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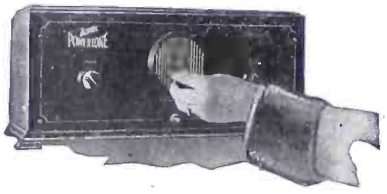

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RADIO WORLD

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A Clinical Study of Low-Loss Coils

Six Specimens Analyzed by Bureau of Standards, as to Shape, Using Four Different Kinds of Wire—Loose Basket Weave Gets First Honors, Using 32-Strand No. 38 Enamelled Copper Litz, for Broadcast Frequencies—Coil Wound with No. 24 DCC on Hard Rubber Tubing Close Second—Popular Impressions Exploded

By Herman Bernard

Associate, Institute of Radio Engineers

THE latest report of the Bureau of Standards on coils used for broadcast reception establishes the following points:

(1) A coil wound in single-layer fashion on a hard rubber cylindrical form is a low-loss coil of great excellence.

(2) The loose basketweave coil shows up the best, but the difference in efficiency between it and the other single-layer coil is slight.

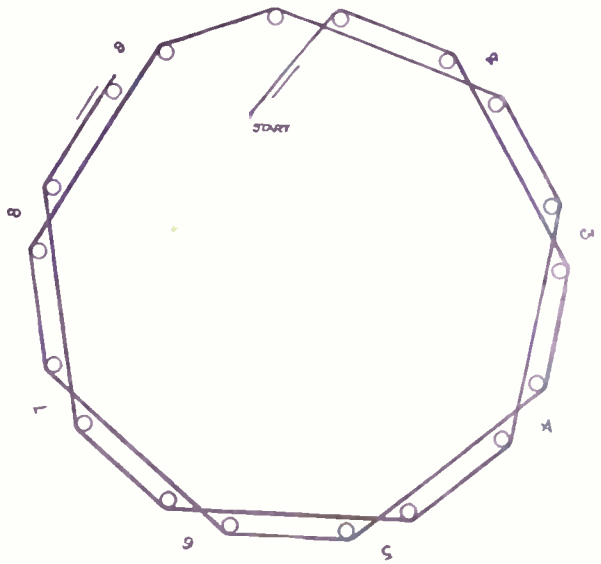
(3) About the worst coil is the two-layer type.

(4) For most broadcast work No. 24 DCC wire is suitable, although No. 32-38 litz wire has a somewhat lower RF resistance.

(5) The effect of broken strands in increasing the RF resistance of litz is slight, the resistance being only 0.3 ohm more even if six of 32 stands are broken, as compared with perfect strands.

(6) Binders on coils are not severely injurious and receive sanction, especially collodion.

(7) Large wire, like No. 16 DCC, while having a lower resistance on higher broadcast waves, has a higher resistance even than No. 28 wire on lower waves, and No. 28 on lower waves has a lower resistance than No. 24.



TEMPLATE that may be used for winding a loose basketweave coil like the one tested.

(8) The RF resistance of wire depends not only on the size of wire but also on the shape of the coil, although litz has the lowest resistance in nearly all forms of winding.

These points are of paramount importance to the home constructor of radio sets and coil and set manu-

Honeycomb and Layer Coils Show Up Poorly

facturers, particularly because the findings run counter to many accepted beliefs. For instance, the single layer coil, wound on a hard rubber tubing, has been subjected to unjust appraisal on the score of losses, yet on the controlling points—radio-frequency resistance and inductance—it shows up superbly. The loose basket weave coil is wound on dowel sticks, with a pair of dowels at each corner, succeeding turns being wound at alternate members of each pair of sticks.

The two-layer coil was simply an "added starter" in the Bureau of Standards tests, included perhaps simply as a caution, while the six coils specifically included as "low-loss," and which were the basis of the constructive tests, were the single layer, the narrow basket weave, the loose basket weave, the bankwound, the radial basket weave and the honeycomb. Experimenters know the radial basket weave coil as the "spiderweb." Thus six types of coils were in the constructive group, the "outsider" being the two-layer coil.

Tests Were Various

The tests were made also of variegated forms of the six fundamental coils. For instance, the bank-wound coils were of the two, three and four-layer types, while the spiderweb coil was tested when wound on cardboard and also when wound on hard rubber. In spider-web instances the forms were left intact, while in the cases of the two basket weave coils (narrow and loose wound examples), the coils were removed from the forms.

Aside from actual construction of coils, the binder question was discussed. "Where a binder is required for holding the turns in position, collodion introduces the least amount of resistance." The binders compared were shellac, commercial insulating varnish A, paraffin, spar varnish, collodion and commercial insulating varnish B. Tests conducted by RADIO WORLD's laboratory (p. 12, issue of January 2, 1926) showed that a half-and-half solution of drug store collodion and amyl acetate introduced lower extra resistance at all points from 200 to 550 meters than did the collodion alone. Hence the Bureau of standards report is confined to a comparison of the six binders enumerated. RADIO WORLD'S Laboratory tested three, the third being sodium silicate.

Hund and De Groot the Authors

The report of the Bureau of Standards is entitled "Radio-Frequency Resistance and Inductance of Coils Used in Broadcast Reception." A copy is procurable from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents. Ask for "Technologic Papers of the Bureau of Standards, No. 298."

The authors of the report are August Hund, electrical engineer, and H. B. De Groot, junior aid. They present their facts with great clearness and with the object of giving the highly trained engineer scientific information while still shaping the report, so far as possible, to make it understandable by persons possessing a more limited knowledge of the science. Also, they pay fine regard to practical use, rather than confining themselves exclusively to theoretical values.

The object of the present digest and review of this interesting and valuable paper is to present the results in a still less technical form, for the guidance of experimenters. Therefore only such matter as is directly quoted from the report is to be regarded as the literal finding, the rest being the reviewer's popularized construction of the report.

Equal Self-Inductance

All the coils tested were adjusted to the same self-inductance, 291 microhenries, at a frequency of 1 kc per second (1,000 cycles), an audible frequency. This is 300,000 meters, chosen because it represents the minimum value of the apparent inductance, larger values of apparent inductance being obtained at the broadcast frequencies. The report states:

"The quality of coils can be considered in terms of a number of different properties, each of which is of importance in the use of the coil."

A footnote sets forth:

"It may help the reader to recall that the function of the coil is essentially to introduce inductance in the circuit, a given amount of inductance being introduced with the minimum possible length of wire and of resistance. On account of the capacity action of a coil the apparent inductance is usually much larger at broadcast frequencies, since the decrease due to skin effect action is small in comparison. The capacity action of a coil tends to transfer more or less energy across the turns than along them, thus turning the coil with increasing frequency gradually into a condenser with a resistance which is due to the insulation between the turns."

The five important characteristics then are listed: the RF resistance, a low value being desirable; the magnitude of the ratio L/R (apparent inductance divided by the resistance); the percentage increase of RF resistance to the direct-current resistance (should not be unreasonably large); the percentage decrease of the ratio L/R at radio frequencies with respect to the value at audio frequencies (1 kc), which percentage should not be unreasonably large; the apparent inductance, which "should not be too large compared with the value at 1 kc, because the increase is mostly due to the coil capacity."

Winding Data

The single layer coil was wound on hard rubber tubing with four types of wire, one type for each specimen, e.g., No. 28 DCC, No. 24 DCC, No. 16 DCC and No. 32-38 DSC litz. The diameter of the hard rubber tubing where 24 DCC and 28 DCC wire were used was a trifle more than 3 inches (81 mm for 28 DCC, or 3.191 inches and 82 mm for 24 DCC or 3.22 inches). The loose basket weave was wound on air, with just enough col-

Report Data Useful For Various Size Coils

The winding data given in the Bureau of Standards reports was for measuring purposes, independent of actual tuning in of stations. Hence no tuning condenser value was given, but for the apparent inductance this was figured out by the reviewer to be .0003 mfd. In many instances .00025 will do, because of the capacity effect of tubes, wiring etc., in actual broadcast receivers.

Those having other values of tuning condensers may use fewer turns for .00035, .000375 and .0005 mfd. The larger the capacity, the fewer the number of turns required.

The tubing diameter used by the Bureau is the "inside diameter" and may not be easy to duplicate exactly, but a 3½" diameter, either inside or outside, will suffice amply for the experimenters' needs.

Winding Directions for Coils Like the Ones Tested

Herewith is a table showing the types of coils and wire, with other data, on the four coils that showed up best in the Bureau of Standards tests. The number of turns for the basket weave coils is not given in the report, but for the 32-38 DSC wire 65 turns may be used and for the 24 DCC wire 60 turns, the same as for the solenoid. The value of a useful tuning condenser for the coils is not given, as that was beyond the scope of the article, but .0003 mfd. may be used, this tuning in the broadcast band.

Loose BW stands for loose basket weave, this being a coil with longer tangents than ordinarily. SL stands for single layer. The 32-38 DSC wire is litz, having 32 stands of No. 38 enameled copper, double silk covered. The 24 wire is copper, but not enameled. The litz wire corresponds to No. 23 solid wire, not readily procurable, hence No. 24 DCC is selected as suitable solid wire.

Type	*Wire*	*Core*	*Dimensions*	*Turns*
Loose BW	32-38 DSC	Air*	See **	..
Loose BW	24 DCC	Air*	See **	..
SL	32-38 DSC	Hard rubber	3.19" dia. 2.32" long	65
SL	24 DCC	Hard rubber	3.19" dia. 1.77" long	60

(*) Just enough collodion to hold coil together. (**) Nine diagonal alternating winding. Nine pairs of pins set on a circle of 92.5 mm diameter (3.64 inches), the pins 2.5 mm diameter (.098 inches) and with small spacing between a pair of pins being 10 mm (.39 inch). A template for the LBW coil form is published elsewhere in this article.

