# RADIO WORLD

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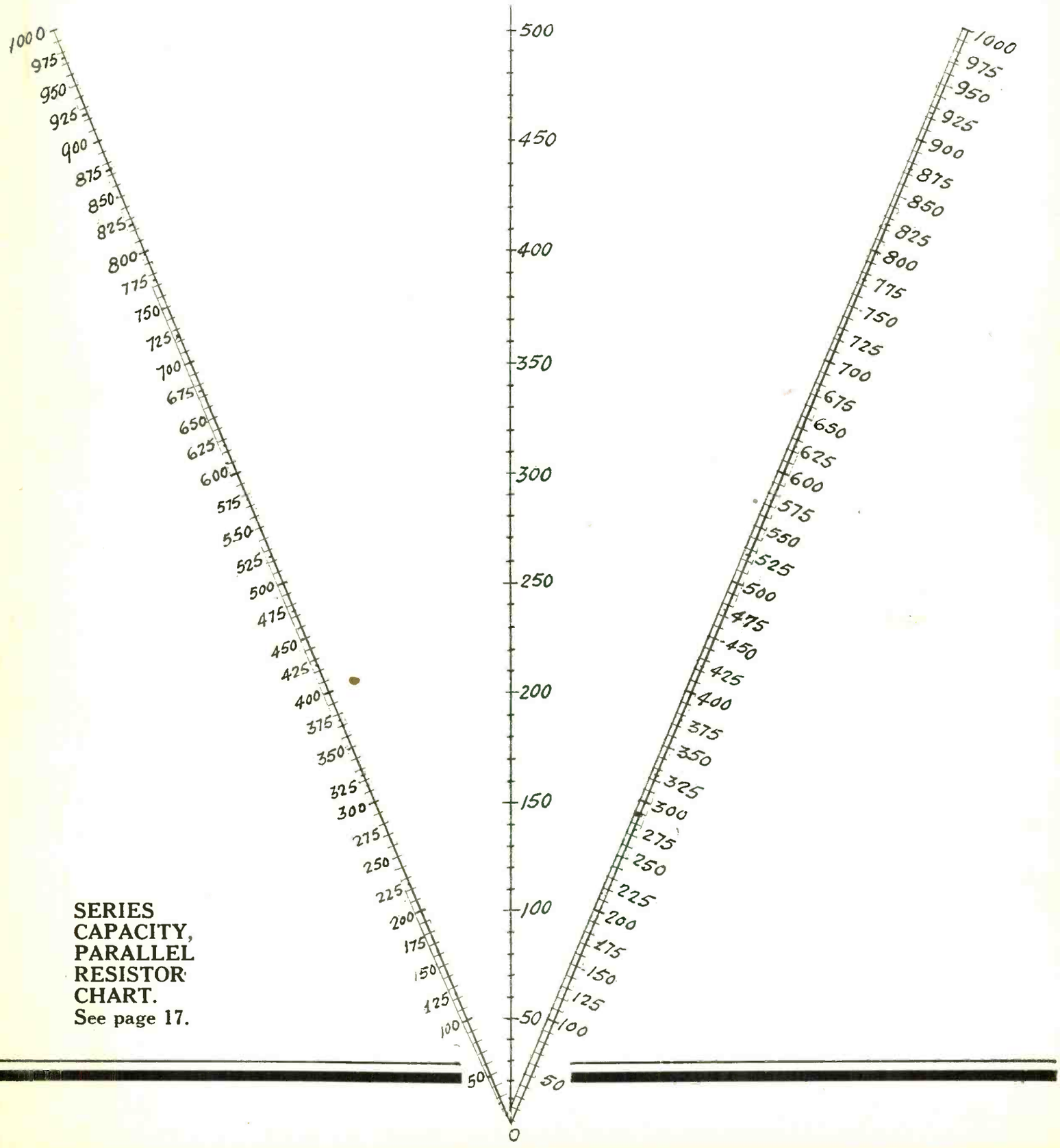
The First and Only National Radio Weekly
*Twelfth Year* *580th Consecutive Issue*


## ALL-WAVE COIL DATA

## CAPACITY, INDUCTANCE MEASUREMENTS

## *NEW TWIN B TUBE*




SERIES CAPACITY, PARALLEL RESISTOR CHART.
See page 17.

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# COVERING 10 TO 555 METERS

## Circuits for Switching and for Plug-in Coils, with Winding Data for 465 kc and 175 kc Intermediate Frequencies.

*By Herman Bernard*

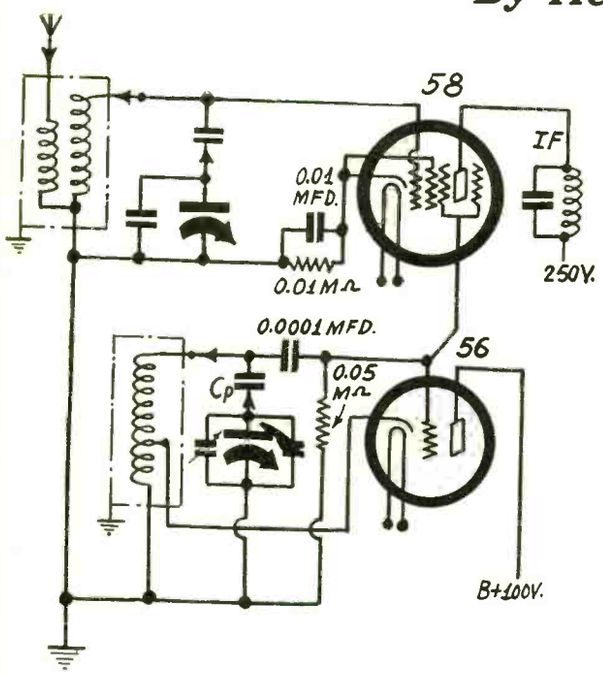


**FIG. 1**

**Mixer for a-c operation, separate modulator (58) and separate oscillator (56). The padding condenser in the modulator is used only on the two highest frequency bands. Cp is the oscillator padding condenser. This circuit is for switching.**

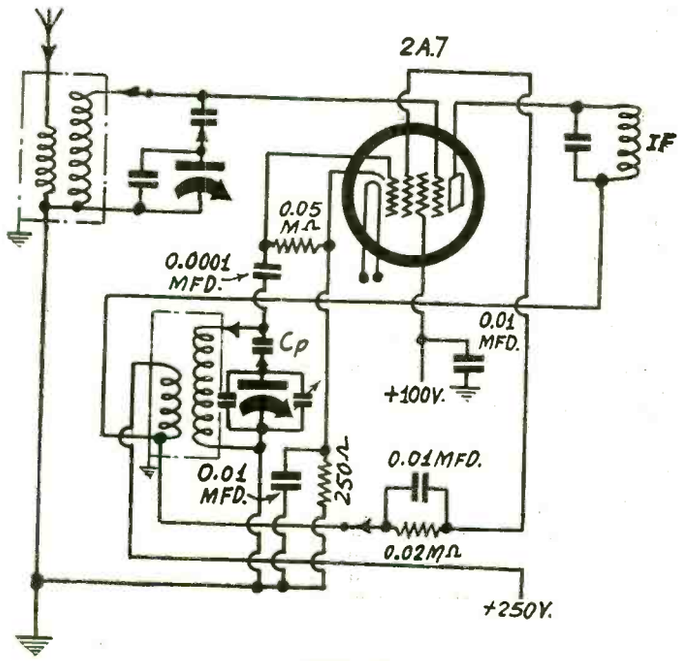


**FIG. 2**

**Another switching circuit, this one for the 2A7, the circuit being the more stable in frequency than a similar one used generally with the 2A7. To insure that the oscillator is self-starting the 0.05 meg. grid leak is returned to cathode.**

SOME unexpected requirements arise when coils are to be wound for all-wave use, say, 540 to a little above 30,000 kc, or about 555 to 10 meters. Besides, the frequency ratio of the tuning circuits has to be considered, so that there is not too much crowding at the higher frequency bands. If a ratio of about 1-to-3 prevails at the broadcast level, the equivalent span would be ten times as great at the highest frequency band for the same ratio, and anything like practical tuning would be nearly impossible.

The table herewith presents the data for the broadcast band, obtained experimentally for a superheterodyne using an intermediate frequency of 465 kc. It is a little more favorable to have a high intermediate frequency, as the separation of frequencies is helpful on at least part of the short-wave tuning.

### Experimental Findings

On the basis of coils actually wound, and frequency ratios in conjunction with known maximum capacities, it was ascertained that the oscillator minimum capacity, everything counted, was 55 mmfd., and that for the r-f tuning was 42 mmfd.

The higher minimum for the oscillator was necessary for accurate padding. The inductance values are given for a condenser of 410 mmfd., 220 microhenries and 110 microhenries respectively, modulator and oscillator, with the number of turns to achieve the inductance, allowing for the effect of an aluminum shield at 2 1/6 inches outside diameter, 2½ inches high, the form diameter being 1 inch.

Different circuit conditions—a larger or smaller minimum capacity in the oscillator, for instance—would give different inductance and padding condenser requirements, but as the present broadcast data were obtained experimentally, they will be accepted as the basis of computation of the rest of the coils.

(*Continued on next page*)

# WINDING DATA FOR 1-INCH DIAMETER (SHIELDING)

## TUNING CONDENSERS, 410 MMFD.*

### Intermediate Frequency, 465 kc.

| Band | Lrf | Turns | Lo | Turns | Cp | Frequency Coverage R-F | Frequency Coverage Osc. |
|---|---|---|---|---|---|---|---|
| (1) | 220 mch. | 119 32 en. | 110 mch. | 70 32 en. | 580 mmfd. | 540- 1,600 kc. | 1,005- 2,065 kc. |
| (2) | 26 mch. | 35 26 en. | 16.5 mch. | 25 26 en. | 4,830 mmfd. | 1,500- 4,700 kc. | 1,965- 5,165 kc. |
| (3) | 3.8 mch. | 15 18 en. | 3.8 mch. | 15 18 en. | 1,270 mmfd. | 4,000-11,000 kc. | 4,465-11,465 kc. |
| (4) | 1.15 mch. | 5.8 18 en. | 1.15 mch. | 5.8 18 en. | 475 mmfd. (both) | 10,000-20,000 kc. | 10,465-20,465 kc. |
| (5) | 0.38 mch. | 3 18 en. | 0.38 mch. | 3 18 en. | 475 mmfd. (both) | 18,000-35,000 kc. | 18,465-35,465 kc. |

Lo = oscillator inductance.
Lrf = radio frequency inductance.
en = enamel-covered wire.
Turns = number of turns of wire on 1-inch diameter, size wire on second line. Turns are to right of inductance.
Cp = padding condenser for oscillator.
Cp (both) = padding for oscillator duplicated also for r-f.
* For the last and next to the last bands the tuning capacity is reduced to 220 mmfd. maximum by the 475 mmfd. series condensers. For (3), (4) and (5) r-f minimum is 50 mmfd., same as oscillator always is. R-F minimum 42 mmfd. for (1) and (2).

(*Continued from preceding page*)

The fine wire used, No. 32 enamel, is necessary, due to the short length of the form, and besides one must provide room for a primary next to the secondary. If this is done the primary may have only 12 turns, separated from the secondary by 1/16 inch, as loose coupling is essential in the broadcast band for maintaining freedom from squeals due to otherwise low selectivity ahead of the mixing process.

### Tap Locations

For the other coils, the same or a little greater separation existing, the primaries in the antenna circuit may have about one-quarter the number of secondary turns, of the same kind of wire as used on the secondary.

The oscillator circuit for separate tubes has a tapped coil in a Hartley circuit. This tap location is not critical. For broadcasts it may be about one-eighth the total number of turns, say, 15 turns between ground and tap and 104 turns between tap and grid. For the second coil system (lowest frequency of short waves) the tap may be one-quarter the number of turns up from ground end, while for the rest of the windings the location should be approximately at center.

Considering the broadcast band, the padding condenser is 580 mmfd., and may be constituted of a fixed mica condenser of 500 mmfd. rating (0.0005 mfd) and across it an air dielectric condenser of 56 to 90 mmfd. range, like the new one may by Hammarlund.

However, the fixed condensers have a tolerance of 10 per cent. in commercial production, and if the value is maximum over-capacity, you will have 550 mmfd. with a minimum of 56 from the variable, or too much capacity. If the minimum difference exists, 450 mmfd, capacity actually, then you have a working minimum of 506 mmfd. and a maximum of 540 mmfd. and would not get enough capacity.

### Capacity Checked

So it is helpful to determine the value of the fixed condenser, and if the oscillator coil is used and this capacity alone is put across as the secondary, even across the oscillator coil hooked up temporarily in another circuit, resonance should be at 690 kc. The capacity will be satisfactory if the resonance point is 680, 690, 700 or 710 kc. It is well to have a few of these fixed condensers, preferably of the moulded type, and even if you can not well make the measurement, you can try one condenser after another in the circuit, to determine which one affords the proper results within the scope of the variable.

The fixed and variable capacities for padding are put in parallel, and the circuit as a whole in series with the tuning condenser. It is not practical to ground the padding condenser in this circuit, as there would be no return, or if a resistor were used to establish a return, all the plate current would have to pass through this resistor, and to make the padding condenser effective the resistance would have to be inimically high.

### First Short-Wave Band

Overlap is provided in all bands. For instance, the broadcast band tuning winds up at 1,600 kc, or it may turn out to be 1,575 kc as such a relatively small difference is not easily avoided, but the next band starts at 1,500 kc. The oscillator tuning in all instances is 465 kc higher than the modulator tuning, and the mixing of the two frequencies in the modulator gives an output equal to the intermediate frequency which the primary in the plate circuit of the modulator accepts.

The same capacities are assumed for the first short-wave band, the inductances are different and padding is introduced, but the padding condenser is 4,830 mmfd. (0.00483 mfd), but a fixed condenser of 0.005 mfd. would serve the purpose, if not far off, which may be determined experimentally by having several such condensers and trying one after another. The capacity of 4,830 mmfd., across the broadcast oscillator coil, will resonate at 230 kc, and a third harmonic beat with a broadcast frequency of 690 kc may be used for testing, the variation allowable being the same as for the previous test, since the broadcast frequency used here (third harmonic) is the same frequency, 690 kc, as the fundamental when we were testing for 580 mmfd.

### Two Minima Made Alike

Farther than the first short-wave band we can not proceed without doing something about the difference in minimum capacities, modulator compared to oscillator. If nothing is done the modulator will cover so much greater frequency span that the oscillator could not track it. So we must introduce extra fixed capacity in the modulator circuit, which has the further advantage of reducing the frequency ratio, giving a little better spread and improving the frequency stability.

If the inductances are made equal, 3.8 microhenries, for the second short-wave band, then a padding condenser may be used even in this band, of 1,270 mmfd., which, across the broadcast oscillator coil, would cause, an oscillation of 375 kc, so 750 kc may be used as the broadcast frequency test (second harmonic).

The modulator minimum having been lifted to 55 mmfd., to match the oscillator minimum, the same situation obtains for the two remaining bands. However, for these two bands, while the capacities are the same in both circuits, they are considerably reduced from the 410 mmfd., because it is imperative to contract the frequency ratio. This might be done by parallel capacity, but then the inductance-to-capacity ratio would be too low, particularly at the high frequency end of either tuning either circuit, for sensitivity.

### Two A-C Circuits

Therefore a series condenser is used in each circuit, and its capacity is 475 mmfd., the broadcast test frequency used when the unknown capacity is across the broadcast oscillator coil being 700 kc. Thus we have changed to 220 mmfd. tuning condensers, but since the minimum is virtually unchanged by the series capacity, we have a capacity ratio of 55 to 220 or 4 to 1, and a frequency ratio of 2 to 1.

The tables do not give primary or tickler windings. For primaries the general data

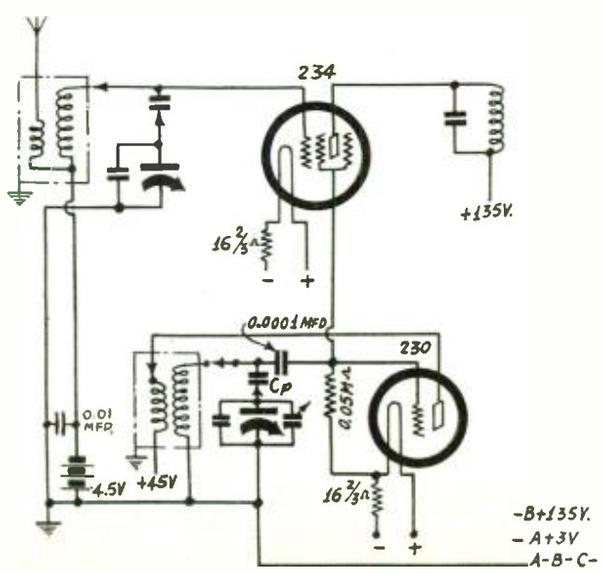


**FIG. 3**
**For battery operation, either switching or plug-in coils, the circuit may be as shown. Tubes of the 2-volt series are used. The same inductance values are to be used as for a-c operation. These data are given in accompanying tables.**

# WINDING DATA FOR 1¼-INCH DIAMETER (NO SHIELDING)

## TUNING CONDENSERS, 410 MMFD.*

### Intermediate Frequency, 465 kc.

| Band | Lrf | Turns | Lo | Turns | Cp | Frequency Coverage R-F | Frequency Coverage Osc. |
|---|---|---|---|---|---|---|---|
| (1) | 220 mch. | 87 32 en. | 110 mch. | 54 32 en. | 580 mmfd. | 540- 1,600 kc. | 1,005- 2,065 kc. |
| (2) | 26 mch. | 33 26 en. | 16.5 mch. | 19.5 26 en. | 4,830 mmfd. | 1,500- 4,700 kc. | 1,965- 5,165 kc. |
| (3) | 3.8 mch. | 10 18 en. | 3.8 mch. | 10 18 en. | 1,270 mmfd. | 4,000-11,000 kc. | 4,465-11,465 kc. |
| (4) | 1.15 mch. | 4.7 18 en. | 1.15 mch. | 4.7 18 en. | 475 mmfd. (both) | 10,000-20,000 kc. | 10,465-20,465 kc. |
| (5) | 0.38 mch. | 2.4 18 en. | 0.38 mch. | 2.4 18 en. | 475 mmfd. (both) | 18,000-35,000 kc. | 18,465-35,465 kc. |

Lo = oscillator inductance.
Lrf = radio frequency inductance.
en = enamel-covered wire.
Turns = number of turns of wire on 1¼-inch diameter, size wire on second line. Turns are to right of inductance.
Cp = padding condenser for oscillator.
Cp (both) = padding for oscillator duplicated also for r-f.
* For the last and next to the last bands the tuning capacity is reduced to 220 mmfd. maximum by the 475 mmfd. series condensers. For (3), (4) and (5) r-f minimum is 50 mmfd., same as oscillator always is. R-F minimum 42 mmfd. for (1) and (2).

