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Eleventh Year *562d Consecutive Issue*

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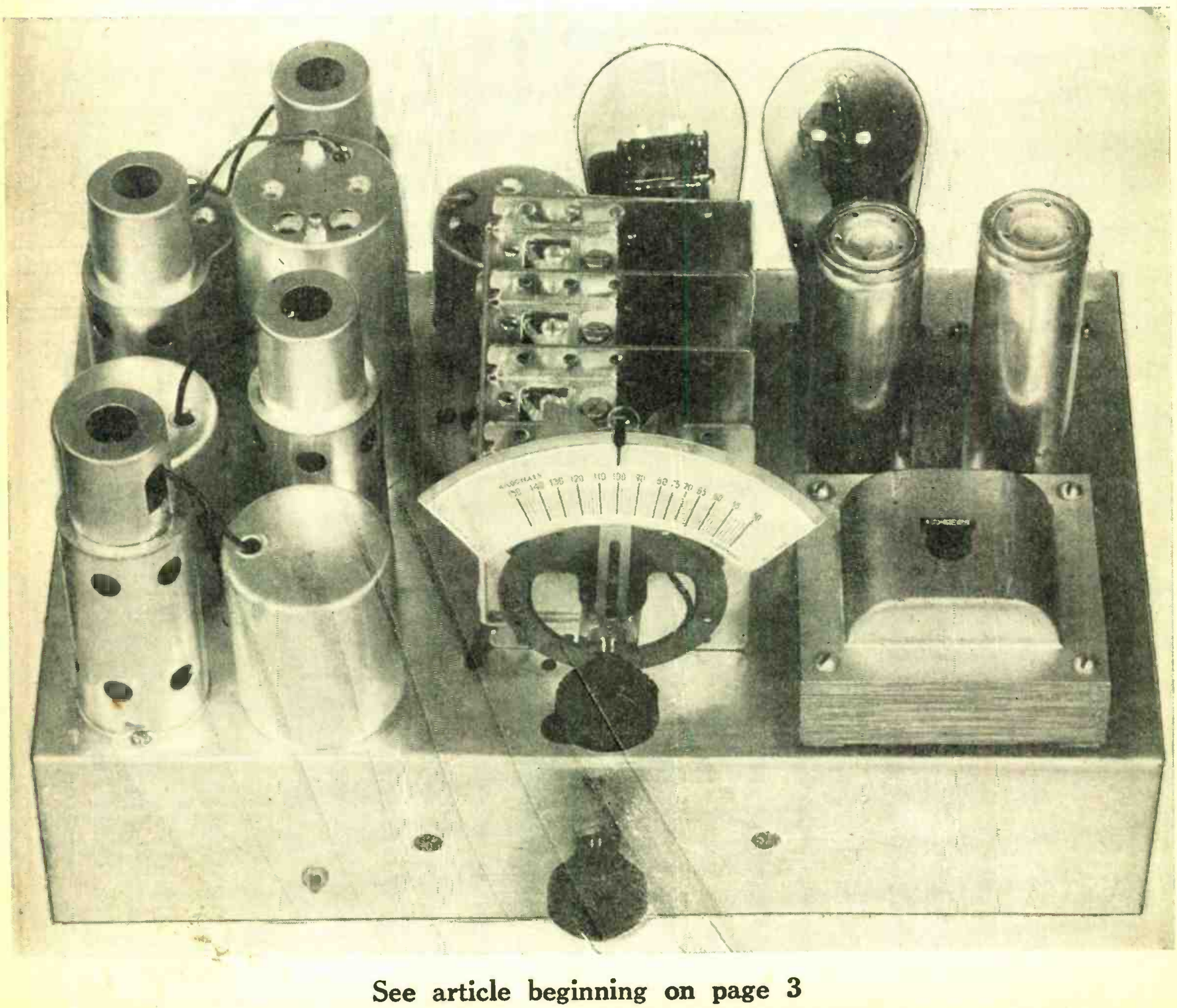
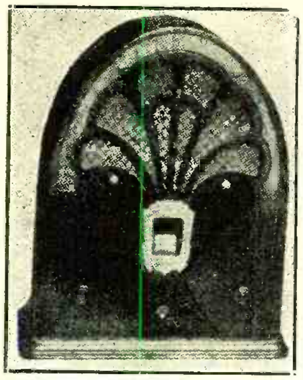
THE SUPER DIAMOND



See article beginning on page 3



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- ☐ 0-400 Milliamperes D.C. ....No. 394

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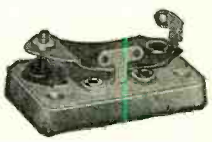
PADDING CONDENSERS



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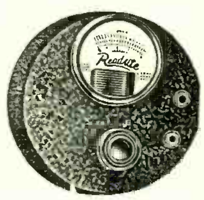

Often it is desired to determine the resistance value of a unit, to determine if it is correct, or to measure a low voltage, and then a continuity tester that is also a direct-reading ohmmeter and a DC voltmeter comes in triply handy.

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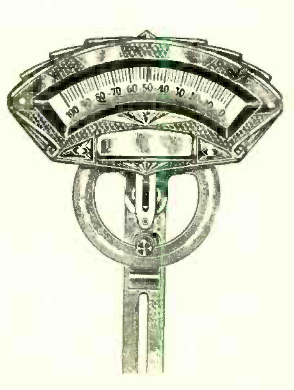

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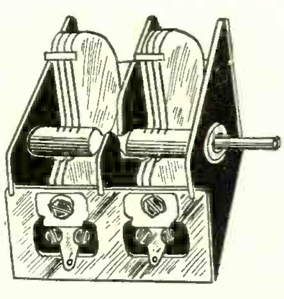

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SUPER DIAMOND TROUBLE-SHOOTING

By Herman Bernard

LAST week the Super Diamond was described. It is a six-tube superheterodyne. This week the same circuit diagram is printed, except that the padding condenser is shown in a grounded position. Many prefer that type of padding circuit, because of absence of body capacity when adjusting the padding condenser. This advantage prevails particularly if the moving plate of the padding condenser is the one that is grounded. That is the thick, stiff lug on the Hammarlund padding condenser. The flexible lug connects to coil return. The grounded padding condenser requires a separate return for the oscillator's tuned winding, whereas last week's diagram showed a common return (black lead) for the oscillator's tuned winding and for the pickup coil in the cathode leg. Aside from those small changes and a solitary padding condenser the diagram does not differ at all from the one published last week.

Every effort has been made to simplify the circuit to the utmost, particularly as constructors have more trouble with superheterodynes than with t-r-f sets. Besides circuit simplicity, there was the necessity of selecting just the right coils and padding condenser. It was found that coils generally obtainable commercially do not true up sufficiently because of the oscillator inductance being off. This arises from the fact that coil makers have different inductances for different makes and capacities of condensers. The present circuit has its inductances specially selected for 0.00037 mfd. condensers, with the minimum sum capacity of the circuit consisting of 20 mmfd. contributed by the condenser itself and 20 mmfd. by the wiring, tube, trimming condensers, etc.

The Tuning Range

The inductances were so selected that the circuit will tune from 500 to 1500 kc. The span of the broadcast band will be exceeded in any instance, and it was deemed far preferable to exceed it at the low frequency end rather than at the high frequency end. One reason is that the r-f section need not be stabilized for a frequency well beyond the broadcast band, which would reduce sensitivity too much at the low frequency end. Another reason is that the frequency difference is less, between maximum and minimum, and therefore the oscillator can be padded more accurately. Much of the trouble in supers has to do with mispadding, on account of wrong oscillator inductance or wrong padding condenser or both.

A padding condenser, marked 700-1000 mmfd., actually measured 940 mmfd. maximum, which is close enough in manufacturing, especially as anyone ordering the condensers in quantity need only specify a value sufficiently in excess of the requirement. So a 20-100 mmfd. trimmer was placed in parallel with the padding condenser and the adjustment made for 1025 mmfd. The actual capacity required for the present circuit is 912 mmfd. It is not necessary to know this for any constructional reason, so long as the padding condenser goes beyond 912 mmfd. and may be adjusted to the lower and correct value. However, to make double assurances, a padding condenser of 750-1250 mmfd. is now specified.

As a protection to prospective builders the combination coil was taken out and others of the same manufacture and presumably of the same inductance were put in, but the results were never correct, and the first coil was the only one of six that performed properly, and then only with the extra capacity added. So there was a shortcoming in both inductive and capacitive directions.

Ordinarily a builder would not know just what was wrong and would consider the circuit grossly overrated, whereas in fact it comes up to the fine performance claimed for it in every particular if properly built, using proper constants.

Frequency-Calibrated Dial

So coils were carefully wound up by me to give exactly the right tuning characteristic at the r-f and oscillator levels, and moreover a dial was calibrated in kilocycles, and a special die made to have the calibration comply exactly with the condenser plate displacement. This is the scale shown on the front cover illustration. A somewhat similar scale, commercially obtainable, was tried out but the coincidence was not good enough. The special scale registered with the tuned circuit as near to perfection as is necessary, in that the scale accuracy was greater than the accuracy with which the dial could be read. This is always the goal, but is not often attained.

Therefore a new opportunity presents itself—the use of a dial with scale calibrated in frequencies, where the readings will be exact, the divisions affording discrimination between frequencies 10 kc apart from 500 to 800 kc, and 20 kc apart from 800 to 1500 kc. The dial markings omit the last cipher, i.e., are 150 to 500.

The best time for trouble-shooting is before any trouble arises. Therefore special precautions were taken as trouble preventives, because if the intermediate is lined up at 175 kc, the r-f circuit trimmers adjusted properly, and the padding accurately done (using parts that permit such accuracy), then the circuit is bound to work, so long as the oscillator is oscillating. That the connections throughout are properly made is taken for granted. That no mistake should occur in the oscillator circuit the color code is given this week for the grounded padding condenser system. It was given last week (slightly differently, of course) for the ungrounded padding condenser system.

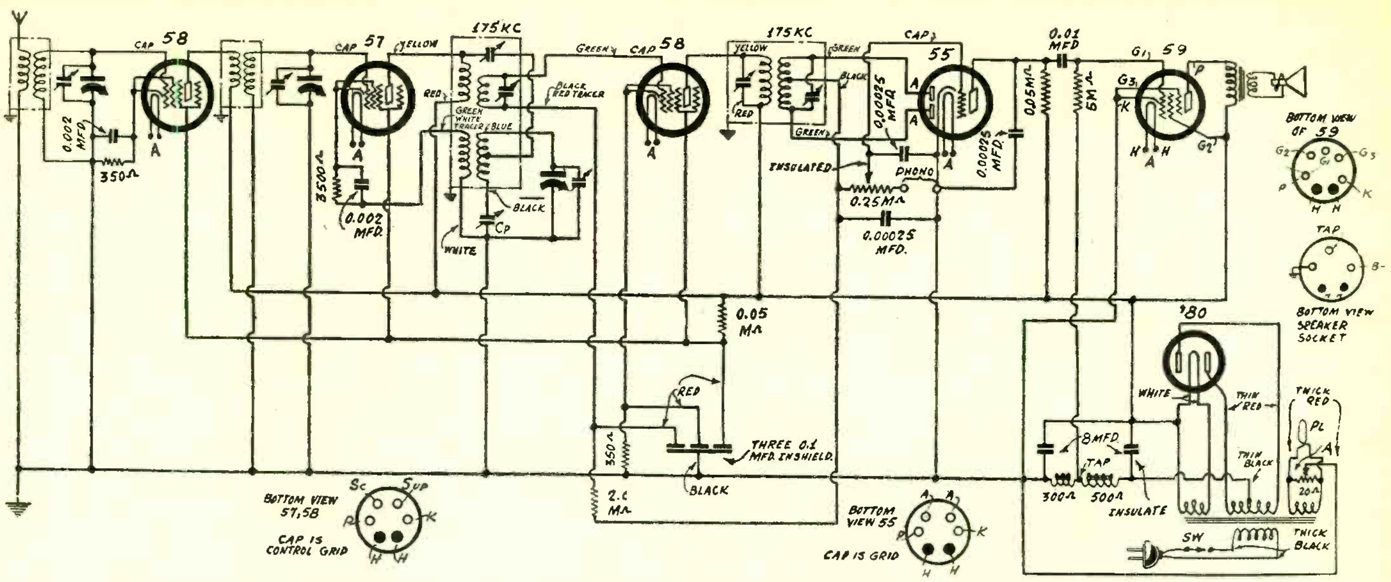
Incorrect and Correct Parts

Just to show you how far off a circuit can be because of mismated parts, the subsequent combination or twin coils put into the circuit required much higher padding capacities. The test, of course, is whether you can adjust the padding condenser for maximum response at the low frequency end, and 540 kc was used as trial frequency. Not only would not the commercially rated condenser of 700-1000 mmfd. enable reaching 540 kc with keen response, but that end wasn't even reached when the padding capacity was increased to more than 1400 mmfd.

With the correct coils there is a different story to tell, not only in regard to the ease of establishing a balanced circuit, but also in the results obtained. For one thing, the vice of mispadding, making bird-like tweets almost over the entire scale, was absent, and in its place was greatly increased sensitivity.

The conditions under which this balance was worked out was an intermediate fre-

(Continued on next page)



The circuit of the Super Diamond, with grounded padding condenser of 750-1250 mmfd. Some commercial oscillator coils have white as return for the oscillator and black as return for the cathode pickup winding. Phono in detector diagram stands for phonograph pickup. Short the open with a wire lead if phonograph pickup connection is not desired.

(*Continued from preceding page*)
quency accurately lined up at 175 kc, r-f secondary inductances of 250 microhenries, oscillator tuned winding of 200 microhenries, three-gang tuning condenser of 0.00037 mfd. capacity, padding condenser of 750-1250 mmfd., minimum circuit capacities, 40 mmfd. The maximum effective capacity of the oscillator condenser then was 0.00028 mfd.

T-R-F Test

Under these conditions of intermediate frequency of 175 kc and oscillator tuned winding of 200 microhenries inductance, the tie-down points for padding are 600, 990 and 1450 kc. As explained last week, the circuit may be tested for some local stations of known frequency, and adjusted thus by hooking up for t-r-f, connecting the grid clip intended for the 57 tube instead to the vacated grid cap of the 55. Remove the 0.00025 mfd. condenser from potentiometer arm and also the one across the total potentiometer.

However, it is not necessary to attend to the r-f level positions if you have a frequency-calibrated dial, because you then know at what settings the various frequencies are to come in. For instance, for 600 kc, the first test, adjust the padding condenser for maximum response from a modulated test oscillator set at 600 kc, input to antenna post, aerial off. The trimmers or r-f level adjusters have nothing much to do with at this frequency. The next test is at 1450 kc, when the sole adjustment is that of the trimmers across the r-f and autodyne input tuning condensers. The padding condenser has virtually no effect here. The autodyne trimmer possibly need not be touched, and especially as tight coupling between oscillation winding and cathode pickup coil result in the interdependence of the two circuits. The r-f stage trimmer will prove very effective in bringing up the volume at 1450 kc, and even the oscillator trimmer may be adjusted slightly at this high frequency. Then 990 kc is used as a reference point, and notation made if coincidence is exact. If the dial reads too high in frequency for 990 kc, the padding condenser capacity has to be lowered, as the previous padding has been upset by the oscillator trimmer adjustment. The repadding for the correction must be done at 600 kc. If the dial reads too low in frequency, a checkup should be made at 600 kc by using more padding capacity.

Close Padding

The procedure may be undertaken in the opposite direction by aligning first at 1450 kc, by trimmers only, then adjusting the padding condenser at 600 kc, then checking up at 990 kc.

The padding has been worked out so accurately that it is not off more than 4 kc at the least exact points, near the extremes of the frequencies tuned in. Moreover, the tiedown is for three points, instead of for two. The accuracy, of course, depends somewhat on the selection of the correct tiedown frequencies, but these have been given.

If the tracking is bad, strong stations may be heard at the r-f tuning position and again at the oscillator tuning position. To decide which is which, remove the r-f tube and wrap aerial around the lead to cap of the 57 two or three turns. Some response from strong locals will be heard. You might not exactly call it reception, but it is response sufficient for the purpose. The r-f level is controlling, and the oscillator must be gaited to that. Remember that if the oscillator tunes too low in frequency at low frequencies, the padding condenser capacity is too small, if the padding condenser tunes too high in frequencies at low frequencies the padding condenser is too high in capacity. At the high frequency end, if the oscillator tunes too high the trimmer across it is not in far enough, whereas if it tunes too low in frequency, the trimmer across it is too far in.

Padding Procedure

So much has been written about the padding because it is the chief cause of trouble, even if the constants are properly matched. To facilitate the work of padding the procedure will be repeated:

(1)—Align intermediate channel accurately at 175 kc with modulated test oscillator to plate of prong of 57 tube.

(2)—Have trimmers on all three sections of tuning condenser all the way out, set the calibrated dial at 600 kc, test oscillator being set at that frequency, its output fed to antenna post; adjust the padding condenser for maximum response.

(3)—Turn to 1450 kc on the dial, use that frequency of test oscillator, and adjust the r-f and autodyne trimmers for keenest response, also the oscillator trimmer.

(4)—Turn to 990 kc, check up. Use 990 kc this time for the test oscillator frequency. If dial reads too low at maximum response in this test, the padding capacity is too high, due, no doubt, to recent addition of trimmer capacity to oscillator, so reset padding condenser at 600 kc retest. If dial reads too high in frequency, padding capacity is too small, so increase it, at 600 kc retest.

(5)—Recheck at the three points, 600, 1450 and 990 kc.

If the circuit tunes in police calls and other frequencies much higher than the broadcast band, the oscillator trimming capacity is too small, so screw down the compensator on that condenser.

This is not a hit-or-miss proposition by any means, but a scientific procedure of foregone accuracy, a higher degree of accuracy than is generally obtainable in superheterodynes that use the padding system.

Squealing Cures

Next in importance to padding comes unwanted regeneration. It is quite possible that the r-f level or the intermediate level or both will oscillate, and this isn't wanted.

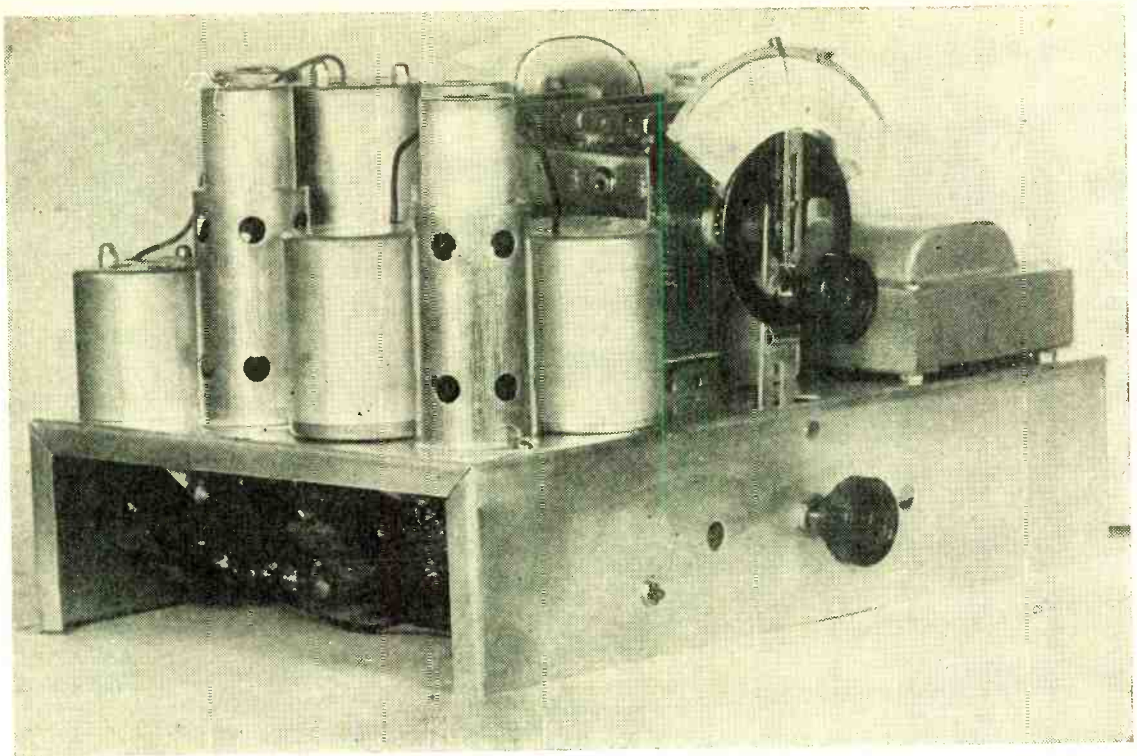
Nor is it desired to dampen the circuit to the extent that no builder ever will encounter oscillation where it is not wanted. One of the advantages of building such a circuit is that it can be made to produce so much more than a commercially subdued circuit. The danger is that there will be oscillation at first. Determine the frequency level of oscillation as follows:

If the intermediate amplifier is oscillating there will be squeals all over the dial for every carrier picked up, so nearly 96 squeals will be heard.

If the r-f level is oscillating there will be squeals at the high frequency end only, providing tracking is properly done, for poor tracking also produces carrier and image squeals.

The Single Intermediate Tube

To cure the oscillation in either or both instances you may increase the value of the biasing resistors from the 350 ohms specified to whatever value is necessary to put the quietus on the circuit. This is an infallible remedy at the r-f level, but not quite so at the i-f level. So in addition try reversing the primary connections of the second intermediate transformer, putting the red lead to plate and the yellow lead to B plus, besides increasing the biasing resistor, and in addition, if these don't stop the trouble, put a 3,500-ohm resistor in series with the plate feed to the intermediate tube (between primary return and B plus line), put some bypass condenser across it, 0.002 mfd. or higher, and if the oscillation stops, leave the circuit that way, otherwise omit the bypass condenser. This group of remedies consti-



tutes a sure cure for oscillation at both levels.

It may perplex some to see only one intermediate stage, and to reconcile this with any considerable sensitivity and amplification. but when it is remembered that the tube is worked not far from its point of highest performance, it can be realized that some feedback is actually present, with stability, and that therefore the gain is about as much as that from two-tube intermediate amplifiers with deadened circuits.

The present type of circuit with general commercial coils used, and other parts consistent with the popularity of the day, does not lend itself at all to a two-stage intermediate amplifier. This much can be gleaned from the possibility of oscillation trouble at the i-f level even with only one stage. How hopeless two stages would be is proved by many experiments the author has made, as well as by service men who design kit-sets for stores, and who also have tried that system without being able to solve the feedback problems, that is, not without reducing the sensitivity and selectivity to the level prevailing when only one stage was used. To use a two-stage intermediate requires a much more expensive set-up.

We have gotten as far as the second detector now. The automatic volume control is concerned with that, and consists of the feeding of the rectified voltage from the diode to the return of the first intermediate's control grid through a bypassed 2 meg. resistor. There is no danger of positive grid or zero bias, as the a-v-c simply adds to the bias provided by the 350-ohm cathode resistor.

Bias Features

It is theoretically possible to operate the set with no bias on the first audio amplifier, which is the triode unit of the 55, but this would be true only if there were no voltage input to the detector, and there always is some, even if no station is tuned in.

Really, the practical result is that trouble, if you can call it such, arises when the signal is very strong, for then the bias on that tube rises to a large value, so high that the plate current is practically cut off, and the condition known as saturation occurs. This happened on only one station, WOR, the strongest by far of the locals tuned in at New York City. Nothing additional need be done about this save to turn the volume control to less than full-on position, still consistent with all the volume any home or tolerant ears can stand.

The audio amplifier is standard, save for the diode-biased triode, which is gaining in popularity, too, and the power tube bias is taken in the approved manner from part of the voltage drop in the field coil of the dynamic speaker. This coil is used also as the B supply choke, and with the two 8 mfd. condensers provides sufficient filtration.

Hum Remedy

If by any chance hum seems to be greater than it should be, reverse the connections to the primary of the output transformer, so that the lead that went to B plus goes instead to plate, etc. This change often can be made directly on the speaker without touching the connections in the receiver itself.

It is always well to test the electrolytic condensers, and certainly they should not give a low resistance reading when an ohmmeter with battery is connected across it with proper polarity (positive to cap, negative to can).

STANDARD RESISTOR CODE

Ohms	Megohms	Body	End	Dot
350	..	Orange	Green	Brown
3,500	..	Orange	Green	Red
50,000	0.05	Green	Black	Orange
2,000,000	2.0	Red	Black	Green
5,000,000	5.0	Green	Black	Green

LIST OF PARTS

Coils

Two shielded radio frequency transformers for 0.00037 mfd. condensers.

One combination oscillator and 175 kc first intermediate transformer, in a single high shield. Total outleads, eight.

One 175 kc intermediate transformer, with center-tapped secondary.

[*The intermediate frequency coils have both primary and secondary tuned.*]

One power transformer, primary, 105-120 volts, 50-60 cycles; secondaries, 5 volts, 2 amperes; 700 volts center-tapped, 60 ma; 2.5 volts, 7 amperes.

One dynamic speaker, with 1,800 ohm field tapped at 300 ohms, and with output transformer for 59 tube used as pentode built in; equipped with 18-inch cable and UY plug.

Condensers

One three-gang 0.00037 mfd. tuning condenser with trimmers built in; 3/8-inch shaft 1 1/8 inches long, mounting spades built in.

Two 0.002 mfd. fixed condensers mica.

One 750-1250 mmfd. padding condenser.

One shielded block containing three 0.1 mfd. condensers.

Three 0.00025 mfd. fixed mica condensers.

One 0.01 mfd. fixed mica condenser.

Two 8 mfd. wet electrolytic condensers, inverted mounting type; two insulating washers and extra lug for one of them; nuts for both of them; peak voltage rating 435 volts d-c.

Resistors

Two 350-ohm pigtail resistors.

One 3 500-ohm pigtail resistor.

Two 0.05 meg. (50000-ohm) pigtail resistors.

One 2 meg. (2000000-ohm) pigtail resistor.

One 5 meg. (5000000-ohm) pigtail resistor.

One 20-ohm potentiometer.

One 250000-ohm potentiometer, insulated shaft type.

Other Requirements

Seven socket insulating wafers and seven sockets as follows: four six-spring; one seven-spring; one four-spring; one five-spring; (UY). The UY socket is for speaker plug.

One vernier dial, travelling light type, equipped with pilot bracket, lamp and escutcheon.

One drilled chassis.

Four tube shields.

One a-c shaft type switch.

Three knobs.

