue interference result from some broadcasting station the Commission will require that station to keep a listening watch continuously during the hours that station is in actual operation.

BRITISH TRY DUAL SYSTEM

Washington.

A British company has worked out a type of wire radio system by which radio programs can be received with loudspeakers over a line from a central radio receiver of high power, according to a report from Trade Commissioner Floyd E. Sullivan, London, to the Department of Commerce. The company engaging in this business is Standard Radio Relay Service.

Selective radio receivers with high power amplifiers are located at central points in each district and the programs are picked up and sent out over wire lines which are tapped at intervals to serve subscribers. Dealers as well as individuals are taking advantage of the service.

The subscribers are required to purchase the usual post office license, which is compulsory in England, and a charge of 1 shilling six pence per week is made for the service. Loudspeaker may be either purchaser outright or rented.

Freedom from interference and the annoyance of maintenance are the inducements held out to prospective subscribers. Only programs of English origin are picked up and sent out over the system, and those who prefer to listen to distant stations in Europe and elsewhere cannot take advantage of the service.

J. L. Baird Is Nearly Ready with New Set

London.

A new type of television receiver will soon be placed on the market by the Baird Television, Ltd., according to reports.

This new receiver is said to operate on the mirror drum principle and to be capable of throwing a large picture on a screen. The device is still in the experimental stage. It has been in the laboratory stage for some time, for when Mr. John L. Baird, the inventor, was in New York last Fall he told newspaper representatives that he was then working on such a system. It is also recalled that he did not consider it necessary to have a wide frequency band necessitating going into the higher frequencies to get quality pictures. It is not known at this time whether the new system will utilize broadcast frequencies or higher frequencies.

PHOTO-ELECTRIC CELLS AID WAR ON CRIMINALS

The "electric eye" or photo cell can perform many functions more accurately and more faithfully than the human eye. As an aid in the prevention and detection of crime, this agency of modern science is unsurpassed.

The photo cell may be utilized as "super watchman," giving immediate warning of an attempt to enter a building. For such purposes an infra red or ultra violet light projector is used to throw an invisible beam across windows, doorways or corridors of the building to be watched. This beab is directed upon a cell connected to a miniature relay.

The relay is adjusted so that it is held open as long as the beam falls on it. The moment an intruder intercepts the invisible beam, however, the relay trips. This closes a secondary power relay, which may be used to energize a number of alarm bells at various points and also to turn on lights throughout the building. Cutting one or more wires between the cell and the power relay will produce the same effect. Of course the output leads to the various alarm signals should be well protected.

Keeps Watch Over Child's Crib

In addition to guarding windows and doors, a similar system may be used to keep watch over some particular point within the building, such as a child's crib, a safe or jewel case. The projector should be mounted rather high up on the wall, with the cell supported on or near the floor, so that the rays travel diagonally downward in front of the obpect to be protected. With such an arrangement, it is practically impossible for the intruder to avoid disturbing the system at some point, thus setting off the alarm. Buzzers, bells, sirens and electric lights may be used for signals in any combination not exceedng 100 watts. The more of these devices that are arranged in parallel the greater will be the security of the entire system.

At the same time that the alarm system is put into action, a relay may be employed to actuate the mechanism whereby a concealed camera will take a picture of the intruder. Along these lines, a photo cell device has been designed which employs o standard motion picture camera to take a single picture of every person passing a certain point.

Used for Color-Matching

Thus everyone entering a bank, a vault or a similar place will actuate the mechanism by intercepting a beam of light directed on a photo cell, and his picture will instantly be recorded on the roll of film. In case of a hold-up the film is developed and the bandit can then be identified by comparison with rogues' gallery pictures.

Another interesting "crime detection" application of photo cells is the police "tell tale" system, whereby a watchman or police officer in making the rounds of the shops on his beat, throws the beam from his pocket flash-light upon a photronic cell in the shop window, thereby momentarily turning on all the lights in the store. This is done without entering the premises. After making his inspection the light is removed from the photo cell and the photronic relay promptly turns the store lights "off."

A THOUGHT FOR THE WEEK

THE AMERICAN SOCIETY of Composers, Authors and Publishers, with headquarters in the Paramount Building, on Times Square, New York City, is preparing its new tariff of charges—and, oh, how those who are paying for the "permission of the copyright owners" are going to pay the piper! You see, most publishers, composers and authors are members of the Society, and therefore it is almost impossible to offer any kind of a program without using some of the many thousands of numbers protected by copyright. This necessity for getting copyright permission starts with the smallest restaurant that has a two-man orchestra and includes the biggest radio stations that provide symphony orchestras or grand opera programs. The Society threatens to increase present copyright fees one hundred per cent. Watch the fur fly!

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Eleventh Year

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Master Padding!

FOR constructing and servicing superheterodynes it is necessary to understand padding. Superheterodynes use an intermediate frequency lower than the lowest broadcast frequency and there is no escape from padding in circuits of this type. The modulator tuning is just like any other t-r-f stage, and the same is true of the r-f stage itself, if one is included.

But the oscillator has to tune to higher frequencies, since the oscillator frequency is standard now at higher than the signal frequency. For any given setting the oscillator should tune to a frequency greater than the signal frequency of that setting by the amount of the intermediate frequency.

About as handy a piece of information as any that could be obtained is the tuning curve for the receiver when the set is worked simply as a t-r-f circuit. Then one knows what to expect in dial readings for signal frequencies. By removing the control grid connections from the first and second detectors and runing a wire from the lead that went to first detector instead to the second detector control grid, the t-r-f curve is obtainable. Perhaps only two points will be desired—the extremes, if possible, otherwise as close as possible to the extremes—and broadcasting stations can be used.

Then the trick is to make the oscillator at these two or more settings register the sum of the signal and intermediate frequencies. A series condenser is used, called the padding condenser, which for 0.00035 mfd. at 175 kc or thereabouts is 700-1,000 mmfd., and for 0.00035 mfd. at 400 kc or thereabouts is 350-450 mmfd. The oscillator inductance is lower than that of the r-f coils. Normally one does not have to attend to that. The receiver has the coil, or if the set is being built, the data for the coil are given or the coil itself is obtainable commercially. A vital operation, then, is to register the oscillator setting for the lowest broadcast frequency. But how can it be done if one is not certain of the intermediate frequency, or at least that the intermediate channel is in tune?

The intermediate channel has to be at or near the prescribed intermediate frequency and must be lined up. If you haven't an oscillator for the intermediate frequency, at lease you can make one of the intermediate stages oscillate, and beat with a broadcasting station otherwise tuned in. But it is highly advisable to have the oscillator. If a variable condenser of 0.00035 mfd. is used, voltages made accessable by an adapter that fits into a receiver socket, you can use a small 300-turn honeycomb coil and a small 800-turn honeycomb coil as secondaries, picking up one or the other by switching, and have an oscillator that will serve for 150-300 kc for 450-225 kc, approximately. Feedback may be introduced in any manner, including a smaller honeycomb in the plate circuit, coupled properly to the grid winding.

When the intermediate channel is lined up and the low frequency oscillator setting padded, the high frequency r-f and detector line-up can be made by adjusting the r-f and detector trimming condensers, and then the check-up made to be sure everything is all right.

These precautions should be taken, the padding problem should be removed from the realm of uncertainty. It is not a hard problem to solve, and attempts to service or build such superheterodynes should not be unaccompanied by the service devices that all recognized engineers say are necessary, but that so many others feel they can dispense with and suffer no consequence. The suffering is intense. The folly runs high. Keep away from this trouble by mastering the theory and equipping yourself with the devices for reducing the theory to profitable practice in every case.

Salutation from NBC President

MERLIN HALL AYLESWORTH.

IT affords me considerable pleasure to salute RADIO WORLD upon its Tenth Birthday.

Organized broadcasting was only eleven years old last November. So, you have been recording the story of radio's growth almost from the very beginning. Few publications, devoted exclusively to broadcasting, can lay claim to this distinction.