Collodion Approved As Binder for Coils

Litz, with Six of 32 Strands Broken, Increases Only 0.3 ohm in Resistance—Large Size Wire, Such as No. 16 DCC, Has Higher Resistance on Lower Waves Than No. 24, While No. 28 Has Less Than Either at Those Points—Important Document Sheds Official Light on Absorbing Radio Topic.

lodion to hold the coil together. The nine diagonal alternating winding was used, nine pair of pins set in a circle 92.5 mm diameter (about 3.64 inches). The rim diameter was 2.5 mm (a little less than 1/10 inch). A table is published herewith, based on a table in the report, giving the number of turns, kind of wire, form, etc., for the coils of high rank. The abbreviation mm, used in the Bureau of Standards report, means millimeters, or 1/1,000 of a meter, or .03937 inch, and the nearest convenient equivalent in inches is given in the digested table, since the home constructor will find that system handier, and will obtain approximately the same results.

Appraisal of Coils

Reporting on the results of the coils wound just as described in the official report, the authors state:

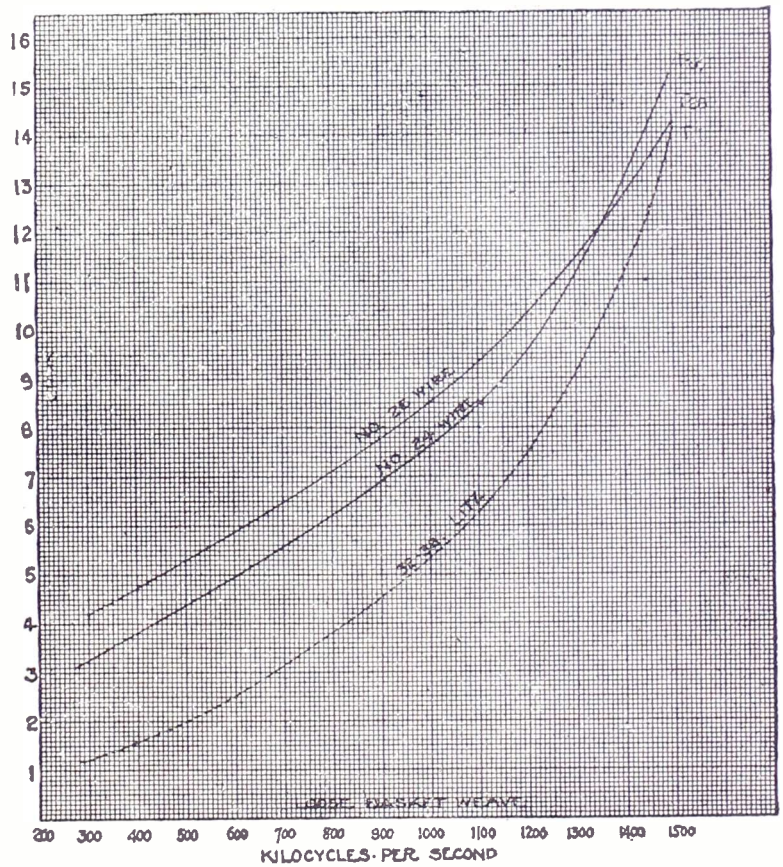
"It is seen that the 'loose basket weave' type of core and the 'singlelayer' coils give the lowest apparent inductance over the entire range of broadcast frequencies (500 to 1,500 kc). This indicates that the coil capacity is comparatively low, while the ordinary two-layer coil acts more or less like a condenser, since the coil capacity is exceedingly large."

The report then states, regarding the ratio of the RF resistance over its DC value to the DC value, that the loose basket weave and singlelayer coils have low values; next comes the radial basket weave coil (spiderweb), using hard rubber for the core, while the four-layer bank wound, three-layer bank wound, and the honeycomb coils show considerable percentage increase.

Inductance Comparisons

The apparent inductance at different frequencies is plotted in a curve. The minimum inductance is 291 microhenries for all coils, at 1 kc. This curve shows that in the broadcast range (550 to 1,500 kc) the lowest apparent inductance among the six coils tested was in the loose basket weave, using No. 28 DCC, while the single layer coil (wound on hard rubber tubing) was next. At no point in the broadcast band was the apparent inductance of this single layer as low as that of the loose basket weave, hence the distributed capacity of the LBW coil was lower at all points, but at no point was the difference more than slight.

For instance at 550 kc (545.1 meters) the apparent inductance of the LBW was 297 microhenries, while that of the SL was 299. At 1,000 kc (299.8 meters) the relationship was 317 and 319, while at 1,500 kc (199.9 meters) it was 354 and 355. The greatest point of difference, 1,200 kc, showed 330 as against 334. Litz wire showed up well on the inductance curve, except on 4-layer bank wound, and honeycomb, the honeycomb coil being at no time, regardless of the kind of wire used, anything attractive.



THE radio-frequency resistance of the loose basketweave coil, showing comparisons of No. 32-38 Litz (T28), No. 24 DCC (T24) and No. 28 DCC (T28). The frequencies in kilocycles are at bottom, the resistance in ohms at left. To read the chart, find where the perpendicular frequency line intersects a horizontal line; and carry the horizontal line to the left to obtain the resistance in ohms, to an accuracy of 1/10 ohm. "All the insulating materials which were used as binders caused very slight increases in the resistance of the coils. Collodion seems best, and also has the inherent advantage of drying rapidly after application to the coil. This is of especial advantage in the construction of a bank-wound coil."

Resistance indings

The curves constituting Fig. 8 of the Bureau's report are given in the text.

Comparative Coil Resistance

of this issue, with identification changes only. The report says:

"Figure 8 gives the curves for the radio-frequency resistance. It is seen again that the values of the resistance vary greatly. Naturally, the ordinary two-layer coil has a very large radio-frequency resistance within the broadcasting range. Though its direct-current resistance is only 2.75 ohms, the effective resistance at 500 kc is 162 ohms, at 580 kc it is 465 ohms. and at 748 kc it is 1,800 ohms. The resistance increases very rapidly until it is mostly due to the dielectric resistance across the insulation between the layers. A three-layer coil wound in the ordinary way (ordinary multi-layer coil) and adjusted, like all coils discussed in this paper, to 291 microhenries at 1 kc has a radio-frequency resistance of several thousand ohms, at a frequency as low as 400 kc."

Regarding curves for the ratio of the increase of the radio-frequency resistance over its direct current value to the direct current value, the report sets forth: "It is seen that the loose basket weave and the single layer coils have low values, next comes the radial basket weave coil, using hard rubber for the core, while the four-layer bank wound, three-layer bank wound, and the honeycomb coils show considerable percentage increases."

The curves of the L/R ratio evoke the following comment:

"Since the apparent inductance and the radio-frequency resistance increase with the frequency, this ratio in certain cases has only small changes although both L and R are changing rapidly. Nevertheless, these curves show about the same comparisons as the resistance curves."

The increase in apparent inductance at the higher frequencies (lower wavelengths) is due largely to the distributed capacity effect.

Resistance Due to Wire and Winding

Litz wire long has been regarded cautiously, because of supposed high resistance on the lower waves and because of the belief that broken strands enormously increase the resistance. The report shows it is not serious to have a few broken strands and also that litz has a relatively low resistance compared with No. 24 and No. 28 wire. The resistance (independent of broken strands) depends somewhat on the nature of the winding. For instance, the loose basket weave coil, using 32-38 litz has a lower RF resistance at all points (1,500 to 200 kc) than No. 24 or No. 28. A narrow basket weave coil, No. 32-38 litz, has a lower resistance than with No. 28 wire at all points, but compared with No. 24 wire, litz has a higher resistance, 1,275 to 1,500 kc., the difference at 1,500 kc being 6 ohms, at 1,400 kc, 5 ohms. But for the major part of the curve—say, 75%—the litz wire shows up much better than No. 24. With spider-web winding litz is better than No. 24 at all points, except from 1,375 kc. to 1,500, where the difference in resistance is never more than 1 ohm, hence negligible, especially in view of the far superior showing on the rest of the scale. Honeycomb litz coils show up better at all points than No. 24 or No. 28 honeycombs, and the same is true with bank winding in two to four layers. No. 24 always shows up better on the resistance score than No. 28. With the single layer coil litz again leads in lower resistance at every cross section.

Taking the single layer as an example, No. 16 DCC wire is shown to have a higher RF resistance than No. 24 wire from 1,175 kc to 1,500 kc and a higher resistance even than No. 28 wire from 1,410 kc to 1,500. No. 28, space wound, (spacing equal to wire diameter) has a lower resistance above 1,200 kc than No. 16, non-spaced, No. 24 or No. 16 DCC wire. Thus it is apparent that litz is highly suitable on short waves where single layer coils are used, space winding is advisable for short waves, and finer wire has probably less resistance for short waves, say No. 28 DCC, with a loose basket weave type winding. Hence the nature of the winding (form of coil) must be considered in conjunction with the size and insulation of wire.

The report states:

"It will be noted that in all cases litz, which corresponds roughly to No. 23 solid wire as regards its cross section, had the lowest effective resistance.* If solid wire is used, it appears unnecessary to use wire larger than No. 24, although No. 16 gives, for the lower frequencies, resistances which are slightly lower. Such a large size of wire would, however, make the winding of certain types of coils more difficult and the size of the finished coil too large for convenient use. Fig. 12 shows a single-layer coil the turns of which are spaced by a distance equal to the diameter of the wire. There seems to be no material reduction in resistance except at the higher frequencies."

Summary

The report is summarized by the Bureau in part as follows:

"The various experimentally obtained curves given in this paper can be used as design bases for comparing coils of six types for any frequency in the broadcast range. For these data to apply it is necessary that the coils be constructed in accordance with the information given in Table 3. The coil dimensions are such that the coils are applicable to modern broadcast reception. A statement of the important characteristics of coils is given in the introduction.