[*Questions about parts should be addressed to Trade Editor.*]

SUPER DIAMOND "8"

Three Audio Stages, with Push-Pull Output

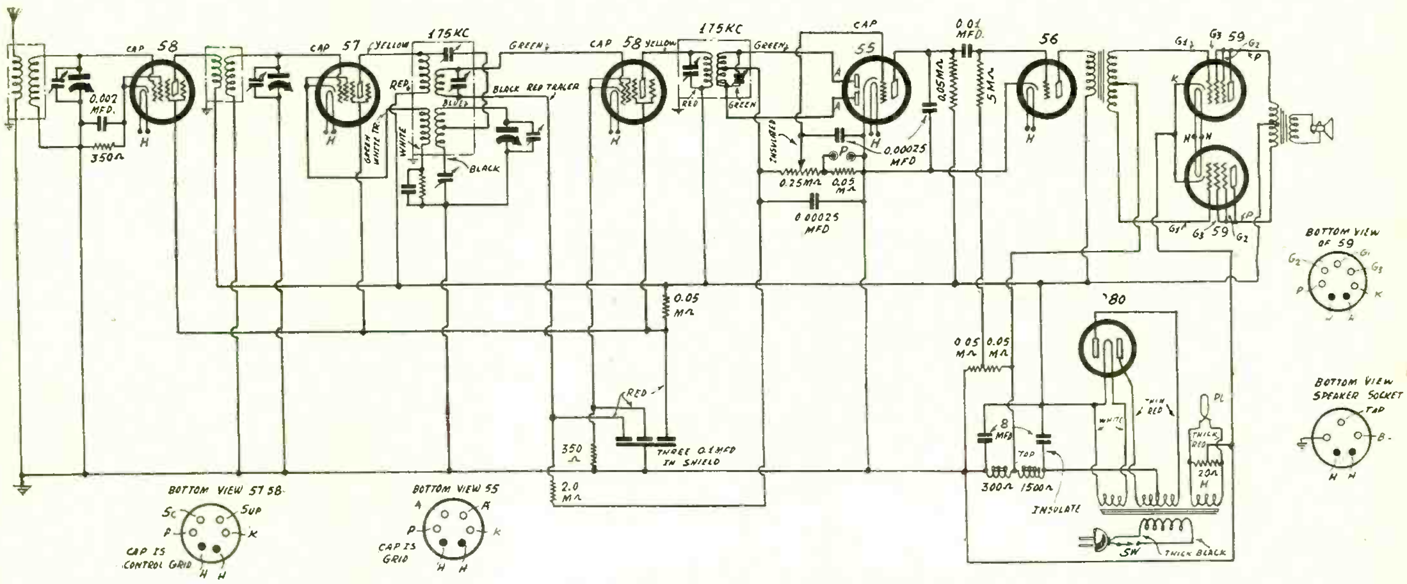


Diagram of the Super Diamond with an extra driver stage of audio feeding push-pull triode 59 tubes. The maximum undistorted power output is 6 watts.

THE Super Diamond as a six-tube set certainly performs well enough and produces enough volume of sound even on distant stations (with volume control full-on) to satisfy any one, and yet it is realized that there are many who like push-pull output, and since the standard chassis is such that eight tubes may be accommodated, the diagram is shown herewith for the Super Diamond "8". The two extra tubes are accounted for by the driver audio stage and the second power tube required by push-pull.

Looking at the radio frequency level we find it is the same as in the six-tube circuit, except that the biasing resistor and condenser across it, in the cathode leg of the 57 autodyne, is on the grounded side. This is entirely immaterial, and the method may be applied to the six-tube circuit by any who prefer it. The condenser and resistor may be grounded to chassis, and some in the construction of either receiver may find this mechanically handier.

Output Stage Loaded Up

The diode here has a limiting resistor of 50,000 ohms, in series with the volume-control potentiometer of 250,000 ohms, and the phonograph pickup (if one is used) may be cut in as a shunt to the 50,000 ohms. This is just a little refinement, enabling operation with or without the pickup, and requiring no special precautions of shorting the otherwise open points if a pickup is used. This device, too, may be used in the six-tube model by any whose fancy it strikes.

The triode of the 55 is resistance-coupled to the 56 second audio tube, which is the driver of the push-pull stage. Naturally, since the 56 takes a negative bias a little less than that of the 59 as a pentode, the 56 will overload before the 59 would in the six-tube circuit, but the volume control may be adjusted manually in a moment to correct for this. When this adjustment is made the 56 is loaded up, and it has enough output to load up the two 59's used as Class A push-pull output.

It must be recognized, of course, that the pentode connection is used in the six-tube model output for high sensitivity, but in the eight-tube circuit we face no requirement of increasing the overall sensitivity, but only of increasing the power-handling capacity. The push-pull 59's are not used as pentodes but as triodes, and this is accomplished by tying together the two extra grids and connecting them to the plate. That is, G2, G3 and plate represent really one element of the tube when the triode connection is used. With push-pull the maximum undistorted power output is at least 6 watts, and that assumes that push-pull merely doubles the output power handling capacity, which is a conservative estimate. Some technicians figure the push-pull result in power-handling to be four times that of the single-sided tube.

Of course 6 watts is a lot of power, and it is too much for any home, unless one has a big house, holds dances and the like, and sort of converts the home into an auditorium or academy. The set, therefore, has reserve power in excess of the six-tube model, although as to sensitivity the two are approximately the same. In either instance the power tubes may be well loaded up during the reception of strong local stations.

Huskier Parts

To build the eight-tube circuit a power transformer of higher rating, both as to heater power and plate supply power, must be used, and as the heater amperage will be about 10 amperes alone, and the total B current will run to about 100 milliamperes. Moreover, the voltage drop through the resistance of the B supply choke (dynamic speaker field) will be higher, 180 volts instead of around 108 volts, and therefore the voltage rating of the power transformer secondary should be higher than 350 volts for each side of the secondary, or the resistance of the field coil should be less, and the resistance of the bias section about as before. It would be well perhaps to use a lower resistance, say, 1,000 ohms total, with 250 ohms for the biasing section. Then the electrolytic condensers would not have to be under such a heavy voltage strain.

The circuit is shown in its eight-tube form as advance information of an intended design, now being constructed, but actually not yet finished. However, as many would like a circuit of this type, and may accept the writer's assurances that the only place to do any up-building is in the audio channel and in the power output, it was deemed well to inform them that the circuit is on the way. As finally shown it may embody some alterations, but they will be minor in character, as the same system was tried out in another receiver and worked well.

Use a Large Speaker

The output transformer in the dynamic speaker has to be different, of course, with an impedance of 10,000 ohms total in the primary, half serving one output tube, the other half the other output tube. With such a circuit it is advisable to use a speaker of as large dimensions as practical, which means 12-inch cone diameter, if you have room for that, or 10.5 inches anyway. It does not seem reasonable to put such a high-powered set in a midget cabinet, although the chassis is small enough to suit that purpose, being 13¾ inches wide by 8¾ inches front to back by 3 inches high. The "eight" is rather for a console installation.

While it is a high-powered circuit, with up-to-date embellishments of tried and tested authenticity, it is not an expensive receiver to build, as the parts, less tubes and cabinet, but including speaker, should not cost more than $25, whereas the parts for the six-tube model should run somewhere around $20.—Herman Bernard.

A THOUGHT FOR THE WEEK

HERE'S a clause for a famous composer to become more famous. Dvorak, the noted Hungarian composer, came to this country about a quarter of a century ago and made some fine and scholarly numbers out of our Southern plantation melodies. Who will add distinction to his name and to American music by taking our hillbilly songs and turning them into compositions that would not be beneath the notice of symphony orchestra conductors? The field is as wide as our mountain districts and as high as the Ozarks.

A SEPARATE C SUPPLY

It Has Advantages in an A-C Receiver

By J. E. Anderson

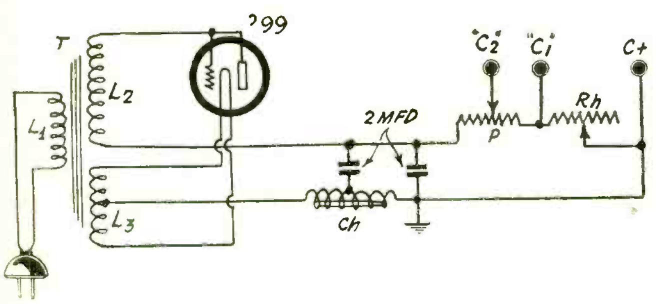


FIG. 1
The circuit of a C battery eliminator as built by Mr. Harlow Dick. It will improve the output quality of a power tube and it can be built at very little expense.

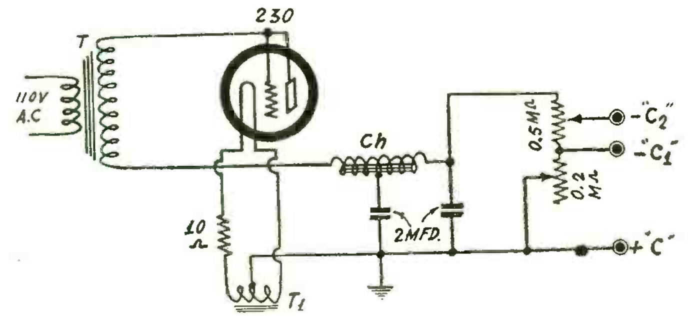


FIG. 2
The circuit of a C battery eliminator similar to that in Fig. 1 but with the filament voltage obtained from a receiver winding and shoke in negative lead.

IT IS very convenient to get the bias for a power tube by the self-bias method; that is, by putting in a suitable resistor in the cathode lead of a heater type tube like the 59 or in the lead to the center tap of the filament of a filamentary tube like the 47. It is a standard practice to do it. Usually a condenser is put across the resistance to by-pass the signal frequencies. But how large a condenser is used? Often only 0.25 mfd. and very rarely as large as 4 mfd.

It is well known that pentode power tube circuits do not reproduce the low frequencies well, and some believe that this is due to some peculiar property of the pentodes. There is no reason at all why the low notes should not be amplified as well in a pentode as in a three-element tube, granted that the tube is given the proper load. That is, there is no reason except the use of a self-biasing resistor with inadequate by-passing.

Let us investigate just what the bias resistance does in a pentode like the '47. This tube has an internal plate resistance of 60,000 ohms, an amplification factor of 150, and an optimum load resistance of 7,000 ohms. If we let the amplification factor be u, the internal plate resistance r_p, and the load resistance r, then the power output for a signal E volts, effective, will be $r(uE)^2/(r_p+r)^2$. If we put in a bias resistance R the output power for the same voltage input will be $r(uE)^2/(uR+R+r_p+r)^2$. The ratio of the second to the first is $(r_p+r)^2/(uR+R+r_p+r)^2$. If we put in the values given above in this ratio, letting R equal 400 ohms, and evaluate, we find that it is 0.276. Thus the bias resistance reduces the output in the ratio of one to 0.276.

Effect of Reduction

This reduction in the output would be the same for all frequencies and there would be no frequency discrimination. But if we put a condenser across the bias resistance the reduction will be less on the high frequencies than on the low. At the very lowest audio frequencies the reduction would be about the same as if no condenser were used, unless the condenser is enormously large. The effectiveness of the condenser depends on how much it reduces the impedance of the resistance.

At 25 cycles per second a condenser of 0.25 mfd. reduces the impedance only by a negligible amount. Even at 100 cycles per second the reduction is less than one per cent. At 10,000 cycles, however, the reduction is so great that the effective value of the bias impedance is only 10 ohms. Therefore at this value of frequency the loss due to reverse feedbacks is negligible. That is one reason why the output of a 47 tube is so rich in the higher frequencies.

If we put a 100-mfd. condenser across the 400-ohm resistance the reduction of the impedance is high even at the low frequencies. At 100 cycles, for example, the effective impedance is less than one ohm. Even at 25 cycles the bias impedance is not more than 10 ohms. Hence with this value of capacity across the 400 ohm resistance there would be practically no loss at the lowest audio frequencies.

Use of External Bias

When the bias for the tube is obtained from a drop in a resistor that carries more than the plate current of the power tube the reverse feedback is considerably less. For example, when the bias resistance is put in the B minus lead where all the current drawn by the receiver flows the improvement is noticeable. Negative leg chokes come under this classification. This is not alone due to the increase in current and hence a decrease in the bias resistance, but largely to the fact that the large filter condensers are effective in removing the a-f from the bias resistance.

When the bias is obtained from a battery or a battery eliminator there is no reverse feedback and the gain in the tube is the same as that obtained with the previous formula not containing the bias resistance. Therefore when quality is the paramount consideration the tube should be biased independently of the plate current in that tube. A battery is not convenient in an a-c set, but a C battery eliminator is not only convenient but practical.

When a C battery eliminator is used it is essential that the rectifier used in it heat up at least as quickly as the power tube, for if the power tube should heat up first there would be a period when the power tube would draw a very heavy current, for its bias would be zero. If the power tube is filamentary the rectifier tube must also be that, and suitable tubes are the 199, 230, 201-A, and similar tubes. If the power tube is of the heater type, like the 59, the rectifier in the C eliminator may also be a heater type tube although a filamentary tube would be preferable. One case where a heater type tube would be advantageous is when a 55 is used as an oscillator and a rectifier. The bias voltage would be obtained by rectification of the high frequency current generated by the oscillator.

Separate Rectifier

A very simple C battery eliminator has been supplied by Harlow Dick, Kansas City, Kansas. The diagram is reproduced in Fig. 1. The rectifier tube used in this particular case is a '99 and the "power" transformer was made of a 1-to-1 audio output transformer. L1 and L2 are the two equal windings. L3 is the filament winding wound over the other windings. In this particular case the filament windings consisted of 102 turns of No. 30 enameled wire, tapped at the center turn.

The number of turns required for the filament winding depends on the number of turns on the primary L1 and may be quite different for different transformers. In any case the number required should be determined experimentally. A certain number of turns should be put on and the voltage measured with a good a-c voltmeter. From the voltage obtained and the number of turns used to get it the required number of turns can be obtained by a simple proportion, for the voltage is proportional to the turns.

In determining the turns in this manner due attention must be given the regulation. There will be a certain drop in the winding and voltage should be just enough higher to overcome this drop. This also can be worked out experimentallly. Suppose the tube to be connected to the winding draws 60 milliamperes. If a resistance is connected across the voltmeter and if this resistance is adjusted until the current is 60 milliamperes, the voltage thus obtained in conjunction with the number of turns used will give the required number of turns, and there will be a compensation for the drop in the winding.

Determination of Turns

Let us suppose that the e.m.f. per turn is v volts and that the resistance per turn is r ohms. Let the current in the winding be adjusted to i amperes in both cases. Then the voltage measured in the first case is $V_1 = N_1(v-ir)$ and in the second case $V_2 = N_2(v-ir)$. Dividing one by the other we have $V_1/V_2 = N_1/N_2$. In this relation N_1 is the number of turns put on the first time and V_1 is the corresponding voltage measured across the resistance. V_2 and N_2 are the required voltage and number of turns, respectively. Thus we know all but

(Continued from preceding page)

N_2 and that can be computed. If the tube is a 199, V_2 would be 3.3 volts and if it is a 230, V_2 would have to be 2 volts. The load resistance should be adjusted so as to draw 60 milliamperes in both cases. If the voltmeter takes a current appreciable as compared with 60 milliamperes, that current should be included in the total current, and the total should be equal to 60 milliamperes.

This method, of course, requires the use of an a-c milliammeter as well as an a-c voltmeter. If a milliammeter is not available the determination of the required number of turns can still be done experimentally. First measure the voltage as obtained with a given number of turns and determine the number of turns required on this basis. Put on a few more turns than thus obtained. When the winding is completed put the tube on it and measure the voltage across the filament. If it is slightly in excess of the required voltage, remove turns until it is just right. and if the voltage is not high enough add turns until it is.

Use of Heavier Wire

I heavier wire is used the drop in the winding will be negligible. But heavier wire is more difficult to handle and it may take more room than is available. If a tube requiring a heavier current is to be used, heavier wire is essential. Since the smallest tube will work just as well as a larger one, it is best to use the smallest tube that is available, for example, a 230. For this tube the No. 30 wire can be used and not many turns of it will be required. If 102 turns are right for a 199, 62 turns should be just right for a 230 tube.

The transformer reconstructed by Mr. Dick had a center tap on the filament winding. While such a tap is desirable it is not essential, for one side of the winding may be connected to the filter choke. This is usually done in B supplies of receivers and it will work just as well here.

Incidentally, in some cases it is not necessary to put on a filament winding on the C battery eliminator transformer because the filament of the tube can be connected to a filament winding serving one of the tubes in the set. This is possible if the filament winding is grounded at the center, which is often the case. If this is done the choke in the C battery eliminator should be put in the negative side of the line and not in the positive as it is done in Fig. 1. Of course, if the filament current for the rectifier tube is taken from one of the windings in the set it is necessary to use a ballast resistor to drop any excess voltage. Thus if the filament voltage is 2.5 volts and the tube is a 230, 0.5 volt must be dropped, which would require a resistance of 8 to 10 ohms.

The Filter

The filter choke in Mr. Dick's eliminator is an audio transformer, the two windings connected in series aiding. The primary is connected next to the filament and the secondary next to the ground. One 2 mfd. condenser is connected from the junction to the negative side and another of the same value is connected from ground to the negative side.

Two voltages are provided for, both adjustable. Next to the ground side is a 200,000 ohm rheostat by means of which the voltage between ground and "C1" can be varied and between this rheostat and the negative side is a half megohm potentiometer by means of which the voltage between ground and "C2" can be varied. The maximum bias available is of the order of 100 volts when a one to one transformer is used, assuming the line voltage is 110 volts.

The filter of the voltage is very good because the inductance of the audio transformed used as choke is very high and also because the current drawn from the tube is very small. It will not exceed one milliampere.

Circuit Variation

In case it is desired to build a C battery eliminator not requiring the filament winding the diagram in Fig. 2 may be followed. It is assumed there is a 2.5-volt winding T1 already in the receiver and that the center of this winding is grounded. The filament of the 230 rectifier tube is connected to the winding with a 10 (or 8) ohm resistance in series. The other parts of the circuit are exactly the same as those in Fig. 1. However, the filter is in the negative lead. This arrangement eliminates the trouble of putting a heater winding on the one to one transformer.

An eliminator of this type can be constructed at very little cost. A suitable transformer T can be obtained for very little because such transformers are not used now and there are many still on the market, both used and unused. The transformer used for the choke will cost even less. The other parts amount to very little, too.

Mr. Dick asserts that his C battery eliminator greatly improved the quality of his set and that it was equivalent to the use of 100 mfd. across the bias resistance. The preceding discussion of the effect of reverse feedback shows why such improvement should be expected. Theoretically the eliminator is equivalent to using an infinite capacity across the bias resistance. Besides that it does not take any voltage from the plate circuit.

One thing must be watched in using an eliminator of this type. In power tubes like the 59 and the 47 the total grid circuit resistance should not exceed about 0.5 megohm. If the grid leak has a value of 0.25 megohm the maximum possible resistance in the circuit with this eliminator is 0.95 megohm. It will only be that if the full voltage of the eliminator is applied to the grid. With a 47 or 59 only a small part of it will be used. The grid return would be connected to "C1" and Rh would be set so that the drop in it would be about 18 volts. If the total voltage drop in P and Rh is 100 volts and the total resistance is 700,000 ohms, the resistance between ground and the grid return would be only 126,000 ohms and therefore the total resistance in the grid circuit would be 376,000 ohms, which is well within the limit.

When it becomes necessary to lower the resistance in the grid circuits lower values of P and Rh may be used, but this would increase the current drown from the rectifier and would make the filtration less.

23 Amateurs Win DX Prizes

Winners in a unique long-distance communication contest, sponsored by the American Radio Relay League, the national amateur organization, have just been announced. Twenty-three high scores are to be awarded piezo-electric quartz crystals donated by the staff of W8YA, of the Department of Electrical Engineering, Pennsylvania State College, in recognition of their outstanding work.

Arthur M. Braaten, operator of station W2BSR, at Riverhead, Long Island, N. Y., had the highest score of the contest, which regarded the total mileage covered in twenty distinct two-way communications as the total score, modified by such considerations as power, frequency band used, and whether the contact was by voice or code. His score was 203,920; the power used, 162.8 watts.

Other winning scores ranged from a few thousands on the lower frequency bands, where distance contacts are more difficult to make, to figures just approaching this high score. The powers in use ran anywhere from 1 watt to 1000 watts. Roland R. Gariepy, W1CSV, 44 Whiting St., Springfield, Mass., totalled 2762 miles on a low frequency band with only 1.5 watts. Elmer Kleppin, W9DBO, Wenona, Ill., covered 7670 miles with only 2.16 watts on the same band, his score being higher than some stations with a hundred times that power.

The twenty-three winners of the crystal awards follows:

W1APK Basil F. Cutting, Pembroke, New Hampshire.

W1ATW E. G. Hubbel, 25 East St., New Milford, Conn.

W2BCO Edw. W. Prichard, 72 Catherine St., Poughkeepsie. N. Y.

W2BHW Rolf Lindenhayn, Jr., 317 Wastena Terr., Ridgewood, N. J.

W2BSR Arthur M. Braaten, Box 979, Riverhead, L. I., N. Y.

W3BMS G. F. Hall, 535 W. Hortter St., Philadelphia, Penna.

W4AJX Le. E. Benjamin, 1219 New Orleans Ave., Tampa, Fla.

W4AKH E. W. Connell, 230 Sorrento Rd., South Jacksonville, Fla.

W5AL Cecil F. Butcher, 2202 Wellington St., Greenville, Texas.

W6AHQ Herbert Becker, 1117 W. 45th St., Los Angeles, Calif.

W6AW Roland Dufour Richardson, 2928 Schuyler St., Oakland, Calif.

W6BBZ Farrell Kikel, 1040 E. 2nd St., Pomona, Calif.

W6CQF Clifford Livingston, Box 2063, Rucson, Arizona.

W7AOL Sidney D. Shaw, R. 7, Box 92-N, Salem, Oregon.

W7LD Niilo Koski, 5822 E. Green Lake Way, Seattle, Wash.

K7PA Richard J. Fox, Box 301, Ketchikan, Alaska.

W8DTN James W. H. Hauke, 5 Arlington St., Bangor, Mich.

W8ECF Donald E. Schryver, 742 Morrison St., Watertown, N. Y.

W9BON Martin Bernstein, 3940 Grenshaw St., Chicago, Ill.

W9DI Wm. J. Bamer, Tobias, Nebraska.

W9EDW H. H. Nelson, 603 Spring St., Aurora, Ill.

W9EQC Richard L. Lybarger, 2509 Brighton Ave., Kansas City, Mo.

W9EVQ Irvin Weeks, 3rd St. E. & 2nd Ave., S., New Rockford, N. Dak.

Amateurs Repel Privilege Cut

Returned from the international radiotelegraph conference at Madrid, Spain, Major Kenneth B. Warner, chairman of the amateur delegations attending the conference, said that the rights of radio amateurs were fully acknowledged at the conference, and not a single one of the privileges under which amateurs have been operating for the past four years was withdrawn.

Major Warner, who is secretary and general manager of the American Radio Relay League, the national amateur organization, represented United States amateurs at the conference with the assistance of Paul M. Segal, Washington, D. C., attorney specializing in radio, general counsel of the League. Warner was also chairman of the delegation of the International Amateur Radio Union. International Federation of Amateur Societies, with delegates from Great Britain and Spain.

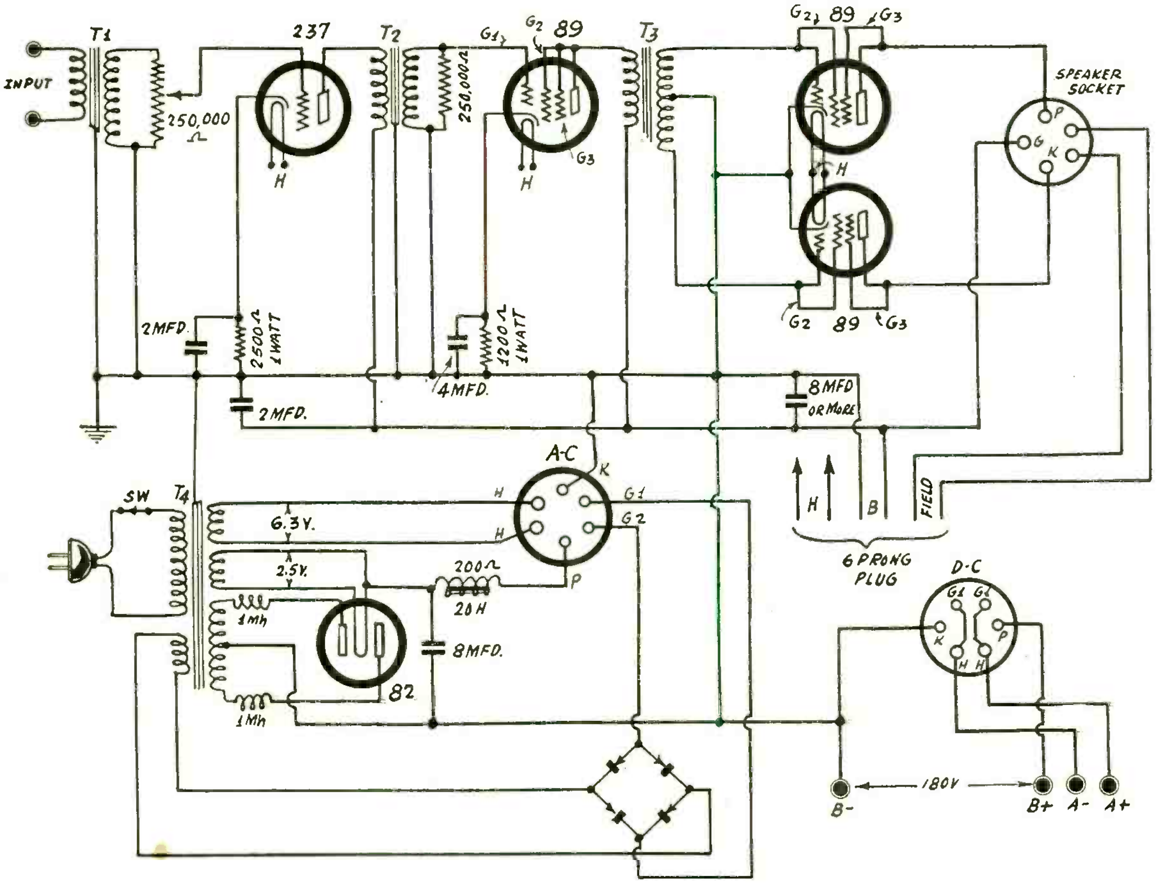
The conference threatened deadlock over several questions at different times, notably the problem of extension of the broadcast band, but amateur matters moved along smoothly. Opposition to the amateur movement was encountered on the part of many nations, but a coalition of the English-speaking countries overcame all threats of restriction. The United States, Great Britain and Canadian delegations, assisted at times by other nations such as British Honduras, loyally supported amateur radio during the entire conference, Major Warner acknowledged with gratitude.

* * *

The question of extending the broadcast band to frequencies about 70 kc lower (i. e., to 480 kc) will go before a Western Hemisphere conference.

A POWER AMPLIFIER

Works on A.C. or D.C., Radio or Microphone



NOW and then we have requests for small public address amplifiers that can be used on batteries as well as on a-c. Usually it is specified that the automobile tubes are to be used and sometimes the output stage is to be of the Class B type.