# WINDING DATA FOR 1-INCH DIAMETER (SHIELDING)

## TUNING CONDENSERS, 410 MMFD.*

### Intermediate Frequency, 175 kc.

| Band | Lrf | Turns | Lo | Turns | Cp | Frequency Coverage R-F | Frequency Coverage Osc. |
|---|---|---|---|---|---|---|---|
| (1) | 220 mch. | 119 32 en | 150 mch. | 94 32 en. | 1,220 mmfd. | 540- 1,600 kc. | 715- 1,775 kc. |
| (2) | 26 mch. | 35 26 en. | 18 mch. | 27.5 26 en. | 4,160 mmfd. | 1,500- 4,700 kc. | 1,675- 4,875 kc. |
| (3) | 3.8 mch. | 15 18 en. | 3.8 mch. | 15 18 en. | 0 | 4,000-11,000 kc. | 4,175-11,175 kc. |
| (4) | 1.15 mch. | 5.8 18 en. | 1.15 mch. | 5.8 18 en. | 475 mmfd. (both) | 10,000-20,000 kc. | 10,175-20,175 kc. |
| (5) | 0.38 mch. | 3 18 en. | 0.38 mch. | 3 18 en. | 475 mmfd. (both) | 18,000-35,000 kc. | 18,175-35,175 kc. |

Lo = oscillator inductance.
Lrf = radio frequency inductance.
en = enamel-covered wire.
Turns = number of turns of wire on 1-inch diameter, size wire on second line. Turns are to right of inductance.
Cp = padding condenser for oscillator.
Cp (both) = padding for oscillator duplicated also for r-f.
* For the last and next to the last bands the tuning capacity is reduced to 220 mmfd. maximum by the 475 mmfd. series condensers. For (3), (4) and (5) r-f minimum is 50 mmfd., same as oscillator always is. R-F minimum 42 mmfd. for (1) and (2).

# WINDING DATA FOR 1-INCH DIAMETER (NO SHIELDING)

## TUNING CONDENSERS, 410 MMFD.*

### Intermediate Frequency, 175 kc.

| Band | Lrf | Turns | Lo | Turns | Cp | Frequency Coverage R-F | Frequency Coverage Osc. |
|---|---|---|---|---|---|---|---|
| (1) | 220 mch. | 87 32 en. | 150 mch. | 66 32 en. | 1,220 mmfd. | 540- 1,600 kc. | 715- 1,775 kc. |
| (2) | 26 mch. | 26 26 en. | 18 mch. | 21 26 en. | 4,160 mmfd. | 1,500- 4,700 kc. | 1,675- 4,875 kc. |
| (3) | 3.8 mch. | 10 18 en. | 3.8 mch. | 10 18 en. | 0 | 4,000-11,000 kc. | 4,175-11,175 kc. |
| (4) | 1.15 mch. | 4.7 18 en. | 1.15 mch. | 4.7 18 en. | 475 mmfd. (both) | 10,000-20,000 kc. | 10,175-20,175 kc. |
| (5) | 0.38 mch. | 2.4 18 en. | 0.38 mch. | 2.4 18 en. | 475 mmfd. (both) | 18,000-35,000 kc. | 18,175-35,175 kc. |

Lo = oscillator inductance.
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have been given in the text, if the coil system is for two separate tubes in the mixer. But if the 2A7 is to be used, then a tickler winding would be required, and this would have about one-fourth the number of turns on the secondaries, except for the two smallest coils, which would have about one-half the secondary turns, or more, whatever is needed to provide oscillation. The separation would be 1/16 inch as before. If any change is to be made in the number of tickler turns it had better be by way of increase rather than decrease when the pentagrid tube is used.

Two circuits are shown, one using the Hartley oscillator with separate tubes, the other the tuned grid oscillator, for the 2A7 tube, both a-c operated. Separate coils are to be used, in conjunction with a switch, but the same type switch may be used. This would be a five-position, six-throw type.

Where the minimum capacity is to be increased no special switching requirement exists, since that capacity is put permanently across the coil. It consists of a trimmer adjusted to correct value.

### Manual Trimmer

However, despite all precautions it is still valuable to have a very small manual trimmer across the oscillator, ineffective at low radio frequencies, but particularly helpful in the last and next to last bands, (4) and (5), as much of the tuning then can be done with it to bandspread effect. The capacity should not be much greater than 20 mmfd.

This added effect is not quite so pronounced if the condenser is put across the modulator circuit instead, but if that is done, then no compensation by extra fixed capacity for the third, fourth and fifth bands need be made, if the manual trimmer is large enough in capacity, say, 20 mmfd., to assure making up the difference between 42 and 55 mmfd. The usual small manual with seven plates will serve nicely if plates are taken off, until only three remain, one stator and two rotor. Or a 50 mmfd. fixed condenser may be put in series with almost any manual trimmer to effectuate about the same result on tuning.

### Switch Works Well

When early attempts were made to get results from switching there was not much success, due largely to the poor switches, but since then positive-contact, low-resistance sturdy switches have been put on the market, and excellent results are obtainable therewith. The capacity of the switch is so small that it need not be taken into consideration. The circuit capacity uncertainties are more baffling, and compensation has to be made with great exactness for the last and next to last bands.

# Practical Measurements of Inductance and Capacity

## *Oscillators Utilized and Coil Wound So That Easy Solutions Obtain*

*By J. E. Anderson*

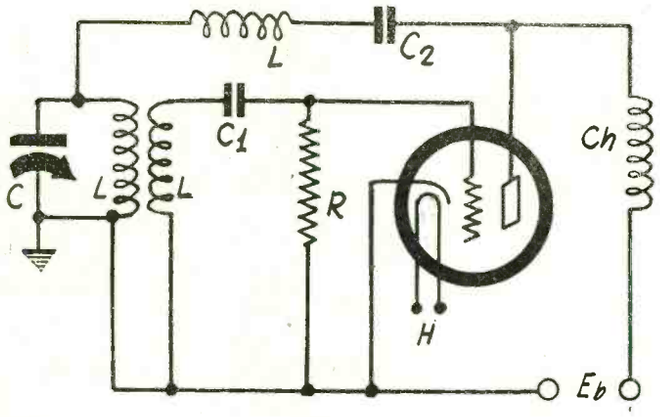



FIG. 1

**An oscillator circuit that is suitable for a variable frequency standard. It is completely stabilized at 1,000 kc and nearly stabilized at other frequencies.**

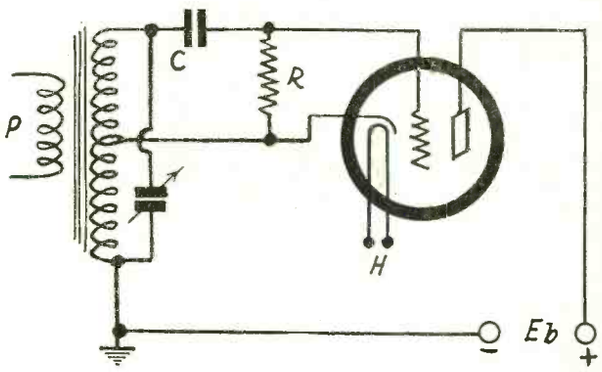



FIG. 2

**A Hartley type audio frequency oscillator that can be used to modulate the output of the oscillator in Fig. 1 by connecting winding P in series with the B supply.**

MANY radio fans are interested in simple methods for measuring inductance, capacity, resistance, and frequency. The equipment must be simple, yet the results should be reasonably accurate, say to one part in 50 or one per cent.

The most important equipment for measuring in the laboratory now is a calibrated oscillator, or any other dependable source of known frequency. Not only is a standard of frequency important because it can be used as a means of measuring other frequencies, but because it can be used for measuring inductance and capacity. Moreover, a high precision standard of frequency is most easily obtained. The frequency of every broadcast station can be used as a standard of sufficient precision. Any radio experimenter will have access to at least 10 different broadcast frequencies, and most of them will have access to about 100. There will be no trouble in calibrating a laboratory oscillator.

### Design of Oscillator

Neither is there any difficulty in constructing an oscillator that will work satisfactorily. Possibly the tuned plate is the most suitable oscillator for this purpose. The diagram of such an oscillator is given in Fig. 1. This circuit contains three equal coils, L, each 253 microhenries. Condenser C2 is so large that it does not affect appreciably the operation of the a-c circuit, and the choke coil Ch also is so large that it does not alter appreciably the a-c circuit. Suitable values are 0.1 mfd. for C2 and 30 millihenries for Ch. These should be regarded as minimum values.

The circuit is plate stabilized by means of the coil L in series with the feed back circuit and grid stabilized by means of the grid stopping condenser C1. The stabilization is complete only at 1,000 kc. If it were to be stabilized at all possible settings of the tuning condenser C, C1 would have to be ganged with C and equal to it at all settings. Complete stability is not necessary in a laboratory oscillator that is to be dependable only to about one per cent. It will be very nearly stabilized at all frequencies covered by the tuner, and if the filament and plate voltages are kept reasonably constant the variation will not be more than one part in 10,000. In order that the stabilization should be exact at 1,000 kc, the value of C1 should be 100 mmfd.

The grid leak resistance R should be 50,000 ohms, for that value will insure freedom from blocking. If the circuit were completely stabilized at all frequencies, the value of R would make no difference. Since it is not, the stability will be greater the higher R is. But it cannot be made much higher than 50,000 ohms without danger from blocking.

### Design of Coils

The value of 253 microhenries for the coils was selected for several reasons. First, but not the most important, is that a value of 100 mmfd. for C1 will stabilize the circuit at 1,000 kc, and 100 mmfd. is a value easily obtained. That the stabilization should be at 1,000 kc is important because it is a number easily dealt with, and it is high enough so that the stabilization will be good between that value and the upper limit of the tuning range.

The main reason for choosing 253 microhenries for the inductance is that it makes certain applications of the oscillator very simple. It eliminates a great deal of figuring, especially in determining the capacity of condensers. We shall mention that later.

If the coil L that is across the condenser C is wound on a two-inch form with No. 26 enameled wire, wound as close as the wire permits, it will require 75 turns to give the desired inductance.

### The Secondary

The secondary L should be wound on the same form and it should be an exact duplicate of the tuned coil. There need be no separation between the two coils. Indeed, the two may be wound as one winding with a tap for ground at the exact center. The extreme terminals are for the plate and grid connections. That is, they should be connected toward the grid and the plate, not to them.

The feedback coil L may also be an exact duplicate of the other two windings, but it should be on a separate form, and it should be completely shielded from the others, or it should be placed at right angles at some distance away. Shielding of the coils is not particularly desirable because the shields will change the inductances. Whatever is done, the inductances should be maintained at the values specified. For that reason, if shielding is done the shields should be several inches away from the coils. It is preferable to shield the entire oscillator and to allow plenty of room between the coils and the shields.

### Tube and Voltage Supply

What tube is used is of little importance. A heater type tube is indicated, and it may be a 227, a 56, a 37, or any other similar tube. The choice would depend on the filament voltage that is available. But the tube may also be a filamentary general purpose tube, like the 230, 201A, or any other. Again the filament voltage supply will determine which to use. If the tube is of the filament type,

the negative end of the filament should be regarded the cathode and the connections made accordingly.

The plate voltage likewise is of no great importance. Perhaps 45 volts is the most suitable, but it may be higher or lower. The supply may be either a battery or a B battery eliminator. Whatever the source, the voltage should be maintained reasonably constant at the value selected when the circuit is calibrated.

### Calibration

A most important thing in a calibrated oscillator that is to be used as a standard of frequency is the dial. It should be of the vernier type, and it should have many divisions on the scale. There are vernier dials available in which there are 100 main divisions and a vernier attachment making it possible to read the dial to one tenth of the smallest division. That is, the dial can be read to one part in 1,000 at full scale.

Condenser C as well as the dial should be constructed so that there will be no change in the calibration when the condenser stops at the ends. The best condenser is one that can be turned all the way around without any stops. But such condensers usually do not have desirable frequency characteristics. The next best thing is to use a condenser that has a desirable frequency characteristic and then use care in tuning. If the dial is of the slow motion type there is little danger in hitting the end stops, and a sharp jar is about the only thing that would cause damage to the calibration. With the slow motion dial there is a warning, and if care is used in not forcing the dial, no permanent upset of the calibration will result.

Instead of using a vernier dial, it is also possible to use a large drum dial that is divided into a large number of divisions. When this type of dial is used, it is of utmost importance that there be no parallax between the divisions and the index; for if there is, no accurate settings or readings are possible.

### Calibration of Oscillator

Perhaps the easiest part of the construction of a laboratory oscillator is the calibration. This is simple because every broadcast station provides a frequency that is accurate enough. The oscillator should be coupled loosely to a radio receiver, which may be done by connecting a wire to the plate of the oscillator and placing one end of it near the antenna of the receiver, without making a connection. Tune in a station near the lower frequency limit and identify it so that its frequency is known. Tune the oscillator to zero beat and note the reading of the oscillator dial. Record it opposite the frequency. Repeat this for a large number of other stations covering the entire scale. When all the data have been obtained enter them on a large sheet of plotting paper and draw a smooth curve through all the points. From this curve the dial setting for any other frequency within the tuning range can be obtained. Thus with the aid of the curve, the oscillator can be set at any desired frequency and also any frequency can be identified with it.

It will be realized that the larger the graph paper the more accurately will it be possible to obtain readings from the curve, but a large-scale graph will not help if the dial cannot be read accurately.

### Modulation of Oscillator

There is no provision for modulation of the frequency generated in Fig. 1. If it must be modulated, the easiest way to do it is to put the audio tone in series with the plate supply. It may be done by means of a winding on the filament transformer. The voltage of this winding should be considerably lower than the d-c voltage applied to the plate. Anywhere from 2.5 to 30 volts would be all right if the supply voltage is not less than 45 volts. The lower voltage will be sufficient.

This scheme will provide a modulation frequency of 60 cycles. For some purposes this is too low. A higher frequency can be obtained with an audio frequency oscillator. A simple oscillator is the Hartley shown in Fig. 2. The transformer is a push-pull output transformer with a rather high step-down ratio. The cathode is connected to the tap of the larger winding, to which the plate return would be connected if the transformer were used as intended. C is a condenser of about 0.1 mfd. and R a grid leak of 50,000 ohms. The winding P, which would ordinarily be connected to the speaker, is used for transferring the oscillation to the radio frequency oscillator by connecting it in series with the plate supply of that tube.

### Use of R-F Oscillator

The inductance in the r-f oscillator was made exactly 253 microhenries. There is a good reason for this choice. If the frequency is expressed in megacycles and the capacity of the condenser in microfarads, the relation between frequency and capacity is $C = (10/F)^2$. Since the frequency is known from the calibration, the capacity is also known for every setting of the dial. This provides an easy means of measuring capacities quite accurately by the substitution method.

Suppose the capacity to be measured is substituted for the oscillator condenser. If the unknown capacity is within the range of the variable capacity, the resulting frequency will also be within range of the calibration. Set an auxiliary oscillator to zero beat with the calibrated oscillator when the unknown condenser is in the circuit. Remove the unknown and replace the calibrated condenser and tune it until the calibrated oscillator is zero-beating with the auxiliary. Note the setting for the frequency. The capacity in the oscillator is obtainable from the above formula. But this capacity is then equal to the capacity of the unknown. The range of capacities is about 50 to 350 mmfd.

### Measuring Small Capacities

If the unknown capacity is very small it can be measured by the difference method. First adjust the auxiliary oscillator to zero beat with the calibrated oscillator when the calibrated condenser alone is in the circuit. Put the small unknown condenser in shunt with the calibrated. Reduce the setting until the oscillators generate the same frequency as judged by zero beat. The total capacity is now the same as it was before or can be computed from the known frequency. But the capacity in the calibrated condenser is known because it is known at every setting. Hence the difference is known, and that is the capacity of the small unknown condenser.

As an aid in this application it might be well to compute the capacity in the calibrated condenser at every setting of the oscillator and to plot a curve. However, the formula is so simple that it is hardly necessary. The capacity is always $C = (10/F)^2$, where F is the indicated frequency, or the frequency obtained from the calibration curve. The indicated frequency, of course, is different from the actual frequency when there is a shunt capacity across the calibrated condenser. The auxiliary oscillator is used for the purpose of knowing the actual frequency when it is not what the curve indicates.

### Measuring Large Capacities

Large condensers within a limited range can be measured in nearly the same manner. But the large condenser must be connected in series with the calibrated condenser. First the frequency is fixed by aid of the auxiliary oscillator. Then the large unknown condenser is connected in series with the calibrated, and this is increased in capacity until the oscillators zero-beat. The known frequency gives the capacity of the combination. The calibration gives the capacity of the calibrated condenser. The un-

(*Continued on next page*)

# *Wave Trap or Detector As Resonance Indicator*

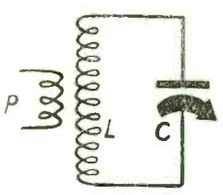



**FIG. 3**

**A wave trap or wavemeter that can be used for checking frequencies and for various measurements.**

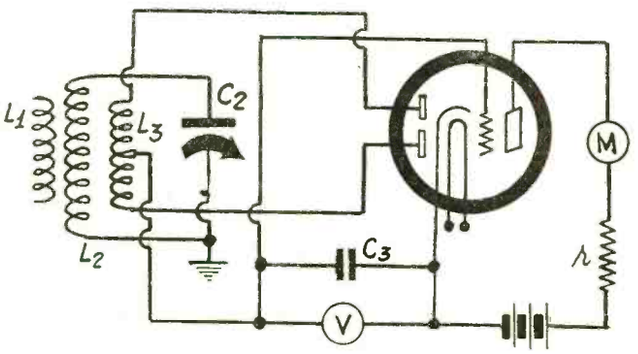



**FIG. 4**

**A detecting circuit of this type can be used as a visual indicator of resonance. The meter in the plate circuit must be of range required by the current. Often this is readily accomplished by using a voltmeter as current indicator only, the resistance r being the voltage multiplier.**

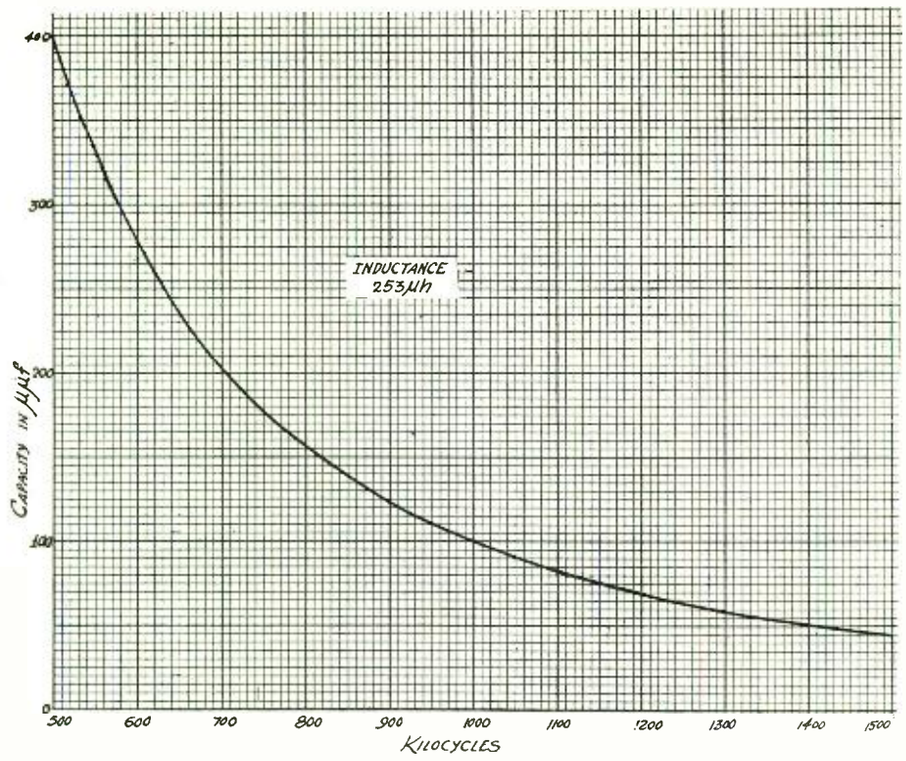



**FIG. 5**

**A curve showing the relation between the capacity and the frequency in the calibrated oscillator when the inductance is 253 microhenries.**

(*Continued from preceding page*)

known is then computed from the two. If C is the capacity of the calibrated condenser and C1 the capacity of the combination, both of which are known, then the capacity of the unknown large condenser is $C_x = CC1/(C - C_1)$.