"Of the coils measured the loose basket weave coil and the single-layer coil, and next to them the radial basket weave coil wound on hard rubber, have the lowest radio-frequency resistance. The four-layer bank-wound coil and the honeycomb winding have the highest resistance. This can not, however, be generalized to other frequency ranges. For instance, for low-frequency sets (20 to 100 kc) the multi-layer bank-wound coil and the honeycomb coil have relatively low resistance, and besides are good coils mechanically while the lose basket weave coil has no special

(Turn to page 23)

Broken Strand Effect of Litz Measured by Experts

The following is published in the report under the heading: "Effect of Broken Strands in Litz Wire":

TABLE 4—*Resistance of Litz Wire Nos. 32-38, at 750 kc.*

Broken Strands	Resistance *Ohms*	Broken Strands	Resistance *Ohms*	Broken Strands	Resistance *Ohms*
0	3.1	11	4.2	22	7.8
1	3.2	12	4.4	23	8.4
2	3.2	13	4.4	24	9.5
3	3.3	14	4.4	25	10.8
4	3.3	15	4.7	26	13.5
5	3.3	16	5.4	27	14.4
6	3.4	17	5.6	28	16.5
7	3.5	18	6.1	29	21.7
8	3.6	19	6.4	30	42.4
9	3.8	20	7.4	31	51.6
10	3.8	21	7.6		

Litz used is Nos. 32-38 and has 32 strands of No. 38 AWG enameled wire braided together. (AWG stands for American Wire Gauge.)

Thus even if as many as 6 strands are broken, the effect is not important, as the resistance is only .3 ohm higher than if no strand were broken. The report says:

"Table 4 shows that it is not so serious to have a few strands broken, since the radio-frequency current apparently finds its way back across the strands. Even if, say, six strands are broken, the radio-frequency resistance is 3.4 ohms as compared with 3.1 ohms for perfect strands."

This finding in respect to broken strands on litz wire is contrary to popular belief on the subject of their effect on resistance.

RF Resistance Tabulated For Different Forms and Wire

As for the resistance factor, the single layer on hard rubber, using litz, showed almost a straight edge for the broadcast range, the resistance being lower than that of the LBW wound with litz, from 1,265 kc (237 meters) to 1,500 kc (199.9 meters), but more for the lower broadcast waves. Thus the popular belief that litz builds up too high a resistance on the low waves was refuted, if a hard rubber cylindrical form is used for single layer winding. No. 28 DCC at all points as a LBW had a higher resistance than the litz LBW. The following table compares in a general way the resistance of the SLHR (single layer hard rubber) with that of the LBW (loose basket weave), which made the best two showings on this score:

Comparative Table of RF Resistance in Ohms of Types of Wire on "Best Two" Coils.

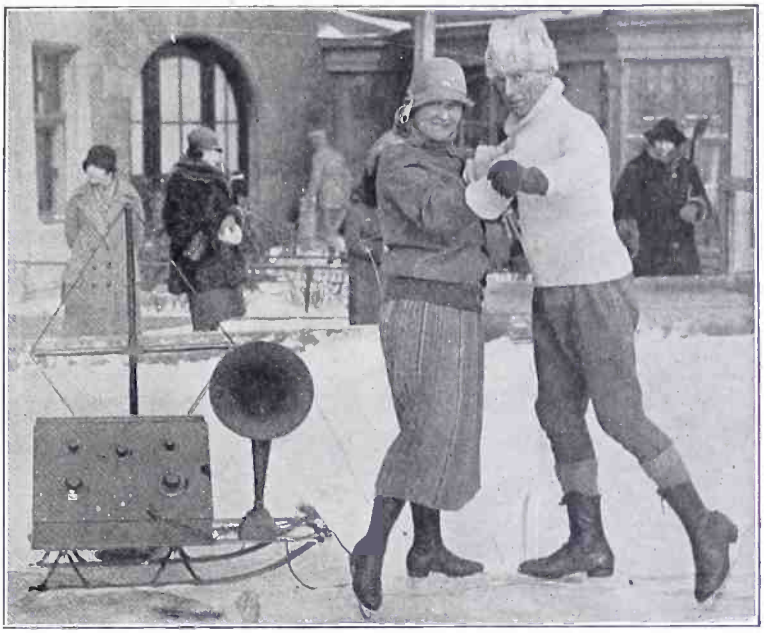
	LBW			SLHR			
f	*L*	24	28	*L*	24	28	*wl.*
1,500 kc..	14.1	15.2	14.2	10.6	16.4	14.2	199.9 m
1,400 kc..	10.9	13.1	12.7	9.8	13.3	13.4	214.2 m
1,300 kc..	8.1	11	11.5	8.8	11.3	12.4	230.6 m
1,200 kc..	7.5	9.5	10.3	7.9	9.8	11.5	249.9 m
1,100 kc..	6.3	8.5	9.3	7.1	9	10.5	272.6 m
1,000 kc..	5.4	7.6	8.5	6.3	8.2	9.6	299.8 m
900 kc..	4.6	6.9	7.8	5.4	7.3	8.6	333.1 m
800 kc..	3.8	6.2	7.1	4.6	6.7	7.8	374.8 m
700 kc..	3.2	5.6	6.7	3.8	5.8	6.8	428.3 m
600 kc..	2.5	4.9	5.8	3.0	5.1	6	499.7 m
550 kc..	2.3	4.6	5.6	2.7	4.7	5.6	545.1 m

[*The above table was compiled by the reviewer from curves in the report and is approximate. LBW stands for loose basket weave, SLHR for single layer wound on hard rubber tubing, while f is for frequency and wl for wavelength. L stands for 32-38 litz, while 24 and 28 designate sizes of DCC wire.*]

A Popular Songstress

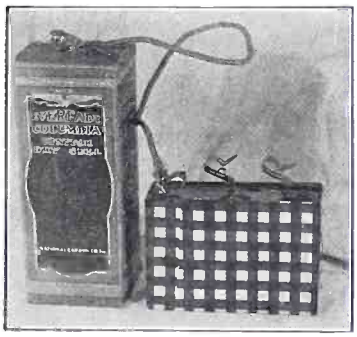
"THE LULLABY LADY," heard weekly from WEAF, New York City.

Portable on Sled Inspires Ice Skaters



THE CHARMS of music, via radio, inspire Lucy Kerr and Lars Graftstrom, slick skaters on a Quebec rink. They bring in music on their 2-control loop set, which is secured to the sled. The speaker is placed in front and the loop on one side. For directional effect the sled is turned, as the loop is fixed on a runner. (Wide World.)

Not So Good

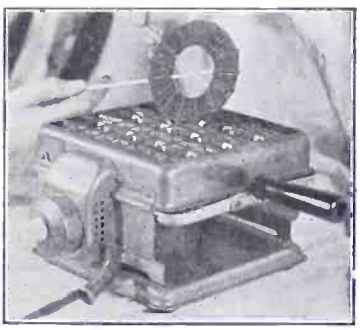


TO get six volts it is not a good plan to connect a 4½-volt dry battery (the C battery type) in series with a 1½-volt No. 6 dry cell, because of the amperage difference. This tends to run one down more quickly.

A Handy Connection

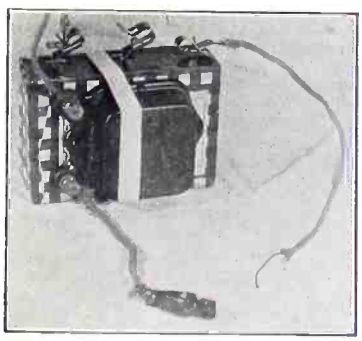
THE POSITIVE pole of a No. 6 dry cell is the center one. The negative post in on the edge. It is often convenient to connect the common A and B post right between batteries. Photo shows B minus connected to A plus. Thus if you use a 5-lead battery cable, the otherwise B minus cable may be used for C minus or an extra B plus.

Toasted Coils!



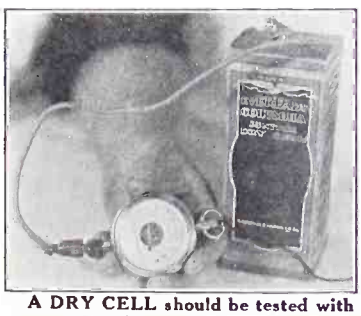
COILS sometimes lose efficiency in damp climate, due to moisture. Toast 'em, that's all! If a binder has been applied, and impatience arises, due to slow drying, be sure to keep the coil farther from the source of heat than shown above, as some binders are inflamable.

Makes Testing Easy



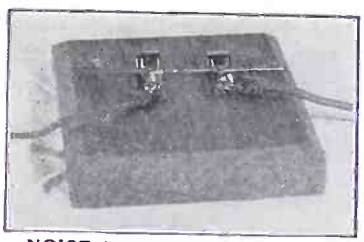
A HANDY tester for short or open circuits consists of a 4½-volt dry battery to which is secured a high-frequency buzzer. The connections are clearly shown. The flexible leads go to the test connections.

An Ammeter Test



A DRY CELL should be tested with an ammeter in series.

Anti-Static Hint



NOISE is sometimes due to static. In some instances, if the above method is used there will be a slight reduction of the static level. Two pieces of bus bar, with ⅜" between, are caught in clips to which the antenna and ground leads are respectively connected.

Simplicity Is Stressed In Set

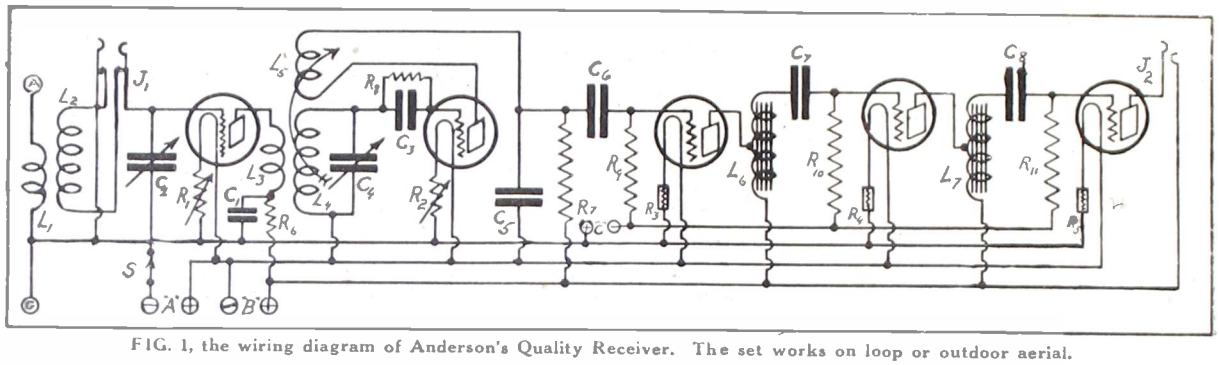


FIG. 1, the wiring diagram of Anderson's Quality Receiver. The set works on loop or outdoor aerial.