A circuit of this type raises several problems, the main one of which relates to the provision for the field. If a 6-volt field is used the speaker may be connected to the storage battery but it cannot be connected to the 6.3-volt winding when the filaments are heated with alternating current. If we use a high voltage field we can connect it to the output of the B supply rectifier, but we cannot connect it very well to the B battery because the drain would be excessive. If we use two speakers we could have one that had a 6-volt field when we operate the circuit on batteries and one that had a 180-volt field when we operate on alternating current. But this would require two speaker sockets, one for each speaker. If we did, there would be the danger of forgetting to make the proper change.

There is one other possibility, and that is to use a separate low-voltage rectifier that would supply the field current when we use a-c. In that case we could employ the same speaker all the time. The rectifier would have to be of the dry disk type.

Dual Use Circiut

In Fig. 1 we have a three stage amplifier employing Class B in the output stage and so arranged that it can be used on either a-c or d-c by making the proper switching. Only one speaker is needed because of the use of a low voltage rectifier for the field.

There are two six-contact sockets, one for d-c and one for a-c, and one six-prong plug that may be inserted in either socket according to the source of power used. The a-c socket is at the left and is marked "A-C." The two heater springs on this socket connect with the terminals of a 6.3 volt winding on the power transformer T4. The K terminal connects to the chassis, or the B minus point for either a-c or d-c power supply. P of this socket connects with the 20-henry choke coil in the power supply for a-c, and the choke is put in the positive side of the line. The two G contacts on the socket connect with the output terminals of the low voltage rectifier.

The d-c socket is at the right, and is marked "D-C." The two heater terminals pick up the binding posts for the storage battery, and they are also connected to the two G terminals. The K terminal of the d-c socket is connected to B minus and to the binding post for the minus of the high voltage battery. P on the socket picks up the binding post for the positive side of the B battery.

The plug is wired so that when it is inserted in either socket the proper voltages are applied to the circuit. The field terminals are connected to the two G-prongs on the plug and the heater terminals are connected to the two H terminals of the plug. P on the plug goes to the plate returns and K goes to ground.

If the a-c power is on and also if the storage and the B batteries are connected to the proper terminal posts, all that is necessary to switch from a-c to d-c, or the other way around, is to switch the plug from one socket to the other.

In case it is preferred to use a two-way switch for throwing the circuit from one to the other it is necessary to use a five pole, double throw switch, for only five of the leads need be switched. This suggests that five-contact sockets and a five-prong plug may be used instead of the six-point sockets and plug.

The B Supply

A special power transformer T4 is needed for there are no standard transformers having all the windings required. First is needed a primary for 115 volts. Then a 6.3-volt, centertapped winding is needed for the

(*Continued on next page*)

LIST OF PARTS

Coils

T1—One microphone to grid audio transformer.
T2—One regular interstage audio transformer.
T3—One special step-down transformer.
T4—One special power transformer having one 6.3-volt winding, one 2.5-volt winding, one about 15-volt winding, and one centertapped 220-volt winding.
Two one millihenry choke coils to carry 100 m. a. or more.
One 20-henry, 200-ohm choke.

Condensers

One 2-mfd. by-pass condenser.
One 4-mfd. by-pass condenser.
Two 8-mfd. electrolytic filter condensers.

Resistors

One 2,500-ohm bias resistor.
One 1,200-ohm bias resistor.
One 250,000-ohm resistor.
One 250,000-ohm potentiometer.

Other Requirements

Five six-contact sockets.
Two UY sockets.
One UX socket.
One full-wave, dry disk, low-voltage rectifier, 1.5-ampere rating or more.
One six-pin plug with cable.
One line switch (may be mounted on potentiometer).
Three grid clips.
One line plug and cord.
One special speaker, 6-volt, 1.5-ampere field.
One line plug and cable.
Six binding posts.

(*Continued from preceding page*)

heaters. This winding should be able to deliver at least 1.5 amperes, which is not a great deal. The third winding is for the filament of the rectifier tube. In view of the fact that the output stage is of the Class B type, an 82 rectifier tube is recommended because of its low and constant internal voltage drop. This tube requires a filament voltage of 2.5 volts and, therefore the third winding should be rated at this voltage. It will have to be a 3-ampere winding. It need not be centertapped, but it is all right if it is.

The fourth winding is that for the plates of the rectifier tube. The voltage each side of the center tap should be such that a rectified voltage of 180 volts will be obtained at the output side of the filter. Just what the voltage should be depends on the voltage drop in the winding and in the filter choke. A voltage somewhere between 200 and 225 volts on each side should be all right. It is essential that the resistance in the winding as well as in the choke be as low as possible because the proper functioning of the Class B amplifier depends on good regulation of the voltage.

Low Voltage Rectifier

The fifth winding is for the dry type, low voltage rectifier. This winding should be designed to give at least 1.5 amperes, for that is the usual current required by the field of a 6-volt speaker used in automobiles. That means rectified current. Hence the rectifier elements should also be able to handle this current. The voltage of the winding should be such that the output voltage is 6 volts on the d-c side of the rectifier. Due to a drop in the rectifier about 15 volts will be required.

The 82 tube requires that a choke of one millihenry or higher inductance be put in each plate lead to remove high frequency noise characteristic of mercury vapor rectifier tubes. These should be designed to carry about 100 miliiamperes.

Only one filter choke is used and this only of 20 henries. While it would be desirable to have a higher inductance it is more desirable to have a low resistance, say not more than 200 ohms. High inductance and low resistance are not compatible unless the coil is bulky. Most of the filtering, therefore, is obtained by capacity across the line. Next to the rectifier is an 8 mfd. condenser, which is of the electrolytic type. There is another condenser of the same capacity on the output side of the filter choke but this condenser is placed so that it is also across the B battery when that is used. The second condenser should be 8 mfd. or larger because it is important to have plenty of capacity in which to store up electricity during times the output tubes take no current for use during the peaks.

The Amplifier

The amplifier consists of a 237 preliminary stage, an 89 triode driver stage, and an 89 Class B amplifier output stage. If a microphone is to be used as a source of signal, the transformer T1 should be a microphone-to-grid transformer, which is a high ratio step-up transformer. A 250,000-ohm potentiometer is connected across the secondary with the grid of the tube going to the slider. This is for volume control. The tube is biased with a 2,500-ohm resistor in the cathode lead, and this is shunted by a condenser of 2 microfarads.

Transformer T2 between the 237 and the driver stage is an ordinary audio coupling transformer as it is working between a general purpose tube and the grid of another tube. The secondary is shunted with a 250,000-ohm resistor to improve quality a bit.

The 89 driver tube is operated as a triode. That is, the screen and the suppressor grids are tied to the plate and the control grid alone is used for input. A special transformer T3 is needed between the driver and the Class B amplifier. The ratio between the primary turns and the turns on each half of the secondary should be 2.4, or the ratio of the primary turns to the turns on the entire secondary should be 1.2. That means that a step-down transformer should be used since the primary has 20 per cent. more turns than the entire secondary. Moreover, the secondary winding should have as low resistance as possible for the grids will take considerable current. The necessity for the driver stage and the special transformer is due to the flow of grid current.

Output Impedance

The output possible depends on the impedance placed on the tubes. If the load resistance per tube is 3,400 ohms, output for two tubes is 2.5 watts and if the load per tube is 2,350 ohms, the output for two tubes is 3.5 watts. There is no other tube requiring such a low output impedance, with the excepion of the 48 tetrode and the 46 used as a Class B amplifier. The nearest triode is the 245, which requires a load of 3,500 ohms when the plate supply voltage is 180 volts. Therefore if a special speaker made for the 89 in Class B is not available a speaker made for 245 push-pull may be substituted, provided that the field also fits the case.

Tube List Prices

Type	*List Price*	*Type*	*List Price*	*Type*	*List Price*
11	$3.00	'32	2.35	56	1.30
12	3.00	'33	2.80	57	1.65
112-A	1.55	'34	2.80	58	1.65
'20	3.00	'35	1.65	59	2.50
'71-A	.95	'36	2.80	'80	1.05
UV-'99	2.75	'37	1.80	'81	5.20
UX-'99	2.55	'38	2.80	82	1.30
'100-A	4.00	'39	2.80	83	1.55
'01-A	.80	'40	3.00	'74	4.90
'10	7.25	'41	2.85	'76	6.70
'22	3.15	'45	1.15	'41	10.40
'24-A	1.65	46	1.55	'68	7.50
'26	.85	47	1.60	'64	2.10
'27	1.05	48	2.80	'52	28.00
'30	1.65	'50	6.20	'65	15.00
'31	1.65	55	1.60	'66	10.50

55 as Full-Wave Detector in T-R-F

Grid Blocking

WHAT is grid blocking and how is it manifested in a receiver? What should be done to stop it?—C. O. B., Atlanta, Ga.

Grid blocking occurs when the grid leak resistance is so high that the grid current cannot escape fast enough, leaving the grids negative. It shows up in different ways, depending on the degree of blocking.

* * *

Push-pull Tube

WOULD it be possible to make a push-pull tube equivalent to two equal tubes in the same bulb, one having two grids, two plates, and a cathode? It seems that such a tube would simplify construction a great deal.—F. W. C., Newark, N. J.

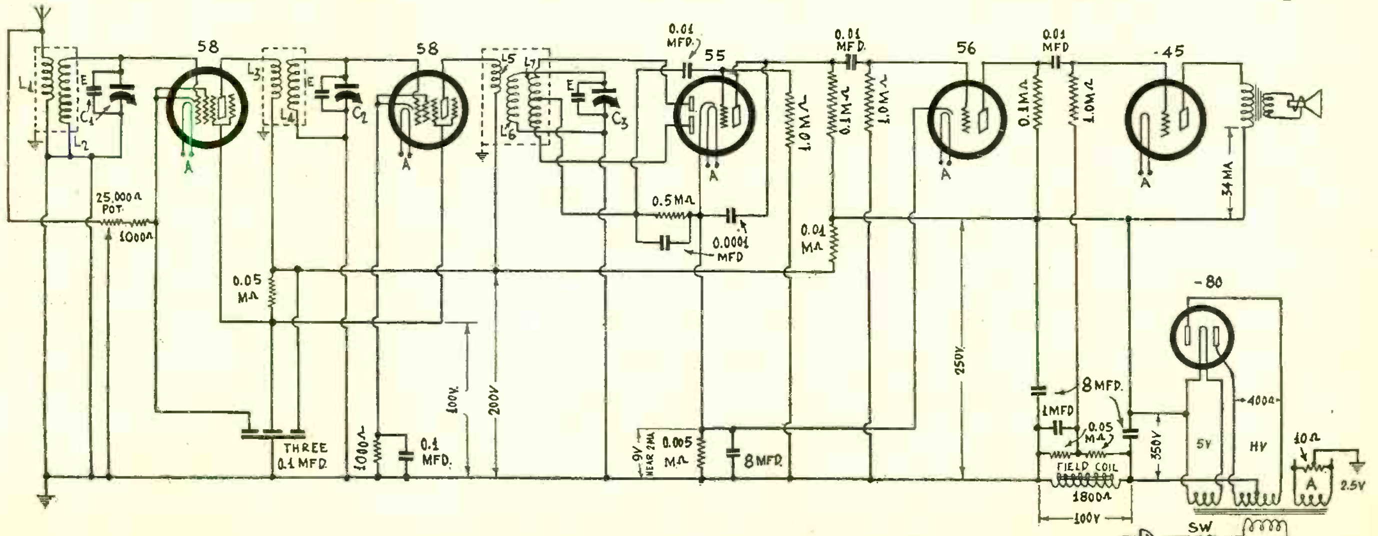
Such a tube is not only possible but it is already in existence. The first tube of the type is of the two-volt type and each side is a triode. It requires a six-contact socket. A tube of this type should find many uses besides its function as output tube. One good application for it would be as oscillator where it is important to keep harmonics from being generated. At least the even order harmonics would be kept down to a very low value. A tube of the same type could easily be made of the heater type, for that would require only seven prongs.

* * *

Use of 55 and 45 Tubes

PLEASE publish a circuit using a 55 tube as full-wave detector and a 45 as a power tube. Six tubes in all would be all right. I would prefer to have plenty of audio amplification in view of the fact that the gain in the 45 is not comparable with that in the 47 or the 59.—F. W. H., Baltimore, Md.

Above you will find the diagram of such a circuit. The r-f amplifier contains two 58s and the a-f amplifier a 56 in addition to the 45. All essential values are given.



In this six-tube receiver the new tubes are used except for output and rectifier. The 55 is used as a full-wave rectifier and triode amplifier.

STATION SPARKS
By Alice Remsen

MY CHOICE
FOR TONY CABOOCH, WLW

Each weekday 9:30 a. m.

What would I ask if I had my choice?
The touch of a friendly hand,
The pleasing sound of a friendly voice,
And a heart that can understand.

Money and fame mean nothing to me,
They both may be quickly lost.
I'd choose them not for my destiny,
With the heartaches which they would cost.

If I had my choice of only one
Of gifts which the gods might send,
I'd choose the best thing under the sun—
The priceless gift of a friend.
—A. R.

* * *

The foregoing verses are dedicated to Tony Cabooch because he seems to have the faculty of projecting a friendly personality out over the air. His many listeners have come to look upon him as a friend. His quaint philosophy and homely poems touch the heart-strings of many people who stand in need of just such a friend. Listen in to Tony and his little daughter; you'll like them!

* * *

The Radio Rialto

Thick flakes of snow are falling here in Cincinnati—the first real snow of the season in this part of the country. It looks so nice, covering the dingy old housetops with a white unsullied purity—but it won't remain that way long. The children are busy already with sleds and skis; hills are fine here for skis. . . . A lot of changes here at WLW, due to the fact that the station is now an outlet for WEAF and the Red Network, as well as WJZ and the Blue Network. . . . We are now carrying the Lucky Strike program, three times weekly; Rudy Vallee and the Fleischman hour, Eddie Cantor, Jack Benny, Ed Wynn, and other noted ones. . . . This does not affect the independent status of the "Nation's Station" . . . it is and will remain a Crosley station, with the right to reject or approve programs sent in from New York or Chicago. . . . John L. Clark, manager of WLW, has become a proud father. It is a boy, and does the Clark chest protrude several more inches than usual? I'll say it does. Mrs. Clark is well known in the theatrical world, being the former Elvira Giersdorf, of the Giersdorf Sisters, and a very sweet girl.... An old friend of mine, Bill Telaak, headed the Fanchon & Marco unit last week at the Albee Theatre. It is quite a few years since I last saw Bill, but he looks the same as ever. I remember when we were on a tour together through Canada and I taught him to play golf. He can really play now. . . . If the snow keeps up I'm going on an old-fashioned sleigh ride on Saturday. Can hear the bells jingling now. . . . Have you listened in to the Flying Dutchmen yet, over WLW, WJZ and the Blue network, on Sundays at midnight, Eastern Standard Time? Do listen in and hear a first-class orchestra, under the direction of William Stoess, hear Charlie Dameron and Maurie Neuman singing vocal choruses, and your girl friend as guest artist. . . . Paul Stewart, well-known Broadway actor, has at last achieved one of his greatest ambitions—he has become an announcer; in addition to his dramatic work, Paul is announcing several morning and afternoon programs. He also writes the continuity of the Crosley Follies, besides acting as master of ceremonies on that program. . . . Billie Dauscha is now a regular feature of the Zero Hour, at eleven p. m. Tuesday nights. . . .

And now for a little news from WABC. Of course, you know by this time that Morton Downey and his wife, Barbara Bennett, are to be congratulated on the birth of a baby boy; the baby has already demonstrated his ability to sing somewhat on the order of his celebrated father. . . . Jack Benny has changed his ideas and will drop the show producing angle from his future radio scripts, due to the fact that Sid Silvers will not be able to take part in the program, owing to Sid's activities in the new Broadway hit, "Take a Chance." . . .

The biggest piece of news to come our way from NBC is that Willard Robison has returned to the NBC networks. He may be heard on Tuesdays at 9:30 p. m. EST, over the NBC-WJZ networks, which will, I believe, bring my old friend in through WLW; I hope so, as he is a veritable genius at his own particular line of work and one of my favorites. . . . Heywood Broun is still on the G. E. Circle program; when he works he is coatless and collarless; Heywood sure believes in comfort. . . . Hendrik Willem Van Loon, on the other hand, bundles up in a thick coat. Ted Jewett is always dapper and fresh in a tuxedo. . . .

Big business is still waiting to see which way the cat will jump before committing itself to big advertising programs, and who can blame them? . . . Dr. Walter Damrosch, the famous conductor, has had the habit for many years of snatching forty winks before his program; he continues to do this in radio, and always completely relaxes and sleeps a bit between rehearsal and broadcast of his NBC Music Appreciation Hour each Friday morning. How I wish I could do the same thing, but I'm always keyed up to a certain pitch during rehearsal and must stay there until after my program, when I can relax. . . . They do say that Alexander McQueen has over a hundred dictionaries in his library and that he guides his life by them. He is a bachelor, and once, when cooking some meat, he is said to have consulted no less than five dictionaries to get the exact meaning of the word "simmering"—let's hope it's a joke. Tom Neely, my old pal, of the NBC program department, and earlier than that of vaudeville, wrote the theme song of his own program, "Sparklets;" the name of the song is "Flippancy." . . . Just found out that Cab Calloway was born in Rochester, N. Y., which is my old stamping ground. . . . Paul Whiteman's picture, "The King of Jazz," is meeting with great popularity abroad, especially in Germany, Holland and Africa.

Andre Kostelanetz, who conducts "Threads of Happiness" and many other programs over WABC, is a keen winter-sports enthusiast, and during his school days in St. Petersburg, now Leningrad, was a sprint-skating champion. . . . From Chicago comes the news that Don Pedro's lilting Spanish melody, heard over KYW and network, will continue to be broadcast from that station, as Don has replaced Carl Moore at the Terrace Gardens. . . . Also Uncle Bob has resumed his Herald and Examiner readings over the same station. . . . Station WBBM in the Wrigley Building, Chicago, has a new $22,000 Wurlitzer pipe organ of a type built especially for broadcasting and recording. Wilson Doty, organist at WBBM for more than a year, will be at the console of the new instrument. . . . Credit for achieving the unusual in musical presentations, notably the Marlboro Cigarette programs, featuring Harriet Cruise, and the Band of Distinction over WBBM six nights a week, is accorded Billy Mills, who before coming to this station was musical supervisor and producer for the Publix and National theatres. . . . Almost forgot to tell you that Tommy Christian will follow Larry Funk into the Gibson Hotel here in Cincinnati, when Larry leaves this week for Kansas City. Tommy, you will probably remember, was at Palisades Park, New Jersey, all summer; a pleasant boy and popular conductor. . . . Well, I guess I'll have to go downstairs to Pogue's and purchase a pair of galoshes. It's still snowing and in the hurry of packing I left mine at home. . . . So here goes! If I don't get snowed under you'll hear from me next week.

* * *

ANSWER TO CORRESPONDENTS

CARLOS WILSON, Atlanta, Ga.: Thanks for your letter. Shall run something about Stern and his orchestra in the near future. Probably a biography, if I can procure it.

* * *

Biographical Brevities
ABOUT JAN GARBER

WJZ, Mondays, 12:30 a. m.

From the Netherland Plaza, Cincinnati

Jan Garber, the popular and clever little orchestra leader, first saw the light of day in Indianapolis twenty-nine years ago. He received his early education in the Indianapolis public schools, and then attended the University of North Carolina, where he became a member of the Delta Sigma Phi fraternity. It was during his college days that Garber first conceived the idea of organizing his own jazz orchestra; it was only a four-piece one—but to Jan it was great, and when he left college the band went with him, their first job being in Washington, D. C.

After three years as a struggling young orchestra leader, Jan found himself with an orchestra of seven men, a Victor recording contract, and an engagement to play the annual Victor ball at the Hotel Pennsylvania in New York. His success at that ball was the turning point in a career which has since won him stardom in the realm of dance band leaders. He invented a new style, "a clowning conductor"; it went over big. Soon after that he and his orchestra went to Florida and played at the Coral Gables Golf and Country Club—and made such a success they were reengaged over a period of four years. Then came tours of the major vaudeville circuits; and then an engagement at the fashionable and exclusive Little Club in New York.

Jan is now under the management of the Music Corporation of America, and is at present playing a limited engagement at the Netherland Plaza Hotel in Cincinnati and broadcasting twice a day through Station WLW. He is married to a very pretty girl who travels with him and has one child, a beautiful little girl, Eunice, four years old. In appearance Jan is not very tall, is dark-haired and eyed, and has a magnetic personality and a swell smile; his boys all like him and work like the deuce for him. He has several good singing boys in Norman Donahue, Fritz Hulbron, Rudy Rudisill and Lea Palmer; also a cute little miss from Memphis, Virginia Hamilton, who sings blues and ballads in a sweet voice and with a Southern accent.

* * *

(If you want to know something of your favorite radio artist, conductor, or announcer, drop a card to the conductor of this column. Address her: Alice Remsen, care RADIO WORLD, *145 West 45th St., New York City.)*

THE PHILCO 37

Battery Super Has Single Push-Pull Output Tube

The Philco Model 37 is a five tube battery operated superheterodyne receiver.

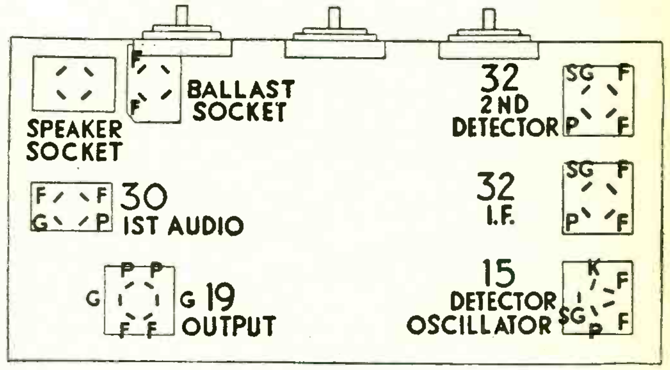
This model contains the new Philco type 15 r.f. pentode tube as detector oscillator, a type 32 screen grid intermediate frequency amplifier, a type 32 screen grid second detector, a type 30 first audio, and the new type 19 push pull (class B amplifier) output tube.

Volume equal to that of most A.C. receivers and economy in B battery operation are highly important features of the circuit. Unlike most receivers, the heavy B battery current drain, necessary to produce loud volume, is present only when such volume is actually coming through the speaker. At all other times, the current drain is small.

The filaments are supplied from the Philco Dry A battery. The chassis is equipped with an automatic voltage regulator tube which affords constant A voltage to the set throughout the life of the battery. The filament current drain from the A battery is 720 milliamperes.

The plates are supplied from standard Philco 45 B batteries. At 135 volts, the B battery current drain varies between 8 and 12 milliamperes.

The intermediate frequency of the superheterodyne circuit in this model is 175 kilocycles.



F—Filament SG—Screen Grid K—Cathode
P—Plate CG—Control Grid

Fig. 1—Tube Sockets, Under Side of Chassis

Caution.—Never connect the chassis to the power supply unless the speaker is connected and all tubes are in place.

Table 1—Tube Socket Data

Tube Type	Tube Circuit	Filament Volts F to F	Plate Volts P to F	Screen Grid Volts SG to F	Control Grid Volts CG to F	Cathode Volts K to F
15	Det.-Osc.	1.9	120(P to K)	60(SG to K)	2.5(CG to K)	5.5
32	I.F.	1.9	120	60	2.5	...
32	2nd Det.	1.9	2.0	45	2.5	...
30	1st Audio	1.9	110	..	.4	...
19	Output	2.0	120/Plate	..	.4/Grid	...