I hardly need remind you that the development of broadcasting has been rapid or, that its growth has exceeded even the most optimistic predictions of its founders. Until a short time ago this growth was chiefly physical. Today we see evidences of artistic development and radio is assuming increasingly greater cultural and educational responsibilities.

M. H. AYLESWORTH.

OLD PATENT OFFICE BUILDING

I HAVE just been to Washington and admired the Grecian architecture of the old Patent Office building. Please let me know how old it is. A. C. T., St. Paul, Minn.

The present building was built in and has been occupied since about 1840. Prior to that time the Patent Department was first in Blodgett's Hotel on E Street, between Seventh and Eighth. This building was purchased in 1810 and occupied by the Patent Office and the Post Office until it burned December 15, 1836, destroying 7,000 models. It was the only public building not burned by the British in 1814. The Patent Office is now housed in the large new Department of Commerce building.

STATION SPARKS

By Alice Remsen

A Gypsy Call

For Frank Parker, of A. & P. Gypsies

Mondays, 9 p. m.; Thursdays, 10 p. m.

Oh, come with me and my caravan,
My wandering abode;
And leave the stones of the city,
For the lure of an open road;
For the ruddy glow of a campfire
Shining through scented dusk;

Tempting you to a roving life
In place of the wornout husk
Of stuffy, prim convention,
That stifles the soul within,
And smothers the hope of freedom
With the blare of a city's din.

Oh, come with me and my caravan,
My wandering abode;
And leave the stones of the city
For the lure of an open road.

* * *

The Music of the A. & P. Gypsies and the sweet singing of Frank Parker should be enough to lure anybody to turn the dials their way on Monday and Thursday evenings. Harry Horlick always manages to have worthwhile music and Frank Parker is an old favorite of mine. If you've not already made their acquaintance, take my tip and tune in. Mondays at 9:00 p. m. WEAF; and Thursdays at 10:00 p. m. WJZ.

* * *

The Latest Recruit to Radio Through WOR is Una Clayton, formerly of vaudeville, who brings her company of players each Thursday at 3:15 p. m. in a sketch entitled "Keep Smiling." Miss Clayton will give a series of four broadcasts.

* * *

The Linit Bath Club has changed the personnel of its program. Hereafter Allie Lowe Miles will replace Margaret Santrey as "the interviewer"; the Rollickers will be the quartet and a different guest soloist will be heard each week.

* * *

Georgie Jessel Recalls the Time when he and Eddie Cantor, as youngsters in Gus Edwards' show, thought a little girl, a newcomer, was getting too much applause when she played her violin. When she took her next bow they were on either side, also carrying violins, and bowing. I think the name of the little girl was Betty Washington, and Betty is still taking bows with her violin in vaudeville.

* * *

Basil Ruysdael, Distinguished Announcer of WOR, surprised his many friends recently by singing on the program of the Bamberger Little Symphony. It was the first time I had heard Basil sing, but I hope it won't be the last, for he proved to own a delightfully resonant basso and sang several operatic solos, including the aria for basso from "The Magic Flute."

* * *

Frank Ford, Who Runs a Dramatic Stock Company over in New Jersey, has written a series of radio sketches called "Sunset Sketches. They will be heard with a commercial tie-up on one of the big chains some time next month.

* * *

Another New Program, "Four Boys and a Girl," may now be heard over an NBC-WJZ network every Monday at 9:30 p. m. Frank J. Novak, Jr., the versatile band leader and instrumentalist, directs an ensemble of five, including himself. It consists of four male instrumentalists, two of whom also sing, and a young girl vocalist.

* * *

Brad Browne and Al Llewelyn also have a new program over WABC and the Columbia network, Tuesdays and Thursdays ,at 8:45 a. m. Brad Browne will be remembered as the originator and keeper of "The Nit Wits." He has been heard with Llewelyn in "Cellar Knights," "Tramp, Tramp, Tramp," and many other programs during the six years of partnership in the business of comedy. The program will be known as "Brad and Al," and is sponsored by William Rogers and Son.

* * *

The Recent Debut of the " Brummel of Song" brought a new name to the radio firmament and a new voice to listeners-in. His name is William Hall and his voice is a magnificent baritone. He may be heard on the Howard Clothes program each Sunday evening at 6:30 p. m. Bill Hall was born and schooled in Brooklyn. He is tall, six feet, five inches, has blue eyes and is definitey handsome.

* * *

Sidelights

HOWARD CLANEY'S hobby is water color painting. . . . JAMES WALLINGTON was once a college correspondent for the Rochester (N. Y.) "Democrat-Chronicle," when he attended the University of Rochester. He also sang baritone with a college quartet and with the Glee Club. Must say, Jimmy, that you picked out a good one when you picked the Flower City. I lived there myself for a few years. . . . THE PICKENS SISTERS have a younger sister, Patti, who also is talented vocally. It looks as if the trio will soon be a quartette. . . . RUTH LYON likes to ride horseback. . . . so does FRANK PARKER. . . . T. DANIEL FRAWLEY managed stock theatrical companies for many years. With his own organizations he made eight trips around the world. His itinerary included Japan, China, India, Java, Burma, Ceylon, Egypt and Africa. . . . WALTER WINCHELL began his newspaper work writing a column for a theatrical weekly, "The Vaudeville News." And well I know it, for I was on that paper, too, and Walter used to criticize my poetry—and how! . . . ALINE AND PETER DIXON never dreamed their audience would take them seriously when they announced they needed seeds for their imaginary garden in "Raising Junior," so now the Dixons are using some of the seeds received on a real garden at their home in Long Island.. . . . JESSICA DRAGONETTE has recovered from the serious attack of laryngitis which caused her to desert the air for awhile. . . . JUNE PURSELL is being used as a model for the cover of a popular magazine. . . . RUTH ETTING'S hobby is dress designing.

* * *

ANSWERS TO CORRESPONDENTS

STANLEY B. SZAFRANSKI, South Bend, Ind. The WGN program, "Painted Dreams," does not come through a New York station, but I shall try and get all the particulars for you and let you know in a future issue. Am glad you like "Station Sparks."

ANNE LAHEY, Paterson, N. J. Gene and Glenn are not brothers. Their program originates from Station WTAM, Cleveland, Ohio. Write direct to them for their photograph.

Biographical Brevities

About Lanny Ross

Lanny Ross was born in Seattle, Washington, of theatrical parents. His father, Douglas Ross, is still well known as an actor and producer, and at the present time is producing plays in London, England. The first five years of Lanny's life were spent in Seattle, the ensuing five he was on the road with his parents. At the conclusion of this itinerant period in his life Lanny attended school in Long Island, swam, played ball and disported himself like an average American lad. This was in 1913.

His grandfather's death in Seattle took the family back to the Northwest. During this time Lanny joined the Boy Scouts and proved himself a good salesman for Liberty Loan Bonds and War Saving Stamps.

Then came a period at a private school in Victoria, British Columbia, where Lanny acquired an Eton veneer and learned to play a good game of cricket—he still does. After a short trip to San Francisco, the next chapter in the story of Lanny Ross swings to New York, where he entered the Cathedral Choir at St. John the Divine as a boy soprano. He next pursued his education at Taft School, where he forsook cricket and baseball for the cinder path. Upon graduation he matriculated at Yale, glorifying Eli on the track. Then Lanny came to New York and took an audition at NBC. Then began his gradual climb up the ladder of fame, and when the Maxwell House program went to Columbia it secured the young baritone for soloist. Lanny recently received a law degree from Columbia University and a scholarship from the Juilliard Graduate School of Music. He devotes his spare time to the study of operatic music and the German and Italian languages.

Lanny is a good-looking chap, six feet tall, with dark gray eyes, brown hair and a most intriguing smile. He is unmarried and lives with his family in an uptown Manhattan apartment. He spends all his spare time at home. His mother is a talented musician, and played piano for Pavlowa several seasons in London. Lanny is without affectation and artistic mannerisms and attributes his success to his mother, who guided him through his school, college and radio periods. His hobbies are running, study and reading.