When measuring the capacity of a condenser by the series method when the capacity is not much larger than that of the calibrated condenser, the calibrated should be set near minimum.

A variable condenser can be calibrated against the oscillator by the method of differences or by substitution. It is only necessary to measure the capacity of the unknown variable at many places on its dial. This method neglects the self capacitly of the coil.

### Indicators of Resonance

Sometimes it is convenient to have visual resonance indicators instead of aural. Many devices are available. One is the simple wave trap, which is shown in Fig. 3. The tuned circuit consists of a coil L and a capacity C. A small winding P is put on the coil and this is connected to the source. A thermomilliammeter can be connected in series with the tuned circuit to show when the current is the greatest, or the trap might be used as a trap proper by noting its effect on some other tuned circuit to which it is loosely coupled and in which the visual indicator is located.

Fig. 4 is a visual indicator circuit which can be used two ways. L1 is supposed to be connected to the source and is the primary of the transformer. L2 is a resonant circuit, which may be calibrated. L3 is a centertapped winding on this coil which is connected to duplex diode circuit of the tube.

### D-C Amplifier

When the current in the tuned circuit is maximum the rectified voltage in the diode is maximum. For load on the diode is a voltmeter V, which is shunted by a condenser $C_3$. The reading on the voltmeter will be proportional to the current in the resonant circuit. Of course it should be a high resistance voltmeter in order that it should not take too much power from the resonant circuit.

The grid of the triode of the tube is connected to the negative end of the load so that the triode amplifies the d-c voltage developed. Therefore if a milliammeter is connected in the plate circuit of the triode it will indicate resonance. However, when resonance occurs the reading on M will be least. A resistance r is connected in series with the milliammeter to prevent excessive current. Its value depends on the voltage in the plate circuit, the sensitivity of the milliammeter and on the signal involved. About 50,000 ohms is a mean value.

When the milliammeter is used as indicator the voltmeter may be replaced by a resistance of 0.5 megohm. The milliammeter method of resonance indication is considerably more sensitive because of the amplification in the triode.

If the trap in Fig. 3 is coupled loosely to the resonator in Fig. 4, which may be done by connecting P in series with L1, if P consists of only a few turns, the indications at resonance of the trap will be just the reverse of what they were before. That is, as the trap is tuned through resonance the voltmeter reading will drop and the milliammeter reading will increase. The assumption is that L2C2 had previously been tuned to the signal.

While a visual indicator of resonance is convenient, there is none more accurate than the zero beat method, and that should be used whenever it is possible. Of course, the zero beat method can be used visually, too, if there is sufficient power to swing the needle of the indicating meter. But it might require 1,000 times more power to give the indication with a meter than with a headset.

### Coupling to Standard Oscillator

The standard oscillator in Fig. 1 is supposed to be shielded. When it is there is no way of coupling to it, and any connection to it might change, will change, the frequency. The surest way of coupling without changing the frequency is to connect the grid of a radio frequency amplifier to the grid of the oscillator and then take the oscillation from the plate circuit of this amplifier. But this adds another tube.

Another way of coupling without appreciably changing the frequency is to make use of the coil L in the plate circuit. A small winding can be put on the form of this coil and the oscillation taken off by that means. But the coupling to this coil should be loose, so that only a few turns should be used for the pick-up winding.

### Measuring Inductances

Inductances can also be measured with the calibrated oscillator and a known inductance. Suppose L in the wave trap, Fig. 3, is the same as L in the oscillator. Measure the frequency of the trap with the oscillator and then substitute the coil to be measured for the coil in the trap. Again measure the frequency. The two inductances are then inversely proportional to the squares of the two frequencies. Thus the unknown inductance can be computed. It is understood that the condenser C in the trap is to remain unchanged while the two frequencies are measured.

For coupling between the oscillator and the trap the small winding on the coil in the plate circuit of the oscillator can be connected in series with the winding P on the trap. It may be necessary to leave one side open in the link circuit. For indicator in the trap a thermomilliammeter can be used. It is also possible to connect the trap circuit across the input of a grid biased detector and detect by means of a meter in the plate circuit of that tube.

### Lists of Parts for Calibrated Oscillator

LLL—Three 253 microhenry coils as described, two to be on one form and one to be on another form.
Ch—One 30-millihenry choke coil
C—One 350 mmfd. variable condenser with a first rate dial attached
C1—One 100 mmfd. stopping condenser
C2—One 0.1 mfd. condenser
R—One 50,000-ohm grid leak
One heater type tube (227, 56, or 37)
One metal cabinet.

## General Electric Enters Automobile Set Field

An automobile radio receiving set with dynamic speaker, all contained in a single metal case no longer than the average automobile heater, which can be attached to a car with but one bolt, has been developed by engineers of the General Electric Company. A remote control box can be clamped in any position to the steering post or on the instrument panel, within easy reach of the driver.

Ignition interference has been taken care of by the double shielding of the vibrator power supply, complete shielding of the entire apparatus and the use of a tone control which makes it possible to reduce noises that persist in exceptional instances.

The set is mounted on a single stud and necessitates boring only one one-half inch hole in the bulkhead of the car. A new vibrator type of B battery elminator is employed. Three of the four tubes are of new type: a radio frequency exponential pentode, type 78; a seven-element type 6A7; and a duo-diode pentode, type 6B7. The output tube is a type 89. The use of tubes with multiple functions result in seven-tube performance from a four-tube set.

### HE HAD A CAT

Art Van Harvey, the Vic of Vic and Sade, missed the boyhood joy of having a dog for a pet. Instead Art had a pet cat that fought every dog in the neighborhood.

# WHAT'S ON 75-200 METERS

## Police Signals, Airplane Communication, Amateurs and Foreign Stations Receivable

"All radio cars! Pick up white man about 30 years of age, six feet, 150 pounds, dark hair, wearing dark blue sweater . . . last seen running out of bank corner Gary and Liberty streets. . . . search subway and elevated stations . . . wanted for murder . . . notify 50th precinct station. . . ."

In every large city of the country such radio alarms are all a part of the routine work of the department but the great drama of police signals is missed by the average radio set owner, points out F. A. D. Andrea.

"Far more thrilling than any paperback detective story ever written or enacted," be continued, is the highly dramatic real life police activity of a single day as reflected in police departmental broadcasts. It so happens that police broadcasts are sent out on waves ranging from about 192 meters down to 120 meters.

### What's in Store

"As most radio sets in this country are designed to receive the normal broadcast band—200 to 550 meters—only those having shortwave sets have been able to tune in police signals, and heretofore the shortwave sets, some of them in combination with longwave sets, have been built only in the standard sized cabinets and consoles. More recently, however, it has become possible for the average home receiver owner to become acquainted with what is going on in the radio world that lies below the normal broadcast band even if he owns one of the tiniest of sets, those known as sub-midget, or pee-wee models.

"Not only does this reception range cover police broadcasts but airplane communications, amateur voice broadcasts and sound from television broadcasts, as well.

"In connection with police broadcasts, it is well to keep in mind that in some communities it may not be permitted to receive police signals, which are there held for departmental use only. It is the custom to issue warnings for radio fans in such communities and this is done by the set manufacturer as well as by local authorities.

### Sometimes Aids in Capture

"But where the set owner can do so there is the great opportunity of listening in to some mighty interesting stuff. Missing persons, alarms for the capture of criminals and all sorts of special announcements keep the police and the radio fan on the alert. It is a wellknown fact that quick action by private citizens as a result of receiving police signals has been the means of preventing crime and of capturing criminals in many instances.

"Practically every large city in the country utilizes police broadcasting stations. In some cities, of course, like New York, the city also utilizes a regular broacasting station for special announcements to the public and for the usual entertainment purposes.

"In the Ohio territory, if a set is used that permits of lowwave reception, the listener, in respective communities, has the following police stations: Akron, WPDO 121.9 meters; Cincinnati, WKDU, 175.1 meters; Cleveland WRDH, 121.9; Columbus, WPDI 123.4; Dayton WPDM, 123.4; Toledo, WRDQ, 121.4.

### What's Doing in New York

"In New York, there are, counting all sections of the territory, the following police broadcasting stations in the metropolitan area: Brooklyn, WPEE, 122.4; WRDU, 187.8; Bronx, WPEF, 122.4; New York, WCF, 123.4; WPEG, 122.4.

"Here are some of the other cities (there are listed 94 police stations in all) where police broadcasting stations are located:

"Chicago, 3; Atlanta, Buffalo, Dallas, Denver, Detroit, 3; Indianapolis, Kansas City, Los Angeles, Louisville, New Orleans, Richmond (Ind.), St. Paul, St. Louis, San Antonio, Tulsa, Washington, Wichita, Boston, and many other localities. It is interesting to note that Honolulu, Hawaii, has police broadcasting station KGPQ, on 122.4 meters.

"Thus from a town of 16,000, like Klamath Falls, Oregon, to the largest city in the country, the police broadcasting stations run.

### Amateurs Brought In

"While police signals, as already pointed out, are not the only interesting thing on the air between 75 and 200 meters, the general inclination that most fans have for police action makes this band of especial delight to those set owners who can pick up these signals.

"The voices of many amateurs are brought to the set owner for the first time, the airplane communications that fall within the 75-200 meter band and the sound that is put on the air with the visual signals of television, are likewise made available to these set owners. Some foreign stations too, are receivable, for those on border territory, and even occasional reception of such distant stations as these foreign stations powerful enough to be received on the average good set."

# *Microphone Resistance Compared to Impedance*

## *By E. E. Griffin*

Chief Engineer, Universal Microphone Co.

More or less confusion has always existed as to the resistance of microphones and microphone buttons. This has always been one of the much mooted questions in sound transmission. And yet there really is no mystery, no hocus pocus of any kind.

In some cases the d-c resistance is practically the same as the a-c impedance, while in others it is entirely different.

Take the case of a microphone button in series with a 1½ volt dry cell. Considering the d-c resistance of the microphone as 200 ohms, we will have a current of 7½ milliamperes flowing in this circuit.

This value of 200 ohms d-c resistance is also its approximate a-c resistance or impedance. The alternating current impedance of a carbon microphone is not always its apparent talking resistance, but rather the ratio of the power absorbed by it to the square of the current flowing through it.

### 80% of Speech Resistance

The general assumption is that the a-c resistance of a carbon microphone is about 80% of its apparent talking resistance.

In the case of a two-button microphone, an entirely different condition takes place. We have one source of current, a single dry cell, and the two buttons of the microphone are in parallel. Thus the microphone presents a parallel circuit, each leg of which being 200 ohms the total overall resistance is 100 ohms, and thus with 1½ volts of battery in the circuit a total current of 15 mils will flow.

The actual d-c resistance, as far as battery supply is concerned, will be 100 ohms. Its a-c impedance, however, as connected to the primary of the microphone transformer is entirely different, since the two buttons in relation to the transformer are connected in series, thus presenting some 350 to 400 ohms a-c impedance.

### Microphone as Generator

In regard to the transformer, the microphone is now considered an acoustically-driven a-c generator, with an impedance of approximately 400 ohms, and thus the transformer in order to match efficiently this value must have a primary winding of approximately 400 ohms effective impedance and must be provided with a center tap to take care of the microphone's d-c exciting current.

This condition is adequately taken care of in the Universal No. 1089, 0089 and 1152 transformers and for the single button microphone a number 0075.

Each of these transformers has an extremely low resistance, with comparatively high a-c impedance, which insures flat frequency characteristics from well below 30 cycles to well over 12,000 cycles.

## Moisture Cited as Cause of Condenser Breakdown

Hartford, Conn.

Glenn H. Browning, engineer of the Tobe Deutschmann Corporation, addressed the regular monthly meeting of servicemen held at Hatry & Young's headquarters.

Mr. Browning brought out some facts relative to condenser breakdown. According to Mr. Browning, moisture is one of the vital reasons for condenser breakdown.

Mr. Browning will speak before the Institute of Radio Servicemen at the Pennsylvania Hotel, New York City, May 8th, and is planning a series of talks throughout the United States which will emphasize the importance of selecting better type material for radio replacement work.

# NEW CLASS B TUBE

## 53 is Two Valves in One Envelope for A. C.; May Be Used as Class A Driver, Too

*By Hood Astrakan*

THE new development in tubes, whereby two Class B types are put in one envelope, has been augmented to include such a dual tube for 2.5-volt a-c operation. The tube will be known as the 53, and will be released some weeks hence by the licensed tube manufacturers. While the official information has not yet been given out, preliminary data as published herewith will be found to conform closely to what will be set forth in the authoritative statement.

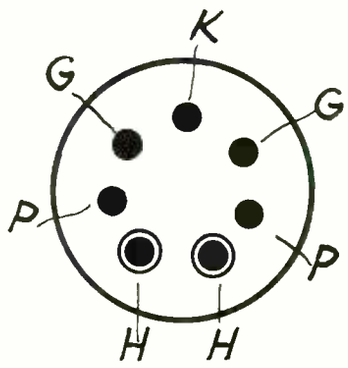
The tube will have a seven-pin base, type ST-14, which is the same type base as the 59 has, and the disposition of the pins will be symmetrical, with heaters at the two angles of a triangle formed with the central cathode, individual plates to left and right of heaters, and individual grids to left and right of cathode, as shown in the diagram.

### 10 Watts Output

The heater current, at 2.5 volts, will be 2 amperes. The plate voltage, taking a typical example, would be 300 volts, the dynamic peak plate current per plate 125 ma, the average plate dissipation 10 watts.

In this instance of typical operation, at 300 volts, there would be no grid bias, whereupon the no-signal plate current would be 17.5 milliamperes per plate. The load resistance, plate to plate, should be 10,000 ohms. The nominal power output would be the average plate dissipation, 10 watts, based on an average power input of 350 milliwatts between grids.

The operation of the Class B amplifier under conditions for which such a tube is designed presupposes that the grid bias is zero, and therefore the plate current increases sharply with signal voltage intensity. The mu of the tube is made so high that the plate current is low at zero bias, although in the present example it is higher than in some previous tubes intended for Class B operation.




**Socket connections for the new 53 Class B twin output tube.**

Since the change is from zero bias to positive values, it is clear that the grid acts as an anode and rectification of the signal takes place in the amplifier tube. This is evidenced by the presence of grid current. Since grid current constitutes a condition ripe for distortion, especially even-harmonic distortion, precautions must be taken to avoid any severity of distortion, which requires that the interstage transformer be of special design.

### Step-down Transformer

Instead of the usual step-up ratio of transformation as found in Class A amplifiers, a step-down ratio is used. However, the step-down ratio should not be too severe, as this, too, would introduce distortion.

Since the advent of Class B amplification in broadcast receivers, using the 46, additional facts have been learned about this special system, and it is now recommended that care be exercised not to make the step-down ratio too high. Moreover, the d-c resistance of the secondary winding has to be small, due to the presence of grid current, for if it were large the operation of the tube would become erratic.

Grid current may be utilized to neutralize the second harmonic distortion generated in the plate circuit of the driver tube, especially as the output is a form of push-pull.

As is usual with Class B output tubes, another one of the same tubes may be used as Class A driver. Thus the single-sided 53 would be driver for the 53 Class B. In the driver example, however, the tube is made a triode by interconnecting the two grids and also interconnecting the two plates.

### Higher Load Resistance

Just what the load resistance for the plate of the driver should be will depend on factors inherent in the circuit, but in general the plate load resistance should be higher than recommended for the Class B plate circuit, where 10,000 ohms plate to plate was the specification. Somewhere between 20,000 and 40,000 ohms normally would be used in the Class A driver plate circuit.

In this plate circuit some distortion will be present, and as it would appear in the next stage in amplified form, it is essential to reduce this to as low a value as possible, hence at least twice the Class B resistance load should be used, and in addition a transformer wound for an ensuing circuit that makes the grid current work as a neutralizer of the plate circuit distortion in the previous stage.

As a Class A driver, 300 volts of B supply, typical operation is at 6 volts negative bias, 294 volts (the difference) applied to the plate circuit, whereupon the current will be only 7 milliamperes. The amplification factor will be 35, the plate resistance 11,000 ohms, the mutual conductance 3,200 micromhos, the power output 0.4 watt.

### Grid Resistor

When the Class A tube has a grid resistor, and self-bias, the resistance may be 0.5 meg., but if fixed bias is used the resistor should not be more than 0.1 meg.

Class B amplification has the advantage of supporting very large volume of sound with great clarity and, due to freedom from the amount of distortion would be present in a Class A output under similar input and plate voltaging conditions, although at low signal levels the distortion is greater than that of Class A output circuits.

# *The 79 for Class B Use, With 250 Volts on Plate*

**RCA Radiotron Co., Inc., and E. T. Cunningham, Inc., released the folowing:**

Recently conducted life tests on the 79 have shown that these tubes are satisfactory for Class B operation with 250 volts on the plate.

At regular intervals during the test checks were made to determine the change in power output which took place during the life of the tubes. The results which show that the power output was practically uniform during the test period indicate that the tubes are satisfactory for Class B operation with 250 volts on the plate.

In order to determine whether the tubes are satisfactory from the viewpoint of grid emission, a group of 79's was operated under shield cans with abnormally high voltages applied to the heaters. The change in grid current, which is an indication of grid emission, was so slight that the tubes may be safely operated in Class B circuits at 250 plate volts.

With a plate supply of 250 volts and a type 37 used in the driver stage, the 79 in a Class B stage will give a power output of approximately 8.0 watts. Suitable operating conditions for the 79 are given below:

**TYPICAL OPERATION**

| | | | |
|---|---|---|---|
| OUTPUT TUBE—ONE TYPE 79 | | | |
| Heater Voltage | 6.3 | | Volts |
| Plate Supply Voltage | 250 | max. | Volts |
| Grid Voltage | 0 | | Volts |
| Plate Current (No signal) | 10.5 | | Milliamp. |
| Average Plate Current (8 watts output) | 46.0 | | Milliamp. |
| Plate-to-Plate Load | 14000 | | Ohms |
| Average Power Output | 8.0 | max. | Watts |
| INTERSTAGE TRANSFORMER | | | |
| Transformer Ratio (Primary to ½ secondary) | 2.6 | | |
| Transformer Efficiency | 70 | | Percent |
| DRIVER TUBE—ONE TYPE 37 | | | |
| Heater Voltage | 6.3 | | Volts |
| Plate Voltage* | 233 | | Volts |
| Grid Voltage* | —17.0 | | Volts |
| Plate Current | 6.5 | | Milliamp. |

*For convenience in power supply design, the sum of the driver plate and bias voltage is made equal to the plate supply voltage of the 79.

### MAKES 4,200 APPEARANCES

Jess Pugh, genial editor of the "Northwestern Chronicle," has filled more than 4,200 engagements before Rotary and Kiwanis clubs and similar organizations. The "Chronicle" is "published" by the Northwestern Yeast Company every Sunday at 11:30 a.m., P.S.T., over an NBC-KGO network.