Table 2—Resistor Data

No. in Figs. 3 and 4	Resistance (Ohms)	Color Body	Color Tip	Color Dot
(18) (35)	1,000	Brown	Black	Red
(1)	2,900	Red	White	Red
(11)	6,000	Blue	Black	Red
(26)	25,000	Red	Green	Orange
(25)	51,000	Green	Brown	Orange
(27) (29) (32)	99,000	White	White	Orange
(31) (34)	490,000	Yellow	White	Yellow

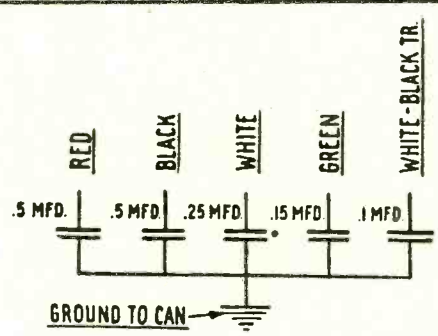


Fig. 2—Internal Connections Filter Condenser Bank

Model 37

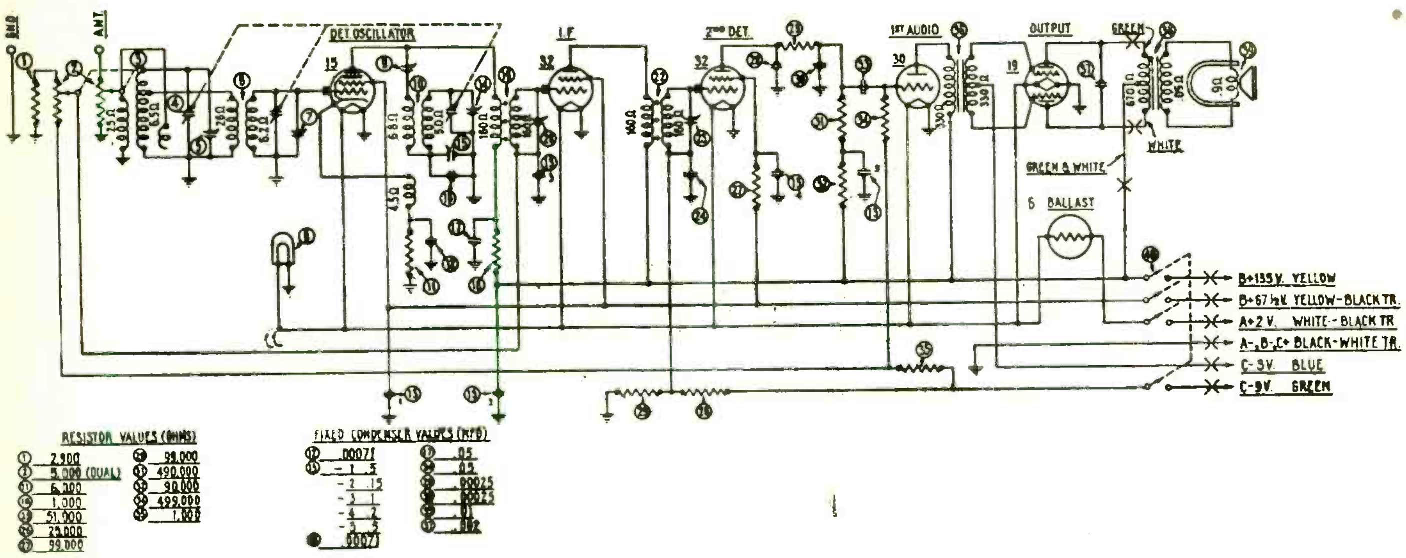


Fig. 3—Schematic Wiring Diagram

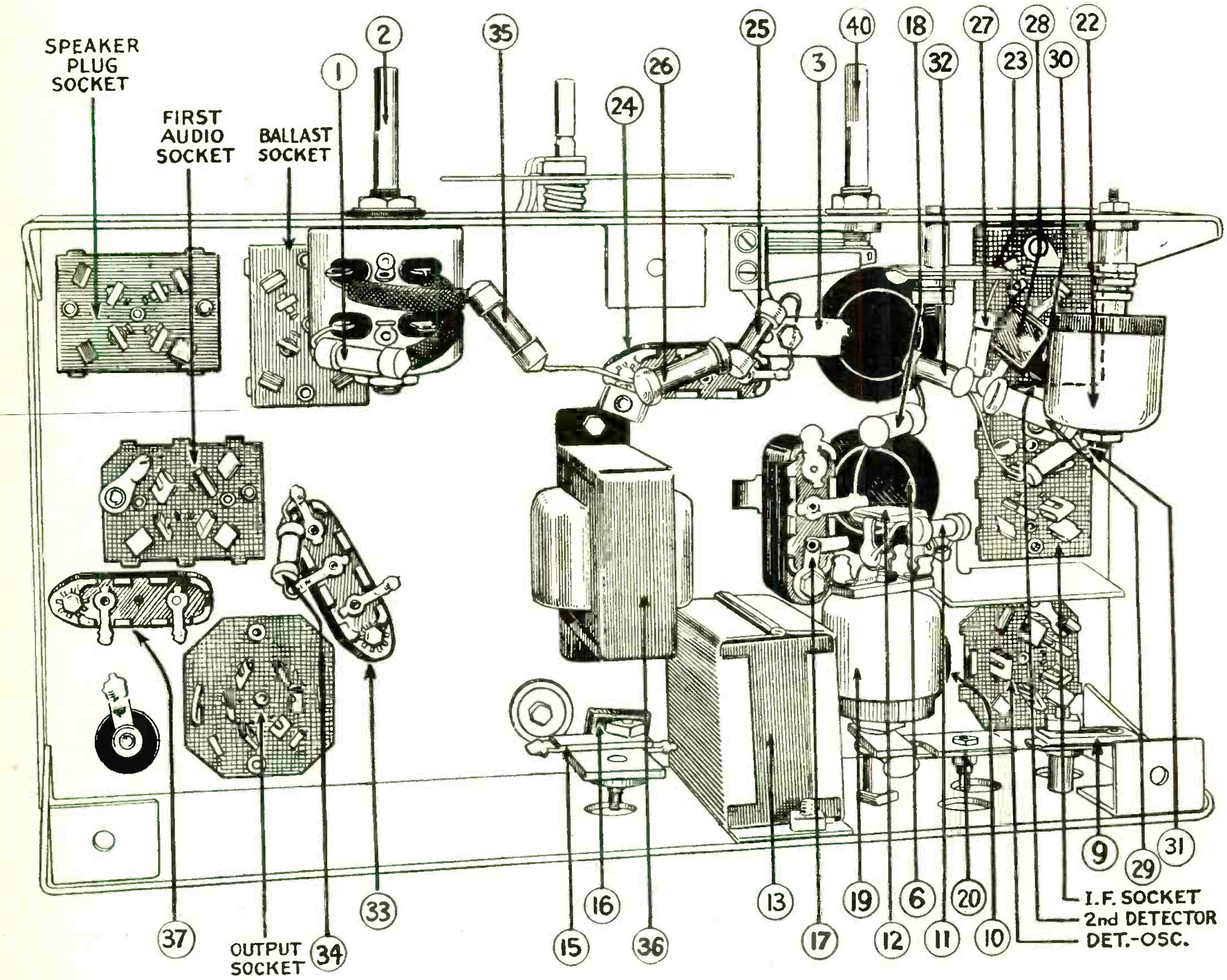
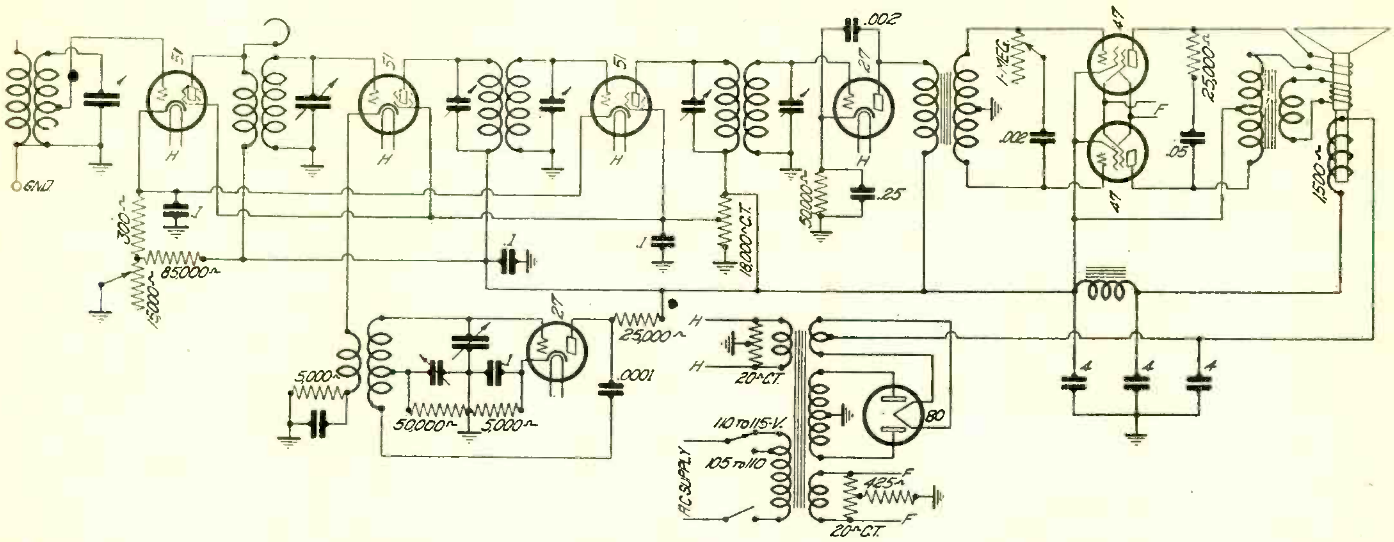


Fig. 4—Parts Diagram

The Balkeit L-8 Receiver



HERE IS a diagram of the Balkeit Model L-8 receiver, an eight-tube superheterodyne of sound design. It will be noticed that the first three tubes are 51's, which are variable mu tubes with practically the same characteristics as the 235. The detector tube is a 227 and is connected in a biased circuit. This tube is followed directly by a stage of push-pull 247.

Note the manner in which the volume control works. A 15,000-ohm variable resistor is connected between the common cathode return of the r-f and i-f amplifiers and ground. Between the high voltage line and the high side of the variable resistor is a fixed resistor of 85,000 ohms. Current flows through the 85,000-ohm resistor and this is added to the current from the tubes, boosting the bias. The extra bleeder current helps to control strong signals.

The oscillator is of a peculiar type. It employs both grid bias and grid leak with stopping condenser. The tuning and series condensers serve to block the grid current, and to provide a leakage path to the cathode a 50,000 ohm resistor is connected across the series padding condenser. The bias resistance is 5,000 ohms. The highest filtered voltage available is applied to the plate of the oscillator, but through a 5,000-ohm resistor. Under the conditions of operation of this tube a very wide voltage swing with little wave-form distortion is possible. The output of the oscillator is impressed on the first detector tube by means of a pick-up coil in the cathode lead.

Sound Output

The push-pull stage of 247 insures a high sound output with very little distortion. As a means of eliminating some of the excess high frequency power that develops in an amplifier using 247 tubes, a high frequency shunt consisting of a 0.05 mfd. condenser and a 25,000-ohm resistor in series, is connected between the plates of the two output tubes. In the lead to the center of the filament transformer is a 425-ohm resistor which serves to bias the 47 tubes. The resulting bias is unusually high for the 47 type tube, but since the circuit is push-pull overbiasing is permissible since it makes the circuit approach Class B. However, there is no bypass condenser across the bias resistor, which is necessary in Class B operation.

The speaker field is used as the first filter choke in the B supply. Since there are two filter chokes and four 4 mfd. by-pass condensers the filtering is thorough.

Provision is made for adjusting the primary of the power transformer to the line voltage. The entire winding is to be used when the voltage is between 110 and 115 volts and the tap when the voltage is between 105 and 110 volts.

New Push-Pull Single Tube, the 79, for Class B Audio

The RCA Radiotron Company, Inc., and E. T. Cunningham, Inc., have announced a new tube, the RCA-79 and C-79. This tube is of the heater type and takes a filament voltage of 6.3 volts. It is, therefore, intended primarily for automobile receivers and other mobile sets.

The significant feature of the new tube is that it is push-pull. That is, it is really two equal tubes in one bulb. It has two control grids and two plates. The cathode and the filament are common, however. This tube, therefore, will do what two output tubes will do provided that a push-pull input and a push-pull output transformers are used.

Another feature of the tube is that the amplification factor is very high so that it is intended for use in lass B amplification. The grid bias is either zero or very low. Since the tube is to be used as a Class B amplifier a special coupling transformer and a driver tube are needed for proper operation.

The complete characteristics of the tube are not yet available. They will be published as soon as they can be obtained and circuits incorporating it will be given.

While the tube is primarily intended for Class B output amplification it is clear that it can also be used for many other purposes. One that suggests itself immediately is for push-pull oscillation. It might be applied as oscillator in a superheterodyne. An oscias oscillator in a superheterodyne. An oscillator of this type, provided is were well balanced, would prevent the generation of the even harmonics, and that would eliminate many of the noises ordinarily heard in a superheterodyne.

Replacement Parts for Model 37

No. on Figs. 3 and 4	Description	Part No.
1	Resistor (2,900 Ohms)	5309
2	Volume Control	7239
3	Antenna Transformer	05726
4	Tuning Condenser Assembly	05740
5	Compensating Cond.—Antenna—Part of Tuning Cond. Assembly	
6	Detector Transformer	05727
7	Compensating Cond. — Detector—Part of Tuning Cond. Assembly	
8	Pilot Light	5316
9	Comp. Cond.—1st. I.F. Primary	04000-A
10	Oscillator Coil	05728
11	Resistor (6,000 Ohms)	7352
12	Cond. 710 Mmf. White and Yellow	5863
13	Filter Cond. Bank (.1, .15, .25, 2-.5 Mfd.)	03915
14	Comp. Cond.—High Frequency—Part of Tuning Cond. Assembly	
15	Comp. Cond.—Low Frequency	04000-F
16	Cond. 710 Mmf. White and Yellow	5863
17	Condenser (.05 Mfd.)	3615-AC
18	Resistor (1,000 Ohms)	5837
19	First I.F. Transformer	05697
20	Comp. Condenser — 1st. I.F. Secondary	04000-A
22	Second I.F. Transformer	05698
23	Comp. Cond. 2nd. I.F. Secondary	04000-A
24	Cond. .05 Mfd.	3615-AU
25	Resistor (51,000 Ohms)	4518
26	Resistor (25,000 Ohms)	4516
27	Resistor (99,000 Ohms)	4411
28	Condenser 250 Mmf. Yellow	3082
29	Resistor (99,000 Ohms)	4411
30	Condenser 250 Mmf. Yellow	3082
31	Resistor (490,000 Ohms)	4517
32	Resistor (99,000 Ohms)	4411
33	Condenser (.01 Mfd.)	3903-X
34	Resistor (490,000 Ohms)	4517
35	Resistor (1,000 Ohms)	5837
36	Input Transformer	7233
37	Condenser (2,000 Mmf.)	7296-B
38	Output Transformer	2646
39	Voice Coil and Cone Assembly	02887
40	Battery Switch	7283
	Tube Shield	05720
	Knob	03064
	Knob Spring	4147
	Four Prong Socket	5026
	Five Prong Socket	4956
	Six Prong Socket	6417
	Dial Complete	05811
	Bezel	6413

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.

Shorted Tuning Condenser

MY SET works fine up to about WEAF and there it stops suddenly. Not a thing can be obtained from it between WEAF and WMCA. What could be the reason? I have checked everything and am sure the wiring is correct.—W. A. J., New York, N. Y.

In a case like this the tuning condensers are to be suspected. If you examine the condensers closely you may find that one of the rotor plates touches the nearest stator plate and that a short develops. Perhaps you will find that a burr on the edge of a plate is causing the trouble or that one of the plates is bent. If you cannot find the trouble by inspection open up one of the tuning coils and test with a continuity tester. The condenser should remain open all the time. You have to make this test on all the tuning condensers for the trouble may be in any one of them.

* * *

Fading and Distortion

MY SET is sensitive enough to pick up stations 2,000 miles away almost any time of the day. I have noticed that certain distant stations fade a good deal and when they do the signals come in very distorted. I have tried everything to remedy this but so far have not succeeded in making any improvements. Can you suggest anything that will help?—B. W. R., Akron, Ohio.

Against the distortion we have nothing to suggest because undoubtedly the trouble is with the signals and not with the set. This distortion is a part of the fading. To cure the fading in so far as the strength of the signals is concerned you can put in an automatic volume control. But this would not cure the distortion. You will have to do away with the Heaviside layer to overcome that.

* * *

Finding Effective Inductance

IN BUILDING circuits I often have occasion to measure inductance of coils in the circuit, that is, the effective inductance when shielding and tubes are in place. Can you suggest a simple method of doing it?—W. H. C., Cleveland, Ohio.

Perhaps the simplest method is to plot a curve of wavelengths against known capacities. For the purpose you will need a calibrated oscillator. The formula is $(\frac{1}{2}\pi F)^2 = L(C + Co)$. The left hand member of this equation is proportional to the square of the wavelength and the right hand member is the product of the inductance and the total capacity in the circuit. Co is the distributed capacity and C is the known capacity which you add to the circuit. Co includes the capacity of the tuning condenser in the circuit but this condenser may be set at minimum while the measurement is being made. If you plot C along the axis of abscissas and $(\frac{1}{2}\pi F)^2$ along the axis of ordinates the points will lie on a straight line. Draw a straight line so that it passes through as many of the observed points as possible. The slope of this line is the inductance and the intercept on the capacity axis is the value of Co. The intercept is the distance between the origin and the point where the line cuts the axis of capacity. Use as large values of C as practical. The slope of the curve is the ratio of the distance from the axis of capacity to the line at any value of C to the value of C selected less the intercept. This method yields a value of the inductance that is as accurate as the calibrations of the oscillator and the variable condenser giving C. Errors in particular observations are minimized by the fact that the curve represents the average of all the observations. If all the points fall on the curve all the observations are equally accurate. Resonance can be indicated either by a thermo-milliammeter in series with the tuned circuit or with a vacuum tube voltmeter across it. A vacuum tube voltmeter is only a grid bias detector with a d-c milliammeter in the plate circuit of the tube.

* * *

Determining Inductance

IN THE ISSUE of Dec. 24 you explain how inductance may be determined by means of a calibrated oscillator and a known capacity. I have tried to apply this method but it does not seem to check. Is there an error in the formula?—W. R. G., New York, N. Y.

There is a slight typographical error in the formula. One of the F's in the denominator should be Fo. There is also an error in the application. $Fo + F$ is 730 kc and not 620. The correct answer to the sample problem is $L = 793$ microhenries. A better method of determining inductance, when a calibrated condenser is available, is given in answer to W. H. C. in this issue.

* * *

Difficulties in Padding

DURING many attempts at padding superheterodyne oscillators I have found that no two are alike. In some cases the series padding condenser must be over 1,000 mmfd. and in others less. What is the reason for the variation?—N. L. W., Hartford, Conn.

Variations are due to differences in the capacities of the variable condenser used for tuning. Coils are made to fit particular condensers. If the coils are designed for one condenser and are used for another, there is trouble in padding. However, if both the oscillator and the r-f coils have been made for the same condenser there is little trouble. The value of the padding condenser required really depends on the value of the inductance in the r-f circuit, for when the inductance is fixed the capacity at any frequency is the same regardless of the maximum capacity of the condenser used. When trouble of this kind is met it can usually be overcome by changing the intermediate frequency a little. As a matter of fact if the oscillator inductance is approximately correct a fixed value of series condenser, say about 1,000 mmfd., could be used by tuning the intermediate frequency circuits. The method to do this would be to supply a signal frequency of 600 kc and setting the r-f condenser where this frequency resonates. At that setting the oscillator will generate a frequency depending on the inductance and the series capacity in the circuit, and that fixes the intermediate frequency. It is only necessary to tune in 600 kc signal by means of the intermediate tuners. That adjusts the padding at 600 kc. Next the padding should be adjusted at 1,450 kc by means of the trimmers. This method works if the i-f tuners cover a sufficiently wide band, which they usually do. Incidentally, this method yields good results without the use of an intermediate frequency oscillator. It is a good method to use in an emergency. Let us see how this works out. Suppose the r-f inductance is 245 microhenries. At 600 kc the capacity in the r-f circuit is 287 mmfd. If the series condenser is 1,000 mmfd. the effective capacity in the oscillator circuit is 223 mmfd. This neglects the small difference in minimum capacity in the r-f and oscillator circuits, which is allowable. Now let us assume that the inductance in the oscillator circuit is 190 microhenries. With this inductance and 223 mmfd. the oscillator frequency is 772 kc. Hence the intermediate frequency generated at this setting of the condenser is 172 kc. The i-f tuner can be adjusted to this without trouble. Leaving this adjustment the trimmers can be adjusted at 1,450 kc, or some frequency near that, until the signal comes in best, and the circuit is adjusted. At 1,450 kc the minimum capacity in the r-f circuit is 49.1 mmfd. In the oscillator it should be 55.5 mmfd. to yield 172 kc intermediate at 1,450 kc signal frequency, or only 6.4 mmfd. more than was assumed. That is so small that it will not affect the adjustment at the 600 kc setting appreciably.

* * *

Minimum Capacity

IN a tuned circuit is it justifiable to assume that the minimum capacity in the circuit is proportional to the maximum capacity and therefore that the relative tuning range is the same for large as well as for small condensers?—S. G., Bronx, N. Y.

It is not. There are many fixed capacities and they are the same regardless of the size of the tuning condenser. It is not even true of the minimum of the condenser itself. It is only slightly less for a 140 mmfd. condenser than for a 350 mmfd. condenser. The tube capacity remains the same and even the capacity of the coil is practically fixed regardless of the number of turns just so the diameter of the coil is the same. In general, the smaller the maximum capacity of a circuit the smaller is the relative tuning range. A circuit in which the maximum capacity is about 350 mmfd. easily covers the broadcast band but a condenser having a maximum of 200 mmfd. covers barely a two-to-one range.

* * *

Audio A. V. C.

IS IT practical to arrange an automatic volume control so that audio voltage is used on the a. v. c. rectifier? I know that it has been used but I wonder if it is practical.—R. B. H., Toledo, Ohio.

Yes, it can be done but the trouble is that the a. v. c. voltage is proportional to the modulation. If no signal happens to be coming in on the carrier the circuit has full sensitivity. This, perhaps, is the gravest objection to the method. There is also the objection that the quality is affected. A strong audio signal will be cut down while a weak one will not. This objection could be overcome in part by making the time constant of the circuit so great that the a. v. c. voltage remained high over the weak passages. But then there would be difficulty in tuning, unless it were done by meter in the radio circuit, for the signal would not respond quickly. The best a. v. c. is one that operates on the carrier and not on the modulation. Incidentally, of the audio a. v. c. had a small time constant the modulation would be almost removed, especially low frequency modulation. Sets now do not amplify the low frequencies very well and if there were an audio a. v. c. in the set the discrimination against the low frequencies would be greater.

TRADE MOVES TO STOP FLOOD OF NEW TUBES

A wide scope of subjects is covered by the present activities of Radio Manufacturers Association, Inc. (RMA), a report on them following:

At a meeting of radio industry leaders in New York City, including the Board of Directors and Receiving Set, Tube and Parts Divisions of Radio Manufacturers Association, several measures to improve merchandising conditions and prevent unfair competition were adopted.

Chief among these was unanimous adoption by the RMA Board of Directors of a formal resolution calling on radio patent licensors, including the Radio Corporation of America, to take adequate action against unlicensed manufacturers. The resolution follows:

"Inasmuch as the manufacture and sale, without royalty payments, of unlicensed radio apparatus which infringes patents under which members of this Association are licensed and pay royalties, subjects such members to serious disadvantages in competition;

"Therefore, be it resolved, that the owners of patents under which members of this Association are licensed and pay royalties be requested by this Association to enforce in every proper manner respect for their patents by the manufacturers and vendors of competing apparatus which infringes such patents."

This action immediately follows recent numerous lawsuits instituted by holders of loudspeaker patents against many prominent chain-store, furniture and other purchasers of unlicensed products and is expected to result in similar action to protect receiving set manufacturers against many unlicensed and irresponsible manufacturers.

RMA to Certify Sets

Receiving sets offered to the public by RMA set manufacturers soon will bear an RMA label certifying official Association approval and manufacture under RMA standards. Only manufacturers who are members of the RMA will be permitted to use this label on their products as another measure to protect "legitimate" manufacturers.

The RMA label will certify official Association approval by the RMA Engineering Institute. Establishment of this new Institute was recently authorized. The Institute will be under the direction of Franklin Hutchinson, chairman of the RMA Engineering Committee, and will consist of five leading engineers appointed by Chairman Hutchinson and approved by the RMA Board. The Institute will give its approval to receiving sets of RMA members which are manufactured in accord with specifications adopted by the Institute and the RMA Board.

Specifications Listed

The initial specifications under which the RMA label may be used provide that:

(1) All sets which carry the RMA label shall have been submitted to the Underwriters' Laboratories for approval, except sets for which the Underwriters have no requirements.

(2) Sets shall cover the entire United States and Canadian broadcast band.

(3) Sets shall be non-interfering in accordance with RMA standards.

(4) Sets shall meet quality and performance standards of the RMA.

Too Many New Tubes

Cooperation between leading receiving set and tube manufacturers to reduce the number of new tubes brought into the market was effected at meetings of the RMA Set and Tube Divisions and at the meeting of the Board of Directors at the Commodore Hotel. President Fred D. Williams, of Indianapolis, presided over the Directors' meeting.

Chairman S. W. Muldowny of the Tube Division held a preliminary meeting of prominent tube manufacturers to discuss the burdens not only on manufacturers, but on jobbers and dealers evolved from the promotion of new tubes. At the RMA Directors' meeting, when a joint conference of set and tube manufacturers was held, it was decided that Chairman Murray of the Set Division should formally and in detail advise all receiving set manufacturers and their engineers of the serious difficulties, including loading up of dealers, involved in the promotion of numerous new tubes with "unnecessary and minor" changes from previous ones. Set manufacturers will be urged to reduce their demands on tube makers for products embodying only minor or special developments.

No Trade Show Next Year

There will be no RMA trade show in 1933. The Board of Directors voted to skip the annual trade show and learn decisively if business is impaired or retarded by the holding of a show. On this point there are conflicting opinions.

Radio manufacturers, jobbers and dealers are urged to use their advertising appropriations and space more in announcement of broadcast features on the air and less on technical matters. This new advertising policy, designed to help broadcasting interests as well as the radio public and radio sales, was stressed at the RMA Board of Directors' meeting by President M. H. Aylesworth of the National Broadcasting Company during an informal luncheon discussion. President Aylesworth also promised to develop broadcast programs designed especially to promote use and, therefore, sales of automobile receiving sets and also sets particularly adapted to office use. Business programs for business men, President Aylesworth said, are now on the air but will be developed further and more successfully if manufacturers will build sets more adaptable to offices and office furniture.

Support by the radio industry of broadcast features, such as special sporting events of general interest and others, was discussed by President Aylesworth with the RMA Board.

"Sampling" Excessive

Radio manufacturers are being asked to reduce their demands on parts makers for unnecessary amounts of free samples. This free sample burden on the parts and accessory makers is estimated to cost upward of $250,000 a year.

Further standardization of parts and accessories also will be developed by the RMA. Floyd C. Best, of Fort Wayne, Ind., was appointed chairman of a special parts standardization committee. Recommendations for standards will be developed by the parts and accessory manufacturers and submitted for adoption to the RMA Engineering Division and its Standards Committee for approval. It is proposed to submit such parts standards to set makers well in advance of new seasons, saving tooling cost of parts makers and reducing cost of parts to set manufacturers.

Forms providing for exchange between receiving set manufacturers of cost accounting information are being developed.

WIDER BAND, UNDER 550 kc, UP TO PARLEY

The data will include direct labor cost, material cost, volume of manufacture of units and other information. The cost data will be exchanged confidentially among the producers.

Legislative affairs of interest to the radio industry hereafter will be in charge of Paul B. Klugh of Chicago. Mr. Klugh was elected Chairman of the Association's Legislative Committee.

Auto Radio Co-operation

Formal relations having been established in the development of automobile receiving sets by the RMA and the Society of Automotive Engineers, Director C. E. Brigham has appointed a large RMA committee on automotive radio and has himself accepted membership to represent the RMA on a joint committee established by the Society of Automotive Engineers and the American Society of Mechanical Engineers of the American Standards Association. Virgil M. Graham, of Rochester, N. Y., is chairman of the new RMA Committee on Automotive Radio, and eight or ten members of the committee in the future will work with the Society of Automotive Engineers on their mutual engineering problems.

The Tube Standards Committee of which R. M. Wise, of Emporium, Pa., is chairman, has submitted a letter ballot and example of the proposed RMA tube numbering system. Uniformity in the numbering of tubes is the object of the new plan which will be voted on by the RMA.

Interesting data and opinion have been received by the RMA from the National Electric Light Association. When leading manufacturers and leading dealers in local communities are ready to make urgent request upon power companies to promote and sell radio equipment, according to C. E. Greenwood, Commercial Director of NELA, it is believed that satisfactory responses will come from the power companies.

It is estimated by NELA that each receiving set provides revenue of $6 a year in electric energy consumed, allowing for additional lighting on account of longer hour burning.

2% Tax on Auto Sets

Detailed below is the U. S. Treasury ruling on taxation of automobile receiving sets and components. The ruling was received by the RMA from the Treasury Department:

"You are advised that automobile radio sets specifically designed and primarily adapted for use in automobiles are considered automobile accessories within the meaning of section 606 (c) of the Revenue Act of 1932 and are taxable when sold by the manufacturer at the rate of 2 per cent under that section, rather than at the rate of 5 per cent under section 607, imposing a tax on certain component parts of radio receiving sets.

"Under section 606 (c) such radio receiving sets may be sold free of tax to a manufacturer of automobiles, who becomes liable for the tax in the same manner as the manufacturer if the sets are resold by him otherwise than on or in connection with, or with the sale of, taxable automobiles.

"When such sets are sold by the manufacturer to a dealer for resale or for installation by him, or to a consumer, the tax is imposed at the rate of 2 per cent under section 606 (c).