* * *

Alice Remsen's Selections

SUNDRY SUGGESTIONS FOR WEEK COMMENCING APRIL 17. EASTERN STANDARD TIME USED THROUGHOUT

April	P. M.
17—N. Y. Philharmonic Symphony..WABC—	3:00
17—Footlight Echoes .....WOR—	10:30
(Mario Cardinale, Alice Remsen, George Shackley)	
18—A. and P. Gypsies .....WEAF—	9:00
(Frank Parker and Harry Horlick)	
18—Evening in Paris.....WABC	9:30
(Alice Remsen, Pierre Brugnon and Max Smolen)	
19—Jack and Jean .....WOR—	6:45
(Jack Arthur and Jean King)	
19—Sweetheart Program .....WJZ—	10:15
(John Fogarty)	
20—Stanco Big Time Program.....WEAF—	8:00
(Jack Arthur and Alice Remsen)	
20—Playboy Hour .....WABC—	10:30
(Norman Brokenshire, Welcome Lewis and Nat Brusiloff)	
21—Blackstone Plantation .....WJZ—	9:00
Julia Sanderson and Frank Crumit)	
21—The Beggar's Bowl .....WOR—	10:15
(Basil Ruysdael and George Shackley)	
22—Raising Junior .....WJZ—	6:00
(Aline Berry, Peter Dixon and Raymond Knight)	
22—Maxwell House Tune Blenders....WABC—	7:15
(Lanny Ross)	
23—The Bright Spot .....WABC—	7:30
(Guy Lombardo and His Orchestra)	
23—The Little Symphony .....WOR—	8:00

(If you care to know something of your favorite artists, drop a card to the conductor of this page. Address her: Miss Alice Remsen, care Radio World, 145 W. 45th St., New York City.)

AUDIENCE UP 22,000,000 IN 2-YEAR SPAN

The number of radio sets in homes in the United States is constantly increasing, and the fact that the number increases even during a depression is taken to mean that radio's position is thoroughly well established.

While most of the set and tube manufacturers have not been able to make any money during their past fiscal year, or have shown only a slight margin of profit, as compared to a substantial one the previous two years, average, it is expected that because of the increasing market those who have been able to weather the storm will be in an enviable position soon.

The number of radio-equipped families, counted two years ago as part of the census taken by the Department of Commerce, showed that 12,000,000 families had radio sets out of a total of about 30,000,000 families.

4,500,000 Increase

In this connection a "family" was taken to mean any group living in the same household, and thus an entire orphan asylum or other institution would be counted as one "family."

However, during the two years the number of families with sets has increased about 4,500,000, so that the total is 16,500,000, as compared to a total of 35,000,000 families. The percentage was about 40 for the census figures, but it is now .7. It is expected that before the present year is out more than half of the total families in the United States will have radio receivers and that in less than ten years 75 per cent. of the families will have them.

Conflicting Conditions

The greatest percentage of sets is found in the large centers, so that there are many places in the United States right now where more than half the total number of families have sets. Also in sections not well developed, including those with non-homogeneous populations, with considerable population in the class called economically underprivileged, the percentage of sets runs very small, sometimes under 5.

New York State is first, with the largest number of sets, although Massachusetts has the largest percentage. Pennsylvania has the second largest number of sets.

The census figures gave 4.1 as the average number of persons per family, so on the basis of 16,500,000 families with sets, assuming 4.1 still holds, the listening audience may be estimated at 67,650,000. The census figures for 1930 estimated the listeners as 45,500,000, approximately.

Dog Hears Own Bark That Encircled Earth

Schenectady, N. Y.

A wire-haired terrier owned by one of the engineers of the General Electric Company had a great time barking at himself around the world during radio tests of a hook-up. The terrier barked into the microphone and a moment later he heard his own bark on a loudspeaker, after that bark had gone around the world by way of Holland, Java, and Australia. The dog kept up the barking, having a great time. The operators, too, enjoyed the demonstration.

Rolfe's Tempos Various Now

B. A. Rolfe and his orchestra are back on the air. They play over the WJZ network of the NBC. Rolfe formerly was with the Lucky Strike program, and played fast tempo music, all choruses.

"I'm going to play dance numbers in every known tempo," said Rolfe, referring to the new program.

He has a sponsor and will head the Ivory Program. Thursdays, 8:30 p. m., EST, is the schedule.

ULTRA WAVE IN AIRPLANE TEST

Hartford, Conn.

The American Radio Relay League, the organization of the amateur operators, conducted a successful demonstration of communication between ground and airplane, using an ultra wave.

Joseph Lyman, of Boston, piloted the airplane, while Daniel Kelly, a Boston amateur, was aboard as operator. Amateur stations between Boston and New York had been informed of the test and more than 100 operators tried to pick up the conversation or maintain contact with the plane.

A station established by the League on Sheldon Hill, outside Hartford, carried on two-way communication with the plane and many amateurs throughout a 25-mile zone also listened to the talk. The plane was over Worcester at the time.

One of the amateur bands is 76 centimeters.

As ultra waves travel much as light does, and are affected by obstructing objects as well as limited to the range of sight, it was pointed out that two planes at a sufficient altitude could carry on a conversation without danger of being heard from the ground, and also that there might be semi-secrecy in ground-to-plane communication.

Labor Plans Chain If It Gets Clear Channel

Washington.

Stiff renewal of the fight for a cleared channel is being made by organized labor. A bill has been introduced in the Senate authorizing the Federal Radio Commission to grant such a channel. A subcommittee of the Senate Committee on Interstate Commerce held a hearing on the measure at which representatives of WCFL, Chicago, the labor station; the American Federation of Labor, and of railroad labor organizations argued in favor of the bill.

E. N. Nockles, general manager of WCFL, and representing the Federation, cited a resolution of the Federation to the effect that the Commission had awarded six or seven cleared channels to "overlapping interests" and asking for an investigation of these assignments.

WCFL shares time on 970 kc with KJR, Seattle, Wash., and since KJR has night hours, the labor station is confined to daytime operation.

"We want a cleared channel for labor," said Mr. Nockles. "We believe the only way we can get it is through Congress. Once permission is received to use a cleared channel we will spend from $300,000 to $400,000 to establish a chain of labor stations on that channel, with the central station located in Chicago."

OUTDOOR VISION PICKUP CALLED "YEARS AWAY"

Besides conducting a campaign against extravagant claims for short-wave devices the National Better Business Bureau is investigating the claims made by so-called television companies that offer stock to the public for sale.

For the most part the experiments made in the television field by companies that hold transmitting licenses have been financed as part of the laboratory budget of large undertakings, but some companies have entered the television field without any transmitting license, with the idea of manufacturing receivers. Some of these companies have resorted to the practice of publishing what looks like a newspaper, and which deals with financial topics, including, of course, television.

Praise for Particular Stock

The stock of the company is lauded, the statements made are quite optimistic, and the prospective customer to whom the paper is sent finds that a personal visit or a telephone call naturally will follow in a few days. Then spoken words add glories to the prospects of the stock beyond those bestowed on the printed page.

The Bureau warns investors to be wary of television stocks, particularly as the present situation does not warrant the statement that television as a mode of steady entertainment has actually arrived. Just what degree of perfection television should reach before it may be called commercially practical the Bureau does not state.

Big-Scale Television "Years Away"

Its utterance on this subject follows:

"To estimate the approximate time when television will arrive requires an understanding of what is popularly understood as 'television. If it is the transmitting by radio of pictures of people or objects in motion and capturing them by some equipment that will in turn reproduce tham without great detail so that they can be seen on a small screen or through a peephole, then it has been an accomplished fact for some years. If the popular conception of television is the broadcasting of elaborate outdoor events, such as ball games, so that continuous images can be observed at distant points in satisfactory detail and large size simultaneously with the action, then, judging from the problems which science must surmount before this is accomplished, television is years away."

Guardian of Apes Enjoys His Radio

In an isolated experiment station near Orange Park, Florida, a youthful scientist is living with a group of anthropoid apes and William Shakespeare for company.

The apes are there as objects of an experiment which the scientist is carrying out under the auspices of Yale, but Shakespeare enters the party every Thursday by way of an NBC network.