# HIGH-MU DISTORTION

## Circuit Adjustments to Make Bias Correct

*By Einar Andrews*

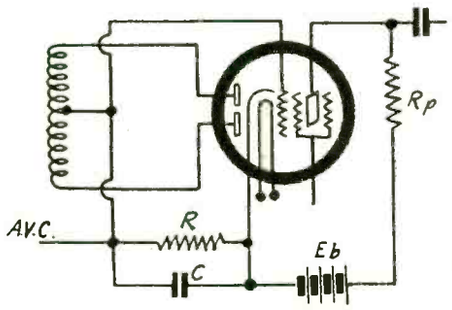



**FIG. 1**

**A duplex diode pentode or high mu triode will not work satisfactorily in a circuit of this type because the bias becomes excessive on strong signals.**

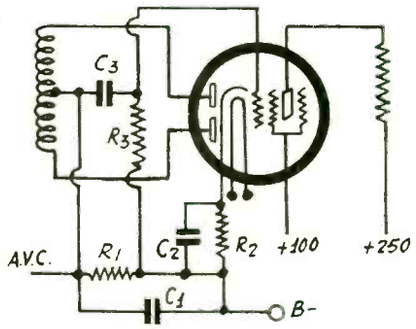



**FIG. 2**

**Fixed bias as in this circuit is not a complete remedy against overworking of the tube because the signal may exceed the bias on low frequencies.**

THE NEW tubes, the 2B7, 6B7, and 75, have given a good deal of trouble when used in sensitive receivers equipped with automatic volume control. Either no signals come through or they come through badly distorted. What is the explanation? It is certain that the tubes are not at fault, directly at least.

Refer to Fig. 1, which is a typical detector circuit using the 2B7 or the 6B7. R is the load resistance on the diode, and the a. v. c. voltage is the drop in this resistor, the drop resulting from the rectification of the signal and as filtered by condenser C. The control grid of the pentode part of the tube is connected to the negative end of this resistor and therefore the bias on the pentode is equal to the drop in R.

### High Bias Developed

The amplification factor of the pentode is very high, and therefore it requires only a very low bias to cut off the plate current. The normal operating bias is 4.5 volts, so that it is certain that if the bias goes as high as 10 volts the plate current will be cut off.

When a strong signal comes along the rectified voltage across R may be several times this bias, and the stronger the signal the higher the bias. For this reason the pentode of the tube will be overbiased to the extent that no signal can come through. It acts as a noise suppresser tube, but does so both at the wrong time, for it suppresses the signal at high input. If the grid is allowed to go to zero bias it cuts out the noise because the tube will not amplify at zero bias.

### Using Fixed Bias

The degree to which the bias rises depends on the number of tubes that are automatically controlled, for a given signal strength at the antenna, for if there are many tubes controlled automatically, a lower voltage is required in R to reduce the amplification. If a single tube is thus controlled the bias on that tube must be very high before the signal is cut down to the required level. Therefore, when the rectifier-amplifier is a 2B7 or like high mu tube all the r-f amplifiers should be put on the automatic volume control. In the case of a superheterodyne using the 2A7 or 6A7, the oscillator modulator might also be put on the control. Certainly, the i-f amplifiers should be put on it.

It might be thought that the solution of this difficulty is simply to provide a fixed bias on the pentode, as is done in Fig. 2. Here a stopping condenser C3 is put between the negative end of the load resistance R1 and the grid of the pentode and a grid leak R3 is connected between the grid and the positive end of the load resistance, which is also the negative end of the fixed bias resistance R2. As far as bias is concerned, this arrangement is all right, for no matter what happens to the voltage drop in R1, the operating bias on the pentode is fixed by R2.

There is no improvement in respect to the signal, however. The audio component in R1 is also proportional to the radio carrier and that, at times, will greatly exceed the fixed bias. This excess of signal over bias will first occur on the low audio frequencies, but if the signal is very strong, and if the modulation is deep, it will also occur on the higher audio frequencies.

### A Remedy

A good remedy in the case of Fig. 1 is to return the grid to a slider on R. That is, R is made a potentiometer and the slider of that potentiometer is connected to the control grid of the pentode. By this means it is possible to use any desired portion of the drop in R for bias and for signal. If the slider is moved close enough to the cathode the tube can be operated correctly regardless of the total drop in R. There will be no danger of underbiasing the tube, for that could only occur if the signal were overmodulated in the first place, and this is carefully guarded against at the transmitting station. If the station operator slips up on that there is nothing that the receiver operator can do about it. The slider method is satisfactory because it controls the input to the pentode without at the same time interfering with the operation of he automatic volume conrol.

Even when the arrangement in Fig. 2 is used the potentiometer method is desirable as a means of preventing the audio signal voltage from exceeding the fixed bias. In this case R3 should be a potentiometer and the grid should be returned to its slider.

### Deep Waves

The problem of overworking a tube is closely associated with bias and of plate supply. An analogy will help to visualize what takes place under certain conditions. Let Fig. 3 represent a cross section of the ocean near a beach. The lower curved line represents the bottom, the straight dotted line the surface of the water when it is not disturbed by gravitational waves, and the sinusoidal line a wave train.

As long as the water is deep the wave can roll along without distortion. But as it nears the beach the troughs begin to drag on the bottom. This corresponds to the case when the negative side of a voltage wave enters the region of current cut-off. The wave breaks just as the ocean wave breaks as it enters shallow water.

### Inadequate Plate

What determines the "depth" in the case of a radio tube is the plate voltage or plate current? Under certain conditions the wave may break in the plate circuit. Suppose, for example, that the plate current is supplied through a high resistance R, Fig. 4, and that the signal is taken off in a shunt circuit comprising a stopping condenser C and a low impedance load L. The conditions are right for breaking of the wave, and entirely

(*Continued on next page*)

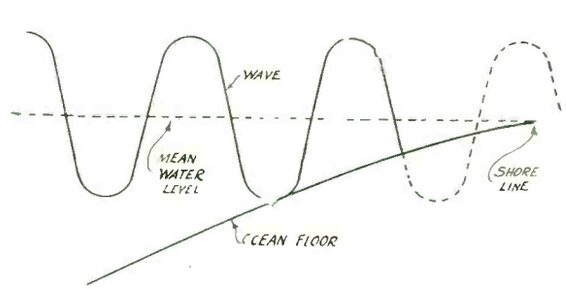



**FIG. 3**

**This analogy illustrates what happens to a radio signal when the bias is excessive or when the plate supply is inadequate for the signal load. The distortion begins before the trough touches the bottom because of the undertow. The crest topples over forward as a result.**

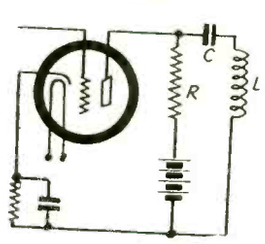


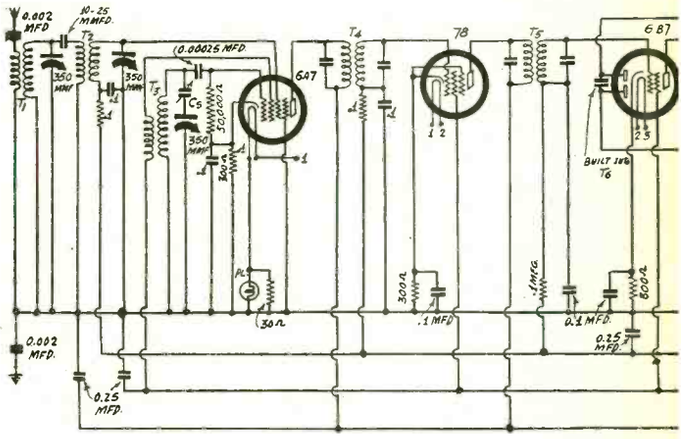

**FIG. 4**

**A resistance in the plate circuit in parallel feed will cause the wave to break in the load circuit because current cannot be supplied fast enough.**

# A 7-TUBE

## New 6B7 as Detector-Ampli

*By Bruns*




**F**

**This is the circuit of a seven-tube d-c superheterodyne due to the use o**

THIS d-c superheterodyne was designed for good quality and plenty of volume, for local reception primarily. Since DX was not an object, the usual radio frequency amplifier was omitted, and the signal was led directly to the control grid of the 6A7. As a means of improving the selectivity in the radio frequency level, two tuned circuits were put ahead of the tube and the two were loosely coupled by a small adjustable condenser having a range from 10 to 35 mmfd. A small value of this condenser is essential or the selectivity will be worse with two circuits than with one.

The oscillator is the inner part of the 6A7, the innermost grid being the control grid and the second the anode. It will be noticed that the anode voltage is the same as the screen voltage on the 6A7 and the other tubes. This is a deviation from standard practice, but was selected as a result of experiment. The receiver seemed to work slightly better with this voltage on the anode than with the usual higher voltage. From a practical point of view, however, it makes little difference.

### Arrangement of Oscillator

The oscillator is of the tuned grid type with the series padding condenser on the high potential side of the tuning condenser. In wiring the padding condenser, the screw side should be connected to the stator of the variable condenser, because that makes the screw lower in potential and makes adjustment of it somewhat less free of body capacity. A grid condenser of 0.00025 mfd. is used, and a grid leak of 50,000 ohms, returned to the cathode and not to ground.

The signal control grid is biased by means of a 300-ohm resistor in the cathode lead, shunted by a 0.1 mfd. condenser. In addition to this limiting bias the grid is also returned to the automatic volume control voltage so that the detecting efficiency varies inversely as the strength of the signal.

The oscillator and the tuners have been proportioned on the basis of an intermediate frequency of 175 kc. This means that the oscillator inductance is about 0.8 as large as the radio frequency tuned coils and that the padding condenser should be adjustable to about 920 mmfd.

### The Intermediate Amplifier

There are three 175-kc doubly tuned transformers in the intermediate selector. The third of these has a centertapped secondary.

The first intermediate tube is a 78, operated in typical fashion. It is biased by means of a 300-ohm resistor in its cathode lead and this resistor is shunted by usual 0.1 mfd. condenser. The grid return of this tube is also connected to the a. v. c. voltage source.

The second intermediate amplifier is the pentode part of the 6B7. This use of the tube is not usual, but it works out very well. The pentode is biased in exactly the same manner as the 78, both as to limiting bias and a. v. c.

The centertapped winding on the third i-f transformer is connected to the diode elements of this tube. The condenser shown on the diagram as connected between the two anodes is built into the transformer and should not be mistaken as an extra condenser.

### The Audio Amplifier

For load resistance on the diode a 250,000-ohm potentiometer is employed, and this is used as manual volume control. At first the slider of this potentiometer was connected directly to the first audio tube but later is was found preferable to arrange the circuit as in the figure and to use fixed bias on the first 37. A stopping condenser of 0.01 mfd. was connected between the slider and the grid and a 0.5-megohm grid leak was inserted between the grid and ground.

For biasing the tube a 5,000-ohm resistor was employed and this was shunted by a 4 mfd. electrolytic condenser. This condenser was necessary to prevent low frequency motorboating. Besides this, it also improved the quality.

Following the first 37 is a resistance-capacity coupler with a plate resistance of 100,000 ohms, a stopping condenser of 0.01 mfd., and a grid leak of 0.5 megohm. Then follows another 37 amplifier. This second tube is biased with a resistance of 2,500 ohms. Higher and lower values for this resistance were tried and the value selected seemed to work the best. The high bias is necessary because of the very strong signal required by the power stage. Another 4 mfd. condenser is used across this bias resistance.

### The Power Stage

The power stage consists of two 48 tubes operating in push-pull. A regular push-pull input transformer, T7, couples the stage to the 37 preceding. An output transformer, T8, couples the output stage to the speaker. In the set as constructed the transformer was mounted on the chassis, but a preferable arrangement is to have the transformer built into the speaker, and it should have been designed especially for the 48s. Best results will not be obtained otherwise.

The two power tubes are biased with a 200-ohm resistor in the common cathode lead. Since the current through this resistance will be about 118 milliamperes and the voltage drop across it will be about 20 volts, the wattage of the resistor should not be less than 3 watts.

At first a 4 mfd. condenser was connected across the 200-ohm resistor but it made no appreciable difference whether it was used or not. This means the stage was well balanced. The condenser was moved to the bias resistance of the first 37, where it served a very useful purpose.

### Plate Voltage Supply

The full line voltage, except for a small drop in the 30-henry choke, is applied to the plates of the tubes and to the screens of the 48s. The screen voltage is lower, being about 80 volts. A 7,500-ohm resistor drops it from the high voltage. To make the screen voltage reasonably constant a bleeder resistance of 10,000 ohms is employed. If the total voltage divider resistance be made adjustable the screen voltage can be varied for best results in any case. The absolute values of the two resistances is not very important, but the smaller one should not be lower than 5,000 ohms.

Radio frequency by-passing for the voltage supply leads is done by 0.25 mfd. condenser located near the high frequency tubes. There is one of these for the screen supply and another for the plate supply lead. A condenser of like

# Distortion Avoid with

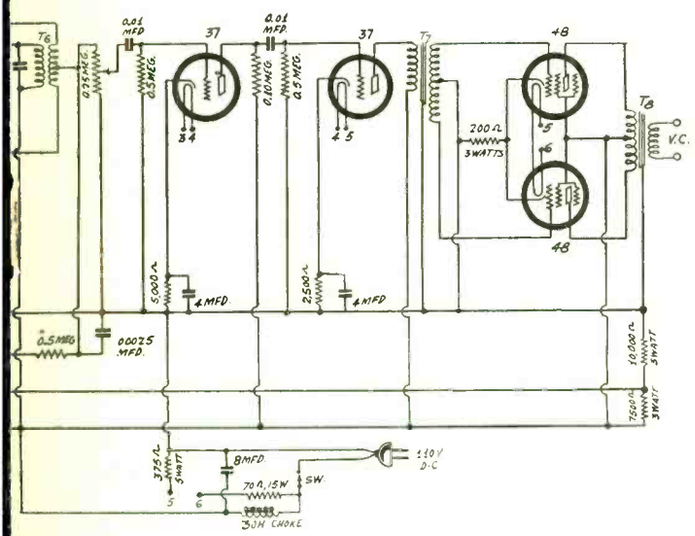
(*Continued from preceding page*)

wrong for quality reception. The signal voltage on the grid may require a heavy plate current. This current tries to flow through the load and condenser C. But the high value of R prevents. The circuit is too shallow, so to speak, and the current wave in the load breaks.

If the parallel type of output circuit is to be used, as in Fig. 4, the resistance R

# D-C SUPER
## fier, 48's in Push-Pull Output

*ten Brunn*




**G. 1**
**for local reception primarily. It is capable of high output 48's in push-pull.**

capacity is also used as a common by-pass for the a. v. c. line.

### The Filament Supply

All the filaments are connected in series, including that of the pilot light. Starting at the chassis and the first tube, we note that the pilot light is connected to the chassis and to one end of the filament of the 6A7. After that the filaments are connected as indicated by the numerals, equally number terminals being connected together. One of the terminals on the upper 48 is labeled 6. This goes to the lower end of the 70-ohm ballast resistor, which is also numbered 6. This ballast is connected to the positive side of the line.

The choice of this resistance was made as follows: There are five tubes requiring 6.3 volts and a pilot light requiring 5 volts. The total of these voltages is 36.5 volts. Each of the 48s requires 25 volts, or a total of 50 volts. Therefore the total drop in the filaments is 86.5 volts. The average line voltage is 115 volts. Hence there should be a drop of 28.5 volts in the ballast. The current will be 0.4 amperes, for that is the current required by the 48s. Hence the resistance should be 71 ohms. The nearest easily obtainable value is 70 ohms, and the resistor is so marked. The wattage of this resistor should be at least 15 watts for it will dissipate a good deal of heat.

The tubes preceding the 48s will only require 0.3 amperes. Hence it is necessary to provide a shunt to take the extra 0.1 ampere. This is connected between the chassis and point 5 on the filament series. The drop in this, we found, was 36.5 volts. Therefore the resistance should be 365 ohms. The nearest easily obtainable value is 375 ohms. A 5-watt resistor will do provided that the precaution is taken never to remove one of the 0.3-ampere tubes while the power is on.

If one of the tubes ahead of (5) or the pilot light should burn out, or should be taken out of the socket with the power on, the current through the 375-ohm resistor will be increased and the wattage in the resistor will rise to about 12 watts. A 15-watt resistor, therefore, would be safer.

The pilot light will not stand as much current as the tubes with which it is in series. For that reason a small 30-ohm resistor is connected in shunt with it. This should be varied to suit the pilot light, for all lights are not the same.

When the power is first turned on the pilot light will burn brilliantly, but will dim as the tubes heat up. It is necessary to choose a value of the resistance across the light that will protect it during the warming-up period and which will not dim it too much when the circuit has attained the steady state. Of course, pilot lights do not cost much so it will do no great harm is one burns out occasionally.

### The A. V. C. Circuit

The a. v. c. voltage is taken from the centertap of the last i-f transformer. There is a 0.00025 mfd. condenser across the potentiometer of high frequency filtering and a 0.5 megohm resistor in the line to the controlled grids. This resistor prevents short circuit of the audio signal.

### LIST OF PARTS

#### *Coils*

T1, T2—Two radio frequency transformers for 350 mmfd. condensers
T3—One oscillator coil for 350 mmfd. condensers and 175 kc i-f.
T4, T5, T6—Three 175 kc intermediate transformers, doubly tuned and one with centertapped secondary
T7—One push-pull audio frequency input transformer
T8—One push-pull speaker coupling transformer—may be built into speaker
One 30-henry choke capable of carrying 150 milliamperes

#### *Condensers*

Two 0.002 mfd. condensers
One gang of three 350 mmfd. tuning condensers with trimmers
Cs—One 700 to 1,350 mmfd. padding condenser
Two 0.00025 mfd. condensers
One trimmer type, 10-35 mmfd. condenser
Two 0.01 mfd. condensers
Six 0.1 mfd condensers
Three 0.25 mfd condensers
Two 4 mfd. electrolytic condensers, or larger capacity
One 8 mfd. electrolytic condenser

#### *Resistors*

Four 0.1-megohm resistors
One 50,000-ohm resistor
Three 0.5-megohm resistors
One 250,000-ohm potentiometer for volume control
Three 300-ohm bias resistors, wirewound
One 2,500-ohm bias resistor
One 5,000-ohm bias resistor
One 200-ohm, 3-watt bias resistor
One 70-ohm, 15-watt resistor
One 375-ohm, 3-watt resistor
One 10,000-ohm, 3-watt resistor
One 7,500-ohm, 3-watt resistor

#### *Other Requirements*

One vernier dial with pilot light
Three grid clips
Three five-contact sockets (one for loudspeaker)
Three six-contact sockets
Two seven-contact sockets
One line switch (may be attached to the potentiometer)
One seven-tube chassis

## ance
## High Mu Tubes

should be replaced by a high inductance, low resistance choke coil. A heavy d-c current can flow through this coil, and that current will be maintained steady as the signal voltage fluctuates. The variations in the plate current will go through the condenser C and the load L. The choke will make the circuit "deep," and therefore the wave in the load will not break.

## Hellmund Is Promoted to Westinghouse Chief

Dr. S. M. Kintner, vice president in charge of engineering of the Westinghouse Electric and Manufacturing Company, announces the appointment of R. E. Hellmund as Chief Engineer. Mr. Hellmund is the first Westinghouse executive to hold this office since the death of B. G. Lamme in 1924.

Mr. Hellmund is well known throughout the electrical and allied industries for many inventions and improvements in design of electrical equipment covered by his more than 300 patents. He was born in Gotha, Germany.

H. W. Cope, formerly assistant director of engineering, was appointed assistant to the Vice President, responsible for the coordination of certain headquarters, engineering departments and district office engineers.

# Radio University

*A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (52 issues) at $6, without any other premium.*

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

### *"Raspy" Signals*

RECENTLY I installed a 56 tube as a resistance coupled amplifier to boost the signal. Before I put this tube in the quality of the output was excellent, but now it is very raspy. Will you kindly explain the reason and suggest a remedy?—W. H. C., New York, N. Y.