By J. E. Anderson

Consulting Engineer

THE receiver shown in Fig. 1 represents a departure from traditional hook'ups in several respects. The changes have been effected in the interests of simplicity of operation and of improved quality of reception. It consists of an RF amplifier tube, a regenerative detector, and three stages of audio frequency amplification. In the design of the set and in the selection of parts for it, the two most desirable qualities in a radio receiver have been kept uppermost in the mind, namely, selectivity and quality of reproduction.

The Loop Jack

The input RF transformer, L1L2, is a commercial coil of the low-loss type, wound to tune the entire broadcast band with a .0005 mfd. condenser. Provision has been made for the substitution of a loop antenna in place of this transformer in case that is desired. This substitution is recommended for local reception under most conditions, and even for distant reception, unless a very good low-loss antenna is available. In many cases the reception will be better with a loop than with an antenna even if the best RF transformer is used, the signals will be louder and interference will be less. The jack, J1, provided for the loop substitution is double circuit jack. It has, however, been converted into the equivalent of a three spring jack by soldering together the two springs on the ground side, and also by soldering the grounded side of the coil to this junction. This permanent connection is made to eliminate one possible poor contact and thus decrease resistance in the circuit and minimize potential noise from this source. The remaining contact at the high potential side of the coil is the only one needed to effect the loop substitution.

Uses .0005 Mfd. Condensers

The second coil unit, L3L4L5, is of similar construction and inductance value to the first RF transformer. The two variable condensers C2 and C4 which tune the two secondaries L2 and L4, respectively, are each of .0005 mfd. capacity, of the low-loss type.

The coupling between the detector and the first audio amplifier is by means of resistance. A commercial coupling unit is employed, but not as it comes, however. The coupling condensers in these units are entirely too small for audio-frequency amplification of quality. The connections in the unit have been so changed that the small condenser which fits into the mounting clips is used for the by-pass condenser across the coupling resistance. That is, C5 is placed in the clips, while the coupling condenser C6 is connected directly between the grid of the first audio tube and the tickler return lead. The by-pass condenser has a capacity of .001 mfd. and the coupling condenser a capacity of .25 mfd. The normal value of the coupling resistance is 100,000 ohms; but, of course, different values may be used in the clips if conditions require a change.

The Auto-transformers

The two coupling coils L6 and L7 are auto-transformers made of ordinary audio frequency transformers by connecting the two windings in series aiding and then properly connecting up the combinations in the circuit. The terminal marked G has been connected to the plate battery, the terminal marked P to the grid of the tube, and the two terminals marked B and F, joined together, have been connected to the plate of the tube preceding the coil. This connection puts the secondary of the transformer in the plate circuit and therefore it becomes the primary. Both the secondary and the primary are in the grid circuit. This method of connecting the auto-transformer puts a very high impedance in the plate circuit of the tube and retains all the advantages of choke coil coupling. At the same time it allows a slight step-up in voltage and thereby increases the amplification.

A Salvaging Hint

If transformers have to be purchased for the set to be constructed, it is, of course, best to buy auto-transformers which have been designed especially for this type of amplification; but if inexpensive transformers are already available, they may be used in this manner to obtain quality incomparably superior to that obtainable with the same transformers used in the ordinary manner. It is a way of salvaging something little better than junk and making something good out of it. Transformers of moderately high ratios are preferable to those of high ratio, or the step-up will be practically nil.

The two blocking condensers C7 and C8 are each of 0.5 mfd. capacity. No smaller values should be employed because the low notes in the signal will be suppressed by them. It would be preferable to use condensers of greater capacity, say up to 4 microfarads. The same holds true of condenser C6, although a smaller one may be used there on account of the resistance coupling. All the three large blocking condensers must have very high insulation. That is, they must withstand at least 350 volts DC, and must not be grid leaks in disguise.

A Sad Experience

I had an exasperating experience in this direction. The two last condensers, C7 and C8, which were first tried in the circuit, were as leaky as a bullet-riddled pail, the current through the two of them being readable on a 0-150 millammeter. With this amount of leakage the grids became positive, the plate currents in the last two tubes became excessive, and the distortion was intolerable. A high negative C battery was of no avail. Good condensers remedied the trouble. A similar experience was recorded when the positive terminal of a good condenser happened to press against the base of the grid leak mounting, which was made of supposedly insulating material but which in reality was grid leak material. The base leaked more than the half megohm leak placed in the clips. It pays to make sure that the material is genuine bakelite or hard rubber.

The grid condenser C3 is of the usual value, .00025 microfarad, and the grid leak across it is one megohm. A variable Bretwood leak may be used to good advantage if maximum sensitivity is desired under all conditions of signal strength. The grid leaks R9 and R10 are of half megohm resistance each, while R11 is of one-quarter megohm.

Three Amperites Used

The filament current in the three audio tubes is controlled automatically by means of 1-A amperites R3, R4 and R5, while the current in the radio frequency amplifier and the detector is controlled by means of two 20-ohm rheostats R1 and R2. Two rheostats are used for the sake of obtaining symmetry on the panel rather than out of necessity. Just about as good results may be obtained if a single rheostat is used in common for these tubes.

The plate voltage for all the tubes is supplied through a single bus-bar. This is done in order to simplify wiring and to eliminate unnecessary binding posts. Since the high potential required for the audio frequency tubes is too high for the radio frequency amplifier, a resistance R6 is inserted in the plate lead of that tube. This resistance is normally 100,000 ohms, the same as the coupling resistance R7 through which the detector gets its plate supply. This will make the voltage on these two tubes the same. If, however, it is desired to get a higher voltage on the RF amplifier than on the detector, a lower resistance may be placed in the clips holding R6, say 75,000, 50,000, or 25,000 ohms. The choice of resistance here depends on what voltage is used on the audio tubes, as well as on that required for best operation of the RF tube. The voltage on the three audio-frequency amplifiers should not be less than 90 and preferably 135 or more. This high voltage is required for undistorted amplification of the signal when loud speaker volume is expected, and it is also required on the detector so that the effective plate voltage on that tube be sufficient to cause satisfactory regeneration and detection for all

Anderson's Quality Receiver

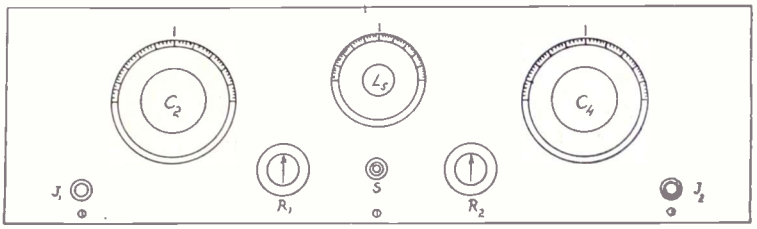


FIG. 2, the panel view of Anderson's 5-tube set.

settings of the tuning condensers. For the same voltage on the B terminal the effective voltage on the RF tube will be somewhat higher than the effective voltage on the detector because the voltage drop in R6 is less than that in R7. This is because the plate current in the RF tube is less, the grid being negative, than the plate current in the detector, the grid of which is positive. The effective voltage on the RF tube should be between 45 and 60 volts.

Voltage Differences

The plate voltages on the first and second audio tubes will be a little less than the plate voltage on the last tube, since the voltage drop in the windings of the cho e coils is greater than the drop in the loud speaker. The difference, however, will not be great enough to make it necessary to make separate provisions for grid bias on these three tubes. The signal voltage in the first two audio tubes will be at a low level, and these tubes will not be overloaded even if the grid bias is not exacty right. In the last tube, though, the signal voltage will be high, and there is likely to be some overloading at times unless the grid bias on that tube is accurately adjusted. Hence the common C battery is adjusted for that tube. For approximate adjustment of this bias, tune in the set on a loud signal so that the last tube is slightly overloaded. Then adjust the C battery until the signal is freest from distortion. Overloading is indicated by harshness or "raggedness" of the loud passages in the signal. This should be made minimum.

Meter Tests

A better way of adjusting the grid bias is to use a milliammeter of about 0-15 range, or if this is not available, a sensitive voltmeter, in series with the loud speaker. Overloading is indicated by jumping of the needle of the meter. If the needle kicks down on loud passages, the grid bias is not enough; if the needle kicks up, the negative bias is too high. If the needle kicks equally up and down as if uncertain which way to go, the bias is correct, but the tube is overloaded. The extent to which the needle jumps around indicates the degree of overloading. If the tube is operated at the correct grid bias, and is not overloaded, the needle stands almost perfectly still. When that condition obtains the signal will be clear and natural, free from "raggedness." If it is not, the last tube is not to blame, but the fault may lie in any of the preceding tubes, not infrequently at the transmitting station.

By-Pass Condensers

The by-pass condenser C1 is of .001 microfarad. It is connected directly from the low potential side of the primary L3 and the negative bus-bar, and is used to facilitate the passage of RF current across R6 and the B battery. A very large by-pass condenser, say of 4 microfarads, connected across the B battery will help prevent oscillation in the audio tubes due to the coupling effect of the battery between the several audio tubes. This condenser is not shown in Fig. 1. It is not necessary when the B is fresh, but is sometimes required when the battery is nearly exhausted, when its resistance is high.