It is on Thursdays that Shakespearean plays are presented by the National Broadcasting Company, with students of the University of California as actors. Far away in Florida, the listener picks up the broadcast from San Francisco, and enjoys "the pleasantest quarter-hour of the week."

TAX OPPOSED IN TRADE PLEA TO THE SENATE

The radio industry, through Radio Manufacturers Association, Inc., is prepared to appeal to the U. S. Senate for relief from the excise tax of five per cent. on radio and phonograph sales adopted by the House of Representatives.

The proposed radio tax would fall on the public, could not be borne by an industry already severely stricken, and calls for radio and a few other "selected" industries to bear the burden of special manufacturers' sales taxes, according to a statement issued by Bond Geddes, executive vice-president of the association.

"The radio industry is entirely willing to contribute equally with others to the Government's revenue necessities and acquiesced in the House Ways and Means Committee proposal for a general manufacturers' sales tax, even to the considerable extent of 2.25 per cent," said Mr. Geddes.

Attacks House Action

"Now, in the 'revolt' of the House against its leadership and in its hasty, hysterical adoption of 'any sort' of taxes, radio and a dozen other selected industries are penalized and stigmatized as luxuries or semi-luxuries and asked to bear the entire burden of taxation on all industry.

"The ill-considered, unfair and discriminatory results in the House are obvious and the radio industry is prepared to appear to the Senate.

Cites Radio's Service

"In its widespread service to the public as a great agency of communication, religion, education and daily individual and national development, as well as entertainment, radio cannot be fairly classified as a luxury, semi-luxury or non-essential. Like the daily newspaper, which is carefully exempted in the House bill from any additional tax burden, radio is a daily and vital means of communication. Its use is universal and we oppose a special discriminatory tax on this great service to the millions of the American radio public. The classification of radio, with cosmetics, candy, etc., as a luxury, is absurd.

Cites Three Losses

"Annual reports published of three prominent radio companies reflecting industry conditions which are general, report 1931 losses, respectively of $182,080, $215,597 and $1,447,253. The special excise tax of five per cent. on manufacturers' sales of radios, phonographs and accessories, therefore, is one which necessarily will be borne directly by the buying public, as it cannot be absorbed by the industry.

Revenue Will Be Less, He Says

"Furthermore, the revenue returns expected from the proposed radio tax will be much below the estimate of Federal experts. Not $11,000,000, as estimated by House and Treasury experts, but $7,731,750 in taxes would be realized at five per cent. based on 1931 sales if equaled in 1932, which is improbable, especially if a sales tax is added to reduce volume. Tax burdens always increase sales resistance, increase prives to the public, and, therefore, decrease volume of sales. The radio source of taxes would be unquestionably diminished and thus further decrease the anticipated returns."

Tradiograms

By J. Murray Barron

H. Marshall Scolnick, 338 Berry St., Brooklyn, N. Y., announces The Television Enterprises of America has been formed to manufacture and sell a television receiver that will show an image 10x12 inches.

* * *

Solar Manufacturing Co., 599-601 Broadway, N. Y. City, has been organized to manufacture radio parts. Otto Paschkes, former president of Polymet Mfg. Corp., and Paul Hetenyi, until recently executive vice-president and chief engineer of Polymet, are prime movers in Solar. W. C. Harter, formerly sales manager of Polymet, is now in similar capacity with Solar.

* * *

Globe Television & Phone Corp., Starrett-Lehigh Building, N. Y. City, announces a combined sight and sound console receiver. The cabinet houses two separate receivers for simultaneous television and broadcast reception.

* * *

The May Radio & Television Corporation now occupies an entire six-story building, Lafayette and Great Jones Street, N. Y. City.

* * *

Insuline Corporation of America, 23-25 Park Place, N. Y. City, has in production master and multiple antenna couplers.

* * *

S. A. Weiss, Inc., 205 E. 42nd Street, N. Y. City, has been appointed representative for the Grinnell refrigerators.

* * *

Triad Television & Mfg. Co., of Pawtucket, R. I., makers of the Triad tubes, recalls that less than two years ago there were nearly 100 radio tube manufacturers, most of whom were doing a nice business. At present there are less than a dozen and there are very few of thise which remain who claim to be satisfied with the business they are doing. H. H. Steinle, sales executive, reports Triad sales for February, 1932, better than for January. Furthermore, during January "we shipped nearly three times as many tubes as we did during January 1931. This is also true of February."

* * *

Lynch Manufacturing Corporation, 1775 Broadway, New York City, reports total sales for the first quarter of the present year almost exactly 100 per cent. greater than those for the same period last year. The sales refer to resistors, in which the company specializes. Sales of grid leak mountings dropped, as the pigtail type of leak is almost universally used. Precision wire-wound units increased even more than the above average, according to A. E. Stevens, sales manager, while there was an exceptional gain in the sale of metalized resistors for ignition noise suppression in automobiles.

* * *

The annual report of Arcturus Radio Tube Company, of Newark, N. J., for 1931, shows a loss of $266,103.11 after all charges and adjustments, as compared with a loss of $1,368,898.14 for 1930. Net opertating profit before depreciation totaled $63,394.81 in 1931 as compared with a net loss of $791,891.79 in 1930; the improvement being due to the manufacture and sale of nearly twice as many radio tubes in 1931. Balance sheet at the close of the year shows current assets exceeding current liabilities in radio of more than 10 to 1, with cash alone considerably exceeding all current and fixed obligations.

* * *

LuxTron Devices Company has been incorporated under the name of LuxTron Mfg. Co., Inc. S. Wein is the president and chief engineer, Thomas W. Benson vice-president. The company has moved from 338 Berry Street, Brooklyn, N. Y., to 241 Lafayette Street, New York City. The corporation specializes in photo cells and small relays. A pamphlet describes how the photo cell functions and also how the relay works in conjunction with the cell.

* * *

Ohmite Manufacturing Company, 636 North Albany Avenue, Chicago, announces the publication of the Ohmite Rheostat Bulletin 12, an eight page booklet which illustrates and describes the Models J and L Ohmite all-porcelain, 50 and 150 watts, 1 ohm to 35,000 ohms.

* * *

One hundred radio manufacturers will exhibit their radio and electrical products in the Eighth Annual RMA Convention and Trade Show at Chicago, May 23d to 26th. More than 85 per cent. of the available exhibit space in the Stevens Hotel has been reserved.

Admission to the show will be limited to the trade, with the public excluded, as usual. Invitations will be sent May 1 to the trade.

Literature Wanted

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

Foster Porter, Hunter, Ky.
Gordon McKnight, 1457 Winchester Ave., Lakewood, Ohio.
C. B. MacLean, 183 Euston St., Charlottetown, P. E. Island, Canada.
Harry Williams, 139 Shenango Blv'd. Farrell, Penna.
G. T. Geordano, 1720 S. 16th St., Philadelphia, Penna.
Lester H. Geiger, Jr., 1063 Oakdale Road, Atlanta, Ga.
Bob Hamann, 332 Cherry St., Quincy, Ill.
John Lynch, 4135 Wood St., Wheeling, W. Va.
Maxson Weide, Montecito Union School, 69 San Ysidro Rd., Santa Barbara, Calif.
H. F. Holbrook, 2601 Library Ave., Cleveland, Ohio.
S. M. Altschaft, 329 High St., Buffalo, N. Y.
Stanley B. Szafranski, 2012 W. Roger St., South Bend, Ind.
H. G. Gelzer, 6724 S. Karlov Ave., Chicago, Ill.
W. C. Markham, (Television) 2742 Fifth St., Trenton, Mich.
E. G. Mattox, 1629 Summerdale Ave., Chicago, Ill.
William Davidson, 278 East Main St., Waterbury, Conn.