As a rule, this is a symptom of incorrect bias on the tube you inserted or on some other tube in which the bias became incorrect when the new tube was added. The remedy is to find what tube is not correctly biased and to make the necessary adjustments. It is also possible that the plate voltage is not correct now, either on the added tube or on some other tube that receives a higher signal voltage. The bias is probably too high.

* * *

### *Power Tube as Voltage Amplifier*

WOULD you recommend the use of a power tube like the 59 as a voltage amplifier in order to prevent distortion in the output. It seems now that the tube preceding the power tube is greatly overloaded. If you think it all right to use this or a similar tube as voltage amplifier, will you kindly give the correct resistors and condensers?—T. R. L., Erie, Pa.

A power tube will overload just as easily as any other tube having the same amplification factor. There is seldom reason for using a power tube for voltage amplifier. It is not a question of power at all, but only voltage. As an example of when a power tube might be advantageous, consider the case where the signal voltage on the output tube grid should have an amplitude of 200 volts. In order to swing the grid the variation in the plate output voltage must be 400 volts, and the plate supply voltage must be higher than that. Now if the tube ahead cannot be safely operated with such a high plate voltage, even when there is a high resistance in the plate circuit, then it becomes necessary to use a tube that will stand it. It will not help to use a 59 for a 56 because the maximum voltage on the 59 is no greater than that of the 56. Both are rated at 250 volts maximum. There is no receiving power tube that requires such a high input voltage that it cannot be loaded to the limit by a small receiving tube taking about 250 volts on the plate. The tube taking the highest signal input voltage is the 250, but that only takes an amplitude of 84 volts. A 56 with a plate supply voltage of 250 will easily swing it, and almost any one of the other receiving tubes.

* * *

### *Power Detector*

IS IT not possible to devise a detector capable of delivering so much power that the audio frequency amplifier could be dispensed with? This, it seems to me, would be an ideal way of building a radio receiver. What are the possibilities of such a scheme?—W. T. C., Hartford, Conn.

Such an arrangement would be close to the ideal, all right. And it is not impossible. To make it work it would first be necessary to obtain adequate amplification in the radio and intermediate amplifiers. Then it would be necessary to coordinate the loudspeaker and the impedance of the rectifier. Undoubtedly, it would be feasible if the rectifier were a 25Z5 or some other cathode type tube. It would not do to omit the power stage, for the power must be delivered to the speaker no matter what the arrangements may be. The power tube would be operating at radio or intermediate frequency.

* * *

### *Erratic Super Performance*

MY SUPER works well at times, but it is not dependable. Now and then the sensitivity drops practically to zero on certain wavelengths. When it does I have found that it can be restored by retrimming the oscillator, and it requires an entirely different setting of the padding condenser. If you have any explanation for this will you kindly pass it along?—W. J. S., Detroit, Mich.

It appears that the padding condenser changes value in jumps. This may possibly be due to a slipping of the adjusting screw. If that should slip a thread, what you describe would happen. It may also be that the condenser shorts, and that you have to make an adjustment to break that short. Perhaps the easiest way out of it would be to get a new padding condenser.

* * *

### *Image Trap*

LAST year some time you described a method of eliminating image interfering by means of a tracking wave trap. I have lost the copy and should like to know in what issue it appeared. Has this system been used extensively in commercial superheterodynes? Are there any other ways of suppressing images?—W. L., Boston, Mass.

The article appeared in the Dec. 3, 1932, issue of Radio World. As far as this writer knows, it has not been applied to commercial superheterodynes. Yes, there are other methods of eliminating the image interference. One way is to increase the intermediate frequency and thus remove images farther from the desired signal. When that is done, the radio tuner is sufficient to suppress images. It is always possible to increase the selectivity of the radio frequency tuner until the image interference is practically eliminated. This is the method employed in commercial superheterodynes when the intermediate frequency method is not used. Incidentally, there is also an article in the Dec. 10, 1932, issue. In this tracking curves are given, showing to what degree the tracking may be achieved in a broadcast super.

* * *

### *Reduction of Inductance by Shield*

ABOUT how much is the inductance of a coil reduced by the shield around it? I refer particularly to coils and shields now used in commercial sets.—H. E. H., Brooklyn, N. Y.

The reduction is about 10 per cent. It is greater for small coils than for large, apparently. One coil had a computed value of 74.8 microhenries and a measured inductance, inside the shield, of 66.75 microhenries. The reduction is under 11 per cent. Another coil had a computed value of 57.3 microhenries and a measured value of 50.4, also in the shield. The reduction in this case is 12 per cent. The reduction in each case is greater than the value stated, but this is due to the fact that in computing, factors were omitted which made the inductances as computed slightly too large.

### *Computing Ratings*

WILL you kindly explain how the wattage requirements of a resistor can be determined easily? I have worked on this problem without getting anywhere.—P. W. M., Oklahoma City, Okla.

The wattage rating of a resistor should be at least equal to the dissipation in the resistor. For safety it should be much greater. Just how much greater is a matter of judgment. The dissipation is easily found. If you know the current through the resistance and the voltage drop across it, the dissipation is the product of the current in amperes by the voltage. The result is in watts. If you know the current and the resistance, the wattage is the product of the resistance and the square of the current. If you know the voltage and the resistance, the wattage is the square of the voltage divided by the resistance. Ohms, volts, and amperes must be used if the results are to be obtained in watts. Formally the three relations are $W = VI = RI^2 = V^2/R$. R is the resistance of the resistor in question, I is the current through it, and V is the voltage between the ends of the resistor.

* * *

### *Cure for Motorboating*

PLEASE give a remedy for motorboating in an audio amplifier. I have a three-stage amplifier which motorboats badly. I cannot stop it by any means that I can think of.—J. R. L., Washington, D. C.

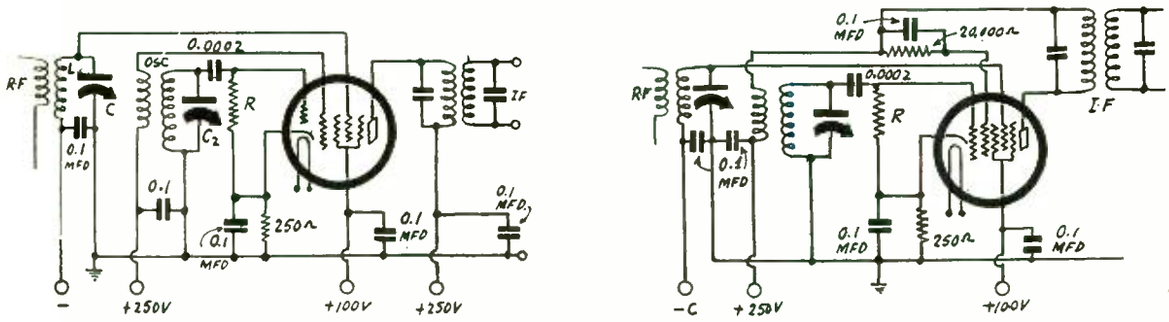
Remove one of the a-f stages and provide sufficient amplification ahead of the detector. Use larger by-pass condensers in the B supply filter, especially the one next to the amplifier. If this is large enough motorboating will stop. Put individual resistance-capacity, or choke-capacity filters in all the a-f plate returns, and the detector plate return if the detector is other than a diode. Leave by-pass condensers off the grid bias resistors. Use lower values of grid stopping condensers in the a-f amplifier or lower values of leak resistances, or both. One of these methods ought to stop the oscillation. The most radical treatment, and undoubtedly the best, is to remove one of the audio tubes and convert it into a radio or intermediate frequency amplifier. The fewer stages in the audio amplifier the better.

* * *

### *Disadvantages of Pentagrid*

IN YOUR opinion, is the 2A7 the best modulator-oscillator that can be used in a superheterodyne? Are there any disadvantages that have not yet been pointed out? I wish to build a superheterodyne that is as nearly perfect as possible and I realize that the oscillator is one of the most important features of the circuit. If this oscillator is not as good as some others I should like to know it, for I don't mind using an extra tube.—W. T. B., Washington, D. C.

From a practical point of view the pentagrid tube is undoubtedly the best. But it has disadvantages, of course. In the first place, it is an autodyne and as such partakes of the defects of this type of oscillator-modulator. It is of utmost importance so to design a super that the harmonics of the oscillator do not reach the modulator. It is impossible to prevent them from reaching the modulator in the pentagrid. Of course, the oscillator could be designed so that they are not generated to any appreciable degree, but that complicates the circuit a great deal. Moreover, it may seriously interfere with the functioning of the tube as a detector. If the oscillator is an entirely separate tube, it is possible so to couple that the harmonics are not introduced into the modulator. For example, the harmonics do not flow to any great extent in the oscillating coil and if the pickup voltage is transferred to the modulator by mutual inductance the harmonics are left behind. However, this is more or less theoretical. Any defects in the circuit resulting from harmonics can be eliminated by other means,




**The two recommended connections for the pentagrid tubes. The circuit on the right is supposed to be more stable, but the one to the left is more flexible and is used more.**

the main one being a high selectivity in the radio frequency tuner. As was stated before, from a practical point of view the pentagrid tube is the best.

* * *

### *Frequency Modulation*

WHAT is meant by frequency modulation as distinguished from amplitude modulation? The latter type of modulation I understand to be a variation of the amplitude of the carrier wave in accordance with the intensity of the sound to be transmitted.—W. H. C., New York, N. Y.

In frequency modulation the carrier frequency is modulated, or varied, in accordance with the amplitude, or intensity, of the sound to be transmitted, or rather in accordance with the dots and dashes to be transmitted.

* * *

### *Super Will Not Work*

I HAVE just finished a superheterodyne, but I cannot get a thing through it. It will not make a sound of any nature. I have checked over all the connections and am reasonably sure that they are all correct. What is the trouble, do you suppose?—D. R., Bronx, N. Y.

We wonder whether it is really finished. How could it be if it does not give any sound? First of all, measure the voltages on all the elements. They must be right before anything else is done about it. Next, make certain that the oscillator does oscillate. Chances are that when the oscillator works, something will be coming through. Of course, after the oscillator has been started there remain the adjustments of the r-f and i-f tuners. Perhaps some bias adjustments also will be necessary.

* * *

### *Selectivity and Coupling*

IS THE selectivity of a tuned circuit reduced by the plate resistance of a tube ahead of a coupler? If so, is the selectivity greater the greater the plate resistance of that tube or is it less?—M. M., Newark, N. J.

The selectivity is reduced by the plate resistance of the tube ahead, and the reduction is greater the lower the plate resistance. In practical circuits the selectivity may be reduced by 50 per cent., as compared with the selectivity of the tuner alone. The increase in the damping, which is proportional to the decrease in the selectivity, is dependent on $L/Cr_p$, in which L is the inductance of the tuned primary, C the capacity across the coil, and $r_p$ is the plate resistance of the tube ahead of the coupler. If the coupler is of the tuned grid type, the case is about the same qualitatively.

* * *

### *Line Transmission of Radio*

IS IT practical to lead the radio signals in from an antenna on the roof of a tall building to an office located on one of the lower floors by means of a long transmission line? If so, what kind of line is needed and how should it be treated?—W. B. L., Mineola, L. I.

Yes, that is being done now. A shielded cable is needed, with the inside conductor one lead and the outer sheath the other. The line should be terminated properly, which means that there should be a suitable step-down transformer at the antenna end and another transformer of the step-up type at the receiving end. What the ratio of turns of these transformers should be depends on the characteristic impedance of the line used and on the impedances of the antenna and the input to the set. They can best be determined experimentally to suit each case.

* * *

### *Estimate of Transformer Worth*

WHICH is the better power transformer, one that weighs 10 pounds or one that weighs 6 pounds, the two being rated at the same currents and voltages? Please explain the reason for the preference.—R. T. M., Rochester, N. Y.

The heavier transformer is the better, all other things being equal. Presumably it is heavier because there is more iron and more copper in it. Therefore, there will be less loss in the iron core and less loss in the copper. The larger transformer will run cooler, on the same load. Moreover, the larger transformer will have more radiating surface, and that is another reason why it will run cooler.

* * *

### *Measuring Potential*

PLEASE explain how to measure the voltage drop across a very high resistance in which a very low current flows. I have tried many meters but all give wrong results. As a matter of fact, they don't give any results.—P. C., New York, N. Y.

A vacuum tube voltmeter is about the only way in which to do it. First calibrate the tube, plate current against grid voltage and plot the curve. Then use the drop in the resistance as bias on the tube, with correct polarity, of course. From the plate current and the calibration curve you can determine the drop in the resistance because the drop in the resistance is equal to the indicated grid bias. If you have a means for measuring the resistance you can connect a sensitive milliammeter in series with it and measure the current. The voltage is then equal to the current multiplied by the resistance. If this fails because the milliammeter is not sensitive enough, the vacuum tube method will work.

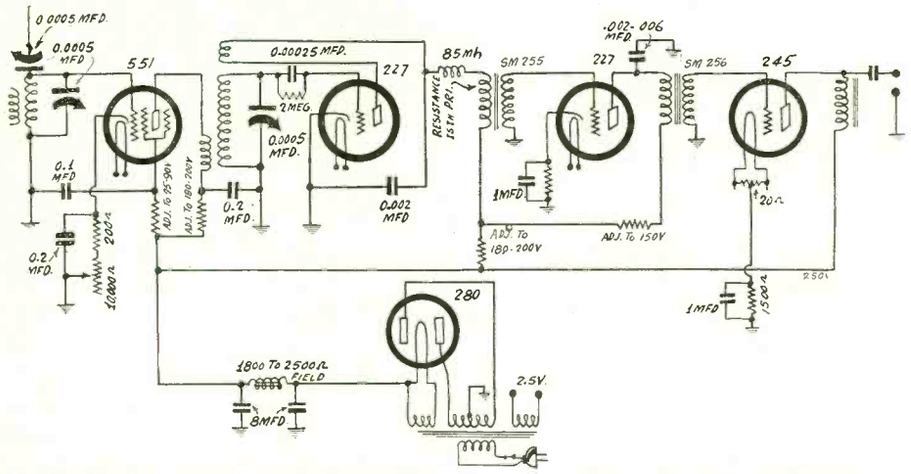
* * *

### *Connections of Pentagrid Tubes*

PLEASE publish circuit diagrams of the recommended connections of the pentagrid tubes, like the 2A7 and 6A7. I understand there are two good connections. Which of the two is preferable?—W. G. C., Covington, Ky.

You will find the two connections in the diagrams on this page. The connection at the right is said to be superior because it makes the oscillator more stable. But the other method works fine, too, and it is used more frequently than the other. Incidentally, the tubes will work with much lower voltages on the oscillator anode. Only the circuit at the left is capable of taking different voltages on plate and the oscillator anode.

# EXPERIENCE




**A circuit that gave excellent results. It was built by Franklin K. Schiener, using old parts.**

I HAVE been a subscriber for your magazine for many years and have followed with interest the various circuits you have sponsored. I hope you continue the established policy of catering to the experimenter just as you have done in the past. Incidentally, all of your competitors who strayed away from the experimenter and home set builder have passed into the great beyond.

In the last ten years I have built almost every conceivable circuit. I have a well-equipped laboratory with about $2,500 worth of apparatus and parts. A great deal of this equipment is still in original cartons, as I used to buy in quantities. I made 175 kc superheterodynes long before they were commercially available.

Last Sunday I thought I would see just what results could be obtained with some of the parts in the lab, so I stuck together the circuit herewith. The whole set is only 6 x 8. The three Silver-Marshall transformers and 2 mfd. condenser are on the underside of a 6 x 8 bakelite panel. On top are the sockets, two Hammarlund condensers, two coils, two National Velvet Vernier Dials—you need them on this set. All small parts can also be placed on underside so that the job looks neat on top. The S. M. square transformers weight down the assembly and act as a good base.

I was actually astounded by the results obtainable. My lab of course is favorably located near Caldwell, N. J. But even so, to bring in WLW with WOR on the air, and WSN with WEAF and forty or more other distant stations with a 4-inch antenna and no ground is darn good work even for an 8-tube super. And here is a little midget jigger that just reaches out and drags them in. And not the very latest tubes. I am going to see some day what it will do with a 58 and a 56. Then I am going to try out that old circuit you and I used to use comprising a variometer to tune a stage of r-f and a coil and condenser for the detector with a variometer to tune the plate.

FRANKLIN K. SCHIENER.

* * *

I HAVE just built a five-tube battery set with which I have had quite remarkable success. Using an inside aerial in a steel building in New Haven, Conn., I have, in about two weeks, received 149 stations including KFOX, KECA, KNX, and KGER in California; KGA in Spokane, XEW, XEAW, XER, XEPN in Mexico; VONF in St. Johns, Newfoundland; and many others. Enclosed is a diagram of this set. It is built on a 7-tube Super-diamond chassis and uses full shielding of the tubes and regulation t-r-f coils, as well as a three-gang condenser. When phones are used only 67.5 or 90 volts of B battery are on the 33 plate. The receiver is, of course, not regenerative. It tunes down to CKOK on one end of the dial and to the 1712 kc police stations; 15 police stations have been logged besides the 149 broadcast stations.

The selectivity is remarkable, also. WMAQ and WSM come in with no interference from WEAF, at the low frequency end of the dial and at the other WHOM, WJSV, WLAC, WKBW, WCKY all come in with some space between each, while distant stations are very sharp. CFCF is crystal clear between KYW and KRLD or KTHS. I have built several a-c t-r-f sets but must admit that this 5-tube battery hook-up surpasses them.

G. H. B., Jr.

# MEN OF THE MOMENT

Al Goodman and his orchestra provide the incidental music on the new series of programs featuring Irving S. Cobb, broadcast over some forty stations of the Columbia network, heard on Wednesday and Friday at 9 p. m. EDST. For several years Goodman was musical director for the late Florenz Ziegfeld and was in the pit for many of the famous producer's outstanding successes. Currently he is directing the musical end of "Strike Me Pink."

* * *

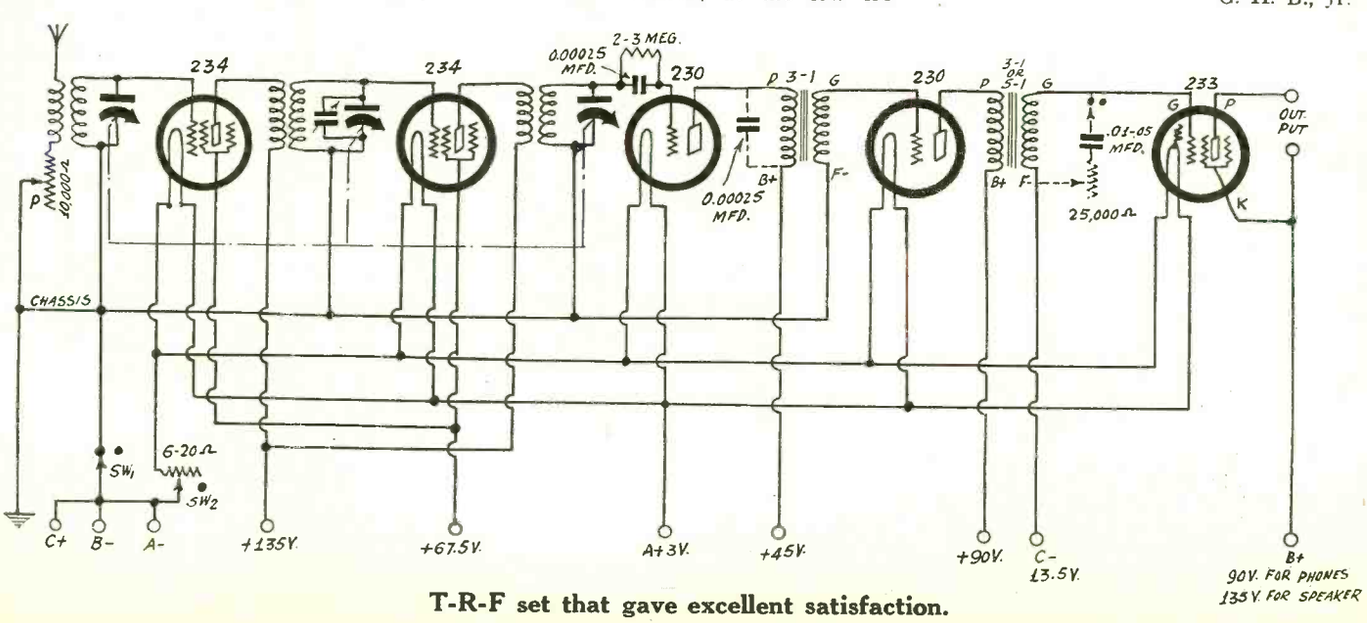
Colonel Louis McHenry Howe, President Roosevelt's closest political adviser, appeared with Edwin C. Hill on the "Inside Story" program over a coast-to-coast WABC-Columbia network recently. Howe is said to be the "Colonel House" of the Roosevelt administration. For twenty years the small, unimposing-looking man has been close to the President's family. Currently he is a resident of the White House, a member of the official Secretariat and a prime force in the "kitchen cabinet." Though his name carries weight in Washington, he is almost a man of mystery.