The negative of the plate battery is returned to the positive of the filament battery so that the extra 5 volts (voltage at filament) may be effective on the plates. Hence the total applied voltage is about 140.

The Panel Layout

The layout of the set is indicated by the panel drawing, on which the various parts are marked to correspond with those on the circuit diagram. The radio-frequency tube is directly behind R1, the detector is behind R2, and the regenerative coil between these two tubes. The rest of the apparatus is placed in a row back of these and the two condensers. The RF coil is placed at the extreme left; then R6 and the resistance coupling unit C6, C5, R7 and R9; then a tube, a coil, and a blocking condenser, twice over; and finally the output tube. The Amperites are placed immediately in front of the tubes to which they belong, and the resistances R10 and R11 are placed back of the blocking condensers C7 and C8. The terminal strip is mounted at the left behind the RF coil, in a vertical position, and inset so that the heads of the binding posts are flush with the back edge of the baseboard. The C battery is located between the RF coil and the terminal strip. The layout is fairly compact and affords very short leads in most cases.

Good Quality

The quality of the set compares favorably with the best resistance coupled amplifier, the sensitivity of the set is entirely satisfactory, and the selectivity is adequate. It has the advantage over resistance coupled amplifiers that it requires a lower source of plate voltage to obtain an adequate effective plate voltage, and also that the intermediate audio amplifier tubes do not overload so quickly for a given applied voltage.

May Use Hi-mu Tubes

The set has been designed for use with ordinary storage battery tubes throughout; that is, tubes having a filament voltage of 5 and a mu of 8. A power tube of the usual variety may be used in the set without any change, except the replacement of a suitable Amperite for R5. High mu tubes may be employed for the first two audio amplifiers in the circuit, but in case they are used the C voltage on these two tubes must be adjusted separately from that on the last tube. High mu tubes do not require so much negative grid bias as do low mu tubes. The set has been operated successfully with True Blue and Sea Gull tubes throughout, as well as with UV201A.

The size of the panel is 7x24", and the baseboard is 7x22.5". All leads from the aerial and the batteries are through small holes drilled in the back wall of the cabinet.

LIST OF PARTS

One RF tuner L1L2.
One oscillator tuner L3L4L5.
Two variable condensers, .0005 mfd., C2, C4.
Two rheostats, R1, R2, 20 ohms.
One double mounting.
Three single mountings.
Two 50,000-ohm resistances, R6, R7.
One grid leak, one megohm, R8.
Two half megohm grid leaks, R9, R10.
Oue-quarter megohm resistance, R11.
Two .001 mfd. condensers (C1, C5) and one .00025 mfd. (C3.)
One .025 mfd. condenser C6.
Two 0.5 mfd. condensers C7, C8.
Three No 1A Amperites, R3, R4, R5.
Five standard sockets.
Two Autoformers, L6, L7.
Two jacks, one double circuit (J1) and one single (J2).
One filament switch.
Six binding posts.
Hard rubber panel, 7x24'.
Baseboard and cabinet to match.
Two 4" vernier dials, vernier, and one 3" plain dial.
One 7.5 volt C battery.

DX and Quality Charm Owner of a Powertone

Results Editor:

I'm sure you'd be interested in hearing what the Powertone is doing.

To us—greenhorns—it was mystic. I, being designated operator-in-chief, fell to. Twirling the little black button we whirled dizzily through space. Music, talk and more music and talk—we didn't give one station a chance for a complete performance. We wanted to see how many stations we could get in thirteen minutes.

Was getting feverish now. Must get distance, or DX as I learnt the favored few termed it. Our expert advised me to turn the dial slowly. I did. My cramped fingers clutched the little button with most tender affection. "Please give me a distant station." A whisper. I shriek for silence and get it. I hear a voice. I'm sure it's at least Chicago. All are breathless. The announcer is telling us—"This is station WMCA." My reputation is temporarily bankrupt. I keep twirling the little dial with a silent prayer to the DX gods. Another whisper. I nurse the little button carefully. The voice is becoming a little clearer and this time triumphant I command silence. "CKAC, Montreal" and I'm cocky again. I'm a confirmed DXer.

This is becoming a serious matter now and I feel that I must chart the ether. Its "Me & Magellan." I lay my course along the northwest passage on the dial and leap blithely from station to station. Occasionally a thunderbolt of what I am pleased to call static interrupts but I brush it aside lightly and we view a fascinating panorama of music, speeches, lectures and other radio delectables.

The little "box" has surely proven a storehouse of surprises and has been a means of whiling many a pleasant hour away or has proven an equally pleasant background while engaged in other work around the house. Passing from our novitiate of the past two weeks of DXing we are now contenting ourselves with the very satisfactory programs given by the Local stations.

I am appending a list of the stations we have had and we all join in smashing our mental bottle of champagne across the bow of the Powertone, wishing it its deserved success.

H. BLATT,
4408—17th Ave.,
Brooklyn, N. Y.

The Raytheon Power Unit

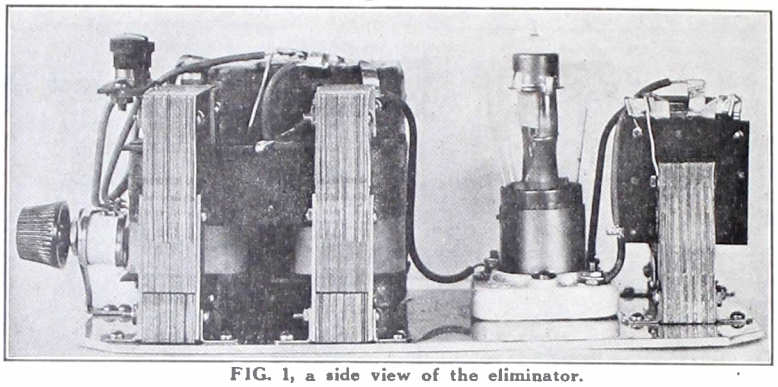


FIG. 1, a side view of the eliminator.

LIST OF PARTS

One AC step-up transformer, with a tapped primary and a tapped secondary L1L2L3 (Shore).
Two 0.1 mfd. fixed condensers C1C2 (Aerovox).
Two 2.0 mfd. fixed condensers C3C4 (Aerovox).
One 8.0 mfd. fixed condenser C5 (Aerovox).
One 0.5 mfd. fixed condenser C6 (Aerovox).
One rectifier tube (Raytheon).
Two 20 or 25 henry choke coils L4L5 (Shore).
One rheostat, 0 to 5 megohms.
One resistor, 20,000 ohms.
Three binding posts.
One 110 volt, 25 ampere AC fuse.
One Navy base (standard) socket.
One socket for fuse.
One baseboard, composed of either sheet aluminium or wood with a metal covering.
One bracket to hold the variable resistance.
Two switch points.
One single throw, single circuit, knife switch.
One switch arm.
Accessories: No. 14 rubber covered wire for wiring, nuts and bolts, tinfoil, and a flexible cord (about 25 feet long) with plug.

By Lewis Winner

Associate, Institute of Radio Engineers

A TYPE of B battery eliminator different from any heretofore described in RADIO WORLD is shown in Fig. 1. Full-wave rectification is employed. A gaseous discharge tube is used as the rectifier. This tube is commercially known as the Raytheon. It is really the heart of the circuit; that is, the entire filtering system is built around the action of the tube.

Rectified AC is in reality pulsating DC. If a photograph were taken, the pulsating DC would be like the big teeth of a saw. It is because of this irregularity that a filter system is employed. If we rectify AC and properly filter it, then it will be somewhat on par with the DC which is obtained from a storage battery. As soon as the filter system is destroyed we hear the pulsating DC in the receiver, rather than the AC hum. The DC note is as annoying and is on the same basis as the raw AC.

Now as to the manner in which this tube changes AC to DC. The discharging action takes place between the anode and the cathode, by means of the burning up of the remainder helium gas. The vessel which contains the elements also contains highly exhausted helium gas. Because of the small area of the ends of the anode wires, which are inserted in a block of lava, being exposed to this gas, no reversible flow of current can take place. This, therefore, gives the tube its rectifying qualities.

When the two-wave rectification system is employed, the filtering system is more easily controllable. Therefore the hum is not so hard to get rid of. This does not mean that an eliminater which employs a tube to rectify only half the cycle is not efficient. Only with this type, a heavy filtering system is required.

The hum present in the Fig. 1 eliminator is only that of mechanical vibration of the eliminator itself. By placing the eliminator about a foot away from the receiver, this may be avoided. With the average 5-tube receiver, employing resistance AF amplification with a total plate drain of 24 milliamperes, a voltage of 155 may be obtained, which is about 20 volts more than is necessary. By referring to the graph, Fig. 5, voltages at various plate milliampere ratings may be obtained, e. g., at 60 milliamperes, full voltage tap, 73½ volts are obtainable; at 60 milliamperes, 90% tap, 12 volts are obtainable.

This eliminator is not bulky. The complete eliminator weighs 15 pounds. An aluminum plate was used to mount the parts. This was done so that a common ground could be made easily. However, a baseboard, made as per Fig. 3, with a thin layer of tin or some other metallic substance placed over the wood, will serve the purpose and also cut down the expense.

Now as to the material employed in the making of the eliminator. The choke coils and the AC step-up transformer were made by the Shore Electric Co. Fig. 2 shows the dimensions of the laminations. The core (that upon which the wire is wound) is ¾" high and 1" wide. The primary L1 consists of 1,200 turns of No. 26 enameled wire. The tap (90% tap) is made at the 1,000th turn. The secondary consists of 4,400 turns of No. 31 enameled wire. The tap is taken at the 2,200th turn. The direct current resistance of the primary is approximately 30 ohms. The direct current resistance of the secondary winding is approximately 550 ohms. The both choke coils L4 and L5 consist of 5,950 turns of No. 31 enameled wire, wound on the same type of core used for the transformer. The direct current resistance of this winding is approximately 330 ohms.