New Incorporations

Buffalo Appliance and Radio Corp., Buffalo, N. Y. —Atty., T. D. Powell, Buffalo, N. Y.
Postal Radio Corp., Wilmington, Del., radio supplies—Attys., Corporation Fiscal Co., Wilmington, Del.
Modernesque Corp., Wilmington, Del., combination radio cabinet known as Modernesque—Atty., Franklin L. Mettler, Wilmington, Del.
John F. Rider Publications, 1440 Broadway, New York, N. Y., publish radio publications—Atty., O. Robinson, 1440 Broadway, New York, N. Y.
Rudy Vallee Orchestra Units Corp., 67 West 44th Street, New York, N. Y.—Attys., Bushel & Gottlieb, 270 Broadway, New York, N. Y.
Schwartz & Munn, Saranac Lake, N. Y., refrigerators—Atty., S. D. Matthews, Saranac Lake, N. Y.
Highway Refrigerator Sales Co., Brooklyn, N. Y. —Atty., L. Wolfsky, 347 Fifth Ave., New York, N. Y.
Appliance Sales Co., New Brunswick, N. Y., deal in refrigerators, furnaces—Atty., Thomas C. Mitchell, New Brunswick, N. J.
Utility Refrigeration Co., New York, N. Y.—Atty., W. Bernstein, 25 West 43rd Street, New
Foremost Refrigeration, Brooklyn, N. Y.—Atty., York, N. Y.
L. Rocklin, 101 Essex St., New York, N. Y.

CORPORATE CHANGES

Designation

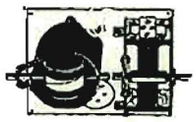
Electric Television and Broadcast Corp., Delaware, apparatus, 500,000 shares no par.

Revival and Extension

Greenbar Electric and Hardware Corp., (Manhattan), New York, N. Y.

DYNAMIC TUNER ASSEMBLY—OTHER COILS

A tuning condenser with a dynamic coil to match, mounted on an aluminum base that has socket built in. The condenser shaft goes in a dial (not furnished). The tuned circuit includes a fixed and a movable winding (rotor coil) in series. The moving coil is used as a trimmer, set once and left thus, so two separate tuning dials are made to read alike, or gang tuning is made practical. No equalizing condensers needed. Do not couple the adjoining shafts.



For antenna circuit input to any tube fitting four-prong UX socket, or for interstage coupling for 226, 201A, 199, 240 or 280, but NOT interstage for 232 or 222, order PR-BT-L-DC.

For interstage coupling for 232 and 222, order PR-BT-R-DC.

For antenna circuit, as RF input to any five-prong tube, order PR-BT-L-AC.

For interstage coupling for 224, order PR-BT-R-AC.

The assembly will be sent free with a $4 subscription, 35 weeks (7 mos., 1 week). Shipping weight, 2 lbs.

The dynamic coil alone, for either .0005 mfd. or .00035 mfd. tuning. The same coil serves either capacity, as the series rotor may be set in position to increase or reduce the total secondary inductance.

For antenna coil, all circuits, and interstage coupling for all tubes except screen grid, order PR-BT-3A, free with $2.00 subscription, 16 weeks.

For interstage coupling from plate circuit of screen grid tube, order PR-BT-3B, free with $2.00 subscription, 16 weeks.

ANY ONE OF THESE FREE WITH $2 SUBSCRIPTION

(PR-T-5)—Standard 3-circuit tuner for .0005 mfd. where primary is for any type of tube other than plate circuit of screen grid tube.
(PR-T-3)—Same as T-5, except for .00035 mfd. condenser instead of for .0005.
(PR-2-R5)—Radio frequency transformer for .0005 mfd. condenser where high impedance untuned primary is in plate circuit of a screen grid tube, and secondary is tuned by .0005 mfd.
(PR-2-R3)—Same as 2-R5, except that it is for .00035 mfd. tuning.
(PR-5-TP)—Radio frequency transformer for use where primary is tuned and placed in plate circuit of screen grid tube, while secondary is not tuned. For .0005 mfd.
(PR-3-TP)—Same as Cat. 5-TP, except that it is for .00035 mfd. tuning.
(PR-RF-5)—Radio frequency transformer for .0005 mfd. tuning, where untuned primary is in plate circuit of any type tube except screen grid. Useful also as antenna coupler.
(PR-RF-3)—Same as Cat. RF-5, except that it is for .00035 mfd. tuning.

Send $2 for 16 weeks' subscription and select any ONE of above ten coils as premium. Shipping weight, 1 lb.

RADIO WORLD
145 West 45th Street New York City

BINDER FREE

For New Yearly Subscribers

This binder is made of fine brown Spanish fabricoid and will hold 52 issues of Radio World. Year 1931-32 stamped in gold on front cover. A very limited supply on hand. Sent free to new yearly subscribers who send $6 direct to publication office before March 25, 1932. If already a subscriber, send $6 and 52 issues will be added to present subscription. No other premium with this offer.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK CITY

BLUEPRINTS OF STAR CIRCUITS

8-TUBE AUTO SET

Sensitivity of 10 microvolts per meter characterizes the 8-tube auto receiver designed by J. E. Anderson, technical editor of Radio World, and therefore stations come in with only six feet of wire for aerial, and without ground. Most cars will afford greater aerial pickup, and besides the car chassis will be used as ground, so with this receiver you will get *results*. The blueprint for construction of this set covers all details, including directions for cars with negative A or positive A grounded. The circuit features are: (1) high sensitivity; (2), tunes through powerful locals and gets DX stations, 10 kc either side; (3), latest tubes, two 239 pentode r-f, two 236 screen grid, two 237 and two 238; push-pull pentodes, all of 6-volt automotive series; (4), remote tuning and volume control on steering post, plus automatic volume control due to low screen voltage on first detector; (5), running board aerial. The best car set we've published. This circuit was selected as the most highly prized after tests made on several and is an outstanding design by a recognized authority. Send for Blueprint 631, @ 50c

SHORT-WAVE CONVERTER

If you want to build a short-wave converter that costs only a very few dollars, yet gives good results, furnishing all its own power from 110 volts a-c, and uses no plug-in coils, you can do so from Blueprint 630. Price.....25c

5-TUBE AC, T-R-F

Five-tube a-c receivers, using variable mu r-f, power detector, pentode output and 280 rectifier, are not all alike by any means. Forty circuits were carefully tested and one selected as far superior to the others. This prized circuit was the 627, and if you built it, you will always be glad you followed our authentic Blueprint, No. 627. This is the best 5-tube a-c t-r-f broadcast circuit we have ever published. Price 25c

A-C ALL-WAVE SET

An all-wave set is admittedly what many persons want, and we have a circuit that gives excellent broadcast results, and is pretty good (not great) on short waves. No plug-in coils used. Cost of parts is low. Send for Blueprint, No. 628-B, @.....25c.

In preparation, an 8-tube broadcast superheterodyne for 110v d-c. Write for particulars.

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

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TRANSFORMERS, (Radio Power) rewound; specials made. Supreme Radio Laboratory, Dept. W, 16 Fulton Ave., Rochester, N. Y.

WILL SELL FOR BEST OFFER, 1932 Scott All-wave receiver. Perfect condition. Box 353, Ilion, New York.

EBY Ant—Ground twin binding post assemblies, 30c each. Guaranty Radio Goods Co., 143 W. 45th St., N. Y. C.

FULL-SCALE PICTURE DIAGRAM OF TWO-TUBE 15-200-METER BATTERY RECEIVER—Printed in Radio World dated April 2, 1932. This is the diagram asked for by so many readers who were interested in the short-wave receiver described in issue of Feb. 27, 1932. Both copies mailed for 30c. RADIO WORLD, 145 W. 45th St., New York City.

"TALKING MOVIES," by James R. Cameron. A History of the Talking Movie since 1899, with an elementary explanation as to how the pictures are produced and reproduced. Paper cover, $1.50. Radio World, 145 W. 45th St., New York, N. Y.

"1932 OFFICIAL RADIO SERVICE MANUAL," by Gernsback. Complete Directory of all 1931-1932 Radio Receivers. Full Radio Service Guide. Leatheroid binding, $4.00. Radio World, 145 W. 45th St., New York, N. Y.