* * *

"The Voice of Experience," which attracted a large audience as a WOR feature is now heard six times weekly as a WABC-Columbia network feature. Informally speaking on varied human interest topics, "The Voice of Experience" will be heard from 11:00 to 11:15 a. m., EST, daily except Saturdays and Sundays, with an additional quarter-hour period at 8:00 p. m., EST, each Wednesday. There will be a seven-week break from July 24 to September 8, inclusive, when the program will not be broadcast.

* * *

Earl Lawrence, whose musical arrangements enhance the Neil Sisters' programs, says he can can only write music when the weather is bad.




**T-R-F set that gave excellent satisfaction.**

# PENNSYLVANIA BILL BANS ALL SETS IN AUTOS

Radio and automotive interests are uniting to defeat a bill introduced in the Pennsylvania State Legislature to prohibit use of radio receiving sets in automobiles. The bill would provide a fine and imprisonment for persons operating radio sets in automobiles. The bill was introduced in the Legislature at Harrisburg by Representative Louis Schwartz, of Philadelphia. The Pennsylvania bill is the only instance in many years in which there has been any effort to ban automotive sets. Official investigation by authorities in many states has definitely determined that automotive radio actually is a highway safety factor, by reducing driving speed, says Radio Manufacturers Association, Inc.

### Short-Wave Ban

The RMA board of directors has decided that no opposition will be made to legislation, offered in a few states, regulating and requiring licensing of short-wave sets in automobiles which are capable of receiving police broadcasts, but restruction of regular broadcast receivers in automobiles will be opposed. The association, however, will oppose federal regulation of short-wave automotive sets, as proposed in a bill in the House of Representatives at Washington.

From forty-three State Legislatures in session this year has come an unusual volume of new radio legislation. While much state legislation on radio has been proposed very little has been enacted, partly due to opposition.

### Luxury Tax Fought

In the Missouri, California and Connecticut Legislatures bills have been proposed, which the RMA and other radio interests are opposing, to levy "luxury" sales taxes on radio and other products. Chairmen of the various State Legislative Committees of the RMA, generally local radio jobbers of prominence, are cooperating in opposing such legislation.

## Try-Mo Is Expanding; New Catalogue Ready

Try-Mo Radio Corp., 85 Cortlandt Street, New York City, which has three stores in the Manhattan Borough and has been identified with retail stores and the radio mail order business ever since radio began, is practically forced to bring out a new catalog properly to list the new items stocked and which have come from their experimental laboratories since the last issue.

Great progress is reported in the short-wave department, with numerous short-wave models of the 2-volt type and the a-c as well as a-c and d-c combination type. All are in kit form, but wired models, ready to operate, are obtainable. Large additions have been made and new and greater stocks carried in the replacement and servicemen's departments. So large and varied is the stock of merchandise that practically anything one wants in radio can be found under one roof. In order better to acquaint the out-of-town public who order by mail a new and altogether different catalog is ready for free distribution. It will consist of 108 pages, thoroughly indexed, and arranged in the most up-to-the-minute manner.

## *More Power for WAAT*

Washington.

The application of Bremer Broadcasting Corporation (WAAT), Jersey City, N. J., for a modification of its license to increase power from 300 watts to 500 and to install new equipment was approved by Examiner R. H. Hyde in a report to the Federal Radio Commission.

# CHART AVOIDS COMPUTATIONS

The capacity of two condensers in series, the inductance of two coils in parallel, provided they have no mutual inductance, and the resistance of two resistors in parallel, are determined by the same formula. Suppose, for example, that one of the values is A and the other B, then the combined value, D, is $D = AB/(A + B)$. In other words, the result is the product of the two divided by their sum.

Because of the identity of form it is possible to use the same straight-edge chart for determining the resultant when the individual parts are known. A convenient diagram for doing the work without recourse to mathematics is shown on the front cover. The two side scales represent the individual values and the central scale the resultant.

To use the diagram lay a ruler so that it passes through the two known values on the side scales. Read the resultant on the central scale where the rule crosses it. Let us take a few examples. Let it be required to find the resultant of two resistors 1,000 ohms each when they are connected in parallel. The rule is laid so that it passes through the two points at the upper ends of the scales. It crosses the center scale at 500 ohms. Had the values been units or tens or hundreds, the rule would have been laid in the same manner. The only difference would have been the assignment of different values to the scales. Likewise, had the two values been 1,000 millihenries or 1,000 micromicrofarads, the rule would have been laid in the same manner. But the resultant would have been determined as millihenries or micromicrofarads, as the case many have been

The rule is laid in the same manner for any other two equal values. That is, it would have been laid at right angles to the central line, but lower down.

When the two values are different the process is the same but the rule is necessarily laid at an angle with the central line. Suppose, for example, that we wish to combine 4 and 10. The rule is laid so that it passes through 1,000 on one scale and 400 on the other. It makes no difference which of the two possible ways is selected. The resultant of the two is read at the point on the central scale where the rule cuts that line.

# MIKES ALL SET FOR OPENING OF WORLD'S FAIR

More than 100 radio pick-up points already have been installed by the National Broadcasting Company in the World's Fair Grounds in Chicago, where the Century of Progress Exposition will open on June 1st.

Plans to give radio listeners the most complete coverage ever attempted for such an extended series of events are now being formulated.

Microphone connections have been installed in all places of interest, ranging from the various exhibit groups to the Children's Enchanted Isle. The court of the Hall of Science, the Court of the States and Soldiers Field are expected to be the scenes of major broadcasts.

### Roosevelt to Speak

Following the broadcast of the opening ceremonies a number of programs, ranging from international sporting events to educational and musical programs, will be heard through NBC network stations daily.

The opening, which will be in the nature of a pageant on a giant stage erected in Soldiers Field, will, according to present plans, bring to listeners throughout the world the voices of President Roosevelt, Governor Horner of Illinois, Rufus C. Dawes, exposition president, and the ambassadors of all nations represented at the fair.

The initial ceremonies will begin with a parade from the Loop to Soldiers Field with massed bands, singing societies, various branches of the United States Military, Naval and Marine services, and visiting dignataries participating.

### Five Months of Frolic

Throughout the five months that follow, a great array of special and sports events, ranging from tennis, track and swimming to the National Air Races and intercollegiate football games, will be broadcast by the NBC.

Because the majority of the contemplated events have only tentative dates at present, the task of setting up even a preliminary broadcasting schedule is almost impossible. The National Broadcasting Company, however, will broadcast every event of major importance during the entire period of the exposition, according to present plans.

### NOEL COWARD IS ADMIRED

Noel Coward, the author-playwright-actor, is the celebrity most admired by Mary Steele, whose contralto voice is heard regularly. Mary's husband, Bob Brown, the announcer, is non-committal on the subject of Mr. Coward.

## Dr. Damrosch to Remain with N.B.C.?

Radio listeners and the general broadcasting field are interested in knowing whether Dr. Walter Damrosch will continue next season as conductor of the music appreciation concerts which have been broadcast by the N. B. C. The greatest appeal of these concerts has been to pupils and teachers in public schools throughout the country. This special appeal has been based on the fact that the symphony concerts have been heightened in interest by lectures by Dr. Damrosch.

There seems to be a question of money at issue, for even great artists like Dr. Damrosch have some regard for the almighty dollar. M. H. Aylesworth, president of N. B. C., has announced that the series of concerts will be continued for the season of 1933-34, but it is understood that another conductor may replace Dr. Damrosch in case the present incumbent does not agree to a reduction in salary. At this time there seems to be considerable doubt as to exactly what will happen, but everybody concerned hopes that Dr. Damrosch will see a great light.

### A THOUGHT FOR THE WEEK

*PERHAPS YOU THINK WALTER WINCHELL is very hardboiled. Perhaps he is, but we worked with him and discovered that he's a regular human being. At any rate, do you think this same W. W. lost control of himself temporarily when he sent his check for a thousand dollars to the Stage Relief Fund? We don't think so; it was just Walter Winchell doing his bit, openheartedly and willingly, for the boys and girls with whom he worked when he, too, was an actor. That's all!*

RADIO WORLD

**The First and Only National Radio Weekly**

***Eleventh Year***

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. B. Anderson, technical editor; J. Murray Barron, advertising manager.

## A.P.'S NEWS RESTRICTION

THE property right in news is well established. The work that the newsgatherer does is protected under our laws. It is therefore not surprising that the Associated Press taboos the use of its news dispatches, or contents thereof, in chain broadcasts, permitting local stations to have A. P. news broadcast, with credit to the A. P. and to the local newspaper member of the association, and taxing the local paper, to reduce the contribution of such papers as do not engage in news broadcasting.

If the A. P. alone took such action it would not be very effective, as substantially the same news events are detailed in dispatches sent out by the United Press, International News Service and others, but the expressed likelihood is that the others will follow suit. That would clinch the safeguarding of the dispatches from use by chain newsmongers, although of course would not bar editorial utterances on local, national and world events. The duration of the property right in news, moreover, is not indefinite, although the courts have left for the special determination in each case the question when news cease to be news. Thus it would be no violation to tell now of Marconi sending the letter S across the Atlantic. History and news are different, in that history endures, news may not, though news may make history.

The A. P. decision is a blow to the growing crop of news disseminators that now has important sponsors and that is heard over the large chains. That the A. P. should restrict the air use of the news it pays so dearly to gather and transmit is not overwhelming, and the action is at least understandable, contrasted with outbursts heard occasionally at meetings of the Newspaper Publishers Association, when little minds cry for a complete cessation of the newspaper publication of radio programs. The reading public wants the newspapers to print the programs and the newspapers that want the reading public had better print them.

## NEW TUBES KEEP COMING

DURING recent months new tubes have been announced at an average rate of almost one a week, despite overtures by set manufacturers and some supply houses, who hold the plethora of tubes confusing. The point is raised that some of the tubes represent merely small refinements, hence these tubes need not be brought out at all, particularly at this time.

It is no doubt the higher object of the tube manufacturers to lend their best assistance to the improvement of the technical side of radio, so that sets may be better, hence the parade of new tubes is unimpeded. That the major receiver developments of recent years concern new tubes, and that the groundwork for such improvement therefore was performed in the tube factories and laboratories, can not well be denied.

It is surely disconcerting for a set manufacturer to be ready to shoot with a new model, only to ascertain that a new tube will soon come out that really ought to be in the set. However, the structural difference in the receiver, and the voltage supply sources, need not be changed, so the manufacturer, to take advantage of the gain, has to change his set accordingly. Likewise the supply house has to extend further its line of tubes and hire persons of especially good memory to have spontaneous familiarity with the designations and characteristics of the tubes. Formerly any one could bear in mind the tubes and their characteristics. Today life is incomplete without a tube chart.

## THE CHANNEL PROBLEM

THE Pan-American conference that was to be held in Mexico last month has been postponed, not because of lack of interest on Mexico's part, but probably because all countries at this particular juncture are deeply concerned with far more serious problems.

Nevertheless the conference is expected to report favorably on the aspirations of Mexico and Canada for more wavelengths. The proposal to extend the broadcasting band considerably, in either direction, is not likely to be adopted, so that if our two neighbors are to get more channels they must be obtained at our expense.

It can not be denied that the United States has obtained a goodly share and that it has deserved such share, but even so the situation is not altogether to our liking, particularly in regard to high-powered Mexican stations interfering with stations of both low and high power in our own country. Even if some channels have to be relinquished, it is conceivable that improved conditions will result, for the conference is vested with a quasi-police function, and a friendly and co-operative spirit should result in the solution of some awkward problems.

## 75,000 Square Feet Taken by Westinghouse

Three entire floors and part of a fourth floor in the 70-story RCA Building, main structural feature of Rockefeller Center, have been leased to the Westinghouse Electric & Manufacturing Company, according to an announcement just made by Rockefeller Center, Inc.

All the New York offices of the manufacturing company and its subsidiaries, including the headquarters sales offices of the Northeastern District, will be transferred in the late Spring or early Summer to the 14th, 15th, 16th and 17th floors of the skyscraper. The lease involves approximately 75,000 square feet.

With the exception of the Westinghouse Electric Elevator Company, these offices are now concentrated in the Westinghouse Building at 150 Broadway. The executives and sales offices of the elevator company are now located at 460 West 34th Street.

The lease is among the largest in the New York real estate field during the last year.

# GOLDBERGS OFF AIR WITH CHAIN, HAVOC ENSUES

San Francisco.

Discontinuance of the NBC-KPO network has resulted in the discontinuance of the Goldbergs, so far as many listeners here are concerned. The feature is on the air otherwise and elsewhere, as usual.

Pacific Coast listeners to the serial story of the Goldberg family are still calling NBC's San Francisco headquarters and stations on the network to ask what's the trouble.

### 14,000 'Phone Calls

More than 14,000 telephoned inquiries have been received to date from the great western audience which has been following the fortunes of the Goldberg household, and letters are still flooding in from the entire coast region, proving that the Goldbergs, after more than a week's absence from the local airways, were more keenly missed than ever. An average of 100 letters a day had been received.

More than 6,000 calls were tabulated in the San Francisco NBC switchboard alone, and a proportionate number at all other stations on the Pacific Coast the first night the Goldbergs were off the air. Long distance calls continued to arrive in the San Francisco offices from Sacramento and other cities.

### Fire Department Responds

One whole fire department division was represented in one telephone call, and several hotels have called several times in order to answer inquiries from their patrons. Letters have arrived from individuals and groups, all equally interested in the fate of the East Side household which has won the affections of an entire nation. One letter on the stationery of a business firm bore 67 signatures.

### Men Write In

An interesting sidelight in the deluge of calls and letters is the fact that three-fourths of both come from men. This harks a departure from the usual fan mail response to any program. Ordinarily the bulk of letters and telephone calls come from women, but the Goldbergs' appeal, while directed to the family as a group, apparently is strongly felt by men, and many of the letters still arriving are from business men.

## New Station Refused

Washington.

Denial of the application of the Arkansas Radio & Recording Co., Little Rock, Ark., for a permit to construct a broadcasting station and renewal of the application of the Arkansas Radio & Equipment Co. (KARK) Little Rock, were recommended to the Federal Radio Commission by Examiner E. W. Pratt in a report made public recently.

The Arkansas Radio and Recording Co. requested an assignment of 890 kilocycles frequency, 250 watts night power, 500 watts day and unlimited hours of operation, the facilities of KARK.

# STATION SPARKS

## *By Alice Remsen*

## The Call o' the Sea

### For Malcolm La Prade, Cook Travelogues

**(WJZ and network, Sundays, 1:15 p. m.)**

**When young an' full o' deviltry**
**A sailor man you'll be;**
**You pack your duds, an' leave your home,**
**An' sign up for the sea.**
**You think it's just a lazy life**
**A'sailin' 'round the world,**
**But you find out the diff'rence 'fore**
**Your first mainsail you've furled.**

**It isn't always tropic seas**
**With palm trees wavin' there;**
**It isn't always dusky maids**
**With flowers in their hair;**
**An' you're not always makin' port**
**An' raisin' merry hell;**
**Nor findin' desert islands**
**As adventure stories tell.**

**They work you hard upon a ship,**
**You surely earn your pay,**
**A'standin' watch or wheel at night,**
**Or swabbin' decks all day;**
**A'shiftin' suits or shakin' reefs,**
**A'hangin' to the yards—**
**Oh, it ain't all just drinkin' rum**
**Or in fo'c's'le playin' cards.**

**And yet, with all the hardships, mate,**
**There's somethin' 'bout the sea**
**That sort o' gets the younger lads,**
**The same as it got me,**
**An' I may curse an' grumble, like**
**A mean an' onery pup—**
**But still an' all—I love it—**
**An' I'll never give it up.**

—A. R.

* * *

**And if you listen in to Malcolm La Prade** telling those travel yarns, you, too, will feel the call of the sea; you'll want to pack up and get aboard an ocean liner, a sea-going yacht or even an old tramp of a fruit steamer. You'll want to smell the salt sea air and touch at those glamorous ports, full of romantic adventure. Listen in; you'll like it!

* * *

## The Radio Rialto

### Back to the Old Routine

Am gradually getting back into the old routine again, which is something to be thankful for; after having been away five months in an entirely different environment, it was rather hard to slip back again. . . . Heard from Margaret Maloney this morning; she is convalescent and expects to be back at her office in a few days. . . . Bissell Brooke popped in to see me last week. She has resigned from her position as Radio Editor of the Baltimore Sunday Sun and will locate in New York; this is good news. I like Bissell; she's a good scout. . . . Helen Nugent is singing at the Paramount Grill. Located there after she left Columbia. . . . Beth Challis is still warbling at WOR, and so is Jack Arthur. . . . Heard Marie Gerard over WOR recently. Marie has a very beautiful soprano voice, and I used to enjoy her over WABC when she did light opera and classical programs. Now Marie is taking up popular music, and when she develops her own style, this young lady will be a jolly good commercial bet for some sponsor looking for a really intelligent songstress. . . . Did you know that Joseph McCord, author of that corking novel, "Bugles Going By," now running in McCall's, serially, was a former news broadcaster? Well, he was—when he wrote feature articles for the Baltimore News and Post. The lad is now in New York, living in Greenwich Village, of all places. . . . For the correspondent who wanted to know where Willard Robison, conductor of the Deep River orchestra, was born: in Shelbina, Missouri, September 19th, 1899. He's five feet, ten inches, weights 175 pounds. Fair complexion, light brown hair, blue eyes. His wife's name is Doris; has one child, a daughter, Joilne, eleven years old. . . .

### Happy Events In Radio

Howard Claney, that good-looking NBC announcer, is having a series of masks made of his face by Marcia Linya, the sculptress. Miss Linya will display them at her exhibition in New York next month. Howard himself is an artist, in oils and water colors. . . . Yes, spring is here: Harry Reser is getting his boat ready; so is Lee Sims and Jimmy Melton. . . . By the way, Harry Reser is a descendant of Davy Crockett, famous hunter and scout. . . . Guy Lombardo is busy at this writing playing dances through the State of Virginia and North Carolina. . . . Jan Garber and his orchestra also are playing through the South. University students like Jan; he's a lively little fellow and his band is okay. . . . Good gracious me—Dan Cupid has been busy at NBC again. Kathleen Wilson, pretty NBC actress, at the San Francisco studios, was married April 12th to Rawson Holmes, young Stanford graduate and scion of a well-known California family. . . . From the same studio Kenneth Carney, producer, eloped with Nell Burleson, advertising manager of a San Francisco store. They motored to Reno over the week-end and returned married. . . . Reno was also the scene of Bert Horton's and Mildred Susan Barnett's wedding. Bert is a well-known character actor, and Mildred is executive secretary to George Eboy and the Fulton Theatre Corporation. . . . Mona Lowe, the NBC blues singer, will be the next to step out of the single trail. She weds Paul Rickenbacher, Southern California radio executive, some time this month. The NBC Bluettes will be her bridal attendants. . . .