Over the primary, lay on a few layers of .014" thick manila paper. Now get some No. 18 double cotton covered wire. Bring the beginning of the wire to the core. Bring the wire ⅛" from edge and wind until ⅛" from other edge. Leave this end open. Place a few layers of .014" thick manila paper over this winding. Over this layer wind the secondary. C1 and C2 are both 0.1 mfd. fixed condensers. C3 and C4 are 2.0 mfd. fixed condensers. C5 is an 8.0 mfd. fixed condenser. C6 is a 0.5 mfd. fixed condenser. All of these condensers should have a voltage breakdown of at least 350. The resistance R1 is variable and of the carbon type. The resistance should be variable from zero to 5 megohms. A Bretwood leak may be used. R2 is a 20,000 ohm resistor.

Placing the Parts

The placing of the parts is a very important factor. Take the template, Fig. 3,

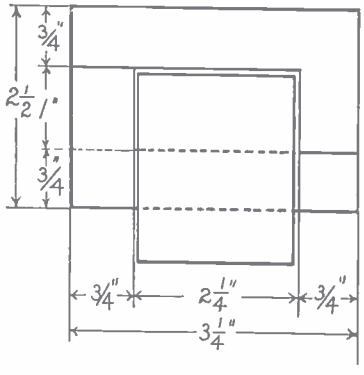


FIG. 2, the measurements of one of the laminations.

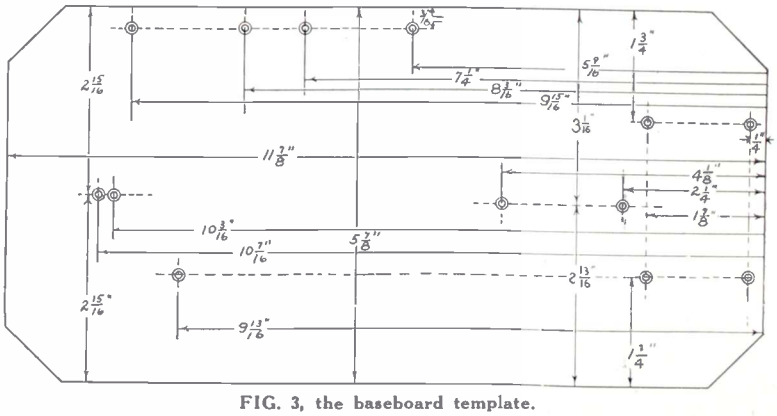


FIG. 3, the baseboard template.

Both Sides of Wave Rectified

and carefully follow the directions. All holes are measured from the center and from the left hand side of the board, which is 11⅞" long and 5⅞" wide. The two holes on the extreme left are for the step-up transformer. The two holes opposite are also for the step-up transformer. Now the two holes in the center, each opposite each other, are for the socket, which holds the tube. The four holes on the top (long edge) are for the choke coils. The two holes in the center and on the extreme right hand side are for the variable leak. The only other hole is for the mounting of the fixed resistor. Now the holes for the fuse and the switches, which have been left off the baseboard, as well as the original model, may be placed anywhere, according to the discretion of the builder. However, the other parts should be placed as per drilling holes given on the template.

The Wiring

Bring the two taps of L2 to two switch points. Bring the switch arm to one terminal of the flexible lead going to the AC line. Bring the other terminal of L1 to one terminal of single throw knife switch.

Bring the other terminal of the fuse direct to the AC line. Connect one end of the secondary winding L2 to one terminal of C1 and to the anode of the tube. Connect the tapped portion of L2 and L3 to the other terminal of C1 and to one terminal of C2. The other terminal of C2 goes to the end of the secondary winding L3 and to the anode of the tube. The cathode of the tube goes to one terminal of C3 and to one terminal of the choke coil L4. The other terminal of the condenser goes to the tapped secondary terminal. The other terminal of L4 goes to one terminal of C4 and to one terminal of L5. The other terminal of L5 goes to one terminal of C5, to one terminal of C6, to the resistance wire of the high resistance rheostat R, and to the B+ Amp.

(*Concluded on page 30*)

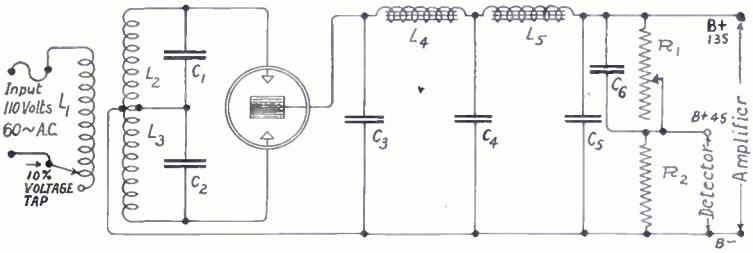


FIG. 4, the electrical diagram of the eliminator.

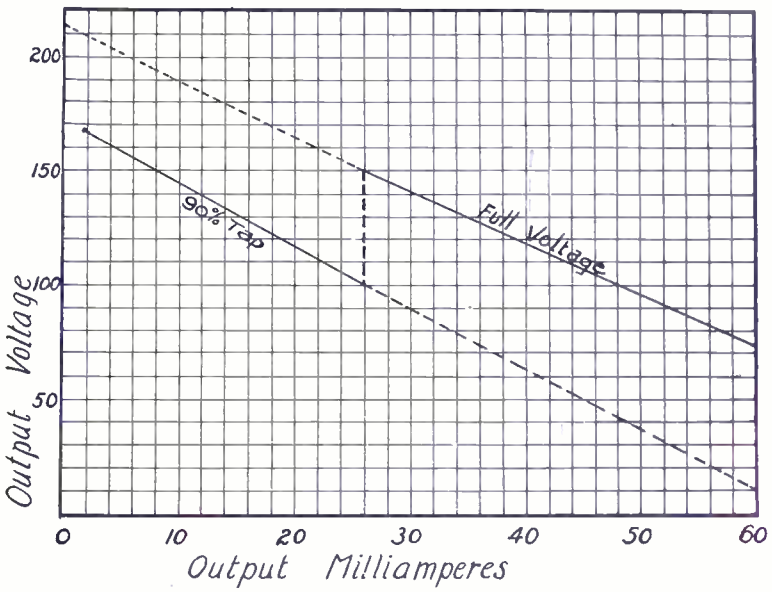


FIG. 5, the graph, depicting how many volts can be obtained with both the high and low voltage taps, with a specific number of milliamperes being drawn by the plates of the tubes.

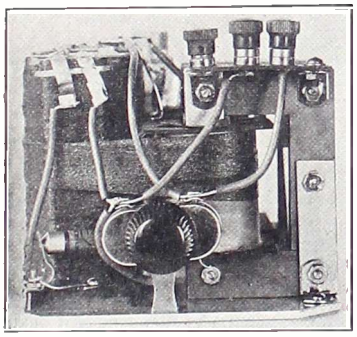


FIG. 7, the front of eliminator.

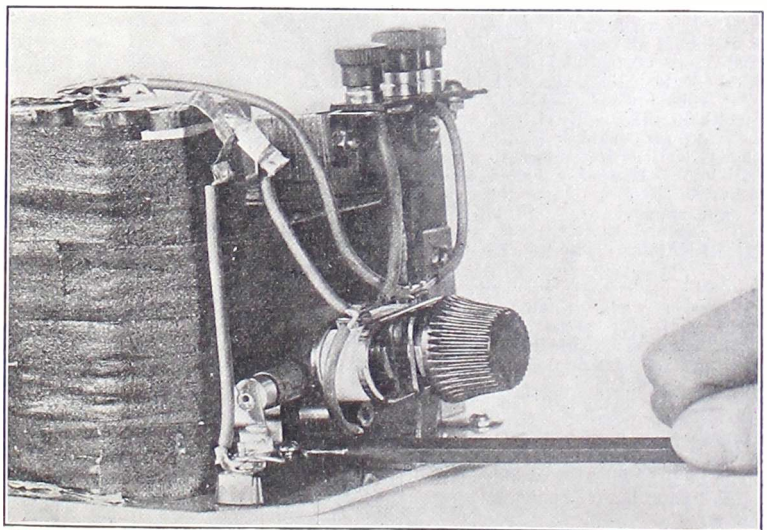


FIG. 8, pointing to grounded portion. The screw that holds the fixed resistor in place is brought to the baseboard. One terminal of this resistor is brought to the screw and is thereby grounded.

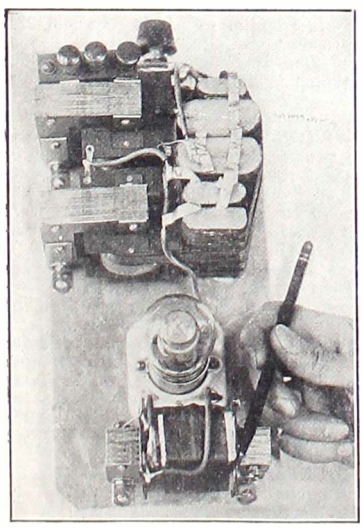


FIG. 6, a clear view of the outlay of the parts for the eliminator.

Radio University

A Question and Answer Department conducted by RADIO WORLD for its Readers by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., N. Y. C.

I WOULD like to have a diagram of a 6-tube receiver employing two stages of tuned radio-frequency amplification, without regeneration, a non-regenerative detector and three stages of resistance coupled amplification, with a C battery in the last stage. One resistance should control the filaments of the RF tube and the detector tube ,one ballast resister should control the filament of the second RF tube and one ballast should control the filaments of the last three tubes.—T. R. Dessoms, Port Jervis, N. Y.