"In view of the provisions of section 620 of the Revenue Act of 1932, a manufacturer or assembler of such automobile radio sets may purchase taxable radio chassis, cabinets, tubes, reproducing units, or power packs tax free from the manufacturer thereof, for use as parts of such sets only, provided he furnishes with his purchase order an exemption certificate, in the form prescribed in Article 7 of Regulations 46, to the effect that such articles are purchased for use as material in the manufacture or production of, or for use as a component part of, an article to be manufactured or produced by the purchaser which will be taxable under Title IV or sold free of tax by virtue of section 620 of the Revenue Act of 1932. If radio chassis, cabinets, tubes, reproducing units, or power packs purchased tax free under such a certificate are resold by the vendee otherwise than as parts of radio receiving sets specially designed and primarily adapted for use in automobiles, such resale is taxable under section 607 as if made by the manufacturer or producer."

Increased Sales to France

Substantial increase of American radio imports to France during the fourth quarter of 1932 has been arranged, according to advices to the RMA from the Department of Commerce at Washington. The original protest against the French quota was made by the RMA a year ago. Since then the Association and also various leading manufacturers have made recommendations for equitable apportionment of imports of American manufacturers.

In detail the following bulletin regarding the French import quota has been received by cable from F. W. Allport, American Commercial Attache at Paris:

"The quotas for importation into France during the fourth quarter of 1932 of radio apparatus and electric motors were announced in the French Journal Officiel. The United States' quotas were substantially increased, radios, parts and accessories being fixed at 85.2 metric tons and tubes at 9.6 metric tons as compared with 63.0 and 5.1 metric tons, respectively, for each of the first two quarters of 1932.

"At the request of the importers of American radio apparatus, the American quota is made subject to licenses to be issued by the American Chamber of Commerce in Paris. Only shipments received under such licenses will be admitted by the French customs. The Chamber proposes to allocate 75 per cent of the quotas among importers according to a weighted formula proposed by them and based on the 1931 output of American manufacturer, the 1931 imports of the products of that manufacturer, and the rate of sale of the makes in France during the first six months of 1932.

"It is expected that the Chamber will announce about October 6 that all applications must be in its hands within 15 days thereafter, partial interim licenses to be issued to leading importers during the period required to calculate individual quotas. The remaining 25 per cent of the quotas will be reserved for emergencies."

Interference Reports Soon

Two reports on radio interference, advising the industry and also the public on interference prevention, prepared by the Joint Committee of the RMA, NELA, and NEMA, will be distributed soon to members of the three Associations. The two reports have been approved by the joint committee, which has been working together for more than a year on mutual problems incident to improving radio reception by eliminating radio interference sources in electrical and radio apparatus and otherwise.

Information is being obtained from all RMA members for compilation and distribution of a new directory of members and their products. This will be a complete directory of radio products of all Association members and will include a roster of all executive personnel.

E. N. Rauland of Chicago was appointed to provide a uniform tax accounting system and uniform practices to simplify excise tax reporting, to develop uniform sales and trade practices, as well as simplicity and economy in the administration of the excise taxes.

New insurance underwriters standards of amplifier and sound apparatus, to assist manufacturers in their engineering and manufacturing, also were ordered developed.

The Wider Broadcast Band

Paul B. Klugh, of Chicago, returned from Europe where he was the official representative of the RMA at the International Radio-Telegraphic Conference at Madrid. He spent several weeks at the conference but reported that a protracted deadlock between European interests on their respective voting powers and also a disagreement on proposed widening of the broadcast band appeared likely to prevent results desired by broadcasting and radio manufacturing interests of this country as well as many other North American and European nations.

Mr. Klugh is the new chairman of the RMA Legislative Committee, in charge of all radio legislation before Congress, State Legislatures or Municipalities, and also is Chairman of the Association's Membership Committee.

While Mr. Klugh was at the Madrid Conference the American Delegation, headed by Vice Chairman Sykes of the Federal Radio Commission, indorsed a plan, presented by Canada, Cuba, and Mexico, to widen the broadcast band by providing seven additional broadcast channels below 540 kc. Further disagreement followed at Madrid and the outlook is for a North American conference of broadcasting interests to provide wavelength facilities for Mexico, Cuba and Canada which may result in important changes in American channel allocations.

Tax Collections Increase

The seasonal increase in radio sales is reflected in the Treasury's returns from the radio excise tax. The Bureau of Internal Revenue reports radio tax collections of $218,722 during October as compared with $165,710 in September. Since the excise tax on radio sets, phonographs, etc., became effective June 20th, the Government has received in taxes $493,727, much less than the Treasury and Congressional estimates of prospective returns. The RMA advised the Treasury and Congressional Committees when the excise tax bill was being framed that the official estimates were greatly in excess of what actually would be received by the Government.

TRADIOGRAMS

By J. Murray Barron

William F. Aufenanger has been appointed superintendent of R. C. A. Institutes, 75 Varick Street, New York City. Mr. Aufenanger has long been identified with radio and R. C. A. and brings to his new position a knowledge and association dating back many years which should prove of real value both to the student and the Institute.

* * *

Charles Gannon, of Erwin Wasey & Co., and Chester E. Haring, of Batten, Barton Durstine & Osborn, Inc., have been appointed members of the governing committee of the Cooperative Analysis of Broadcasting. The other members of the committee are: D. P. Smelser, Proctor & Gamble, chairman; D. B. Stetler, Standard Brands, Inc., and C. H. Land, General Electric Company.

* * *

As midgets multiplied very rapidly, the miniature radio receivers give every indication of following their example. A recent addition in this field is the new Pilot A.C.-D.C. Miniature, now in production.

* * *

What was formerly known as the R. C. A. Building, Fifty-first Street and Lexington Avenue, N. Y. City, will be headquarters for the General Electric Co., and will be called the General Electric Building.

* * *

The New Baltimore Bulletin as issued by Baltimore Radio Corp., 725 Broadway, N. Y. City, edited by B. Jay, is off the press. It is newsy and is issued for the serviceman. "Forgotten Facts," by Nathan Lazarus, president of Baltimore, sizes up the business situation from a good angle, which should help a lot of fellows.

* * *

Ray Miller, in charge of centralized radio sales for Radio Distributing Corporation, R. C. A. wholesalers in New Jersey and Northeastern Pennsylvania, reports a successful culmination of negotiations for a complete R. C. A. Victor Centralized Radio in the new school at Hawthorne, N. J.

* * *

Lit Brothers Department Store in Philadelphia, Pa., is now handling the Stromberg-Carlson line of radio receivers.

* * *

The Transformer Corporation of America, Chicago, is now marketing a new Clarion superheterodyne receiver with class B amplifier.

NEW INCORPORATIONS

Airwynn, Inc., Wilmington, Del., broadcasting—Attys., Corporation Trust Co., Dover, Del.
Bobbie's Photo and Radio Service, Brooklyn, N. Y.—Attys., Attorneys Albany Service Co., 315 Broadway, New York City.
Universal Tube Mfg. Corp., Brooklyn, N. Y., radio tubes—Atty., M. I. Murzin, 245 Broadway, New York City.
Eastern Institute of Electronics, Inc., Wilmington, Del., correspondence school—Atty., Franklin L. Mettler, Wilmington, Del.
Premier Recording Studios, New York City, sound recording machines—Attys., Holley & Oxenberg, 40 East 41st St., New York City.

ASSIGNMENTS

In New York County, N. Y. City

Vincent M. Shermood (Orchestra Music Supply Co.), at 1,658 Broadway, to Emanuel A. Goodman, 145 West 45th St., New York City.

PETITIONS IN BANKRUPTCY

Chicago

Clago Radio Corp., involuntary. Creditors include Century Electric Co.

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.

H. Mori (short wave parts), R. F. D. No. 1, Box 2, Imperial, Calif.
Patrick A. Kelly, 5412 Lancaster Ave., West Philadelphia, Penna.
Cecil Brownlow (W5BMK), The Price Dry Goods Company, Eldorado, Okla.
Edward Kiehnhoff, Radio Sales Service & Supplies, Box A, Wathena, Kans.
Oscar Ise, 1759 Fay Ave., East Cleveland, Ohio.
Tropics Trading Company, Excelsior Hotel Bldg., Fortaleza (Ceara), Brazil, So. America.
Joseph Greig, Gen. Del., Milwaukee, Wisc.
J. R. Meloan, c/o Radio Station KERN, Bakersfield, Calif.
Jack Kaplik, 673 Saratoga Ave., Brooklyn, N. Y.
H. Teboe, 1705 Shuler Ave., Hamilton, Ohio.
Ronald Salyerds, 1128 Sherman St., Akron, Ohio.
Wm. S. Buckley, 3830 Banks Ave., Butte, Mont.
Jesse Seigle, 1111 Ferry St., Easton, Penna.
L. F. Payne, 38 Morris St., Ottawa, Ont., Canada.
Louis Tape, Box 522, Silver Grove, Ky.
H. A. Tholen, 7231 Lyndover Pl., Maplewood, Mo.

SHORT-WAVE CLUB

H. Mori, R. F. D. No. 1, Box 2, Imperial, Calif.

STATIONS BY FREQUENCIES

United States, Canadian, Newfoundland, Cuban and Mexican Transmitters Listed

Corrected to December 20th, 1932

The stations listed herewith are in the order of frequencies, with equivalent wavelengths given. The call, location, owner, and power are stated. The location is that of the main studio, for United States stations. If the transmitter is located elsewhere it is indicated additionally, preceded by T. The power given is the licensed maximum. Some stations use maximum power in daytime only. These are identified by an asterisk after the power figure (*). Usually in such cases the night power is half the day power. CP means construction permit, license awaited.

—EDITOR.

540 KILOCYCLES—555.6 METERS

CKWO—Windsor, Ont., Can.; Essex Bdcsters Lmt. 5 KW.

550 KILOCYCLES—545.1 METERS

WGR—Buffalo, N. Y.; T—Amherst, N. Y.; Buffalo Broadcasting Corporation; 1 KW.
WKRC—Cincinnati, Ohio; WKRC (Inc.); 1 KW.
KFUO—St. Louis, Mo.; Concordia Theo. Sem.; 1 KW.*
KSD—St. Louis, Mo.; Pulitzer Publishing Co.; 500 W.
KFDY, Brookings, S. Dak.; South Dakota State College, 1 KW.*
KFYR—Bismarck, N. Dak.; Meyer Broadcasting Co., 2½ KW.*
KOAC—Corvallis, Oreg.; Oregon State Agricultural College, 1 KW.

560 KILOCYCLES—535.4 METERS

WLIT—Philadelphia, Pa.; Lit Bros. Bdcg. System, Inc.; 500 W.
WFI—Philadelphia, Pa.; WFI Bdcg. Co.; 500 W.
WQAM—Miami, Fla.; Miami Broadcasting Co.; 1 KW.
KFDM—Beaumont, Tex.; Sabine Bdcg. Co., Inc.; 1 KW.*
WNOX—Knoxville, Tenn.; WNOX, Inc.; 2 KW.*
WIBO—Chicago, Ill.; T—Des Plaines, Ill.; Nelson Bros. Bond & Mortgage Co.; 1½ KW.*
WPCC—Chicago, Ill.; North Shore Church; 500 W.
KLZ—Denver, Colo.; Reynolds Radio Co. (Inc.), 1 KW.
KTAB—San Francisco, Calif.; T—Oakland, Calif.; The Associated Broadcasters (Inc.), 1 KW.

570 KILOCYCLES—526.0 METERS

WNYC—New York N. Y.; City of N. Y.; 500 W.
WMCA—New York, N. Y.; T—Hoboken, N. J.; Knickerbocker Broadcasting Co. (Inc.); 500 W.
WSYR-WMAC—Syracuse N. Y.; Clive B. Meredith; 250 W.
WKBN—Youngstown, Ohio; WKBN Broadcasting Corp.; 500 W.
WEAO—Columbus, Ohio; Ohio State University; 750 W.
WWNC—Asheville, N. C.; Citizen Broadcasting Co.; 1 KW.
KGKO—Wichita Falls, Tex.; Wichita Falls Broadcasting Co., Inc.; 500 W.*
WNAX—Yankton, S. Dak.; The House of Gurney (Inc.); 1 KW.
KMTR—Los Angeles, Calif.; KMTR Radio Corporation; 500 W.
KVI—Tacoma, Wash.; Puget Sound Bdcg Co.; 500 W.

580 KILOCYCLES—516.9 METERS

WDBO—Orlando, Fla.; Orlando Bldg. Co., 250 W.
WTAG—Worcester, Mass.; Worcester Telegram Publishing Co. (Inc.), 250 W.
WOBU—Charleston, W. Va.; WOBU (Inc.), 250 W.
WSAZ—Huntington, W. Va.; WSAZ (Inc.); 250 W.
WIBW—Topeka, Kans.; Topeka Broadcasting Association (Inc.), 1 KW.
KSAC—Manhattan, Kans.; Kansas State Agricultural College; 1 KW.*
KMJ—Fresno, Calif.; Jas. McClatchy Co.; 500 W.
CFCY—Charlottetown, Prince Edward Island, Canada; Island Broadcasting Co., Ltd.; 500 W.
CHMA—Edmonton, Alberta, Can.; Christian & Missionary Alliance, 250 W.
CKCL—Toronto, Ontario, Can.; Dominion Battery Co., Ltd.; 500 W. (Uses call CFCL on Sundays), 500 W.
CKUA—Edmonton, Alberta, Can.; University of Alberta; 500 W.

590 KILOCYCLES—508.2 METERS

WGCM—Gulfport, Miss.; T—Mississippi City, Miss.; Great Southern Land Co.; 1 KW.
WEEI—Boston, Mass.; T—Weymouth, Mass.; Edison Electric Illuminating Co. of Boston; 1 KW.
WKZO—Berrien Springs, Mich.; WKZO (Inc.); 1 KW.
WCAJ—Lincoln, Nebr.; Nebraska Wesleyan University; 500 W.
WOW—Omaha, Nebr.; Woodmen of the World Life Insurance Association; 1 KW.
KHQ—Spokane, Wash.; Louis Wasmer (Inc.), 2 KW.*
CMW—Havana Cuba; Columbus Commercial & Radio Co.; 1400 W.

595 KILOCYCLES—503.9 METERS

CJGC—London, Ontario, Can.; T—Strathburn, Ontario, Can.; London Free Press & Ptg. Co., Ltd.; 5 KW.
CNRL—London, Ontario, Can.; T—Strathburn, Ontario, Can. (Uses Transmitter of CJGC); Canadian National Railways; 5 KW.

600 KILOCYCLES—499.7 METERS

WICC—Bridgeport, Conn.; T—Easton, Conn.; Bridgeport Broadcasting Station (Inc.); 250 W.
WCAC—Storrs, Conn.; Connecticut Agricultural College; 250 W.
WCAO—Baltimore, Md.; Monumental Radio (Inc.), 250 W.
WREC—Memphis, Tenn.; T—Whitehaven, Tenn.; WREC (Inc.), 1 KW.*
WMT—Waterloo, Iowa; Waterloo Broadcasting Co.; 500 W.
KFSD—San Diego, Calif.; Airfan Radio Corporation (Ltd.); 1 KW.*
CNRO—Ottawa, Ontario, Can.; Canadian National Railways; 500 W.

610 KILOCYCLES—491.5 METERS

WJAY—Cleveland, Ohio; Cleveland Radio Broadcasting Corporation; 500 W.
WIP—Philadelphia, Pa.; Penna. Bdcg. Co., Inc.; 500 W.
WDAF—Kansas City, Mo.; Kansas City Star Co.; 1 KW.
KFRC—San Francisco, Calif.; Don Lee (Inc.); 1 KW.
WFAN—Philadelphia, Pa.; Keystone Broadcasting Co.; 500 W.
XETR—Mexico, D. F.; Cia Difusora Mexicana, S. A.; 2½ KW.

620 KILOCYCLES—483.6 METERS

WLBZ—Bangor, Me.; Maine Broadcasting Co. (Inc.); 500 W.
WFLA-WSUN—Clearwater, Fla.; Clearwater Chamber of Commerce and St. Petersburg Chamber of Commerce; 2½ KW.*
WTMJ—Milwaukee, Wis.; T—Brookfield, Wis.; The Journal Co. (Milwaukee Journal), 2½ KW.*
KGW—Portland, Oreg.; Oregonian Publishing Co.; 1 KW.
KTAR—Phoeniz, Ariz.; KTAR Broadcasting Co.; 1 KW.*

630 KILOCYCLES—475.9 METERS

KGFX—Pierre, S. D.; Dana McNeil; 200 W.
WMAL—Washington, D. C.; M. A. Leese Radio Corp.; 500 W.*
WOS—Jefferson City, Mo.; Missouri State Marketing Bureau, 500 W.
KFRU—Columbia, Mo.; Stevens College; 500 W.
WGBF—Evansville, Ind.; Evansville on the Air (Inc.); 500 W.

630 KILOCYCLES—475.9 METERS (Continued)

CFCT—Victoria, British Columbia; Victoria Broadcasting Asso..; 50 W.
CJGX—Winnipeg, Manitoba; T—Yorkton, Saskatchewan; Winnipeg Grain Exchange; 500 W.
CHCS—Hamilton, Ont., Can.; T—Fruitland; Spectator; 1 KW.*
CKOC—Hamilton, Ont., Can.; T—Fruitland; Wentworth Bdcg Co.; 1 KW.*
CKTB—St. Catherine's, Ont.. Can.; T—Fruitland; Taylor & Bate, St.; 1 KW.*
CNRA—Moncton, New Brunswick; Canadian National Railways; 500 W.
CMCJ—Havana, Cuba; Rafael Rodriquez; 250 W.
XETA—Veracruz, Ver., Mex.; Manuel Espinosa Tagle; 500 W.
XETF—Veracruz, Ver., Mex.; Manuel Angel Fernandez; 500 W.
CMQ—Havana, Cuba; Jose Fernandez; 250 W.

640 KILOCYCLES—468.5 METERS

WAIU—Columbus, Ohio; Associated Radiocasting Corp.; 500 W.
WOI—Ames, Iowa; Iowa State College of Agriculture and Mechanic Arts; 5 KW.
KFI—Los Angeles, Calif.; Earle C. Anthony (Inc.), 50 KW.

645 KILOCYCLES—464.8 METERS

CHRC—Quebec, Quebec, Can.; CHRC, Ltd.; 100 W.
CKCI—Quebec, Quebec, Can. (Uses transmitter of CHRC); Le Soleil, Inc.; 100 W.
CKCR—Waterloo, Ontario, Can.; Wm. C. Mitchel & Gilbert Liddle, 100 W.

650 KILOCYCLES—461.3 METERS

WSM—Nashville, Tenn.; National Life & Accident Insurance Co.; 50 KW.
KPCB—Seattle, Wash.; Queen City Broadcasting Co.; 100 W.

660 KILOCYCLES—454.3 METERS

WEAF—New York, N. Y.; T—Belmore, N. Y.; National Broadcasting Co. (Inc.); 50 KW.
WAAW—Omaha, Nebr.; Omaha Grain Exchange; 500 W.
CMCO—Havana, Cuba; J. L. Stowers; 250 W.
CMDC—Havana, Cuba; Juan Fernandex de Castro; 500 W.

665 KILOCYCLES—450.9 METERS

CHWK—Chilliwack, British Columbia, Can.; Chilliwack Broadcasting Co., Ltd.; 100 W.
CJRM—Moose Jaw, Saskatchewan; T—old city Moose Jaw, Can.; James Richardson & Sons, Ltd.; 500 W.
CJRW—Winnipeg, Manitoba; T—Fleming, Saskatchewan, Can.; James Richardson & Sons, Ltd.; 500 W.

670 KILOCYCLES—447.5 METERS

WMAQ—Chicago, Ill.; T—Addison, Ill.; WMAQ (Inc.); 5 KW.

675 KILOCYCLES—444.2 METERS

VOWR—St. John's, N. F.; Wesley United Church; 500 W.

680 KILOCYCLES—440.9 METERS

WPTF—Raleigh, N. C.; Durham Life Insurance Co.; 1 KW.
KFEQ—St. Joseph, Mo.; Scroggin & Co. Bank; 2½ KW.
KPO—San Francisco, Calif.; Natoinal Bdcg. Co.; 5 KW.
XFG—Mexico City, Mex.; Sria de Guerra y Marina; 2 KW.

685 KILOCYCLES—437.7 METERS

VAS—Glace Bay, Nova Scotia, Can.; Canadian Marconi Co.; 2 KW.

690 KILOCYCLES—434.5 METERS

CFAC—Calgary, Alberta, Can.; The Calgary Herald; 500 W.
CFRB—Toronto, Ontario, Can.; T—King, Ontario, Can.; Rogers Majestic Corp., Ltd.; 10 KW.
CJCJ—Calgary, Alberta, Can.; Albertan Pub. Co., Ltd.; 500 W.
CNRX—Toronto, Ontario, Can.; T—King, Ontario, Can. (Uses transmitter of CFRB); Canadian National Railways; 4 KW.
XET—Monterrey, N. L., Mex.; Mexico Music Co., S. A.; 500 W.

700 KILOCYCLES—428.3 METERS

WLW—Cincinnati, O.; T—Mason, Ohio; Crosley Radio Corporation; 50 KW.

710 KILOCYCLES—422.3 METERS

WOR—Newark, N. J.; T—Kearny, N. J.; Bamberger Broadcasting Service (Inc.); 5 KW. (50 KW. C. P.)
KMPC—Los Angeles, Calif.; R. S. MacMillan; 500 W.
XEN—Mexico City, Mex. (Actual frequency 711 KC., 421.9 Meters); Cerveceria Modelo, S. A.; 1 KW.

720 KILOCYCLES—416.4 METERS

WGN-WLIB—Chicago, Ill.; T—Elgin, Ill.; WGN, Inc.; 25 KW.

730 KILOCYCLES—410.7 METERS

CHLS—Vancouver, British Columbia (Uses transmitter of CKCD); W. G. Hassell; 50 W.
CHYC—Montreal, Quebec, Can.; T—St. Hyacinthe, Quebec, Can. (Uses transmitter of CKAC); Northern Elec. Co., Ltd.; 5 KW.
CKAC—Montreal, Quebec, Can.; T—St. Hyacinthe, Quebec, Can.; LaPresse Pub. Co.; 5 KW.
CKCD—Vancouver, British Columbia, Can.; Vancouver Daily Province; 100 W.
CKFC—Vancouver, British Columbia, Can.; United Church of Canada; 50 W.
CKMO—Vancouver, British Columbia, Can.; Sprott-Shaw Radio Co.; 100 W.
CKWX—Vancouver, British Columbia, Can.; Western Broadcasting Co., Ltd.; 100 W.
CNRM—Montreal, Quebec, Can.; T—St. Hyacinthe, Quebec, Can. (Uses transmitter of CKAC); Canadian National Railway; 5 KW.
XER—Villa Acuna, Coah., Mex. (Actual frequency 735 KC., 408.1 Meters); Compania Radiodifusora de Acuna, S. A.; 75 KW.
CMK—Havana, Cuba; Cuban Bdcg. Co.; 3150 W.

740 KILOCYCLES—405.2 METERS

WSB—Atlanta, Ga.; Atlanta Journal Co.; 5 KW. (50 KW.—C. P.).
KMMJ—Clay Center, Nebr.; The M. M. Johnson Co.; 1 KW.
WHEB—Portsmouth, N. H.; Granite State Bldg. Corp.; 250 W. C. P.

745 KILOCYCLES—402.4 METERS

CJCA—Edmonton, Alta., Can.; Edmonton Journal; 500 W.

750 KILOCYCLES—399.8 METERS

WJR—Detroit, Mich.; T—Sylvan Lake Village, Mich.; WJR, The Goodwill Station (Inc.), 10 KW.
KGU—Honolulu, Hawaii; M. A. Mulroney and Advertiser Pub. Co., Ltd.
XEQ—C. Jaurez, Coah., Mex.; Feliciano Lopez Islas; 5 KW.

760 KILOCYCLES—394.5 METERS

WJZ—New York, N. Y.; T—Boundbrook, N. J.; National Broadcasting Co.; Inc.); 30 KW.
WEW—St. Louis, Mo.; St. Louis University; 1 KW.

770 KILOCYCLES—389.4 METERS

KFAB—Lincoln, Neb.; KFAB Broadcasting Co.; 5 KW. (25 KW. C. P.).
WBBM-WJBT—Chicago, Ill.; T—Glenview, Ill.; WBBM Broadcasting Corp. (Inc.); 25 KW.

780 KILOCYCLES—384.4 METERS

WEAN—Providence, R. I.; Shepard Broadcasting Service (Inc.); 500 W.*
WTAR-WPOR—Norfolk, Va.; WTAR Radio Corporation; 500 W.
WMC—Memphis, Tenn.; T—Bartlett, Tenn.; Memphis Commercial Appeal, Inc.; 1 KW.*
KELW—Burbank, Calif.; Magnolia Park, Ltd.; 500 W.
KTM—Los Angeles, Calif.; T—Santa Monica, Calif.; Pickwick Broadcasting Corporation; 1 KW.*
CKY—Winnipeg, Manitoba, Can.; Manitoba Telephone System; 5 KW.
CNRW—Winnipeg, Manitoba, Can. (Uses Transmitter of CKY); Canadian National Railways; 5 KW.
XEZ—Mexico, D. F., Joaquin Capilla; 500 W.

790 KILOCYCLES—379.5 METERS

WGY—Schenectady, N. Y.; T—South Schenectady, N. Y.; General Electric Co.; 50 KW.
KGO—San Francisco, Calif.; T—Oakland, Calif.; National Broadcasting Co. (Inc.); 7½ KW.
CMBT—Havana, Cuba; E. Perera; 500 W.
CMBS—Havana, Cuba; Enrique Artalejo; 150 W.
CMHC—Tuinucu, Cuba; Frank H. Jones; 250 W.

800 KILOCYCLES—374.8 METERS

WBAP—Fort Worth, Tex.; Carter Publications (Inc.); 10 KW.
WFAA—Dallas, Tex.; T—Grapevine, Texas; Dallas News and Dallas Journal A. H. Belo Corporation; 50 KW.

810 KILOCYCLES—370.2 METERS

WPCH—New York, N. Y.; T—Hoboken, N. J.; Eastern Broadcasters (Inc.); 500 W.
WCCO—Minneapolis, Minn.; T—Anoka, Minn.; Northwestern Broadcasting (Inc.); 5 KW. (50 KW. C. P.)
VOAS—St. John's, N. F.; Ayre & Sons, Ltd.; 75 W.
XFC—Aguascalientes, Ags., Mex.; Gobierno Edo. Aguascalientes; 350 W.

815 KILOCYCLES—367.9 METERS

CHNS—Halifax, N. S., Can.; Maritime Bdcg Co., Ltd.; 500 W.
CNRA—Halifax, N. S., Can.; Can. Natl Railways; 500 W.

820 KILOCYCLES—365.6 METERS

WHAS—Louisville, Ky.; T—Jeffersontown, Ky.; The Courier Journal Co. and The Louisville Times Co.; 25 KW.
XFI—Mexico City, Mex.; Sria Ind. Com. y Trabajo (Actual frequency 818.1 KC—366.7 Meters); 1 KW.