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

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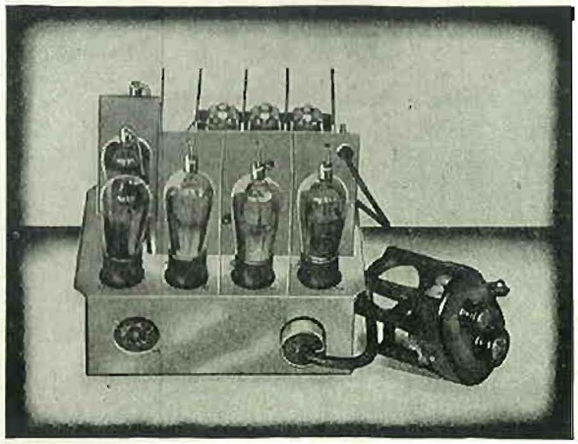
"THE MODERN GASOLINE AUTOMOBILE," by Victor W. Page, M.S.A.E. New Revised and Up-to-date Edition. A whole library of information now complete in one large octavo volume of 1,146 (6 x 9) pages—1,000 engravings. Bound in flexible scarlet fabrikoid. Price $5.00. Radio World, 145 W. 45th St., New York, N. Y.

Anderson's Auto Set, No. 631

In an automobile set what you need and must have is **SENSITIVITY.** You read about high-powered home receivers having a sensitivity of 10 microvolts per meter. Here is an 8-tube auto set, chassis 7 x 11½ x 2¾ inches, that has just such sensitivity. It brings in DX through 50,000 watt locals 10 kc. removed. Did you ever hear of that before in an auto set? Volume is high, without distortion. Push-pull pentode output. This circuit was designed and engineered by J. E. Anderson and is by far the best auto set we've ever heard. Variable mu, pentode r-f tubes.

Complete kit of parts, including remote tuning control, running board aerial, speaker, battery box, everything but tubes which are: two 236, two 237, two 238 and two 239 (automotive 6-volt series). Order Cat. JE-631 @.....$50.00

Set of tubes for car receiver (Cat. 630-TUK), @.....$11.80



INTERMEDIATE FREQUENCY TRANSFORMERS

FOR short wave superheterodyne work 1,600 kc. is the popular intermediate frequency, because you can tune to below 2 meters without interlocking of modulator and oscillator circuits, due to the high intermediate frequency. Our 1,600 kc. shielded transformers have large diameter wire, loose coupling for selectivity and stability, and Bruno-Hund's new superheterodyne condensers built in, accessible to a screwdriver. Both plate and grid circuits are tuned. Shield is 2¾ inch diameter, 2¾ inches high. For variable mu tubes. Order Cat. FF-1600 @.....$1.85

Doubly tuned fixed-frequency transformer, 1 to 1 ratio, 175 kilocycles. Band pass filter characteristic. Hammarlund 20-100 mfd. equalizers across primary and secondary accessible. Aluminum shield (must be grounded) 2¼ inches diameter, 2¼ inches high, removable bottom. For variable mu tubes. Order Cat. FF-175 @.....$1.80

Same as directly above, for 400 kc. Order Cat. FF-400 @.....$1.50

ROLA DYNAMIC SPEAKERS

Series F, Rola dynamic speakers for single pentode output, with 1,800 ohm field coil tapped at 300 ohms. Field coil may be used as B supply choke, with 300 ohm section for 247 bias, if field is put in negative rectifier leg. Output transformer built in. 7" cone. Cat. RO-18 @.....$4.50

Same as above, except that cone diameter is 10.5 inches. Cat. RO-18-10 @.....$5.85

Same as above, except that cone diameter is 12 inches. Cat. RO-18-12 @.....$6.95

Magnavox dynamic 6-inch cone for automobile sets, 6 volt field to be connected to car's storage battery. Speaker fits on fireboard under the instrument board. Shielded cable is supplied with each speaker. Cat. MG-AU @.....$4.95

BROADCAST COILS WITH 80-METER TAP

The shielded 80-550 meter coils have a side lug (shown at left) and four identified lugs at bottom. The side lug is for grid return. The ground symbol lug is the 80-meter tap. P and B go to antenna and ground or plate and B plus. For oscillation B goes to plate and P to B plus.

TAPPED coils are proving very popular, as they make for economy of room and also afford good results. The Roland coils are obtainable for broadcast coverage, 200 to 550 meters, with tap for going down to 80 meters, so television, airplane talks, amateur and other interesting transmission may be heard. An insulated three-deck two-tap long switch is needed for front panel band shifting. See illustration at right. These coils are wound on 1¼ inch diameter and are attached at the factory to aluminum screw bases, with four identified lugs protruding at bottom and a fifth lug at side. An aluminum cover (not illustrated) screws over the base.

The primary is wound over the secondary, with insulating fabric between, and the inductance is kept exactly equal for all coils by keeping the axial length of the winding identical, as well as the number of turns. Therefore at top (what looks like a separate winding), a space is "spun," as well as at bottom, to insure such identical inductance.

For 80-550 meters, for use with 0.00035 mfd. three gang, order Cat. M-35-C (three coils, three shields at this price) @.....$2.45

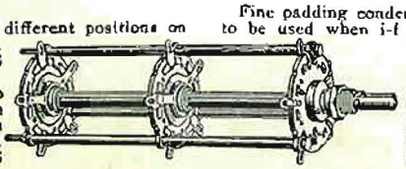
For 0.0005 mfd. order Cat. M-05-C @.....$2.45

175 kc tuning unit: 3-gang condenser, trimmers, r-f and modulator coil, and special oscillator coil with 700-1000 mmfd. padding condenser and 0.6 mmfd. grid-to-grid coupling condenser. Padding directions supplied, (Cat. 175-TU) @ $6.03

LONG SWITCHES

Three decks, four different positions on each deck. Cat. LSW-4-3 @ $2.95

Three decks, two different positions on each deck (used in 627 circuit). Cat. LSW-2-3 @ $2.65



SUPER CONDENSERS

Fine padding condenser, 700-1,000 mmfd. to be used when i-f is 175 kc. Cat. PC-710 @..$ .50

Coupling condenser, oscillator grid to modulator grid, 0.6 mmfd., no pickup winding needed. Cat. C-6T @ .....$ .18

Battery Set
15 to 200 Meters

A SHORT-WAVE receiver, using two 230 (2-volt) tubes, requiring 3 volts filament battery source and 90 volts of B battery. The circuit is detector and one transformer coupled audio stage. This "detector and one step" has been standard for ten years. With this circuit reception the world over has been enjoyed and the elated users number into the teeming thousands. Ranges 15 to 200 meters, using five plug-in coils. Old-timers know this circuit well. Persons who have had no experience with short-waves will find this a most appropriate circuit for a thrilling beginning. The circuit can be wired in 1½ hours.

PARTS REQUIRED: 4 plug-in coils, $1.50; Hammarlund 0.00014 mfd. tuning cond., $1.20; Hammarlund 0.0002 tuning cond., $1.35; three UX sockets, 30c; audio trans., 70c; 50,000 ohm leak, 10c; 300 turn honeycomb, 30c; 0.00025 mfd., clips, 15c; 6.5 ohm limiting resistor for filament circuit, 15c; 20-ohm rheostat, 40c; 20-100 mmfd. equalizer, 20c; battery switch, 20c; 6 bind. posts, 30c; bind. post strip, 10c; vernier dial, 50c; two knobs, 10c; 7 x 10 bakelite panel, $1.25; 7 x 10 baseboard, 25c.

Designed by Jack Tully.

Complete parts, with blueprint, less tubes, (Cat. SW-DAF), @.....$9.10

Two 230 tubes @ total of.....$1.02

NATIONAL DRUM DIAL

National Velvet Vernier drum dial, type H, for ¼" shaft. An automatic spring take-up assures positive drive at all times. Numbers are projected on a ground glass. Rainbow wheel changes colors in tuning. Order Cat. ND-H @ $3.13.

GUARANTY RADIO GOODS CO.
143 W. 45th St., New York, N. Y.