Fig. 251 shows the diagram that you request. L1, L2; L3L4 and L5L6 are all tuned radio-frequency transformers. They are wound on tubings, 3¼" in diameter with No. 22 double cotton covered wire. The primaries consist of 10 turns, while the secondaries consist of 45 turns. There is a ¼" separation left between the windings. L1L2 are wound on one tubing, etc. C1C2 and C3 are all .0005 mfd. variable condensers. R1 is a ½ ballast resistor. R is a ¼ ampere resistor. R2 is a 1 ampere ballast resistor. R4R6R7R8 and R9 are all 1 megohm resistors. R5 is a .5 megohm resistor. R3 is a 2 megohm grid leak resistor. C4 is a .00025 mfd. grid condenser. J is a single circuit jack. Tubes 1, 2 and 3 are all of the 01A type. Tubes 4 and 5 are of the high-mu type. The last tube, 6, is of the power or lo-mu type. Use 90 volts for the B+ No. 2 lead and 135 volts for the B+ No. 1 lead.

This receiver was described by Edward Spiegler in the December 19 issue of RADIO WORLD, using Lemnis coils, in which case .00035 mfd. variable condensers were employed.

* * *

IN REGARD to the 1926 Diamond of the Air. (1)—Will any wiring change have to be made in the last stage of AF amplification when installing the new UX112 tube? (2)—What are the proper B and C voltages to use with this tube? —E. Howarth, 18 Brittania Ave., Hamilton, Ontario, Canada.

(1)—No. Use the No. 112 Amperite in the filament leg of the last tube. This is R7. (2)—When using a voltage of 157.5 on the plate of this tube, a grid voltage of 10.5 will have to be employed; for 135, 9; for 112.5, 7.5; for 90, 6.

* * *

I WOULD like to have the following queries in regard to the 1926 Diamond of the Air and Hayden's Handsome Portable (described in the July 4 issue of RADIO WORLD) answered: (1)—Which is the more selective on a loop? (2)—Which is the more selective on an outside antenna? (3)—Which gives more volume? (4)—With which can you receive the more distance? (5)—Which set is better adapted to portable use? (6)—Can I expect loud speaker results when using the UX199 tubes with either set?—Jack Esarck, 224 Ann St., Whitewater, Wis.

(1), (2), (3), (4), Diamond; (5), Handsome; (6), Yes.

* * *

IN REGARD to the 1926 Diamond of the Air: (1)—Can the method of winding primaries, as employed in the Browning-Drake coils, i. e., 24 turns of No. 28 double cotton covered wire in a slot ⅛" wide, and inserted under the last few turns of filament end of secondary, be used to advantage in the Diamond? If so, what would be the proper number of turns to place on the forms for the RFT and the 3-circuit tuner? (2)—In the Sept. 26 issue of RADIO WORLD, Fig. 7, a by-pass condenser is placed between condenser, C3 and coil, L3. To what contacts on C3 and L3 are these connections made? Fig. 8 shows the by-pass condenser between the A— and the B+ 45, but not as pictured in Fig. 7. Now which is correct? (3)—Is there any advantage obtainable with this receiver over the receiver described by J. E. Anderson in the Aug. 29 issue of RADIO WORLD?—D. W. Mansfield, 1537 South Wilton Place, Los Angeles, Cal.

(1)—According to the latest specifications of the Browing-Drake coils, the primary consists of 20 turns of No. 28 double cotton covered wire wound in a slot 3/16" wide, in the center of the secondary winding on a tubing 4" in diameter. The secondary consists of 50 turns of No. 20 double cotton covered wire. This coil can successfully be used as the RFT in the Diamond. The primary and the secondary of the 3-circuit tuner should consist of the same number of turns wound on the tubing of the same dimensions. The tickler should be wound on a tubing 3" in diameter and consist of 36 turns, using No. 26 silk over cotton wire as the conductor. (2)—That condenser, which you see in Fig. 7, which has a photograph, is C4, and is connected as per Fig. 8, even though it seems as if it is connected to those points which you state. It does not go to any point on the variable condenser as it seems to in the photograph. (3)—No. The RF and the Det. side of this set are exactly the same as that employed by Mr. Anderson in his Diamond. The only change is made in the last two stages of AF amplification, wherein instead of one stage of transformer coupled AF amplification being employed two stages of resistance coupled AF amplification are used.

* * *

I SHOULD very much like to know if I could build the Powertone, described in the Aug. 29, Sept. 5, and Sept. 12 issues of RADIO WORLD, as a 4-tube receiver, using two single condensers?—G. F. Smith, Fort Plain, N. Y.

Yes, this can be done. Instead of the two resistance stages, substitute a transformer. The method of connecting this AFT is standard. That is, the plate post of the AFT goes to the plate post of the socket (the terminal that formally went to the resistor), while the B+ post goes to the B+67½ post on the terminal strip. The G post on the AFT goes to the G post on the socket. The F— post on the AFT goes to the C—. The P post on this socket goes to the top terminal of the single circuit jack. The bottom terminal of this jack goes to the same point that the B+ post of the AFT went to (67½ volt post). When connecting the two single condensers, see that the grid returns of the RF tube is negative and the grid return of the Det. tube is positive. As represented in the diagram, where a double condenser is employed, the grid return is commonly negative, although the detector is made positive by the manner in which the grid leak is connected. That is, instead of the leak being placed across the condenser it is placed in shunt to the filament and brought to the positive side of the filament, thereby giving the tube a positive bias. When connecting the separate condenser, you can place the leak across the condenser, since you already have the required positive bias.

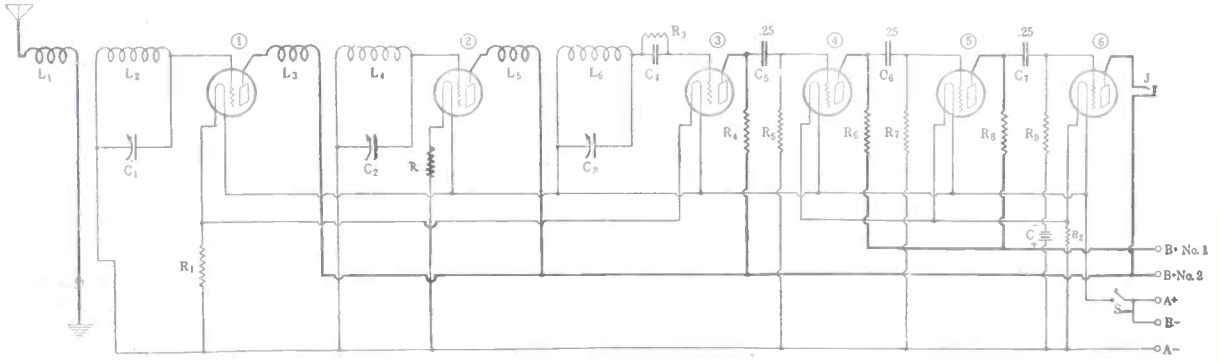


FIG. 251, showing the 6-Tube receiver with CO resistance coupled AF amplification.

* * *

WHICH TYPE of these two antennas is the better to employ, a single wire 100 feet long or a 4-wire, each wire being 33 feet in length. (2)—Why is it that I can receive WIP on 25 and then also on 90 on the same dial on my Diamond (1926 model)? This cannot be duplicated with any other station.—Charles Ihlenfeld, 2227 N. Colorado St., Philadelphia, Pa.

(1)—The single wire. (2)—This is due to tuning in a harmonic.

* * *

* * *

I WOULD like to know if I could add two stages of tuned RF amplification to the 3-tube 3-circuit tuner receiver described by Capt. P. V. O'Rourke in the Oct. 10 issue of RADIO WORLD?—Edward Staving, c/o Evans Pharmacy, 900 Western Ave., Pittsburgh, Pa.

One stage of tuned RF amplification is all that is necessary to add to this receiver. If you will look at the Diamond diagrams in the Nov. 21, 28 and Dec. 5 issues, you will find that without the RF tube added, you have the 3-circuit tuner with 3 stages instead of two stages of AF amplification. Therefore you can follow the diagram of the RF portion of the Diamond receiver and add it to this set.

* * *

IT SEEMS to me that there is some contradiction in the article on the 3-Tube 3-Circuit tuner receiver described in the Oct. 10 issue of RADIO WORLD by Capt. P. V. O'Rourke. In the picture diagram on the front page the rotor plates of the

variable condenser go to the A+ post while in the text, it specifically states that the rotor plates should go to the A— post. Which is correct?—C. J. Sands, 419 Smythe St., Vancouver, B. C.

The rotor plates of this condenser should go as the picture diagram shows, to the plus A.

* * *

PLEASE GIVE me the electrical diagram of the "See-Saw Circuit" published in the December 12 issues of RADIO WORLD and described by P. E. Edelman, with all the constants, as I would like to make this experimental receiver. I want the one that employed three tubes, with one tube balancing the RF tube.

Fig. 252 shows the electrical diagram of that set. The coil in the series with the antenna and the ground in the primary, while that joined to it, with the small bracket on the bottom, is the secondary. L2 is the primary and the wire again joined to it is the secondary. Both these coils are standard radio-frequency transformers. The primaries consists of 10 turns wound on a tubing 3¼" in diameter, with the secondaries adjoining. It consists of 45 turns. There is a ¼" separation between the windings. No. 22 double cotton covered wire is used. The two condensers which shunt these secondaries are of the .0005 mfd. variable type. The grid condenser has a capacity of .00025 mfd. The grid leak has a resistance of 2 megohms. The condenser that connects the plate of the detector tube to the F post of the same tube is one having a capacity of .001 mfd. All the tubes employed may be of the 199 or the —01A type. The amount of resistance in the rheostats depends upon the batteries employed and the tubes used also. Usually with the 6 volt battery and the 201A tube a 6 ohm rheostat is O. K. With the 199 and 4½ volt battery a 25 ohm rheostat should be used. The AFT used should be of the low ratio variety. The success of this type of receiver depends wholly upon the builder, as it is very tricky. Of course, it must be remembered that this is an experimental circuit.

* * *

I HAVE built the Diamond of the Air and get wonderful results. However I find that I cannot receive low wavelength stations well. What can I do to rectify this? I have placed 54 turns of No. 22 double cotton covered wire on a tubing 3" in diameter for the secondaries. Are there too many turns here?—Dr. G. M. Wells, 825 Life Building, Lafayette, Ind.

Take 6 turns off the secondary windings.