830 KILOCYCLES—361.2 METERS

WHDH—Saugus, Mass.; T—Gloucester, Mass.; Matheson Radio Co. (Inc.); 1 KW.
WRUF—Gainesville, Fla.; University of Florida; 5 KW.
KOA—Denver, Colo.; National Broadcasting Co. (Inc.), 12½ KW.
WEEU—Reading, Pa.; Berks Broadcasting Co.; 1 KW.

840 KILOCYCLES—356.9 METERS

CJBC—Toronto, Ontario, Can.; T—Bowmanville, Ontario, Can. (Uses transmitter of CKGW); Jarvis St. Baptist Church; 5 KW.
CKGW—Toronto, Ontario, Can.; T—Bowmanville, Ontario, Can.; Gooderham & Worts; 10 KW.
CKLC—Calgary, Alberta, Can.; T—Red Deer, Alberta, Can.; Alberta Pacific Grain Company; 1 KW.
CNRD—Red Deer, Alberta, Can. (Uses transmitter of CKLC); Canadian National Railways; 1 KW.
CPRY—Toronto, Ontario, Can.; T—Bowmanville, Ontario, Can. (Uses transmitter of CKGW); Canadian Pacific Railway Co.; 5 KW.

842 KILOCYCLES—356.1 METERS

CMC—Havana, Cuba; Cuban Telephone Co.; 500 W.
XEFD—Tiajuana, Mex.; Carlo de la Sierra; 300 W.

850 KILOCYCLES—352.7 METERS

KWKH—Shreveport, La.; T—Kennonwood, La.; Hello World Broadcasting Corporation; 10 KW.
WWL—New Orleans, La.; Loyola University; 10 KW.

860 KILOCYCLES—348.6 METERS

WABC-WBOQ—New York, N. Y.; T—West of Cross Bay Blvd., Queens Co., N. Y.; Atlantic Broadcasting Corporation; 5 KW.
WHB—Kansas City, Mo.; T—North Kansas City, Mo.; WHB Broadcasting Co.; 500 W.
XFX—Mexico City, Mex.; Sria de Educacion Publica; 500 W.

870 KILOCYCLES—344.6 METERS

WLS—Chicago, Ill.; T—Crete, Ill.; Agricultural Broadcasting Co.; 50 KW.
WENR—Chicago, Ill.; T—Downers Grove, Ill.; National Broadcasting Co., 50 KW.
XFF—Chihuahua, Mex.; Estado de Chihuahua; 500 W.

880 KILOCYCLES—340.7 METERS

WGBI—Scranton, Pa.; Scranton Broadcasters (Inc.); 250 W.
WQAN—Scranton, Pa.; E. J. Lynett, prop., The Scranton Times, 250 W.
WCOC—Meridian, Miss.; Mississippi Broadcasting Co. (Inc.); 1 KW.*
WSUI—Iowa City, Iowa; State University of Iowa; 500 W.
KLX—Oakland, Calif.; The Tribune Publishing Co.; 500 W.
KPOF—Denver, Colo.; Pillar of Fire; 500 W.
KFKA—Greeley, Colo.; The Mid-Western Radio Corporation; 1 KW.*
CHML—Mount Hamilton, Ontario, Can.; Maple Leaf Radio Co., Ltd.; 50 W.
CJCB—Sydney, Nova Scotia, Can.; N. Nathanson; 50 W.
CKCV—Quebec, Quebec, Can.; Vandry, Inc.; 50 W.
CKPC—Preston, Ontario, Can., Cyrus Dolph; 100 W.
CNRQ—Quebec, Quebec. Can. (Uses transmitter of CKCV); Canadian National Railways; 50 W.

890 KILOCYCLES—336.9 METERS

CMX—Havana, Cuba; Francisco Lavin; 1 KW.
WJAR—Providence, R. I.; the Outlet Co.; 500 W.
WKAQ—San Juan, P. R.; Radio Corporation of Porto Rico; 500 W.*
WMMN—Fairmount, W. Va.; Holt-Rowe Novelty Co.; 500 W.*
WGST—Atlanta, Ga.; Georgia School of Technology; 200 W night, 500 W day.
KGJF—Little Rock, Ark.; First Church of the Nazarene; 250 W.

890 KILOCYCLES—336.9 METERS (Cont.)

WILL—Urbana, Ill.; University of Illinois; 500 W.*
KARK—Little Rock, Ark.; Ark. Radio & Equip. Co.; 250 W.
KFNF—Shenandoah, Iowa; Henry Field Co.; 500 W.
KUSD—Vermillion, S. Dak.; University of South Dakota; 750 W.*
KFNF—Shenandoah, Iowa; Henry Field Co.; 1 KW.*
CFBO—St. John, New Brunswick, Can.; C. A. Munro, Ltd.; 500 W.
CKCO—Ottawa, Ontario, Can.; Dr. G. M. Geldert; 100 W.
CKPR—Port Arthur, Ontario, Can.; Dougall Motor Car Co., Ltd.; 50 W.
XES—Tampico, Tams., Mex.; Difusoral Portena; 500 W.
CMCF—Havana, Cuba; Raoul Karman; 250 W.

900 KILOCYCLES—333.1 METERS

WBEN—Buffalo, N. Y.; T—Martinsville, N. Y.; WBEN, Inc.; 1 KW.
WKY—Oklahoma City, Okla.; WKY Radiophone Co.; 1 KW.
WJAX—Jacksonville, Fla.; City of Jacksonville; 1 KW.
WLBL—Stevens Point, Wis.; State of Wisconsin, Department of Agriculture and Markets, 2 KW.
KHJ—Los Angeles, Calif.; Don Lee (Inc.); 1 KW.
KSEI—Pocatello, Idaho; Radio Service Corp.; 250 W. C. P. 500 W.
KGBU—Ketchikan, Alaska; Alaska Radio and Service Co. (Inc.) 500 W.

910 KILOCYCLES—329.5 METERS

CFQC—Saskatoon, Saskatchewan, Can.; The Electric Shop, Ltd.; 500 W.
CNRS—Saskatoon, Saskatchewan, Can. (Uses transmitter of CFQC); Canadian National Railways; 500 W.
XEW—Mexico City, Mex.; Mexico Music Co.; S. A.; 5 KW.

915 KILOCYCLES—327.7 METERS

CFLC—Prescott, Ontario, Can.; Radio Association of Prescott; 100 W

920 KILOCYCLES—325.9 METERS

WBSO—Needham, Mass.; Babson's Statistical Organization (Inc.); 500 W.
WWJ—Detroit, Mich.; The Evening News Association (Inc.); 1 KW.
KPRC—Houston, Tex.; T—Sugarland, Texas; Houston Printing Co.; 2½ KW.
WAAF—Chicago, Ill.; Drovers Journal Publishing Co.; 500 W.
KOMO—Seattle, Wash.; Fisher's Blend Station (Inc.); 1 KW.
KFEL—Denver, Colo.; Eugene P. O'Fallon (Inc.); 500 W.
KFXF—Denver, Colo.; Colorado Radio Corporation; 500 W.

925 KILOCYCLES—324.1 METERS

CMCD—Havana, Cuba; Angel Bertematy; 250 W.
CMCN—Havana, Cuba; Antonio Ginard; 250 W.

930 KILOCYCLES—322.4 METERS

WIBG—Glenside, Pa.; St. Paul's P. E. Church; 25 W.
WDBJ—Roanoke, Va.; Times-Royal Corp.; 500 W.*
WBRC—Birmingham, Ala.; Birmingham Broadcasting Co. (Inc.); 1 KW.*
KGBZ—York, Nebr.; Dr. George R. Miller; 1 KW.*
KMA—Shenandoah, Iowa; May Seed & Nursery Co.; 1 KW.*
KFWI—San Francisco, Calif.; Radio Entertainments (Inc.); 500 W.
KROW—Oakland, Calif.; T—Richmond, Calif.; Educational Broadcasting Corporation; 1 KW.*
CKX—Brandon, Manitoba, Can.; Manitoba Telephone System; 500 W.
CFCH—North Bay, Ontario, Can.; Northern Supplies, Ltd.; 100 W.
CFRC—Kingston, Ontario, Can.; Queens University; 250 W.*
CMJF—Camaguey, Cuba; John L. Stowers; 225 W.

940 KILOCYCLES—319.0 METERS

WAAT—Jersey City, N. J.; Bremer Broadcasting Corporation; 300 W.
WCSH—Portland, Me.; T—Scarboro, Me.; Congress Square Hotel Co.; 1 KW.
WFIW—Hopkinsville, Ky.; WFIW (Inc.); 1 KW.
WHA—Madison, Wis.; University of Wisconsin; 750 W.
WDAY—Fargo, N. Dak.; T—West Fargo, N. Dak.; WDAY (Inc.); 1 KW.
KOIN—Portland, Oreg.; T—Sylvan, Oreg.; KOIN (Inc.); 1 KW.
XEO—Mexico City, Mex.; Partido Nacional Rev.; 5 KW.

950 KILOCYCLES—315.6 METERS

WRC—Washington, D. C.; National Broadcasting Co. (Inc.); 500 W.
KMBC—Kansas City, Mo.; T—Independence, Mo.; Midland Broadcasting Co.; 1 KW.
KFWB—Hollywood, Calif.; Warner Bros. Broadcasting Corporation; 1 KW.
KGHL—Billings, Mont.; Northwestern Auto Supply Co. (Inc.); 2½*.
VONA—St. Johns, N. F.; Lane, Gillard & Avery; 30 W.
CMHD—Caibarien, Cuba; Manuel Alvarez; 250 W.

960 KILOCYCLES—312.3 METERS

CHCK—Charlottetown, Prince Edward Island, Can.; W. E. Burke & J. A. Gesner; 100 W.
CHWC—Regina, Saskatchewan, Can.; T—Pilot Butte, Saskatchewan, Can.; R. H. Williams & Sons, Ltd.; 500 W.
CJBR—Regina, Saskatchewan, Can. (Uses transmitter of CKCK); Saskatchewan Co-operative Wheat Producers, Ltd.; 500 W.
CKCK—Regina, Saskatchewan, Can.; Leader Publishing Co., Ltd.; 500 W.
CKNC—Toronto, Ontario, Can.; Canadian National Carbon Co.; 500 W.
CNRR—Regina, Saskatchewan, Can. (Uses transmitter of CKCK); Canadian National Railways; 500 W.
XED—Reynosa, Tams., Mex. (Actual frequency 965 KC—310.8 Meters); Cia. Int. Dif. Reynosa, S. A.; 10 KW.

965 KILOCYCLES—310.7 METERS

CMBC—Havana, Cuba; Domingo Fernandez; 150 W.
CMBD—Havana, Cuba; Luis Perez Garcia; 150 W.

970 KILOCYCLES—309.1 METERS

WCFL—Chicago, Ill.; Chicago Federation of Labor; 1½ KW.
KJR—Seattle, Wash.; Northwest Broadcasting System (Inc.); 5 KW.

980 KILOCYCLES—305.9 METERS

KDKA—Pittsburgh, Pa.; T—Saxonburg, Pa., Westinghouse Electric & Manufacturing Co.; 50 KW.

985 KILOCYCLES—304.4 METERS

CFCN—Calgary, Alberta, Can.; T—Strathmore, Alta., Can.; W. W. Grant & H. G. Love; 10 KW.

987 KILOCYCLES—303.8 METERS

CMGF—Matanzas, Cuba; Bernabe R. de la Torre; 50 W.

990 KILOCYCLES—302.8 METERS

WBZ—Springfield, Mass.; T—East Springfield, Mass.; Westinghouse Electric & Manufacturing Co.; 25 KW.
WBZA—Boston, Mass.; Westinghouse Electric & Manufacturing Co.; 1 KW.
XEK—Mexico City, Mex.; Arturo Martinez; 100 W.

(*Continued on next page*)

1000 KILOCYCLES—299.8 METERS

WHO—Des Moines, Iowa; Central Broadcasting Co.; 5 KW. (C. P. 50 KW.)
WOC—Davenport, Iowa; Central Broadcasting Co.; 5 KW. (C. P. 50 KW.).
KFVD—Culver City, Calif.; Los Angeles Broadcasting Co.; 250 W.
XEA—Guadalajara, Jal., Mex; Alberto Palos Sauza; 100 W.
XEC—Toluca, Mex.; Jesus R. Benavides; 50 W.
XEE—Oaxaca, Oax., Mex.; Alfonso Zorrilla B.; 105 W.
XEFE—N. Laredo, Tams., Mex.; Rafael T. Carranza; 100 W.
XEFI—Chihuahua, Chih., Mex.; Feliciano Lopez Islas; 100 W.
XEFS—Queretaro, Quer., Mex., Salvador Sanchez, 40 W.
XEI—Morelia, Mich., Mex.; Carlos Gutierrez; 100 W.
XEJ—C. Juarez, Chih., Mex.; Juan G. Buttner; 100 W.
XEL—Saltillo, Coah.; Antonio Garza Castro; 25 W.
XETC—Jalapa, Ver., Mex.; Juventino Canchez; 100 W.
XETG—Torreon, Coah., Mex.; Feliciano Lopez Islas; 100 W.
XEU—Veracruz, Ver., Mexico.; Fernando Pazos; 100 W.
XEV—Puebla, Pue., Mex.; Ciro Molino; 100 W.
XEY—Merida, Yuc., Mex.; Partido Socialista S. E.; 105 W.

1010 KILOCYCLES—296.8 METERS

WORK—York, Pa.; York Bdcg. Co.; 1 KW.
WQAO—New York, N. Y.; T—Cliffside, N. J.; Calvary Baptist Church; 250 W.
WHN—New York, N. Y.; Marcus Loew Booking Agency; 250 W.
WPAP—New York City; Palisades Amusement Park; 250 W.
WRNY—New York, N. Y.; T—Coytesville, N. J.; Aviation Radio Station (Inc.); 250 W.
KGGF—Coffeyville, Kans.; Hugh J. Powell and Stanley Platz, doing business as Powell & Platz; 500 W.
WNAD—Norman, Okla.; University of Oklahoma; 500 W.
WIS—Columbia, S. C.; Station WIS, Inc., 1 KW.*
KQW—San Jose, Calif.; Pacific Agricultural Foundation Ltd.; 500 W.
CHCS—Hamilton, Ontario; T—Fruitland, Ontario (Uses transmitter of CKOC—630 KC. temporarily); Hamilton Spectator; 1 KW.*
CKIC—Wolfville, Nova Scotia; Acadia University; 50 W.
CKOC—Hamilton, Ontario; T—Fruitland, Ontario (Uses 630 KC temporarily); Wentworth Radio Broadcasting Co., Ltd.; 1 KW.*
CKTB—St. Catharines, Ontario; T—Fruitland, Ontario. (Uses transmitter of CKOC, 630 KC., temporarily); Taylor & Bates, Ltd.; 1 KW.*
CMBZ—Havana, Cuba; Manuel y G. Salas; 150 W.

1017 KILOCYCLES—293.73 METERS

CMJH—Ciego de Avila, Cuba; Luis Marauri; 15 W.

1020 KILOCYCLES—293.9 METERS

WRAX—Philadelphia, Pa.; WRAX Broadcasting Co.; 250 W.
KYW-KFKX—Chicago, Ill.; T—Bloomingdale Township, Ill.; Westinghouse Electric & Manufacturing Co.; 10 KW.
XEFD—Tijuana, B. C., Mex.; Carlos de la Sierra, 300 W.

1030 KILOCYCLES—291.1 METERS

CFCF—Montreal, Quebec, Can.; Canadian Marconi Co.; 500 W.
CNRV—Vancouver, British Columbia, Can.; T—Lulu Island, British Columbia, Can.; Canadian National Railways; 500 W.
CMHI—Santa Clara, Cuba; Lavis y Paz; 30 W.

1034 KILOCYCLES—290 METERS

CMKC—Santiago de Cuba; M. P. Martinez; 150 W.

1,040 KILOCYCLES—288.3 METERS

WMAK—Buffalo, N. Y.; T—Grand Island, Buffalo, N. Y.; Buffalo Broadcasting Corporation; 1 KW.
WKAR—East Lansing, Mich.; Michigan State College; 1 KW.
KTHS—Hot Springs National Park, Ark.; Hot Springs Chamber of Commerce; 10 KW.
KRLD—Dallas, Tex.; KRLD Radio Corporation; 10 KW.
CMGH—Matanzas, Cuba.

1050 KILOCYCLES—285.5 METERS

KFBI—Albilene, Kans.; Farmers & Bankers Life Insurance Co.; 5 KW.
KNX—Hollywood, Calif.; T—Los Angeles, Calif.; Western Broadcast Co.; 5KW.
XEFC—Merida, Yuc., Mex.; Hugo Molina Font.; 10 W.
CMJG—Camaguey, Cuba; Pedro Nogueras; 50 W.

1060 KILOCYCLES—282.8 METERS

WBAL—Baltimore, Md.; T—Glen Morris, Md.; Consolidated Gas, Electric Light & Power Company of Baltimore; 10 KW.
WTIC—Hartford, Conn.; T—Avon, Conn.; Travelers Broadcasting Service Corporation; 50 KW.
WJAG—Norfolk, Nebr.; Norfolk Daily News; 1 KW.
KWJJ—Portland, Ore.; KWJJ Broadcast Co. (Inc.); 500 W.

1070 KILOCYCLES—280.2 METERS

WTAM—Cleveland, Ohio; T—Brecksville Village, Ohio; National Broadcasting Co. (Inc.); 50 KW.
WCAZ—Carthage, Ill.; Superior Broadcasting Service (Inc.); 50 W.
WDZ—Tuscola, Ill.; James L. Bush; 100 W.
KJBS—San Francisco, Calif.; Julius Brunton & Sons Co.; 100 W.
XEG—Mexico, D. F.; Miguel Yarza; 250 W.
CMBG—Havana, Cuba; Francisco Garrigo; 225 W.
CMCB—Havana, Cuba; Antonio Capablanca; 150 W.

1080 KILOCYCLES—277.6 METERS

WBT—Charlotte, N. C.; Station WBT (Inc.); 5 KW.
WCBD—Zion, Ill.; Wilbur Glenn Voliva; 5 KW.
WMBI—Chicago, Ill.; T—Addison, Ill.; The Moody Bible Institute Radio Station; 5 KW.

1090 KILOCYCLES—275.1 METERS

KMOX—St. Louis, Mo.; Voice of St. Louis (Inc.); 50 KW.

1100 KILOCYCLES—272.6 METERS

WPG—Atlantic City, N. J.; WPG Broadcasting Corporation; 5 KW.
WLWL—New York, N. Y.; T—Kearny, N. J.; Missionary Society of St. Paul the Apostle; 5 KW.
KGDM—Stockton, Calif.; E. F. Peffer; 250 W.

1110 KILOCYCLES—270.1 METERS

WRVA—Richmond, Va.; T—Mechanicsville, Va.; Larus & Brother Co. (Inc.); 5 KW.
KSOO—Sioux Falls, S. Dak.; Sioux Falls Broadcast Association (Inc.); 2½ KW.

1120 KILOCYCLES—267.7 METERS

WDEL—Wilmington, Del.; WDEL (Inc.); 350 W.*
WTAW—College Station, Tex.; Agricultural and Mechanics College of Texas; 500 W.
KTRH—Houston, Tex.; Rice Hotel; 500 W.
WISN—Milwaukee, Wis.; American Radio News Corp.; 250 W.
WHAD—Milwaukee, Wis.; Marquette University; 250 W.
KFSG—Los Angeles, Calif.; Echo Park Evangelistic Association; 500 W.
KRKD—Inglewood, Calif.; Fireside Bdcg. Co.; 500 W. (1 KW. C.P.)
KRSC—Seattle, Wash.; Radio Sales Corporation; 100 W.
KFIO—Spokane, Wash.; Spokane Broadcasting Corporation; 100 W.
CFCA—Toronto, Ontario, Can.; Star Publishing & Printing Co.; 500 W.
CFJC—Kamloops, British Columbia, Can.; S. D. Dalgleish & Sons, Ltd.; 100 W.
CHGS—Summerside, Prince Edward Island, Can.; R. T. Holman, Ltd.; 500 W.

1120 KILOCYCLES—267.7 METERS (Cont.)

CJOC—Lethbridge, Alberta, Can.; H. R. Carson; 100 W.
CNRT—Toronto, Ontario, Can.; (Uses transmitter of CFCA); Canadian National Railways; 500 W.

1125 KILOCYCLES—266.6 METERS

CMHJ—Cienfuegos, Cuba; Arturo Hernandez; 40 W.

1130 KILOCYCLES—265.3 METERS

WOV—New York City; T—Secaucus, N. J.; International Broadcasting Corporation; 1 KW.
WJJD—Moosehart, Ill.; WJJD, Inc.; 20 KW.
KSL—Salt Lake City, Utah; Radio Service Corporation of Utah; 5 KW. (50 KW.—C. P.).
XEH—Monterrey, N. L., Mex.; Constantino Tarnaca; 1 KW. (Actual frequency 1,132 KC.—265 Meters).

1140 KILOCYCLES—263.0 METERS

WAPI—Birmingham, Ala.; WAPI Broadcasting Corp.; 5 KW.
KVOO—Tulsa, Okla.; Southwestern Sales Corporation; 5 KW. (25 KW.—C.P.).
CMBW—Havana, Cuba; Modesto Alvarez; 150 W.
CMCQ—Havana, Cuba; Andres Martinez; 1 KW.
XETA—Mexico, D. F.; M. E. Taglo; 500 W.

1150 KILOCYCLES—260.7 METERS

WHAM—Rochester, N. Y.; T—Victor Township, N. Y.; Stromberg-Carlson Telephone Manufacturing Co.; 5 KW.
CMGI—Colon, Cuba; Armando Lizama; 30 W.

1160 KILOCYCLES—258.5 METERS

WWVA—Wheeling, W. Va.; West Virginia Broadcasting Corporation; 5 KW.
WOWO—Fort Wayne, Ind.; Main Auto Supply Co.; 10 KW.

1170 KILOCYCLES—256.3 METERS

WCAU—Philadelphia, Pa.; T—Byberry; Universal Broadcasting Co.; 10 KW.

1180 KILOCYCLES—254.1 METERS

WINS—New York, N. Y.; T—Astoria, L. I., N. Y.; American Radio News Corp.; 500 W.
WDGY—Minneapolis, Minn.; Dr. George W. Young; 1 KW.
KEX—Portland, Ore.; Western Broadcasting Co.; 5 KW.
KOB—State College, N. Mex.; New Mexico College of Agriculture and Mechanic Arts, 20 KW.
WMAZ—Macon, Ga.; Southern Broadcasting Co., Inc.; 500 W.
CMJE—Camaguey, Cuba; Manuel Fernandez; 30 W.

1190 KILOCYCLES—252.0 METERS

WOAI—San Antonio, Tex.; T—Selma, Tex.; Southern Equipment Co.; 50 KW.

1200 KILOCYCLES—249.9 METERS

WRBL—Columbus, Ga.; WRBL Radio Station Inc.; 100 W.
WABI—Bangor, Me.; Universalist Society of Bangor; 100 W.
WNBX—Springfield, Vt.; First Congregational Church Corporation; 10 W.
WCAX—Burlington, Vt.; Burlington Daily News; 100 W.
WORC-WEPS—Worcester, Mass.; T—Auburn, Mass.; Albert Frank Kleindeinst; 100 W.
KERN—Bakersfield, Calif.; Bakersfield Bdcg. Co.; 100 W.
WIBX—Utica, N. Y.; WIBX (Inc.); 300 W.*
WFBE—Cincinnati, Ohio; Post Publishing Co.; 250 W.*
WHBC—Canton, Ohio; St. John's Catholic Church; 10 W.
WLBG—Petersburg, Va.; T—Ettrick, Va.; WLBG Inc.; 250W.*
WNBO—Washington, Pa.; John Brownlee Spriggs; 100 W.
WCOD—Harrisburg, Pa.; Keystone Broadcasting Corporation; 100 W.
WNBW—Carbondale, Pa.; WNBW, Inc.; 10 W.
KMLB—Monroe, La.; J. C. Liner; 100 W.
WABZ—New Orleans, La.; Samuel D. Reeks; 100 W.
WJBW—New Orleans, La.; C. Carlson; 100 W.
WBBZ—Ponca City, Okla.; C. L. Carrell; 100 W.
WFBC—Knoxville, Tenn.; Virgil V. Evans; 50 W.
KGHI—Little Rock, Ark.; O. A. Cook; 100 W.
KBTM—Paragould, Ark.; W. J. Beard, Beard's Temple of Music; 100 W.
WJBC—La Salle, Ill.; Wayne Hummer & H. J. Dee, doing business as Kaskaskia Broadcasting Co.; 100 W.
WJBL—Decatur, Ill.; Commodore Broadcasting Corporation; 100 W.
WWAE—Hammond, Ind.; Hammond-Calumet Broadcasting Corporation; 100 W.
KFJB—Marshalltown, Iowa; Marshall Electric Co. (Inc.); 250 W.*
WCAT—Rapid City, S. Dak.; South Dakota State School of Mines; 100 W.
KGDY—Huron, S. Dak.; Voice of South Dakota; 100 W.
KFWF—St. Louis, Mo.; St. Louis Truth Center (Inc.); 100 W.
KGDE—Fergus Falls, Minn.; Jaren Drug Co.; 250W.*
WCLO—Janesville, Wis.; WCLO Radio Corporation; 100 W.
WHBY—Green Bay, Wis.; T—West De Pere, Wis.; St. Norbert College; 100 W.
WIL—St. Louis, Mo.; Missouri Broadcasting Corporation; 250 W.*
KGFJ—Los Angeles, Calif.; Ben S. McGlashan; 100 W.
KGVO—Missoula, Mich.; Mosby's (Inc.); 100 W.
KFXD—Nampa, Idaho; Frank E. Hurt, trading as Service Radio Co.; 500 W.
KFXJ—Grand Junction, Colo.; Western Slope Bdcg. Co., 100 W.
KWG—Stockton, Calif.; Portable Wireless Telephone Co. (Inc.); 100 W.
KGEK—Yuma, Colo.; Elmer C. Beehler, trading as Beehler Electrical Equipment Co.; 100 W.
KGEW—Fort Morgan, Colo.; City of Fort Morgan; 100 W.
KVOS—Bellingham, Wash.; KVOS (Inc.); 100 W.
WFAM—South Bend, Ind.; South Bend Tribune; 100 W.
WBHS—Huntsville, Ala.; The Hutchens Co.; 100 W.
CKOV—Kelowna, British Columbia, Can.; J. W. B. Browne; 100 W.
10AB—Moose Jaw, Saskatchewan, Can.; Moose Jaw Radio Assn.; 25 W.
10AK—Stratford, Ontario, Can.; Classic Radio Club; 10 W.
10BJ—Prince Albert, Saskatchewan, Can.; Prince Albert Radio Club; 25 W.
10BP—Wingham, Ontario, Can.; Wingham Radio Club; 15 W.
10BQ—Brantford, Ontario, Can.; Telephone City Radio Assn.; 5 W.
10BU—Canora, Saskatchewan, Can.; Canora Radio Association; 15 W.