Precision Parts

800 TURN HONEYCOMB coil, total diameter 1¾ inches; will tune to 175 kc. with 0.0001 mfd. (or 20-100 mmfd equalizer). Cat. HC-800 @.....$ .85

300 TURN HONEYCOMB coil, same style, tunes to 400 kc. with 0.0001 mfd. Also may be used without condenser as antenna input coil, screen and plate choking, or two used inductively coupled for evening the amplification of t-r-f sets, in untuned stage feeding detector Cat. HC-300 (each) @.....$ .85

50 TURN HONEYCOMB coil, ¼ millihenry, for all short wave purposes. Cat. HC-50 @.....$ .25

1 WATT PIGTAIL RESISTORS, all resistance values. Mention Cat. PGTR and state resistance in ohms thereafter. Price .....$ .15

5 WATT 2,250 OHM resistor to drop maximum B to B plus 180 volts for plates of r-f tubes in any t-r-f set. Cat. 5-W-2 @.....$ .45

POTENTIOMETERS: 400 ohms at 27c; 5,000 ohms @ 25c; 25,000 ohms @ $1.25; 50,000 ohms @ $1.25; 100,000 ohms @ $1.25; 500,000 ohms @ $1.25.

POTENTIOMETER with a-c switch attached. 10,000 ohms, for variable mu grid bias as volume control. Cat. POT-5-SW @.....$1.35

WALNUT FINISH, EITHER DORSET OR STANTON CABINET for midget sets, cut for 7-inch cone. Cat. MDCB @.....$4.90

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Shielded. Cat. DJA-35 @.....$1.85

KELFORD 30 henry choke; stands up to 100 ma; in black shield case. Cat. KEL-30 @.....$1.75

KELFORD 15 henry B supply choke; 60 ma; unshielded. Cat. KEL-15 @.....$ .95

2.5 VOLT center tapped fil. trans., 8 amperes (will stand up to five heater tubes, when voltage is 2.25 v). Cat. FLT @.....$1.62

HAMMARLUND 0.0002 mfd. variable condenser, junior midline; rotation is within 2-inch diameter; for short waves. Cat. H-20 @.....$1.35

HAMMARLUND 60 mmfd. manual trimming condenser, Cat. H-60 @.....$ .70

HAMMARLUND 20-100 MMFD. EQUALIZERS: adjusting screw works in a threaded brass stud, so excess force cannot damage the unit. Cat. 3-MO-100 (price is for three) .....$ .60

CHASSIS for midget, fits in Roland cabinet; chassis is 13½ inches wide, 7½ inches front to back; flaps front and back 3 inches high; drilled for sockets and speaker plug and for volume control and switch at front. Cat. 5-TCH @.....$1.75

CHASSIS for 6 tube midget. Cat. 6-TCH @.....$1.75

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Cat. DJA-35 @.....$1.95

THREE 0.1 MFD. condensers in one shield case; black lead is common; three red leads go interchangeably to destination; mounting screw built in. Cat. 31 @...$ .57

MIDGET POWER TRANSFORMER, for five-tube set, to handle three heater tubes, one 247 and one 280. Cat. MPT-5 @.....$3.15

MIDGET POWER TRANSFORMER for six-tube set, to handle four heater tubes, one 247 and one 280. Cat. MPT-6 @.....$3.55

8 MFD. WET ELECTROLYTIC condenser, for inverted mounting; washer and extra lug provides insulation from chassis for circuits with B choke in negative leg. Cat. LCT-8 @.....$ .62

TELEVISION KIT, 80-100 meters, using two stages 235-r-f, 224 power detector, 224 first a-f, 247 output, 280 rectifier. R-f coils have right-angle honeycomb chokes with 4-turn pickup windings. Designed by Edwin Stannard. Dorset cabinet and Rola speaker included. 110 v., 50-60 c. Order Cat. TK @.....$18.95

APRIL SPECIALS !!

NOTICE our important New departure in announcing Special values. Every month we will show on this page certain *STAR* ★ items, which are NOT LISTED IN OUR CATALOG. These are all specials of which the quantities on hand are not sufficient to catalog them. *Once sold out, no more can be had.*

STOP SHOPPING. The lowest prices are right on this page. *No one undersells us.* We meet any price on ANY NEW Merchandise. Order direct from this page and save money. 100% satisfaction on every transaction. Take advantage of these special offers. ORDER NOW, TODAY.

NEW! "LITTLE GIANT" DYNAMIC SPEAKER

Absolutely the smallest dynamic speaker that will withstand the strain of modern output power tubes, over manufactured. Suitable for use on midget, portable and automobile receivers. Measures but 6¾ in. long over-all, having a 4½ in. diaphragm and weighing but 4 lbs. The "Little Giant" has, under test, actually flooded a ten-room apartment with faithfully reproduced music of virtually original tone quality. Field winding has a resistance of 2500 ohms and may therefore be energized by using it as a filter choke in the power pack, thereby serving a double purpose. This last feature makes the "Little Giant" excellently suited for portable A.C. sets, since it does away with filter chokes and thus with considerable weight. Equipped with built-in output transformer to work from any standard output power tube arrangement. Specify the power tube or tubes used when ordering. Shipping weight 5 lbs. List Price $6.50.

No. 1549. LITTLE GIANT DYNAMIC SPEAKER..Your Price **$2.50**

★UTAH A.C. DYNAMIC SPEAKER—Only a Few Left

110-volt, 60-cycle A.C. light socket supply for field excitation with Westinghouse dry rectifier. 9 in. high, 9½ in. wide, 7½ in. deep. Speaker comes packed in wooden crate. Weight 19 lbs. It is one of the most powerful as well as best reproducers in the market. 9-inch cone.

List Price, $50.00.

No. S.P. 1506—Your Special Price **$7.45**

★FARADON 4-MFD. FILTER CONDENSER

Here is just the condenser for constructing noise filters. In some cases one condenser connected across the line or instrument will be sufficient. However, in most commercial filters there are two condensers connected in series; the center-tap being grounded and the two remaining leads connected across the light line or the interference-producing apparatus. Put up in a neat, black-enameled case with tinned lugs for soldering connections. 2" high x 3½" wide x 2¼" deep. Working potential 600 volts D.C. Ship. wt. 6 lbs. List Price $7.50.

No. S.P. 9062—Faradon 4 Mfd. Filter Condenser. Your Price **$1.50**

World-Wide Short-Wave Set NOT A CONVERTER

NEW

A perfect radio short-wave receiver for use between 18 and 200 meters. To put into operation, connect antenna, ground, 45-volt "B" and two No. 6 dry cell "A" batteries, and headphones to the posts provided, plug in a type '30 tube, and tune in! An ingenious circuit makes possible a 4-coil single-winding plug-in design. This little instrument has the same sensitivity as many big, shielded short-wave receivers costing ten times as much. A power amplifier may be added for any degree of volume. Complete with 4 plug-in coils. Has fine vernier dial for precision tuning. Never has a first class short-wave set sold for so little money. This short-wave set measures 5½x7x4 in. high, over all. Ship. weight, 3 lbs. List price, $12.50.

No. 1666—World-Wide S.-W. Set. Your price..... **$6.25**

NEW! NEW! SYNCHROMATIC ELECTRIC CLOCK

Never was such a first class electric clock sold at such a ridiculously low price! An electric clock using the famous synchromatic movement. Naval observatory time right from your light socket! No spring to wind, no batteries. Never out of order. Lubricated for a life-time at the factory. The entire movement with its white-enameled dial and artistic numbering is enclosed in a dustproof and shockproof genuine molded Bakelite case. The case is of walnut-brown finish with simple but catching design. For 110 volts, 60 cycle A.C. operation only. Complete with cord and attachment plug. Size 3¾"x4½"x1¾". Weight 1 lb. Service men now sell these fine clocks by the hundreds. Be the first in your locality to handle them.

List Price $3.00.

No. 1689—Synchromatic Electric Clock. Your Price **$1.00**

NEW RESONANCE TUNING METERS

This ingenious device INDICATES VISUALLY when a station is exactly "tuned-in-on-the-dot." Receiver is tuned to its most critical resonance point for any given station when needle swings to farthest position. Servicemen profit by installing these meters in sets which are not so equipped. Have only scales and pointers visible through an escutcheon plate. Used in new Stromberg-Carlson sets.