### Will Cuppy In Comedy Series

Will Cuppy, humorist, and Jeanne Owen, actress, are now heard over WEAF and network, each Friday at 7:15 p. m. in a series of broadcasts, "Just Relax." Their first episode was entitled "Farewell to Spinach." Mr. Cuppy, however, because of his rotund body, is a great eater of spinach, despite his light treatment of that vegetable on his opening program. . . . I seem to remember reading reviews of mystery stories by this same Will Cuppy in the Sunday book review section of the New York Herald-Tribune. . . . Another new program to be heard over the NBC networks in the near future is the noted singing surgeon, the Mexican Caruso, Dr. Tirado. He is Mexico's Angel of Mercy. His life has been spent establishing scores of orthopedic clinics in his native country. He is an expert surgeon, and because he found voice in song as he played the good samaritan, that voice enabled him to earn money with which to establish more free clinics. Now he comes to this country, after establishing himself on Station XEW, Mexico City, simply because a friend of his persuaded John F. Royal to listen to a recording of Dr. Tirado's voice. . . . And now it appears that Arthur Tracy will get a new program in June, so what! . . . Evening in Paris appeared in its new form recently. It seemed good to hear singing on the program once more. Nat Shilkret's orchestra gave a good account of itself. Frank Parker was supposed to be on the program, but the voice I heard did not sound like Frank's. Mary McCoy proved to be possessed of a sweet soprano and Agnes Moorehead reminded us of the old Octopus atmosphere with her distinctive speaking voice. Shall listen next week with interest. Do you remember Wendall Hall, the "Redheaded Music Maker"? He is now to be heard over WBBM, Chicago, every Monday and Wednesday at 7:30 p. m. Frank Westphal's orchestra provides his accompaniment. . . . Station WSM, Nashville, is giving music lovers something to talk about each Sunday evening at 5:30, when Mary Cornelia Malone, soprano, and John Lewis, baritone, appear with the WSM Little Symphony under the direction of Alvin Masten, in selections from grand and light operas. This program is really worth while. . . .

### Over at WINS

Station WINS, New York, has a new program, featuring Vivian Vance, "The Girl of WINS," and Hal Schubert, each Tuesday at 7:15 p. m. Songs and comedy. WINS also announces that the organ programs of Dr. Alexander Russell, heard from the Wanamaker Auditorium, have proven so popular that they are to be placed on a regular schedule—Monday and Wednesday at 8:00 p. m. . . . The radio friends of Vera Ross in Cincinnati and Chicago will be pleased to learn that she is once more in her rightful position, on Broadway with a Gilbert and Sullivan revival by Milton Aborn's company. . . . Did you know that Will Rogers was once known as the Cherokee Kid? . . . The sun is shining brilliantly today, even though it's rather cold. . .

So here goes for a brisk walk, then the subway to town and the editorial desk. Oh, by the way, before I forget it! Ed Wynn's broadcasting company, now under way, has two old friends of mine among the executives. They are W. Dayton Wegefarth, formerly of the Keith-Albee enterprises, and a poet of no mean ability, and Peter Dixon, of "Raising Junior" and New York Saturday Sun fame, so shall probably obtain some information from these gentlemen anent the new chain. Do hope, from the bottom of my heart, that it will be a success.

* * *

## Biographical Brevities

### ABOUT CLARA, LU AND EM

Clara, Lu and Em, who have cheered the hearts of so many American housewives, every week-day morning at 10:15 over WJZ and the NBC network, have been friends since their college days.

Clara, who, in private life, is Louise Starkey, was born in Des Moines, Iowa; while in school she won three scholarships and a third prize in a state oratorical contest. She is a Zeta Phi Eta.

Lu, whose real name is Isobel Carothers, was born in Mount Pleasant, Iowa, and always had a knack for self-expression, whether in cooking, sewing or clay modeling, all of which she loves to do. She is the smallest of the three girls, with copper hair and strange blue-gray eyes that change color with change of frocks. She is a Kappa Kappa Gamma.

Em, who is Helen King to her family, was born in Los Angeles, California, but was brought to Peoria, Illinois, at such an early age that the town seems more like home. She's of good old American stock and can trace her ancestors to John Carver, first governor of New York, Dan Carver, a Minute Man, and Rufus King, one of the signers of the Declaration of Independence. She likes to spend a great part of her time at the piano, and when there's time left over she takes a swim or plays ping-pong. She is a model housewife just as she was a model student at

(*Continued on next page*)

# PERSONALITIES

While Jimmy Wallington, NBC announcer, was broadcasting a growl-by-growl description of the lion-taming act at the circus in Madison Square Garden recently, he was standing beside Zacchini, the "human cannon ball," who is shot from a cannon from one end to the other of the huge Garden, and who would be all cut up about it if he missed the landing net. Together they watched a tightrope walker balancing at a dizzy height.

"Humph!" grunted Zacchini. "Look at that fool! Some day he's going to break his neck walking on a wire like that!"

* * *

Carveth Wells, explorer, who has peeked into many of the strange corners of the world, is a staunch advocate of air travel. Since the author-lecturer began his current series over NBC networks he has flown more than 11,000 miles throughout the West. Wells has ridden upon burros in western America, in rickshas in China, in canoes in Africa, behind reindeer in Lapland, upon canal boats in Sweden and has employed a dozen other odd conveyances in all parts of the Earth.

* * *

A school teacher in Foxboro, Mass., recently conceived the idea of getting her pupils in the Center School to write themes on a real topic. So instead of selecting an imaginary subject the teacher asked the pupils to write to Elvia Allman, NBC's diseuse, whose singing of "Skippy" was heard in the school's music course earlier in the day. Miss Allman received 37 letters from the pupils, each one asking her to sing "Skippy." Each letter was signed, "Your new friend." Miss Allman sang "Skippy" on her next broadcast and sent each of her new admirers a photograph.

* * *

William Wirges and Joe Kahn, two-piano team, are often solicited by studio listeners, who ask for copies of their song arrangements. The two pianists make their own trick arrangements of all their music.

* * *

Lanny Ross, tenor, heard on Captain Henry's Showboat, received $50 as an Easter gift from an unidentified admirer. Failing to find out whom it might be from, in order to return it, Lanny will now turn the money over to charity. He is arranging with a social organization to entertain a group of poor children.

* * *

Madame Sylvia, Hollywood physical culture expert, whose broadcasts have been featured over networks. has become a citizen of the United States. She was granted her naturalization papers the other day. She is Mrs. Sylvia Leiter.

* * *

Margaret West, the Texas Cowgirl, heard over NBC networks, first came to New York to sing at Democratic rallies, thinking she might bolster the cause of Vice-President John N. Garner, a fellow-Texan. During her stay in New York she sang her cowboy songs over the air for the first time.

* * *

To describe more fully the three jewelled Easter eggs which the late Czar of Russia gave his Queen, Lowell Thomas. had the baubles, valued at $250,000, brought to the NBC studios during his broadcast. The three diamond-studded "eggs," about the size of baseballs, are now in a New York display. Thomas described famous Easter eggs of other years and touched on these Russian royal jewels. Two armed guards and two detectives accompanied the "eggs" to the NBC studios and waited for Thomas to finish describing them.

Mary Steele, contralto heard regularly on four NBC network programs from the Chicago studios, has a baby pillow on which she has slept since childhood.

* * *

When the sun gets hot and the days get long, it's a sign that the brain-cudgeling season is opening around the broadcasting studios. The experts begin scurrying about, looking for new ideas to unfold before sponsors and the public in the fall. In the Madison Avenue haunts of the Columbia Broadcasting System the season is already open, but this year it's not the hidden personalities that the brain-cudgelers are trying to ferret out; it's the hidden value in radio script acts—specifically the light comedy type.

Drawing-room comedy, which has been notably unsuccessful on the air, deserves another chance, and, says Marion Parsonnet, CBS dramatic director, it will get that chance during the torrid months ahead. More or less polite comedy—a sort of Noel Coward type—will be tried out in the Columbia studios in the experimental work being planned by the dramatic department. The Broadway stage will be drawn upon for talent to augment the ranks of established radio mimes. A certain amount of shopping around will be done for scripts to supplement the output of the CBS writing staff, and new continuity methods will be tried out.

One of the most irritating problems of radio dramatic writing has been that of attaining smooth and coherent transition from sequence to sequence. This, Parsonnet declared, will engage much of the dramatic department's attention during the experimental period. New means of setting the invisible stage will be tried. Methods will be devised for planting a forthcoming scene in the listener's mind before it flashes upon the kilocycles. The goal to be attained, in short, will be the slick scenic transition of the movie screen.

This experimental work will be conducted systematically and a definite weekly period for air tryouts will be announced soon.

* * *

John Pierce, the Radio City Music Hall tenor, frequently heard over NBC networks with Henry M. Neely, the Old Stager, became a singer by accident. He is really a violinist and was induced to sing for radio by friends.

* * *

Walter Blaufuss, orchestra conductor, has received a letter from George Drumm, composer, complimenting him on his interpretation of Drumm's piece "Springtime" on one of Blaufuss' recent programs.

# Station Sparks

(*Continued from preceding page*)

school. She has been a professional organist, pianist and teacher of dramatics and rhythmics for children. She is a Zeta Phi Eta and a Tetha Alpha Phi.

The girls were famous at school for what they called "Gabfests," chatter about their imaginary friends, put on for sorority parties. When they left college the girls separated, Clara to teach in Texas, Lu to teach in Boston, while Em remained in Evanston, Ind. A strange twist of fate brought them all together again and friends suggested that they put their old "gabfests" on the air, and so the radio act of Clara, Lu and Em was born and has thrived and grown mightily since those days. The act is three years old now and is still going strong.

# A.P. PROHIBITS 'CHAIN' TALKERS USING ITS NEWS

The Associated Press, the world's largest gatherer and distributor of news, as well as a good percentage of the newspapers it serves, do not approve of promiscuous use of A. P. material by news commentators on the air. This disapproval is, of course, based on the generally expressed conviction that such news when sent out over the ether hurts the sales of newspapers, although some publishers agree with the stations that skeletonized reports really whet the appetite of the public for further newspaper details.

### Resolution Adopted

Anyway, the publisher of the Nashville (Tenn.) Banner introduced the following resolution at the recent annual luncheon of the A. P. held at the Waldorf-Astoria in New York City:

Be it resolved, That it is the sense of this meeting that the Board of Directors shall not allow any news distributed by The Associated Press, regardless of source, to be given to any radio chain or chains; and be it further

Resolved, That no member newspaper of The Associated Press shall be allowed to broadcast its local news or news furnished by The Associated Press, other than brief bulletins covering events of major local, national or international importance with credit to The Associated Press and the member newspaper, and then only over an individual radio station located at or near the place of publication of the member paper broadcasting; and be it further

Resolved, That it is the sense of the meeting that the Board of Directors shall promulgate at once rules and regulations covering the hours of such news bulletin broadcasts so as to distinguish between morning and evening members, fix a schedule of additional assessments to be applicable solely to those member papers which broadcast Associated Press news, the revenue from which shall be applied to a pro rata reduction of assessments paid by non-broadcasting members; take all steps necessary to protect the news report of The Associated Press from pilfering or such other illegal use by radio news commentators or others; and define the meaning of "brief bulletins" in conformity with the text and spirit of this resolution; and be it further

Resolved, That all resolutions heretofore adopted by the membership in conflict with this resolution be and the same are hereby rescinded and declared null and void.

### Others to Follow

The resolution was passed and now stands as the guide for A. P. members in all matters pertaining to the use of A. P. news on the air.

In addition, representatives of The United Press and the International News Service stated that their organizations probably would join the A. P. in this move by taking similar action.

The broadcasting chains are now considering methods for the gathering of their own news.

# MANY CAUSES ABROAD MADE EXPORTS DROP

Washington.

Despite a 42% drop in radio exports, 1932 compared to 1931, and the displacement of Canada by Argentina as the chief buyer, increased exports amounted to $871,969 in 46 countries. In 57 countries the decrease was $10,194,987, leaving a net drop of $9,323,018.

Gains in manufacturing countries were shown for Austria, The Netherlands, Sweden, and Australia. The principal loss in a market where domestic competition is not serious was in Argentina, where exchange is denied by government fiat for luxuries—radio being so classed for the purpose—the total declining from $2,420,880 to $1,463,332.

Despite the general decline in totals, radio receiving tubes exported increased both in number and in value. Exports of tubes during 1931 numbered 2,375,048, valued at $1,946,928, increasing in 1932 to 3,758,905, valued at $2,012,656.

### Exchange a Factor

Exports of radio transmitting sets and parts decreased from $804,524 to $663,750 and receiving sets decreased from 471,263, valued at $14,357,029 to 290,673, valued at $7,321,849. Foreign sales of components (parts) decreased from $3,887,717 to $2,517,287; loudspeakers, 231,085, valued at $1,064,210, to 137,727, valued at $455,840; and other accessories (battery eliminators, aerial kits, aerial eliminators, noise suppressors, etc.), $574,746 to $340,754.

While it is possible to explain the decreased foreign sales of radio equipment by pointing to the reduced purchasing power of practically all peoples of the world, there are a number of secondary contributory factors, each at least partly responsible. The silver standard in some countries serves to increase the prices of manufactures of gold-standard countries when imported, when, as at present, the price of silver is low.

### Quotas Ominous

High tariffs also have a price increasing effect as to imported goods, but more serious have been restrictions on inports in the form of quotas, the control of exchange by governments to reduce the outflow in payment for credits and goods, nationalistic campaigns to appeal to patriotism as a motive for disregarding advantages that may be possessed by imported goods, activities of the owners of foreign patents to scale down or exclude importations of competing foreign goods, or the assessment of a license fee by which the price on the foreign article must be so increased as to place it beyond competition, the hesitancy of American exporters to grant as flexible terms as during past years in view of the reduced security both as to stability of the account and as to the possibility of restrictions which may prevent payment, and their withdrawal from competition in some markets through economy in selling costs, decision to cease efforts where sales have been made too onerous, either through distinct price disadvantage or uncertainty of return.

An additional factor, and one that will be to some extent permanent, is the growth of domestic radio industries in countries whereforeign goods have become too costly or too difficult to obtain.

# TRADIOGRAMS

## *By J. Murray Barron*

D. F. Repogle, formerly with the DeForest organization, has joined Hygrade Sylvania Company. He brings to his new connection a skill as an engineer and salesman.

* * *

The talk of the hour just now seems to be automobile radio. The demand from the car owners seems to be not only for an auto radio, but something portable that can be used at the camp, boat and the home as well as in the car. In this respect the consumer should be careful. It takes sensitivity in an auto radio receiver to pull in those stations, and many a receiver that works satisfactorily at home operates poorly in the automobile. There are numerous sets advertised for the auto, but they are permanently installed and not of the vari-use type, i. e., the small ac-dc battery jobs.

* * *

Now and then you hear that there isn't much radio business, and yet if one watches the better-known radio stores one sees new radio receivers being delivered almost daily, new window displays, featuring nationally-known receivers and new things the next week. A number of mail order houses who know what to feature likewise report satisfactorily business. There **is** business. For the consumer there are some excellent buys. Your radio dollars will buy a whole lot today, possibly more than they ever will, as prices are expected to advance. The demand for and appreciation of small short-wave receivers of few tubes is still one of the livest.

* * *

With the opening of many seaside resorts and beaches, with their places of amusement and displays of varied merchandise for sales to the public, an increase for public address systems and amplifiers has taken place. As the season is still very young there is plenty of business and orders for worthwhile outfit. It's a big source and outlet for the serviceman or dealer who will get out and make the personal contacts.

* * *

A very sensible and worthwhile arrangement for the installation of the small ac-dc battery type radio receiver has been adopted by Postal Radio Corp., 135 Liberty Street, N. Y. City. For those who want to install this receiver in an automobile with a remote control on the steering wheel there are the necessary clamps and the remote control, with a pilot light. This is a more permanent installation, although the receiver can still be removed for use elsewhere. Another method is an arrangement for the dashboard which requires no remote control, as the receiver can be tuned in the usual way, and when necessary can be removed quickly for use at home or in the camp or seashore.

* * *

M. & H. Sporting Goods Co., 512 Market Street, Philadelphia, Pa., is featuring National S. W. 3 at attractive prices. This is new merchandise in sealed cartons and is a good buy for the ham.

* * *

Raytheon Production Corporation announces tubes are being sold and distributed by the makers themselves. A free copy of the new output tube chart may be had by addressing the organization direct. The address is 30 E. 42nd Street, N. Y. City.

# N.Y. Show at Garden Will Last 11 Days

Electrical Association of New York, Inc., have issued a very attractive and illuminating prospectus announcing the National Electrical Exposition to be held at Madison Square Garden, 8th Avenue and 50th Street, New York City, beginning September 20th and running to and including September 30th. This is eleven days.

In addition to domestic and industrial electrical appliances, radio will play a large part. There will be twin broadcast studios where national radio stars will appear. The serviceman will find many things of real interest and the fan, experimenter and general public are promised a great show.

As a further evidence that it will be conducted by able hands the following show committee is announced: D. W. May, president of May Radio & Television Corp., chairman; E. J. Hegarty, Eastern merchandise manager, Westinghouse Elec. & Mfg. Co.; H. Linde, president Triangle Radio Supply Co., A. Lincoln Bush, treasurer Commercial Radio Sound Corp.; Ralph Neumuller, managing director Electrical Association of N. Y., Inc.; T. H. Joseph, president E-J. Electric Installation Co.; H. C. Calahan, N. Y. manager, General Electric Supply Co.; B. R. Gates, Eastern manager Premier Vacuum Cleaner Co.; E. B. Ingraham, president Allen-Ingraham, Inc.; J. H. McKenna, Eastern sales manager, A. J. Lindemann & Hoverson Co.; J. J. Donovan, general manager, Air Condition Division, General Electric Co.

* * *

Radio experimenters, servicemen and others radio-minded will be glad to learn that N. Y. City will have a Radio Show this year. It will be at the Madison Square Garden and will run 11 days, starting Sept. 20th. The prospectus is out. It will be an electrical show, but radio will play a very large part.

## Literature Wanted

***Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.***

J. Roy Wolfskill, 209 Brookline St., Reading, Pa.
M. F. Bohinick, 116 Springfield, Aldan, Penna.
Anselme Laperriere, 80 Marguerite Bourgeois, Quebec City, P. Q., Canada.
J. Cooper, Chicago Buyer, J. Converse Co., 618 S. Ashland Blvd., Chicago, Ill.
Martin W. Halme, 122 W. First St., Long Beach, Calif.
Reggie Wolfenden, 3 New Street, Clark Mills, New York.
Leland J. Haworth, 1832 Hammersly Ave., Madison, Wisc.
William Tolle, R. No. 4, West Union, Ohio.

### CORPORATION REPORTS

Fada Radio and Electric Corporation—Net loss for year 1932, after deduction of interest, expenses and other charges, $266,216. A reduction of from 10 to 60 per cent made in salaries of entire personnel.

Howe Sound Company—Net loss for quarter ended March 31, 1933, after depreciation, taxes and other charges, but before depletion, $125,547. For the first quarter of 1932 there was a net profit of $23,321, equal to 4 cents a share on 496,038 shares.