1205 KILOCYCLES—248.8 METERS

CMGB—Matanzas, Cuba; Jose Anorga; 30 W.

1210 KILOCYCLES—247.8 METERS

WMRJ—Jamaica, N. Y.; Peter J. Prinz; 100 W.
WJBI—Redbank, N. J.; Monmouth Broadcasting Co.; 100 W.
WGBB—Freeport, N. Y.; Harry H. Carman; 100 W.
WCOH—Yonkers, N. Y.; T—Greenville, N. Y.; Westchester Broadcasting Corporation, 100 W.
KGY—Olympia, Wash.; KGY Inc.; 100 W.
WOCL—Jamestown, N. Y.; A. E. Newton; 50 W.
WLCI—Ithaca, N. Y.; Lutheran Association of Ithaca, N. Y.; 50 W.
WPAW—Pawtucket, R. I.; Shartenberg & Robinson Co.; 100 W.
WSEN—Columbus, Ohio; Columbus Broadcasting Corporation; 100 W.
WJW—Mansfield, Ohio; John F. Weimer (owner Mansfield Broadcasting Association); 100 W.
WALR—Zanesville, Ohio; WALR Broadcasting Corp.; 100 W.
WBAX—Wilkes-Barre, Pa.; T—Plains Township, Pa.; John H. Stenger, Jr.; 100 W.
WJBU—Lewisburg, Pa.; Bucknell University; 100 W.
WBBL—Richmond, Va.; Grace Covenant Presbyterian Church; 100 W.
WMBG—Richmond, Va.; Havens & Martin (Inc.); 100 W.

1210 KILOCYCLES—247.8 METERS (Cont.)

WSIX—Springfield, Tenn.; Jack M. and Louis R. Draughon, doing business as 638 Tire and Vulcanizing Co.; 100 W.
WSOC—Gastonia, N. C.; WSOC (Inc.); 100 W.
WJBY—Gadsden, Ala.; Gadsden Broadcasting Co. (Inc.); 100 W.
WQDX—Thomasville, Ga.; Stevens Luke; 50 W.
WRBQ—Greenville, Miss.; J. Pat Scully; 250 W.*
KWEA—Shreveport, La.; Hello World Broadcasting Corporation; 100 W.
KDLR—Devils Lake, N. Dak.; KDLR (Inc.); 100 W.
KGCR—Watertown, S. Dak.; Greater Kampeska Radio Corp.; 100 W.
KFOR—Lincoln, Nebr.; Howard A. Shuman; 250 W.*
WHBU—Anderson, Ind.; Anderson Broadcasting Corp.; 100 W.
WEBQ—Harrisburg, Ill.; Harrisburg Bdcstg Co.; 100 W.
—Troy, Ala.; Troy Bdcg. Co.; 100 W.
WSBC—Chicago, Ill.; World Battery Co. (Inc.); 100 W.
WCRW—Chicago, Ill.; Clinton R. White; 100 W.
WEDC—Chicago, Ill.; Emil Denemark (Inc.); 100 W.
WCBS—Springfield, Ill.; Chas. H. Messter and Harold L. Dewing; 100 W.
WTAX—Springfield, Ill.; WTAX (Inc.); 100 W.
WHBF—Rock Island, Ill.; Beardsley Specialty Co.; 100 W.
WOMT—Manitowoc, Wis.; Francis M. Kadow; 100 W.
WIBU—Poynette, Wis.; William C. Forrest; 100 W.
KGNO—Dodge City, Kans.; Dodge City Broadcasting Co. (Inc.); 100 W.
KGRS—Amarillo, Tex.; E. B. Gish; 1 KW.
KFXM—San Bernardino, Calif.; J. C. & E. W. Lee (Lee Bros. Broadcasting Co.); 100 W.
KFVS—Cape Girardeau, Mo.; Oscar C. Hirsch, trading as Hirsch Battery & Radio Co.; 100 W.
KPPC—Pasadena, Calif.; Pasadena Presbyterian Church; 50 W.
KFJI—Klamath Falls, Ore.; KFJI Broadcasters, Inc.; 100 W.
WPRO—Providence, R. I.; Cherry & Webb Broadcasting Co.; 100 W.
KGMP—Elk City, Okla.; Bryant Radio & Electric Co.; 100 W.
KGY—Olympia, Wash.; KGY, Inc.; 100 W.
CFCO—Chatham, Ontario, Can.; John Beardall; 100 W.
CFNB—Fredericton, New Brunswick, Can.; Jas. S. Neill & Sons, Ltd.; 50 W.
CJOR—Vancouver, British Columbia, Can.; T—Sea Island, British Columbia, Can.; G. C. Chandler; 500 W.
CKMC—Cobalt, Ontario, Can.; R. L. MacAdam; 100 W.
XEX—Mexico City, Mex.; Excelsior; 500 W.

1220 KILOCYCLES—245.8 METERS

WCAD—Canton, N. Y.; St. Lawrence University; 500 W.
WCAE—Pittsburgh, Pa.; WCAE, Inc.; 1 KW.
WDAE—Tampa, Fla.; Tampa Publishing Co.; 1 KW.
WREN—Tanganoxie, Kans.; Jenny Wren Co.; 1 KW.
KFKU—Lawrence, Kans.; University of Kansas; 500 W.
KWSC—Pullman, Wash.; State College of Washington; 2 KW.*
KTW—Seattle, Wash.; First Presbyterian Church; 1 KW.

1225 KILOCYCLES—244.8 METERS

CMBY—Havana, Cuba; Callejas-Cosculluela; 350 W.

1230 KILOCYCLES—243.8 METERS

WNAC-WBIS—Boston, Mass.; T—Quincy, Mass.; Shepard Broadcasting Service (Inc.); 1 KW.
WPSC—State College, Pa.; The Pennsylvania State College; 500 W.
WSBT—South Bend, Ind.; South Bend Tribune; 500 W.
WFBM—Indianapolis, Ind.; Indianapolis Power & Light Co.; 1 KW.
KGGM—Albuquerque, N. Mex.; New Mexico Broadcasting Co.; 500 W.*
KYA—San Francisco, Calif.; Pacific Broadcasting Corporation; 1 KW.
KFQD—Anchorage, Alaska; Anchorage Radio Club; 250 W.
XETQ—Mexico City, Mex.; Carlos G. Caballero; 100 W.

1235 KILOCYCLES—242.8 METERS

CMCA—Havana, Cuba; Manuel Cruz; 150 W.

1240 KILOCYCLES—241.8 METERS

WXYZ—Detroit, Mich.; Kunsky-Trendle Broadcasting Corporation; 1 KW.
KTAT—Fort Worth, Tex.; T—Birdville, Tex.; S. A. T. Broadcast Co.; 1 KW.
WACO—Waco, Tex.; Central Texas Broadcasting Co. (Inc.); 1 KW.
KGCU—Mandan, N. Dak.; Mandan Radio Assn.; 250 W.
KLPM—Minot, N. Dak.; John B. Cooley; 250 W.
KTFI—Twin Falls, Idaho; Radio Bdcg. Corp.; 500 W.

1249 KILOCYCLES—240 METERS

CMAB—Pinar del Rio, Cuba; Francisco Martinez; 20 W.

1250 KILOCYCLES—239.9 METERS

WGCP—Newark, N. J.; May Radio Broadcast Corporation; 250 W.
WODA—Paterson, N. J.; Richard E. O'Dea; 1 KW.
WAAM—Newark, N. J.; WAAM (Inc.); 2 KW.*
WDSU—New Orleans, La.; T—Gretna, La.; Joseph H. Uhalt; 1 KW.
WLB—Minneapolis, Minn.; T—St. Paul, Minn.; University of Minnesota; 1 KW.
WRHM—Minneapolis, Minn.; T—Fridley, Minn.; Minnesota Broadcasting Corporation; 1 KW.
KFMX—Northfield, Minn.; Carlton College; 1 KW.
WCAL—Northfield, Minn.; St. Olaf College; 1 KW.
KFOX—Long Beach, Calif.; Nichols and Warriner (Inc.); 1 KW.
XEFA—Mexico City, Mex.; Manuel F. Murguia; 250 W.

1260 KILOCYCLES—238.0 METERS

WNBX—Springfield, Vt.; First Congreg. Church Corp., 250 W. day.
WLBW—Erie, Pa.; Broadcasters of Pennsylvania, Inc.; 1 K*
KWWG—Brownsville, Tex.; Frank P. Jackson; 500 W.
WTOC—Savannah, Ga.; Savannah Broadcasting Co. (Inc.); 500 W.
KRGV—Harlingen, Tex.; KRGV (Inc.); 500 W.
KOIL—Council Bluffs, Iowa; Mona Motor Oil Co.; 1 KW.
KVOA—Tuscon, Ariz.; Robert M. Riculfi; 500 W.

1270 KILOCYCLES—236.1 METERS

WEAI—Ithaca, N. Y.; Cornell University; 1 KW.
WFBR—Baltimore, Md.; Baltimore Radio Show (Inc.); 500 W.
WASH—Grand Rapids, Mich. (Uses transmitter of WOOD); WASH Broadcasting Corporation; 500 W. (1 KW.—C.P.).
WOOD—Grand Rapids, Mich.; T—Furn-Kunsky-Trendle Broadcasting Corp.; 500 W.
WJDX—Jackson, Miss.; Lamar Life Insurance Co.; 1 KW.
KWLC—Decorah, Iowa; Luther College; 100 W.
KGCA—Decorah, Iowa; Charles W. Greenley; 100 W.
KOL—Seattle, Wash.; Seattle Broadcasting Co. (Inc.); 1 KW.
KVOR—Colorado Springs, Colo.; Reynolds Radio Co., Inc.; 1 KW.
CMCU—Havana, Cuba; Jorge Garcia Serra; 150 W.

1280 KILOCYCLES—234.2 METERS

WCAM—Camden, N. J.; City of Camden; 500 W.
WCAP—Asbury Park, N. J.; Radio Industries Broadcast Co.; 500 W.
WOAX—Trenton, N. J.; WOAX (Inc.); 500 W.
WDOD—Chattanooga, Tenn.; T—Brainerd, Tenn.; WDOD Broadcasting Corporation; 1 KW. (5 KW.—C.P.).
WRR—Dallas, Tex.; City of Dallas, Tex.; 500 W.
WIBA—Madison, Wis.; Badger Broadcasting Co.; 500 W.
KFBB—Great Falls, Mont.; Buttrey Broadcast (Inc.); 2½ KW.*

1285 KILOCYCLES—233.4 METERS

CMCW—Havana, Cuba; Jose Lorenzo; 150 W.

1290 KILOCYCLES—232.4 METERS

WNBZ—Saranac Lake, N. Y.; Earl J. Smith and William Mace, doing business as Smith & Mace; 50 W.
WJAS—Pittsburgh, Pa.; T—North Fayette Township, Pa.; Pittsburgh Radio Supply House; 2½ KW.*
KTSA—San Antonio, Tex.; Southwest Broadcasting Co.; 2 KW.
KFUL—Galveston, Tex.; News Publishing Co.; 500 W.
KLCN—Blytheville, Ark.; Charles Leo Lintzenich; 50 W.
WEBC—Superior, Wisc.; Head of the Lakes Broadcasting Co.; 2½ KC.*
KDYL—Salt Lake City, Utah; Intermountain Broadcasting Corporation; 1 KW.

1300 KILOCYCLES—230.6 METERS

WBBR—Brooklyn, N. Y.; T—Rossville, N. Y. (Staten Island); Peoples Pulpit Association; 1 KW.
WFAB—New York, N. Y.; T—Carlstadt, N. J.; Defenders of Truth Society (Inc.); 1 KW.
WEVD—New York, N. Y.; T—Forest Hills, N. Y.; Debs Memorial Radio Fund (Inc.); 500 W.
WHAZ—Troy, N. Y.; Rensselaer Polytechnic Institute; 500 W.
WIOD—WMBF—Miami, Fla.; T—Miami Beach, Fla.; Isle of Dreams Broadcasting Corporation; 1 KW.
WOQ—Kansas City, Mo.; Unity School of Christianity; 1 KW.
Corporation; 1KW.
KFH—Wichita, Kans.; Radio Station KFH Co.; 1 KW.
KFJR—Portland, Ore.; Ashley C. Dixon, trading as Ashley C. Dixon & Son; 500 W.
KALE—Kale, Inc.; 500 W.
KTBR—Portland, Ore.; M. E. Brown; 500 W.
KFAC—Los Angeles, Calif.; Los Angeles Broadcasting Co.; 1 KW.
XEM—Mexico City, Mex.; Maria T. de Gutierez; 250 W.

1310 KILOCYCLES—228.9 METERS

WKBS—Galesburg, Ill.; S. E. Yaste and Burrell Banash; 100 W.
WKAV—Laconia, N. H.; Laconia Radio Club; 100 W.
WEBR—Buffalo, N. Y.; Howell Broadcasting Co. (Inc.); 250 W.*
WMBO—Auburn, N. Y.; WMBO, Inc.; 100 W.
WNBH—New Bedford, Mass.; T—Fairhaven, Mass.; Irving Vermilya, trading as New Bedford Broadcasting Co.; 100 W.
WOL—Washington, D. C.; American Broadcasting Co.; 100 W.
WGH—Newport News, Va.; Hampton Roads Broadcasting Corporation; 100 W.
WEXL—Royal Oak, Mich.; Royal Oak Broadcasting Co.; 50 W.
WFDF—Flint, Mich.; Frank D. Fallain; 100 W.
WBEO—Marquette, Mich.; Lake Superior Broadcasting Co.; 100 W.
WHAT—Philadelphia, Pa.; Independence Broadcasting Co.; 100 W.
WTEL—Philadelphia, Pa.; Foulkrod Radio Engineering Co.; 100 W.
WJAC—Johnstown, Pa.; Johnstown Automobile Co.; 100 W.
WFBG—Altoona, Pa.; William F. Gable Co.; 100 W.
WRAW—Reading, Pa.; Reading Broadcasting Co.; 100 W.
WGAL—Lancaster, Pa.; WGAL, Incorporated; 100 W.
WSAJ—Grove City, Pa.; Grove City College; 100 W.
WBRE—Wilkes-Barre, Pa.; Louis G. Baltimore; 100 W.
WKBC—Birmingham, Ala.; R. B. Broyles, trading as R. B. Broyles Furniture Co.; 100 W.
WTJS—Jackson, Tenn.; Sun Pub. Co.; 100 W.
WTRC—Elkhart, Ind.; Elkhart Daily Truth; 50 W.
WTSL—Laurel, Miss.; G. H. Houseman; 100 W.
WROL—Knoxville, Tenn.; Stuart Broadcasting Corporation; 100 W.
KRMD—Shreveport, La.; Radio Station KRMD, Inc.; 100 W.
WSJS—Winston-Salem, N. C.; Winston-Salem Journal Co.; 100 W.
KTLC—Houston, Tex.; Houston Broadcasting Co.; 100 W.
KFPM—Greenville, Tex.; Dave Ablowich, trading as The New Furniture Co.; 15 W.
KTSM—El Paso, Tex.; Tri-State Bdcstg Co., Inc.; 100 W.
WDAH—El Paso, Tex.; Tri-State Bdcstg Co., Inc.; 100 W.
KFPL—Dublin, Tex.; C. C. Baxter; 100 W.
KFXR—Oklahoma City, Okla.; Exchange Avenue Baptist Church; 250 W.*
WKBS—Galesburg, Ill.; Permil N. Nelson; 100 W.
WCLS—Joliet, Ill.; WCLS (Inc.); 100 W.
WKBB—Joliet, Ill.; Sanders Brothers Radio Station; 100 W.
KFGQ—Boone, Iowa; Boone Biblical College; 100 W.
KGFW—Ravenna, Nebr.; Central Nebraska Broadcasting Corporation; 100 W.
WBOW—Terre Haute, Ind.; Banks of Wabash (Inc.); 100 W.
WJAK—Marion, Ind.; Marion Broadcast Co.; 50 W.
WLBC—Muncie, Ind.; Donald H. Burton; 50 W.
KGBX—St. Joseph, Mo.; KGBX (Inc.); 100 W.
KFBK—Sacramento, Calif.; James McClatchy Co.; 100 W.
KCRJ—Jerome, Ariz.; Charles C. Robinson; 100 W.
KGCX—Wolf Point, Mont.; First State Bank of Vida; 250 W.*
KGEZ—Kalispell, Mont.; Donald C. Treloar; 100 W.
KMED—Medford, Ore.; Mrs. W. J. Virgin; 100 W.
KXRO—Aberdeen, Wash.; KXRO (Inc.); 100 W.
KIT—Yakima, Wash.; Carl E. Haymond; 100 W.
KFYO—Lubbock, Tex.; Kirksey Bros.; 250 W.
WIAS—Iowa Bdcstg Co., Ottumwa, Ia.; 100 W.

1320 KILOCYCLES—227.1 METERS

WADC—Akron, Ga.; Allen T. Simmons; 1 KW.
WSMB—New Orleans, La.; Saenger Theatres (Inc.) and Maison Blanche Co.; 500 W.
KID—Idaho Falls, Idaho; KID Broadcasting Co.; 500 W.*
KGHF—Pueblo, Colo.; Curtis P. Ritchie and Joe E. Finch; 500 W.*
KGMB—Honolulu, Hawaii; Honolulu Broadcasting Co. (Ltd.); 250 W.

1330 KILOCYCLES—225.4 METERS

KMO—Tacoma, Wash.; KMO, Inc.; 250 W.
WDRC—Hartford, Conn.; T—Bloomfield, Conn.; WDRC (Inc.); 500 W.
WSAI—Cincinnati, O.; T—Mason, Ohio; Crosley Radio Corporation (lessee); 1 KW.*
WTAQ—Eau Claire, Wis.; T—Township of Washington, Wis.; Gillette Rubber Co.; 1 KW.
KSCJ—Sioux City, Iowa; Perkins Brothers Co.; 2½ KW.*
KGB—San Diego, Calif.; Don Lee, Inc.; 500 W.

1340 KILOCYCLES—223.7 METERS

KGIR—Butte, Mont.; KGIR (Inc.); 500 W.
WSPD—Toledo, Ohio; Toledo Broadcasting Co.; 1 KW.
KFPW—Fort Smith, Ark.; Southwestern Hotel Co.; 50 W.
WCOA—Pensacola, Fla.; Pensacola Bdcg. Co.; 500 W.
KFPY—Spokane, Wash.; Symons Broadcasting Co.; 1 KW.

1345 KILOCYCLES—223 METERS

CMCR—Havana, Cuba; Aurelio Hernandez; 150 W.
CMCY—Havana, Cuba; M. D. Autran; 250 W.

1350 KILOCYCLES—222.1 METERS

WAWZ—Zarephath, N. J.; Pillar of Fire; 250 W.
WMSG—New York, N. Y.; Madison Square Garden Broadcast Corporation; 250 W.
WCDA—New York, N. Y.; T—Cliffside Park, N. J.; Italian Educational Broadcasting Co. (Inc.); 250 W.
WBNX—New York, N. Y.; Standard Cahill Co. (Inc.); 250 W.
KWKK—St. Louis, Mo.; T—Kirkwood, Mo.; Greater St. Louis Broadcasting Corporation; 1 KW.

1350 KILOCYCLES—222.1 METERS (Cont.)

WEHC—Emory, Va.; Emory & Henry College; 500 W.
KIDO—Boise, Idaho; Boise Broadcasting Station; 1 KW.

1360 KILOCYCLES—220.4 METERS

WFBL—Syracuse, N. Y.; Onondaga Radio Broadcasting Corporation; 1 KW.
WQBC—Vicksburg, Miss.; Delta Broadcasting Co. (Inc.); 500 W.
WCSC—Charleston, S. C.; South Carolina Broadcasting Co., Inc.; 500 W.
WJKS—Gary, Ill.; Johnson-Kennedy Radio Corporation; 1¼ KW.*
WGES—Chicago, Ill.; Oak Leaves Broadcasting Station (Inc.); 1 KW.*
KGER—Long Beach, Calif.; Consolidated Broadcasting Corp.; 1 KW.

(Continued on next page)

1370 KILOCYCLES—218.7 METERS

WRDO—Augusta, Me.; WRDO, Inc.; 100 W.
WQDM—St. Albans, Vt.; A. J. St. Antoine and E. J. Regan; 100 W.
WLEY—Lexington, Mass.; Carl S. Wheeler, trading as Lexington Air Stations; 250 W.*
WSVS—Buffalo, N. Y.; Elmer S. Pierce, principal, Seneca Vocational High School; 50 W.
WBGF—Glens Falls, N. Y.; W. Neal Parker and Herbert H. Metcalfe; 50W.
WCBM—Baltimore, Md.; Baltimore Broadcasting Corporation; 250 W.*
WBTM—Danville, Va.; L. H., R. G. and A. S. Clarke, doing business as Clarke Electric Co.; 100 W.
WLVA—Lynchburg, Va.; Lynchburg Broadcasting Corporation; 100 W.
WHBD—Mount Orab, Ohio; F. P. Moler; 100 W.
WHDF—Calumet, Mich.; Upper Michigan Broadcasting Co.; 250 W.*
WJBK—Highland Park, Mich.; James F. Hopkins (Inc.); 50 W.
WIBM—Jackson, Mich.; WIBM (Inc.); 100 W.
WRAK—Williamsport, Pa.; Clarence R. Cummins; 100 W.
WHBQ—Memphis, Tenn.; Broadcasting Station WHBQ (Inc.); 100 W.
KGFG—Oklahoma City, Okla.; Oklahoma Broadcasting Co. (Inc.); 100 W.
KCRC—Enid, Okla.; Enid Radiphone Co.; 250 W.*
WMBR—Tampa, Fla.; F. J. Reynolds; 100 W.
KMAC—San Antonio, Tex.; W. W. McAllister; 100 W.
KFJZ—Fort Worth, Tex.; Ralph S. Bishop; 100 W.
KONO—San Antonio, Tex.; Mission Broadcasting Co.; 100 W.
KGKL—San Angelo, Tex.; KGKL (Inc.), 100 W.
KFLX—Galveston, Tex.; George Roy Clough; 100 W.
WGL—Fort Wayne, Ind.; Fred C. Zeig (Allen-Wayne Co.); 100 W.
KGDA—Mitchell, S. Dak.; Mitchell Broadcasting Corporation; 100 W.
KICA—Clovis, N.M., Southwest Broadcasting Co.; 100 W.
KFJM—Great Forks, N. Dak.; University of North Dakota; 100 W.
KWKC—Kansas City, Mo.; Wilson Duncan, trading as Wilson Duncan Broadcasting Co.; 100 W.
WRJN—Racine, Wis.; Racine Broadcasting Corporation; 100 W.
KGAR—Tucson, Ariz.; Tucson Motor Service; 250 W.*
KRE—Berkeley, Calif.; First Congregational Church of Berkeley; 100 W.
KOOS—Marshfield, Ore.; H. H. Hansetly (Inc.); 100 W.
KFBL—Everett, Wash.; Otto Leese and Robert Leese, doing business as Leese Bros.; 50 W.
KVL—Seattle, Wash.; KVL, Incorporated; 100 W.
KGFL—Raton, N. Mex.; KGFL, Inc.; 50 W.
KUJ—Walla Walla, Wash.; KUJ, Inc.; 100 W.
WRAM—Wilmington, N. C.; Wilmington Radio Asso.; 100 W.
WJTL—Tifton, Ga.; Oglethorpe University; 100 W.
WPFB—Hattiesburg, Miss.; Hattiesburg Bdcg. Corp.; 100 W.
CMGH—Matanzas, Cuba; Alberto Alvarez; 150 W.

1375 KILOCYCLES—218 METERS

CMAC—Pinar del Rio, Cuba; Oscar S. Mechoso; 30 W.
CMGE—Cardenas, Cuba; Genaro Sebater; 30 W.

1380 KILOCYCLES—217.3 METERS

WSMK—Dayton, Ohio; Stanley M. Krohn, Jr.; 200 W.
KQV—Pittsburgh, Pa.; KQV, Inc.; 500 W.
KSO—Clarinda, Iowa; Iowa Broadcasting Co.; 100 W. night, 250 W. local sunset
WKBH—LaCrosse, Wis.; WKBH (Inc.); 1 KW.
KOH—Reno, Nev.; The Bee, Inc.; 500 W.
KQV—Pittsburgh, Pa.; KQV Broadcasting Co.; 500 W.
XETB—Torreon Coah., Mex.; Jose A. Berumen; 125 W.

1382 KILOCYCLES—217.25 METERS

CMJC—Camaguey, Cuba; Feliciano Isaac; 7,5 W.

1390 KILOCYCLES—215.7 METERS

WHK—Cleveland, Ohio; T—Seven Hills, Ohio; Radio Air Service Corporation; 1 KW.
KLRA—Little Rock, Ark.; Arkansas Broadcasting Co.; 1 KW.
KUOA—Fayetteville, Ark.; Southwestern Hotel Co.; 1 KW.
KOY—Phoenix, Ariz.; Nielsen Radio & Sporting Goods Co.; 500 W.

1395 KILOCYCLES—215 METERS

CMCG—Havana, Cuba; Jose Justo Moran; 30 W.

1400 KILOCYCLES—214.2 METERS

CMCH—Havana, Cuba; Hernani Torralbas; 20 W.
CMCM—Havana, Cuba; Martinez-Madicu; 15 W.
WCGU—Brooklyn, N. Y.; United States Broadcasting Corporation; 500 W.
WFOX—Brooklyn, N. Y.; Paramount Broadcasting Corporation; 500 W.
WLTH—Brooklyn, N. Y.; Voice of Brooklyn (Inc.); 500 W.
WBBC—Brooklyn, N. Y.; Brooklyn Broadcasting Corporation; 500 W.
KOCW—Chickasha, Okla.; J. T. Griffin; 500 W.
WCMA—Culver, Ind.; General Broadcasting Corporation; 500 W.
WKBF—Indianapolis, Ind.; T—Clermont, Ind.; Indianapolis Broadcasting (Inc.); 500 W.
WBAA—West Lafayette, Ind.; Purdue University; 1 KW.*
KLO—Ogden, Utah; Peery Building Co.; 500 W.
XEP—N. Laredo, Tams., Mex.; Asociacion Radiodifusora Latino-Americana, S. A.; 200 W.

1410 KILOCYCLES—212.6 METERS

WRBX—Roanoke, Va.; Richmond Development Corporation; 250 W.
WBCM—Bay City, Mich.; T—Hampton Township, Mich.; James E. Davidson; 500 W.
KGRS—Amarillo, Tex.; E. B. Gish (Gish Radio Service); 1 KW.
WDAG—Amarillo, Tex.; National Radio and Broadcasting Corporation; 1 KW.
WODX—Mobile, Ala.; T—Springhill, Ala.; Mobile Broadcasting Corporation; 500 W.
WSFA—Montgomery, Ala.; Montgomery Broadcasting Co. (Inc.); 500 W.
KFLV—Rockford, Ill.; Rockford Broadcasters (Inc.); 500 W.
WHBL—Sheboygan, Wis.; Press Publishing Co.; 500 W.
WAAB—Boston, Mass.; Bay State Broadcasting Corp.; 500 W.
WHIS—Bluefield, W. Va.; Daily Telegraph; 250 W.