EXCELLENT TUNING DEVICE FOR SHORT-WAVE RECEIVERS. The extremely sharp tuning short-wave stations are very easily detected by this visual indicator where the ear usually misses them. Easily installed on any receiver by placing it in series with the plate of the power tube. Shipping wt. ½ lb. Available in two styles.

TM-103—(Illustrated) Enamel finished dial—lighted from flat side of the case over the top of the dial.

TM-100—Translucent dial—lighted from a rear window. Your Price **$.90**

List Price $1.50.

Escutcheon Plate .....$.25 extra

Pilot light and bracket.....$.30 extra

★ VERSATILE PORTABLE PUBLIC ADDRESS SYSTEM

Comprises Microphone, Loftin-White Amplifier and Dynamic Speaker.

A recently completed all-electric A.C. development incorporating all the features and advantages of the direct-coupled Loftin-White Amplifier principle.

The amplifier is a high quality two stage job, having some RADICALLY NEW IDEAS IN AUDIO FREQUENCY AMPLIFICATION and employing 1-'27, 1-'45 power tube and 1-'80 full-wave rectifier. It is remarkably free from A.C. hum.

The design is adaptable to all purposes, i.e., microphone, radio and phonograph. Has an undistorted power output of approximately 3.5 watts; SUFFICIENT TO OPERATE FROM 2 TO 3 ADDITIONAL DYNAMIC SPEAKERS.

The portable address system is sold COMPLETE WITH THE NEW R.C.A.-VICTOR HAND MICROPHONE;—a sturdily constructed unit which will withstand a lot of rough handling.

Put up in a single compact and perfectly balanced carrying case, the front of which is utilized as a baffle for the self-contained dynamic speaker. Complete with microphone and accessories the weight is only 30 pounds. For 50-60 cycles, 110-120 volts A.C. operation. Shipping weight 38 pounds.

List Price, $75.00

No. S.P.9063—Versatile Portable Address System. Your Price, complete with microphone **$25.50**

FREE 76 Page Radio Treatise No. 4

The new Winter edition of our RADIO SERVICE TREATISE, twice as large as our former one, has just come off the press. It is positively the greatest book in print—NOT JUST A CATALOG. It contains a large editorial section—a veritable book in itself—with valuable information NOT FOUND ANYWHERE ELSE. Among the wealth of new technical information listed in the editorial sections are the following: 1932 Complete Radiotron Characteristics SHORT-WAVE TUNERS and PHONO-PICKUPS.—Constructional Data of SERVICEMEN'S TEST OSCILLATOR—ALL ABOUT TONE CONTROLS—SHORT-WAVE ADAPTERS AND CONVERTERS—CONSTRUCTING A 3-TUBE SUPER-HET SHORT-WAVE CONVERTER.—MODERNIZING OLD RADIO SETS.—LATEST TYPE MULTI-MU AND PENTODE TUBES.—ALL ABOUT DC RECEIVERS.—VACUUM TUBES TREATISE.—And dozens of new radio experiments, hints to Servicemen, valuable tables of useful data, etc., etc.

This book is not just another catalog but a veritable mint of radio information which will be of infinite and everlasting value to you.

100 New Hook-Ups, etc. 675 Illustrations.

WRITE TODAY. Enclose 2 cents for postage. Treatise sent by return mail.

6 MONTHS GUARANTEED NEONTRON TUBES

Sold on a 6 MONTHS FREE REPLACEMENT GUARANTEE BASIS, PROVIDING TUBE LIGHTS! All tubes are carefully meter-tested before shipment, and carefully packed. Do not confuse these HIGH QUALITY tubes with any other "low priced" tubes—our low prices are possible because we do a VOLUME business!

Choice	Choice of	Choice	Choice	NEW Choice	Choice
226	112A	245	222	230	235
227	200A-199X	280	210	232	247
171A	199UV-120	171	250		238
201A	224		281		236-37
					351
60c ea.	69c ea.	70c ea.	1.58 ea.	1.08 ea.	1.08 ea.

R.C.A. LICENSED TRIAD AND SPEED TUBES

These nationally advertised tubes are guaranteed UNCONDITIONALLY for six months. The prices are slightly higher than our NEONTRONS because these tubes are of much better quality. See listing above for tube numbers.

Choice Price	Choice Price	Choice Price	Choice Price	Choice Price	Choice Price
63c	80c	75c	$1.76	$1.15	$1.15

★ "POROX" 2-VOLT STORAGE CELL

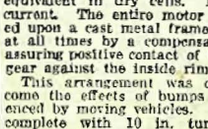
5 Ampere-Hours—For 2-Volt Tubes

One such unit will light a two-volt battery tube for 75 hours continuously. Will handle two 2-volt tubes for 35 hours, etc. Put up in a transparent composition container with two non-corroding terminals clearly marked as to polarity. Easily recharged either directly from a 110 volt D.C. line in series with a 40 watt electric light bulb or from an "A" eliminator in series with a 12 ohm 2 watt resistor. Excellent for use in any circuit requiring a steady source of current. 3" wide x 4" high x ⅞" thick. Instructions included. Ship. wt. 2 lbs.

List Price $4.50

No. S.P. 9060—Porox 2 Volt Storage Cell. Your Price ..... **$.80**

★6-VOLT BATTERY PHONO-MOTOR



At last a REAL battery motor—designed especially to meet the needs of semi-portable and portable address systems especially installations on moving vehicles. It will easily and economically operate from 6 volt storage battery or the equivalent in dry cells. Draws very little current. The entire motor is flexibly pivoted upon a cast metal frame and is held taut at all times by a compensating spring, thus assuring positive contact of the friction drive gear against the inside rim of the turntable.

This arrangement was designed to overcome the effects of bumps and jars experienced by moving vehicles. The motor is sold complete with 10 in. turntable, mounting plate and motor switch and speed control. Shipping weight—10 lbs. List Price, $15.00.

No. SP9058—6-Volt Battery Phono Motor. Your Price..... **$2.50**

★ R.C.A.-VICTOR HAND MICROPHONE

The most ruggedly constructed hand microphone ever manufactured. There is not another of its kind that is quite as sensitive. Designed especially for home recording and personal entertainment. Requires but a 22½ volt battery to operate. Easily connected to any radio or amplifier in a few minutes. This unit is essentially a single button carbon microphone — acoustically centered in a stout metal housing which serves the dual purpose of protection and noise shielding. Responds indiscriminately to all speech and music frequencies. Has a high D.C. resistance and may therefore be shunted directly across the grid and cathode of the detector tube without employing a coupling transformer. Sold complete with 6 ft. connecting cable. Shipping weight, two pounds. List Price, $10.00.

No. S.P. 9064—R.C.A.-Victor Hand Microphone. Your price **$2.75**

Screen Grid Cap Connectors

Newest SCREEN GRID CAP. Small, neat in appearance and ruggedly constructed. A stark necessity in service work. Sold only in lots of 12 or more. Shipping weight 4 oz.

No. 1672—Screen Grid Cap Connector. Your price.....Dozen **$.12**

★Guaranteed 8-Mfd. Electrolytic Condensers

Judiciously used in many parts of any R.F. or A.F. circuits, in power packs, in dynamic speakers, they will perform miracles in eliminating any trace of objectionable A.C. hum or other incidental disturbances. These electrolytic condensers are particularly recommended for 250 power packs. Where the working voltage of the unfiltered A.C. is 800 volts, two electrolytic condensers in series will stand up indefinitely.

Easily mounted through the use of a bayonet socket base which is equipped with a "positive contact" spring. Totally shielded and protected by a copper cap. Shipping weight—1 lb. List Price, $2.50.

No. SP9054—Guaranteed 8 Mfd. Electrolytic Condenser. Your Price.... **$.49**

WE ARE A WHOLESALE HOUSE AND CANNOT ACCEPT ORDERS FOR LESS THAN $3.00.

If C. O. D. shipment is desired, please remit 20% remittance, which must accompany all orders.

If full cash accompanies order, deduct 2% discount. Send money order—certified check—U. S. stamps.

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