Zenith Radio Corp.—Net loss for quarter ended March 31, 1933, after depreciation, expenses, and other deductions, $190,590, compared with $126,131 loss in preceding quarter and $98,603 loss in quarter ended Jan. 31, 1932. Net loss for nine months ended January 31, 1933, after foregoing charges, $329,563, compared with $226,212 loss for nine months ended Jan. 31, 1932.

Marconi International Marine Communication Company, Ltd.—For year 1932, the net income after deducting expenses, depreciation, reserve for taxes and other charges was £148,692, compared with £131,729 for year 1931.

# N. A. B. in Clinch with Music Society on Song Royalties, Following Raise

The National Association of Broadcasters, representing the big networks and most of the smaller chains and more or less independent stations, is showing its teeth. It is going ahead with its recently-announced plan of striking hard at the new charges established by the American Society of Composers, Authors and Publishers, whose citadel is in the midst of the amusement and musical publishing activities on Times Square.

Station owners showed their resentment last year when ASCAPS announced a new schedule of charges, starting with a 3 per cent. flat charge for the first year under the new arrangement and running up to 4 per cent. for the following year and 5 per cent. for each year thereafter. This added several hundred of thousands to the annual collections from broadcasters for the use of copyrighted compositions used on the air. It looks as if the takings from this source would run up to more than $1,500,000 for 1933.

### Society in Strong Position

The Society, as it is known to those in the music field, thus far has had the cards almost entirely in its own hands. Practically all music publishers in this country and abroad are members of the Society. They have signed contracts to the effect that the Society shall act as a clearing house for all matters having to do with the collection of royalties for music played in public for revenue, which means all songs and musical compositions that are currently copyrighted or which have been copyrighted for the first twenty-eight years and all renewals on these copyrights. Such protection, according to the International Copyright Law passed some time ago, affords the publishers protection for fifty-six years, after which the compositions go into the public domain and may be played by anybody at will. Thus the Society is in an almost impregnable position so far as copyrighted numbers are concerned and it has won hands down in practically every case in which it has brought suit for infringement.

### N. A. B. Gathers Ammunition

It is pretty well known in the music trade that the Radio Music Foundation, an offshoot of the N. A. B., is hard at work on a plan by which it will serve as the representative of the publishers, authors and composers of music and the owners of copyrights thereon. It will collect from its members for the use of such music on a basis very far below the charges now being made by the Society. It is endeavoring to sign up many noted composers and song writers on contracts which cover all their future output.

The Society does not appear to be at all worried. This may be due, in part, to the recognized fact that it controls most of the music played on the air—not only of the popular variety but also a substantial percentage of the so-called classics that have not passed the 56-year period. This music, it is figured, is what the public wants to listen to and therefore is what sponsors and the stations themselves prefer to offer.

Anyway, millions are at stake and the Radio Music Foundation, the legal head of which is Newton D. Baker, is working hard to perfect plans which, if worked out practically will change the whole matter of station payments for musical material used.

In the meantime the Society appears to be sitting back and waiting for the next move, merely uttering the syllable query:

"Well?"

# Quick-Action Classified Advertisements

**7c a Word—$1.00 Minimum**
**Cash With Order**

SELL ELECTRIC NEONLIKE WINDOW DISPLAY SIGNS. Complete, 98c. Particulars. Slogans 8 in. x 14 in. Box 63, Rugby Sta., Brooklyn, N. Y.

SERVICE MEN WHO KNOW THEIR BUSINESS, please write. L. Vidlak, East Hampton, Conn.

URUGUAY STAMPS—100 different stamps, $1.00. 200 different stamps, $3.50. Stamps will be shipped direct from Uruguay. Heriberto Meyer, care Radio World, 145 West 45th St., New York City.

NEW RADIO AMATEUR'S HANDBOOK, 180,000 words, 207 illustrations, 218 pages (10th edition, issued 1933). Price, $1.00 per copy. Radio World, 145 West 45th Street, New York, N. Y.

BARGAINS IN FINEST PARTS! — Highest grade, new parts, few of each on hand. National dial, flat type, modernistic escutcheon, type G, clockwise, $2.19; Pilot drum dial No. 1285 @ $1.89; a-c toggle switch, 19c; triple pole, four-throw Best switch, insulated shaft, $1.62; double pole, four throw, $1.08. Direct Radio Co., 145 West 45th St., N. Y. City.

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

## and "RADIO NEWS" RADIO WORLD

**BOTH FOR ONE Year** **$7.00** **Canadian and Foreign $1.50 extra**

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students, the first and only national radio weekly and the leading monthly for one year each, at a saving of $1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks is $6.00. Send in $1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months. Total, 64 issues for $7.00.
RADIO WORLD, 145 West 45th Street, New York, N. Y.

# BLUEPRINT

627. Five-tube tuned radio frequency, A-C operated; covers 200 to 550 meters (broadcast band), with optional additional coverage from 80 to 204 meters, for police calls, television, airplane, amateurs, etc. Variable mu and pentode tubes. Order BP-627 @ .....25c

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

# DUAL-RANGE SWITCHES

**Wiping contact switches that improve with use and have an exceedingly low contact resistance enhance performance in the police-television-amateur bands without disturbing the line-up of the broadcast band.**

The switches are sturdy, compact, smooth and dependable. The frame is insulated from the switch connections, so the switch may be used to slide condenser stator from one extreme of coil to a tap on the coil, or to short out part of the coil without changing condenser stator connection. The mounting hole is to be 5/16 inch diameter, with 8/32 hole ½ inch away, to engage a small flange that prevents slippage. Two extra holes on a fixed bracket permit additional anchorage to front and possibly rear flaps of chassis.

Type A is for governing three tuned circuits (triple pole, double throw) and besides there is a single pole single throw extra section for shorting and padding condenser or antenna series condenser. Entire switch encompassed by 2-inch diameter. Length, 5 inches; shaft, ¼ inch, 1" long. Used in 9-Tube Diamond. Cat. EBS-A at $1.49.

Type B is for governing four tuned circuits and substituting one padding condenser for another (five pole, double throw). The switch is 9 inches long. Used in the 12-Tube Diamond. Cat. EBS-B at $2.49.

We selected these switches because we deem them the best ones made, in the stated price range, and because they make excellent and definite contact and afford long service. The illustration reveals the general type of construction.

**Guaranty Radio Goods Co.**
143 West 45th Street New York, N. Y.

# 115 DIAGRAMS FREE

115 Circuit Diagrams of Commercial Receivers and Power Supplies supplementing the diagrams in John F. Rider's "Trouble Shooter's Manual." These schematic diagrams of factory-made receivers, giving the manufacturer's name and model number on each diagram, include the MOST IMPORTANT SCREEN GRID RECEIVERS.

The 115 diagrams, each in black and white, on sheets 8½ x 11 inches, punched with three standard holes for loose-leaf binding, constitute a supplement that must be obtained by all possessors of "Trouble Shooter's Manual," to make the manual complete

Circuits include Bosch 54 D. C. screen grid; Balkite Model F, Crosley 20, 21, 22 screen grid; Eveready series 50 screen grid; Erla 224 A.C. screen grid; Peerless Electrostatic series; Philco 76 screen grid.

Subscribe for Radio World for 3 months at the regular subscription rate of $1.50, and have these diagrams delivered to you FREE!

*Present subscribers may take advantage of this offer. Please put a cross here ☐ to expedite extending your expiration date.*

**Radio World, 145 West 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.**

# DIAMOND PARTS

**Tuned Radio Frequency Sets**

## FIVE-TUBE MODEL

A-C operated circuit, 50-60 cycles, 105-120 volts, using two 58 t-r-f stages, 57 power detector and 47 output, with '80 rectifier. Three gang shielded condenser and shielded coils in a sensitive, selective and pure-tone circuit. Dynamic speaker field coil used as B supply choke. Complete kit of parts, including 8" Rola speaker and all else (except tubes and cabinet). Cat. D5CK @.....$15.09
Wired model, Cat. D5CW (less cabinet) @.... 17.19

Kit of five Eveready-Raytheon tubes for this circuit. Cat. D5T ..... 4.97

FOUNDATION UNIT, consisting of drilled metal subpanel, 13¾ x 8⅝ x 2¼"; three-gang Scovill 0.00035 mfd., brass plates, trimmers, full shield; shields for the 58 and 57 tubes; six sockets (one for speaker plug); two 8 mfd. electrolytic condensers; set of three coils. Cat. D5FU..... 6.19

*Super Diamond parts in stock.*

## FOUR-TUBE MODEL

The four-tube model is similar, except that there is one stage of t-r-f, and a two-gang condenser is used. Tubes required, one 58, one 57, one 47 and one '80. Complete kit, including 8" Rola dynamic speaker (less tubes, less cabinet). Cat. D4CK .....$13.58

Kit of four Eveready-Raytheon tubes for this circuit. Cat. 4D.TK .....$3.89

FOUNDATION UNIT, consisting of drilled metal plated subpanel 13¾ x 2½ x 7"; two-gang 0.00035 mfd. SFL condenser; full shield; two shields for 58-57; center-tapped 200-turn honeycomb coil; five sockets (one for speaker plug); two 8 mfd. electrolytics; set of two shielded coils; 20-100 mmfd. Hammarlund equalizer for antenna series condenser, Cat. D4FU .....$5.48

## INDIVIDUAL PARTS

Travelling light vernier dial, full-vision, 6-to-1 vernier, projected indication prevents parallax; takes ¼" or ⅛" shaft; dial, bracket, lamp, escutcheon.

0-100 for 5-tube Diamond, Cat. CRD-0, **$0.91.**

100-0 for 4-tube Diamond, Cat. CRD-100, @ **$0.91.**

[If dial is desired for other circuits state whether condenser closes to the left or to the right.]

8 mfd. Polymet electrolytic, insulating washers, extra lug. Cat. POLY-8 fi.....$0.49
Three 0.1 mfd in one shield case, 250 volt d-c rating. Cat. S-31 @..... .29
Rola 8" dynamic for 47 with 1800 ohm field coil tapped @ 300 ohms. Cat. FP @..... 3.85
2 coils for 4-tube. Cat. DP @..... .90
3 coils for 5t-tube. Cat. DT @.....1.35

# DIRECT RADIO CO.

**143 WEST 45th STREET**
**NEW YORK, N. Y.**

## Matched Combination of Dial, Condenser, Coil

Dial obtainable with either of two numerically divided scales or with frequency scale.

Travelling light dial, bulb, escutcheon, 6-to-1 vernier, smooth action. Hub is for ⅜-inch shaft but ¼-inch reducing bushing is supplied. This dial is obtainable with either type numerical scale (100-0 is illustrated) or with frequency-calibrated scale, marked 500 to 150. The frequency scale requires 0.00037 mfd. condenser and 250 microhenries inductance for the broadcast band, or 0.00037 mfd. condenser and 20 millihenries inductance for actual 500 to 150 kc. fundamentals.

Cat. DJAD—0-100 for condensers that increase in capacity when turned to the right. Scale, 0-100..... **75c**

Cat. DJAD—100-0 for condensers that increase in capacity when turned to the left. Scale 100-0 ..... **75c**

Cat. DJADF — Frequency calibrated ..... **94c**

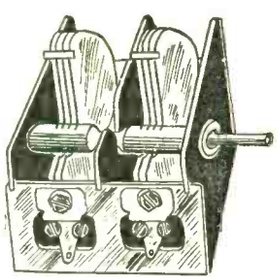
Cat. RFCH — (TH) — Honeycomb coil of 20 millihenries inductence. Two extreme lugs for total winding. Center lug is tap..... **45c**

Cat. TRF-250—Radio frequency transformer 2⅛-inch diameter shield; primary and tapped secondary. Tap may be used for oscillation in cathode leg of beater tube ..... **45c**

Cat. DJA-14-D—Two gang 0.00014 mfd. short-wave condenser with compensators ..... **$1.96**

Cat. DJA-37—Single tuning condenser, compensator built in: 0.00037 mfd. ..... **98c**

## Short-Wave Condenser



Two-gang condenser for short-waves. Low minimum. Sturdy construction. Ball race at front and back of Shaft. Compensators built in at side. Shaft is ¼-inch Aluminum plates. Useful with all standard make short-wave coils. ⅜-inch bushing supplied.

**DIRECT RADIO CO., 143 West 45th Street, NEW YORK, N. Y.**

# ANDERSON'S AUTO SET

**Designed by J. E. ANDERSON**

## FOREIGN RECEPTION ON 6-INCH AERIAL

This new auto set is the most sensitive car receiver we have ever come across. Mexican and Canadian stations were tuned in from New York City on a 6-inch aerial. The circuit, an 8-tube superheterodyne, with automatic volume control.

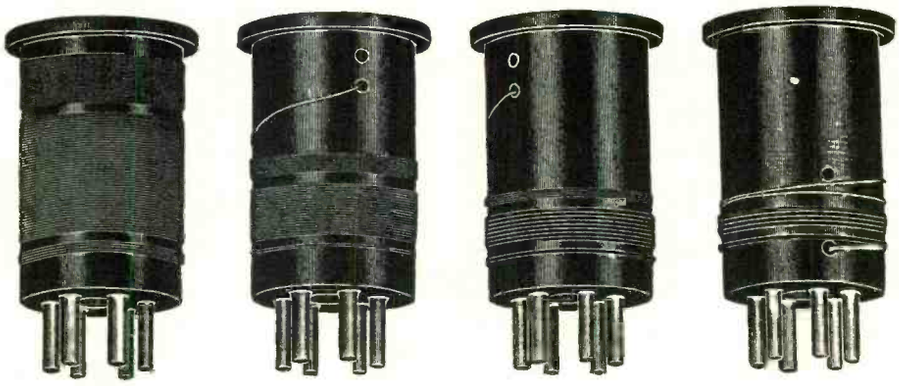
The complete parts, including set chassis and set shield, battery box, remote control, battery cable, all condensers, resistors and coils, speaker with shielded cable; and a kit of RCA tubes (two 239, two 236, two 237, one 89, and one 85) are supplied less aerial. Cat. 898-K @.....$34.60

Wired model, licensed by RCA, with complete equipment, less aerial, but including RCA tubes. Cat. 898-W .....$37.40

**DIRECT RADIO CO.**
143 West 45th St. N. Y. City

# SHORT WAVES

**14 to 200 Meters**



**Use 0.00014 Mfd. Capacity**

## SIX-PRONG PLUG-IN COILS FOR DETECTOR STAGE

PLUG-IN COILS with six-prong bases that fit into six-pin tube sockets (used as coil receptacles) provide three separate windings: primary, secondary and tickler. The three-circuit coil is most efficient in detector sockets.

Either of the two following uses applies:

(1)—As detector input from a tuned radio frequency stage, with primary in the plate circuit of a screen grid tube;

(2)—As detector alone, where there is no r-f amplification ahead of the detector, primary in the antenna-ground circuit.

See coil connections illustrated below.

The form diameter is 1.25 inch, with gripping flange.

THESE coils have proved their effectiveness in many circuits and lend themselves to all types of circuits save those with moving-coil ticklers.

The coils are designed for use with 0.00014 mfd. tuning capacity to tune from 200 meters to below 14 meters. The higher frequency coils have secondaries wound with very thick wire.

The bakelite coil forms are seasoned so that the inductance will not be affected by moisture-content of the forms.

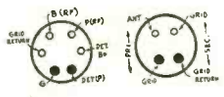
The base pins are strong and durable and the coils will last for several years.

Four coils sent free with 6 months subscription (26 weeks) @ $3.00. Order Cat. PRE-SWBP.

## FOUR-PRONG PLUG-IN COILS FOR ANTENNA STAGE

When a short-wave tuned radio frequency set is built with a stage of t-r-f, the antenna coil should be of the four-pin, two-winding type. Centers of cores should be 6 inches apart or more to prevent back-coupling. No shielding should be used in either case. Coupling between coils makes a circuit tricky to tune. Shields reduce sensitivity too much in t-r-f short-wave circuits.

The four-pin coils are wound with secondaries for 0.00014 mfd. and these match the secondaries of the six-pin coils.



The diagram at left shows connections to make to the sockets of both the UX (four-pin) and six-pin coils. The bottom views of socket connections are shown. The primary of the UX coil connects to Ant. and ground (Grnd.). Follow these connections carefully. If oscillation fails when desired, reverse connections of the secondary (transpose grid and grid return.)

Four UX wound coils sent free with 6 mos. subscription @ $3. Order Cat. PRE-SWAP.

## COIL FORMS

Those who desire to wind their own plug-in coils may use the same forms that prevail in the factory-wound coils detailed above. These coil forms are obtainable in three types. A set of coils of any type consists of four forms.

Any set of four coil forms (not wound) will be sent free for an eight-weeks trial subscription at the regular price, $1.00.

UX forms (four) order Cat. PRE-CFUX.

UY forms (four), order Cat. PRE-CFUY.

Six-pin (four), order Cat. PRE-CFSX.

## TUNING METER

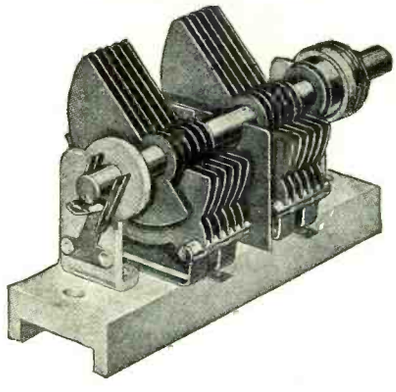
Some short-wave enthusiasts like to tune in stations by the meter method. Thereby they can watch the meter needle for greatest deflection to ascertain resonance. A sensitive milliammeter serves the purpose. One of 5 ma full-scale deflection may be connected in series with the plate feed to an r-f, or intermediate tube, or in the common screen lead of several tuner tubes, or in any other circuit where the steady value of current does not exceed 2 or 3 milliamperes. In all tuner amplifier stages the needle will show higher readings at higher signal levels (modulation is upward) and therefore if only a few milliamperes flow in such circuits the meter may be used. The meter may be used for any d-c current measurement in its range.

The 0-5 milliammeter is of the panel-mount type and is sent free with a six-months subscription (26 weeks) at the regular price of $3. Order Cat. PRE-TUM.

## MICROPHONE

A general utility microphone for home use, that enables you to use the audio amplifier in your receiver and "broadcast" in your home. This microphone is of the high-resistance single-button type, and is useful not only for serious work but also for playing pranks. No battery required. With the microphone are supplied socket templates and directions for connections to detector tubes of various types of receivers. Good results are enjoyably obtained. The microphone will be sent free on receipt of $2.00 for sixteen-weeks subscription (16 issues), the regular price. Order Cat. PRE-MK.

## CONDENSERS



The Hammarlund junior midline short-wave condensers, 0.00014 mfd., work exceedingly well with the coils offered above, but also may be used to advantage in any short-wave set, with any other coils intended for that capacity. These condensers have Isolantite bases, thus enhancing the low-loss construction that prevails throughout.

The condensers illustrated are the single 0.00014 mfd. mfd. and the dual 0.00014 mfd. The shafts are ¼ inch. A vernier dial should be used. See vernier dial offers, for a-c and battery sets, on another page.

Single condenser sent free with three months subscription, (13 weeks) at regular price of $1.50. Order Cat. PRE-H14. PRE-S-14.

Double condenser sent free with six months subscription (26 weeks) at regular price of $3.00. Order Cat. PRE-DU-14.

Manual trimmer (40 mmfd.), free with trial subscription, 8 weeks, $1.00. Order Cat. PRE-MNT.

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

**(WE PAY POSTAGE ON ALL PRODUCTS LISTED ON THIS PAGE)**