1420 KILOCYCLES—211.1 METERS

WTBO—Cumberland, Md.; Associated Broadcasting Corporation; 210 W.*
WILM—Wilmington, Del.; T—Edge Moor, Del.; Delaware Broadcasting Co. (Inc.); 100 W.
WMAS—Springfield, Mass.; Albert S. Moffat; 100 W.
WPAD—Paducah, Ky.; Paducah Broadcasting Co., Inc.; 100 W.
WJMS—Ironwood, Mich.; WJMS, Inc.; 100 W.
KWCR—Cedar Rapids Bdcg Co.; Cedar Rapids, Ia.; 250 W.*
WERE—Erie, Pa.; Erie Dispatch-Herald Broadcasting Corporation; 100 W.
WMBC—Detroit, Mich.; Michigan Broadcasting Co.; 210 W.*
WELL—Battle Creek, Mich.; Enquirer-News Co.; 50 W.
WFDW—Anniston, Ala. T—Talladega, Ala.; Raymond C. Hammett; 100 W.
WJBO—New Orleans, La.; Valdemar Jensen; 100 W.
KGFF—Shawnee, Okla.; D. R. Wallace (owner KGFF Broadcasting Co.); 100 W.
KABC—San Antonio, Tex.; Alamo Broadcasting Co. (Inc.); 100 W.

WSPA—Spartanburg, S. C.; Virgil V. Evans, trading as The Voice of South Carolina; 250 W.*
KICK—Red Oak, Iowa; Red Oak Radio Corporation; 100 W.
WLBF—Kansas City, Kans.; The WLBF Broadcasting Co.; 100 W.
WMBH—Joplin, Mo.; Edwin Dudley Aber; 250 W.*
WEHS—Evanston, Ill.; WEHS (Inc.); 100 W.
WHFC—Cicero, Ill.; WHFC, Inc.; 100 W.
WKBI—Chicago, Ill.; WKBI, Inc.; 100 W.
KFIZ—Fond du Lac, Wis.; The Reporter Printing Co.; 100 W.
KFXY—Flagstaff, Ariz.; Albert H. Scherman; 100 W.
KGIX—Los Vegas, Nev.; Los Vegas Radio Corp.; 100 W.
KGIW—Trinidad, Colo.; Leonard E. Wilson; 100 W.
WMBH—Joplin, Mo.; W. M. Robertson; 250 W.*
KGKX—Sandpoint, Idaho; Sandpoint Broadcasting Co., 100 W.
KGGC—San Francisco, Calif.; The Golden Gate Broadcasting Co.; 100 W.
KXL—Portland, Ore.; KXL Broadcasters, Inc.; 100 W.
KBPS—Portland, Ore.; Benson Polytechnic School; 100 W.
KORE—Eugene, Ore.; Frank L. Hill and C. G. Phillips, doing business as Eugene Broadcast Station; 100 W.
WJMS—Ironwood, Mich.; Morris Johnson; 100 W.
WDEV—Waterbury, Vermont; Harry C. Whitehall; 50 W.
WENC—Americus, Ga.; Americus Broadcasting Co.; 100 W.
WAGM—Presque Isle, Me.; Aroostock Broadcasting Corp.; 100 W.
WHDL—Tupper Lake, N. Y., Tupper Lake Bdcg. Co., Inc.; 100 W.

1430 KILOCYCLES—209.7 METERS

WHP—Harrisburg, Pa.; T—Lemoyne, Pa.; WHP (Inc.); 1 KW.*
WBAK—Harrisburg, Pa.; Pennsylvania State Police, Commonwealth of Pennsylvania; 1 KW.*
WCAH—Columbus, Ohio; Commercial Radio Service Co.; 500 W.
WNBR—Memphis, Tenn.; Memphis Broadcasting Co.; 500 W.
KGNF—North Platte, Nebr.; Great Plains Broadcasting Co.; 500 W.
KECA—Los Angeles, Calif.; Earle C. Anthony, Inc.; 1 KW.
WFEA—Manchester, N. H.; New Hampshire Broadcasting Co.; 500 W.
WHEC—Rochester, N. Y.; WHEC, Inc.; 500 W.
WOKO-WABO—Albany, N. Y.; T—Mount Beacon, N. Y.; WOKO (Inc.); 500 W.

1440 KILOCYCLES—208.2 METERS

WCBA—Allentown, Pa.; B. Bryan Musselman; 250 W.
WSAN—Allentown, Pa.; Allentown Call Publishing Co. (Inc.); 250 W.
WBIG—Greensboro, N. C.; North Carolina Broadcasting Co. (Inc.); 1 KW Daytime.
WTAD—Quincy, Ill.; Illinois Broadcasting Corporation; 500 W.
WMBD—Peoria Heights, Ill.; E. M. Kahler (owner Peoria Heights Radio Laboratory); 1 KW.*
KXYZ—Houston, Tex.; Harris County Broadcast Co.; 250 W.
KLS—Oakland, Calif.; E. N. and S. W. Warner, doing business as Warner Bros.; 250 W.
WMBD—Peoria Heights, Ill.; Peoria Bdcg. Co.; 1 KW.
WTAD—Quincy, Ill.; Ill. Bdcg. Corp.; 500 W.
KDFN—Casper, Wyo.; Donald L. Hathaway; 500 W.
CMBI—Havana, Cuba; Francisco Mayorquim; 30 W.
CMBN—Havana, Cuba; Armado Romeu; 30 W.
CMBL—Havana, Cuba; Julio C. Hidalgo; 20 W.

1450 KILOCYCLES—206.8 METERS

WSAR—Fall River, Mass.; Doughty & Welch Elec. Co., Inc.; 250 W.
WHOM—Jersey City, N. J.; New Jersey Broadcasting Corporation; 250 W.
WSAR—Fall River, Mass.; Doughty & Welch Electric Co. (Inc.); 250 W.
WGAR—Cleveland, Ohio; WGAR Broadcasting Co.; 500 W.
WTFI—Athens, Ga.; Liberty Broadcasting Co.; 500 W.
KTBS—Shreveport, La.; Tri State Broadcasting System (Inc.); 1 KW.

1460 KILOCYCLES—205.4 METERS

WJSV—Alexandria, Va.; T—Mt. Vernon Hills, Va.; Old Dominion Broadcasting Co.; 10 KW.
KSTP—St. Paul, Minn.; T—Westcott, Minn.; National Battery Broadcasting Co.; 10 KW.

1470 KILOCYCLES—204.0 METERS

WLAC—Nashville, Tenn.; Life and Casualty Insurance Co.; 5 KW.
KGA—Spokane, Wash.; Northwest Broadcasting System (Inc.); 5 KW.

1480 KILOCYCLES—202.6 METERS

WKBW—Buffalo, N. Y.; T—Amherst, N. Y.; Buffalo Broadcasting Co.; 5 KW.
KFJF—Oklahoma City, Okla.; National Radio Manufacturing Co.; 5 KW.

1490 KILOCYCLES—201.2 METERS

WCKY—Covington, Ky.; T—Crescent Springs, Ky.; L. B. Wilson (Inc.); 5 KW.
WCHI—Chicago, Ill.; T—Batavia, Ill.; Midland Broadcasting Co.; 5 KW.

1500 KILOCYCLES—199.9 METERS

WFDV—Rome, Ga.; Rome Broadcasting Corp.; 100 W.
WMBA—Newport, R. I.; LeRoy Joseph Beebe; 100 W.
WLOE—Boston, Mass. T.—Chelsea, Mass.; Boston Broadcasting Co. 250 W.
WNBF—Binghamton, N. Y.; Howitt-Wood Radio Co. (Inc.); 100 W.
WMBQ—Brooklyn, N. Y.; Paul J. Gollhofer; 100 W.
WLBX—Long Island City, N. Y.; John N. Brahy; 100 W.
WWRL—Woodside, N. Y.; Long Island Broadcasting Corporation; 100 W.
WSYB—Rutland, Vt.; H. E. Seward, Jr., and Philip Weiss, doing business as Seward & Weiss Music Co.; 250 W.
WKBZ—Ludington, Mich.; Karl L. Ashbacker; 50 W.
WMPC—Lapeer, Mich.; First Methodist Protestant Church of Lapeer; 100 W.
WPEN—Philadelphia, Pa.; Wm. Penn Broadcasting Co.; 250 W*.
WWSW—Pittsburgh, Pa.; Walker & Downing Radio Corp.; 250 W Daytime.
WOPI—Bristol, Tenn.; Radiophone Broadcasting Station WOPI (Inc.) 100 W.
KNOW—Austin, Tex.; A. P. Miller; 100 W.
WRDW—Augusta, Ga.; Musicove (Inc.); 100 W.
KGFI—Corpus Christi, Tex.; Eagle Broadcasting Co. (Inc.); 250 W*.
KGKB—Tyler, Tex.; East Texas Bldg. Co.; 100 W.
KGIZ—Grant City, Mo.; Grant City Park Corporation; 100 W.
KGKY—Scottsbluff, Nebr.; Hillard Co. (Inc.); 100 W.
WKBV—Connersville, Ind.; William O. Knox, trading as Knox Battery & Electric Co.; 150 W*.
KGFK—Moorehead, Minn.; Red River Broadcasting Co. (Inc.); 50 W.
KPJM—Prescott, Ariz.; Scott and Sturm; 100 W.
KXO—El Centro, Calif.; E. R. Irey and F. M. Bowles; 100 W.
KDB—Santa Barbara, Calif.; Santa Barbara Broadcasters. Ltd.; 100 W.
KREG—Santa Ana, Calif.; The Voice of the Orange Empire, Inc., Ltd.; 100 W.
KPQ—Wenatchee, Wash.; Wescoast Broadcasting Co.; 50 W.
WMIL—Brooklyn, N. Y.; Arthur Faske; 100 W.
XETZ—Coyoacan, D. F., Mex.; Manuel Zetina; 100 W.
CMBQ—Havana, Cuba; Gali-Sardinas; 50 W.
CMBR—Havana, Cuba; Tomas Basail; 15 W.

BLUEPRINTS

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 @ ....25¢

628-B. Six-tube short-wave set, A-C operated; 15 to 200 meters; no plug-in coils. Intermediate frequency, 1,600 kc. Variable mu and pentode tubes. Order BP-628-B @ ....25¢

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Volume No. 1 (6 lbs.). Order Cat. RM-VO @ $5.00

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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 FORD MODEL—"A" Car and Model "AA" Truck—Construction, Operation and Repair—Revised New Edition. Ford Car authority. Victor W. Page. 708 pages, 318 illustrations. Price $2.50. Radio World. 145 W. 45th St., New York.

SHORT-WAVE BROADCAST STATIONS—Complete list of those on air and ordinarily receivable; also complete list of Short-Wave Commercial Stations, including Aircraft, Police and Identifying Stations, contained in Radio World issue of Dec. 3, 1932. 15c a copy. Rado World, 145 W. 45th St., 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.

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Radio World, 145 West 45th St., New York, N. Y.

MODULATED OSCILLATORS

Broadcast and Intermediate Frequencies

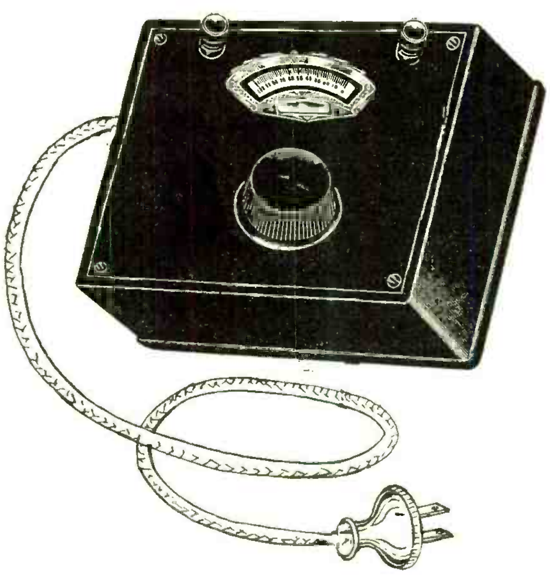
An a-c operated modulated oscillator (105-120 v., 50-60 c.), fully covering the broadcast band (1500 to 540 kc.) and all the commercial intermediate frequencies (115, 130, 172.5, 175, 177.5, 260, 400 and 450 kc.). The vernier dial has scale calibrated in broadcast frequencies, while the eight intermediate frequencies are also recorded directly on the scale. No chart references necessary. Accuracy is 3 per cent. or better, averaging better than 2 per cent. Broadcast calibration is for 10 kc. divisions at low frequency end, 20 kc. for rest.

Fundamental frequencies of oscillation will be from 50.7 to 153 kc, so that some intermediate frequencies may be tested on the fundamental, others on the second harmonic, while the broadcast band is taken care of by the tenth harmonic. No switching necessary despite wide frequency coverage. Sharp tuning, clear squeals in heterodyning, and strong modulation by the 60-cycle line frequency. No hum except at resonance. Frequency stability is of a high order, due to stabilized grid circuit. Calibration is for a 56 tube.

Cat. WOSC, @ $6.93
(56 tube is 87c extra)

Same as above, except for battery operation, with high audio frequency modulation, and requiring 3-volt dry battery and 22.5 volt B battery (not furnished). Tube required is the '30.

Cat. WOSCB, @ $6.53
(230 tube is $1.08 extra)

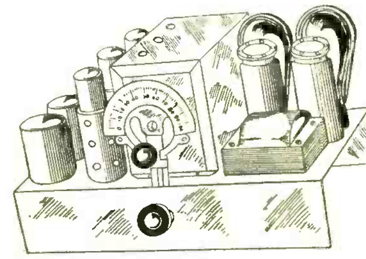


The modulated oscillator has vernier dial calibrated directly in frequencies, covering broadcasts and intermediate. The tube is inserted by removing the panel. Output post is at left, ground post at right.

Direct Radio Co., 143 West 45th Street, New York, N. Y.

DIAMOND PARTS

FIVE-TUBE MODEL



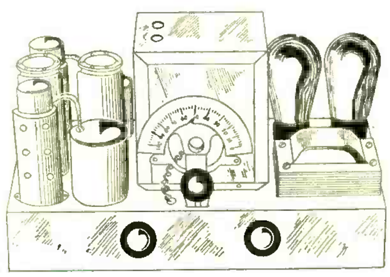
A-C operated circuit, 50-60 cycles, 105-120 volts, using two 58 t-r-f stages, 57 power detector and 47 output, with '80 rectifier. Three gang shielded condenser and shielded coils in a sensitive, selective and pure-tone circuit. Dynamic speaker field coil used as B supply choke. Complete kit of parts, including 8" Rola speaker and all else (except tubes and cabinet). Cat. D5CK @............$15.69
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

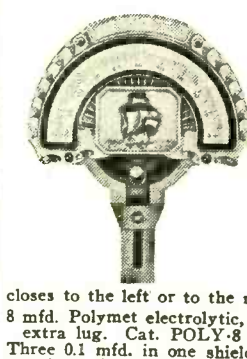


The four-tube model is similar, except that there is one stage of t-r-f, and a two-gang condenser is used. Tubes required, one 58, one 57, one 47 and one '80. Complete kit, including 8" Rola dynamic speaker (less tubes, less cabinet). Cat. D4CK $13.59

Kit of four Eveready-Raytheon tubes for this circuit. Cat 4D.TK 3.80

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 ⅜" 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.

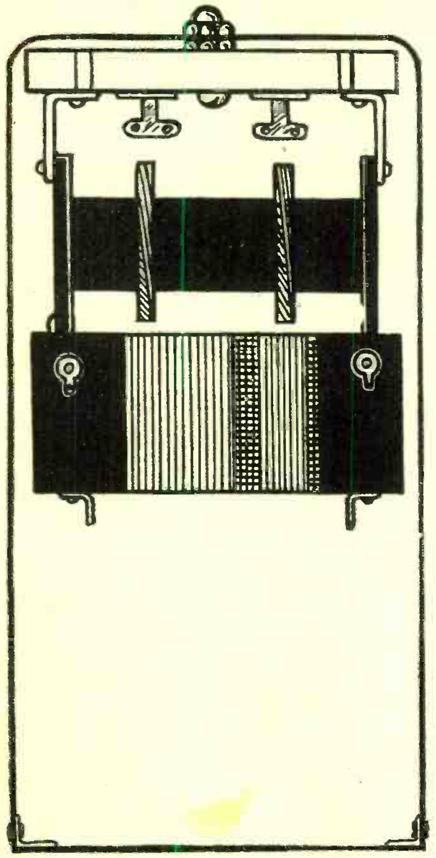
[If dial is desired for other circuits state whether condenser closes to the left or to the right.]

8 mfd. Polymet electrolytic, insulating washers, extra lug. Cat. POLY-8 @..................$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 @........ 3.83
2 coils for 4-tube. Cat. DP @.................. .90
3 coils for 5-tube. Cat. DT @.................. 1.35

DIRECT RADIO CO.

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

Intermediate Frequency Transformers



Twin transformer, consisting of correct oscillator winding and pickup coil, also intermediate frequency transformer, both in one aluminum shield, 2⅛-inch diameter, 4¾ inches high overall. Intermediate condensers adjustable from the top. Mounting brackets at bottom threaded for 6/32 machine screws are 1-11/16 inches apart. Green control grid lead emerges from top, seven leads from bottom. For use with autodyne oscillator. Color code: control grid, green; grid return, black with red tracer; oscillator, high, blue; oscillator return, black; pickup winding, high, green with tracer; pickup return, white; plate, yellow; B plus, red. Padding condenser may be grounded or not, as preferred.

Twin transformer for 175 kc. and for 0.00035 mfd. tuning condenser, to be padded with 750-1250 mmfd. Cat. FF-175-T @..............................$1.80

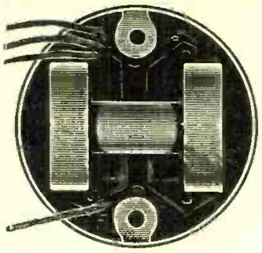
Twin transformer for 450 kc. and 0.00035 mfd. tuning condenser, to be padded with 350-450 mmfd. Cat. FF-450-T @..............................$1.80

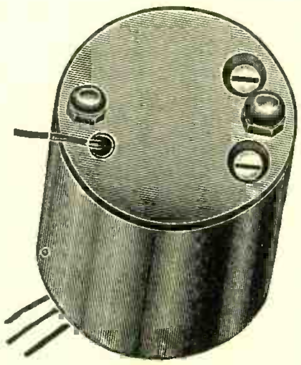
Single transformer for 175 kc. Cat. FF-175 @..............................$1.10

Single transformer for 450 kc. Cat. FF-450 @..............................$1.30

Single transformer for 175 kc., center-tapped secondary. Cat. FF-175-CT..............................$1.25

Single transformer for 450 kc., center-tapped secondary. Cat. FF-450-CT @..............................$1.45





Intermediate transformer alone, in aluminum shield, 2⅛ inches diameter, 2½ inches high, with mounting brackets at bottom. Code: plate, yellow; B plus, red; control grid, green; grid return, black.

NOTE: 450 kc. transformers tune 290 to 465 kc.

Set of two matched r-f coils, twin transformer, and single extra intermediate with center-tapped secondary, for use with 0.00037 mfd. condensers, 750-1250 mmfd. padding condenser, as used in Super Diamond (includes padding condenser and five coils in four shields). Cat. SDCKPC @......$4.35

PADDING CONDENSERS

Cat. PC-75125, padding condenser for 175 kc. supers. (750 to 1250 mmfd)............ 50c

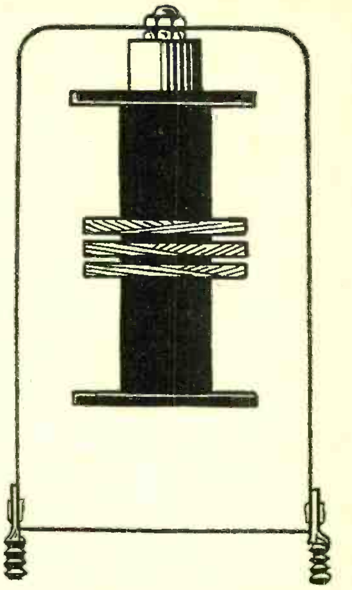
Cat. PC-3545, padding condenser for 400 or 450 kc. supers (350 to 450 mmfd.)........ 50c

The semi-tuned transformer may be used as a so-called untuned stage of r-f feeding the detector, to make the amplification more nearly even throughout the band of radio frequencies by increasing the gain at the low frequency end. For general use the effected center tap on the secondary may be ignored.

If the duplex diode-triode is to be used in t-r-f sets, this transformer may be connected for full-wave detection with primary in preceding plate circuit, extremes of secondaries (green and green with white tracer) to anodes of the diode (55, 85), center (see below) to cathode through a resistor of 0.5 meg. This is one of the most practical ways of applying the diode to t-r-f sets, with or without automatic volume control, as the problem of a grounded rotor of a condenser and a return that cannot be directly grounded is avoided.

The coil also may be used for a·v·c pickup, by putting one choke winding in the plate circuit of the detector, with no condenser from plate to ground, but condenser from other end of this coil to ground, and thus using the pickup of the secondary to feed the a·v·c circuit.

Semi-Tuned Coupler



Special semi-tuned coupler, for a variety of uses. It consists of three inductively related windings in an aluminum shield, 1¾ inches diameter, 3 inches high overall, broadly resonant at the lower frequency extreme of the broadcast band. Secondary is center-tapped.

The transformer may be used as antenna coupler. The windings consist of special honeycomb coils of low distributed capacity, with wire not too fine for this the intended purposes. The color code: red and yellow are primary; green and blacks are one secondary; green with black tracer and black with red traced other secondary. Connect black and black with red tracer for center-tapped secondary. Cat. STC @..................75c

RADIO FREQUENCY CHOKE COILS

50 turns, for short waves. Cat. RFCH-50 @..18c

100 turns, for broadcast band. Cat. RFCH-100 @..20c

100 turns, center-tapped, for pickup winding to feed t-r-f diode detector, full-wave; fits snugly into t-r-f coils of 1-inch outside diameter. Cat. RFCH-100-CT..............................40c

200 turns, for broadcast band, with natural period just outside the lowest broadcast frequency. Cat. RFCH-200-CT 25c

200 turns, center-tapped, for plate circuit of detector, t-r-f sets, where three bypass condensers are used, as in 4-tube Diamond. Cat. RFCH-200-CT. 45c

300 turns, for plate circuit of second detector of 450 kc. supers, or thereabouts. aCt. RFCH-300 @ 28c

400 turns, for plate circuit of second detector of 260 kc. supers or thereabouts. Cat. RFCH-400 @ 30c

800 turns, for plate circuit of second detector of 175 kc. supers or thereabouts....................32c

Tenth harmonic coil, for test oscillator construction, where tuning condenser is 0.00037 mfd., to register fundamentals from 50 to 152 kc., broadcast band read as tenth harmonic, all commercial intermediate frequencies on fundamentals or harmonics. Tap for cathode connection is central lug. Used in a test oscillator. Cat. RFCH-TH @...45c

Tuned Radio Frequency Coils

Broadcast Type

The tuned radio frequency coils are in aluminum shields, 2⅛ inches diameter, 2½ inches high, with mounting brackets at bottom, 6/32 machine holes in them, 2-11/16 inches apart. The coils have terminal lugs protruding at bottom, and connections are imprinted on the shield base. Full band coverage guaranteed. Secondaries are tapped (wire lead emerging), for various special circuit purposes, including 80-200 meter coverage by switching.

Cat. No. 1—Three t-r-f coils for 0.00035 mfd..$1.35

Cat. No. 1-F—Four coils, 0.00035 mfd.......$1.80

Cat. No. 3—Three t-r-f coils for 0.0005 mfd..$1.35

Cat. No. 3-F—Four coils, 0.00035 mfd......$1.80

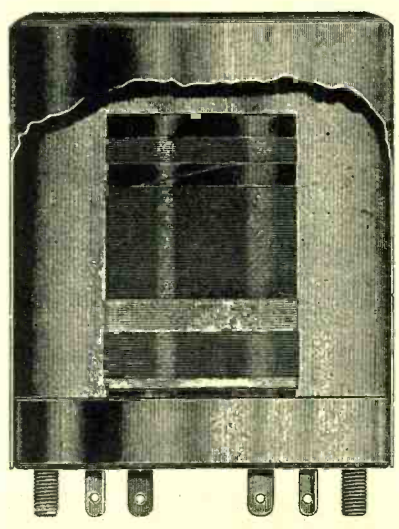
Cat. No. 4—Three t-r-f coils for 0.00037 mfd., 500-1500 kc., to match frequency — calibrated dial $1.35

Cat. No. 5—Four t-r-f coils for 0.00037 mmfd., 500-1500 kc., to match frequency — calibrated dial $1.80

Cat. DJAFD, frequency-calibrated dial for above, traveling light, escutcheon. Hub ⅜ inch. ¼ inch bushing supplied ....$ .84

Cat. DJA-37-3G—Three-gang 0.00037 mfd. for above or for the Super Diamond. Shaft is ⅜ inch diameter $1.80

Coils desired for special purposes often may be supplied from stock, as we can not list all our coils on this page. If you have special requirements, please inquire whether we can fill them from stock.



Short-Wave Plug-in Type

Cat. SWB—Four plug-in coils, 6-pin base; primary, secondary, fixed tickler.............$1.70

Cat. SZ—Six-spring wafer socket for use as coil receptacle for six-pin coils................11c

Cat. SWA—Four plug-in coils, UX base, primary and secondary; primary may be used for feedback if condenser connects aerial to grid....$1.35

Cat. SX—Four-spring (UX) wafer socket for use as coil receptacle for four-pin coils......10c

CONDENSERS

Cat. DJA-14—Single 0.00014 mfd. condenser with compensator built-in. ¼-inch shaft. Supplied with bushing to take ⅜-inch dial hub..98c

Cat. DJA-25—Single 0.00025 mfd. feedback condenser. Useful where 0.0002 or 0.00025 mfd. is specified $1.02

Cat. DJA-14-D—Double (two-gang) 0.00014 mfd. condenser with compensators built in, ¼-inch shaft. Supplied with bushing to take ⅜-inch dial hub $1.96

SPECIALS

Two coils for 4-tube Diamond. Cat. DP...$ .90

Three coils for 5-tube Diamond. Cat. DT..$1.35

Five coils in four shields for Super Diamond. Cat. SDCK $3.95

Two r-f coils and separate oscillator coil for Anderson's Auto Super. Cat. AUSU........$1.45

Two r-f coils and separate oscillator for 175 kc. supers. Cat. 175-SU......................$1.45

SCREEN GRID COIL CO., 145 WEST 45TH STREET, NEW YORK CITY