* * *

I WOULD like to have some advice on the following: (1)—Is it practical to build the Thordarson-Wade set, using transformer coupled amplification instead of the Autoformer method of coupling? (2)—When doing this is it practical to use a C battery? (3)—If it is to be employed, where shall it be placed? (4)—Is it all right to use peanut tubes? (5)—Would a 5 to 1 and a 3 to 1 AFT be O. K? (6)—Will this set work satisfactorily on 4 tubes?—J. H. Ball, 369 Dacre St., Port Arthur, Ontario, Canada.

(1)—Yes, but you should only use four tubes. (2)—Yes. (3)—Connect the F— posts of the AFT together, and connect them to the C— post. Connect the C+ post to the A— post. (4)—If you are going to use peanut tubes, then three stages of AF will be necessary, as the volume derived from a receiver employing small tubes, throughout, is not great. (5)—Yes. (6)—See answers to queries 1 and 4.

* * *

I HAVE built the 3-tube 3-circuit receiver described by Capt. P. V. O'Rourke in the Oct. 10 issue of RADIO WORLD and

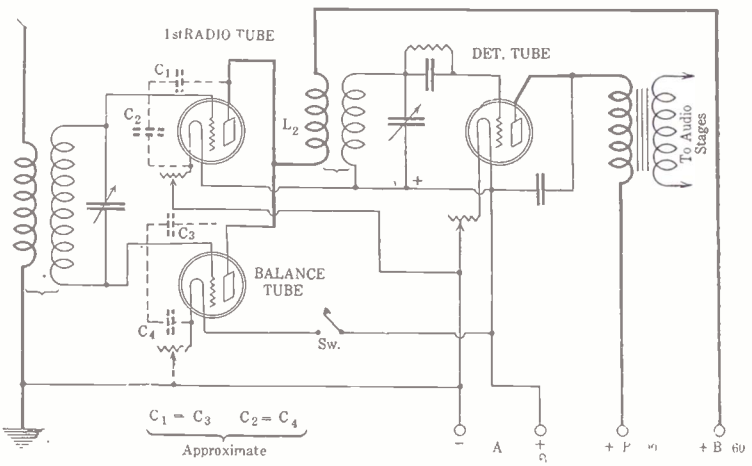


FIG 252, shows tbe Experimental Circuit, desired by Mr. Waintras.

am having some trouble with it. The only way that I can receive loud speaker reception is by connecting a wire across the 45 volt B battery terminal to the other B+ volt 45 terminal. In other words, I have to join the two P2 posts together.—Frank Guth, 600 East 18th St., N. Y. City.

See if the lead connecting the two batteries in series is not broken.

One of the B batteries may be in a discharged condition. It is possible that the tube that you have requires that high voltage to successfully operate the same. Be sure that both B batteries have their fully rated voltage. Try changing the tubes around as the tube you now have in the detector socket may be a poor detector.

* * *

I WOULD like to know which is the best method to employ, whereby oscillations in a 5-tube receiver which consists of 2 stages of tuned radio-frequency amplification, detector and 2 stages of transformer coupled amplification are controllable?—A. C. Jones, Lexington, Ky.

Mount the coils at an angle of 57.3°. Count the number of turns in the primary of the first radio-frequency transformer. Let us say there are 10. Now 10 turns from the filament end of the secondary winding, of the two interstage RFT, make taps. That is, tap the secondaries of the second and the third RFT at the 10th turn. Obtain two small .00004 mfd. variable condensers. Connect the stator plates of one of these to the G post on the first socket. Connect the rotary plates of the same condenser to the tap. Connect the G post of the second socket to the stator plates of the second small variable condenser. Connect the rotary plates of this condenser to the tap on the secondary of the third RFT. You now have two small variable condensers in series with the grids of the RF and Det. tubes. When mounting these coils place them at the rear of the baseboard on angle irons, so that you can vary the angle of inclination of these coils. Do not place them on the end plates of the variable condensers. They also should not be placed so that an electrostatic field exists between the condensers and the coils.

* * *

I WISH to build the 2-Tube Reversed Feed-Back receiver, described in the June 27 issue of RADIO WORLD by Professor Ginnings. However I do not know the constants of all the parts, e. g., R3, C4, and C5. (2)—I would also like to know how to add 1 stage of audio-frequency amplification to this set.—James R. Frile, 1130 Rebecca St., North Braddock, Pa.

(1)—R3 is a 2 megohm grid leak. C4 is .00025 mfd. fixed grid condenser. C5 is a .001 mfd. fixed condenser used for by-pass action. (2)—Obtain a low ratio audio-frequency transformer, a socket and a single circuit jack. Connect the P post on the AFT to the P post of the detector tube. Connect the B+ post on the AFT to the B+45 post. Connect the G post to the AFT to the G post on the new socket. Connect the F— post of the AFT to the F— post on the socket. In series with the F— post on the socket install a ballast (¼ ampere for the —01A tube). Connect the F+ post to the A+ post. Connect the top of the single circuit jack to the P post on the socket. Connect the botom terminal of the jack to the B+67½ volt terminal.

RADIO WORLD'S

Laboratory

Reports for the Guidance of Its Readers

Address problems to Laboratory Director, RADIO WORLD, 145 *West 45th Street, New York City.*

CONSTRUCTIVELY inclined radio fans who are adherents of single control receivers and are frequent users of multi-condenser units cannot but be interested in a cheap capacity testing unit, by means of which they can check the various sections of a multi condenser to ascertain if the capacity values are exact throughout the capacity range of the condenser.

In substance an electrical bridge is an arrangement wherein a difference of potential between two arms can be determined, indicating a difference in resistance, reactance or impedance between the arms; or inversely by obtaining a potential balance between the arms, a balance of resistance, impedance or reactance is indicated. In simpler language a balance of resistance, inductance or capacity is indicated, the exact expression depending upon the units being measured. In the capacity bridge described herein, we obtain a capacity balance and therefore capacity reactance. However for general purposes, the fan who is not sufficiently technically inclined can forget the various expressions associated with the bridge, and balance for capacity.

A schematic wiring diagram of the unit is shown in Fig. 1. The buzzer, actuated by the battery and switch and connected in series with a modulation transformer primary, generates a signal and emf, amplified by the secondary of the transformer and impressed across the bridge arms K J M and K L M. A pair of phones are connected between the points K and M. The arm J K contains a 1,000 ohm non-inductive resistance, as does the arm K L. The arm J M is the standard arm and contains a calibrated variable condenser. The arm M L carries the unknown condenser. The resistances in the arms J K and L K being equal, the voltage between the points J K and L K are equal, and if a balance in the capacity arms J M and M L is obtained, the reactance of the two arms K J M and K L M will be equal. Thus the voltage in one arm balances the voltage in the other arm and an absence of sound in the phones results. However, if there is a variation between the two capacities, the standard and the unknown, a difference of potential will be obtained between the two arms and the buzzer note will be audible in the phones, the strength of this note depending on the value of the potential difference. The foregoing is the theoretical operation of the bridge.

The buzzer should be high-pitched, that is, have a high note, the higher the better, since a high note is conducive to better measurements, by facilitating the detection of variation in potential balance, a high pitched note being more audible than a low pitched note. The next item of concern is the ohmic value of the resistances R1 and R2. It is imperative that they be identical, a variation giving a ratio balance in the arms and therefore in the capacities, the magnitude of which is governed by the difference in resistance of the two resistance. We will assume them to be accurate, as practically identical resistance can be obtained. In fact a variation of one ohm or two ohms is permissible.

As to the selection of the standard capacity, it is essential that it be calibrated in micromicrofaradas. Measurements of a large number of the General Radio 247E condensers have shown the calibrations as furnished by the manufacturer to be accurate to 2% or better. An uncalibrated condenser may be calibrated in a laboratory, which will do the work for a small fee.

The operation of this unit is neither complex or troublesome. Assuming correct wiring, the parts will be arranged as shown in the diagram, the two posts X

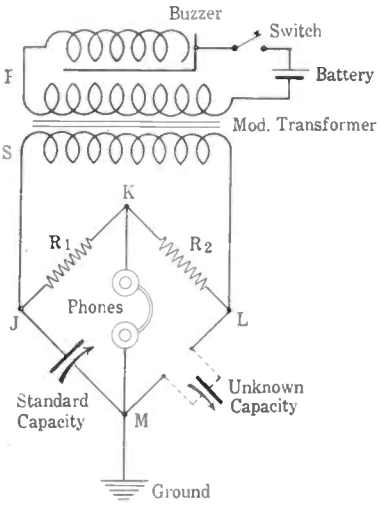


Fig 1

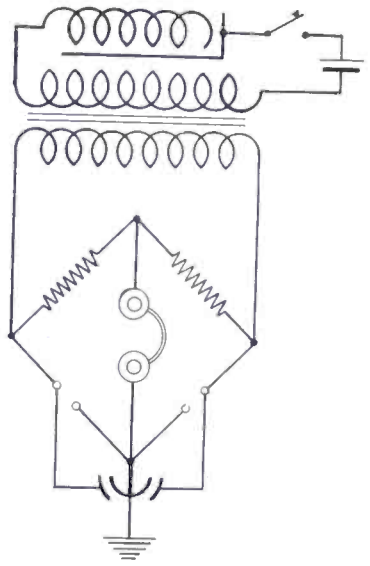


Fig. 2

HOW to hook up a Wheatstone Bridge (Fig. 1). A quick way to test a double condenser is shown in Fig. 2.

The material required for this unit is the following:

One General Radio high frequency buzzer. Any other high pitched buzzer may be utilized to equal advantage.
One modulation transformer. (General Radio, Acme or Dongan).
One battery switch.
Three No. 6 dry cells to supply 4½ volts for the buzzer.
Two 1,000-ohm non inductive wire wound resistances (Kellogg).
One pair of phones
One General Radio 247E calibrated .0005 mfd. variable condenser.
Connecting wire and binding posts or Fahnstock clips.

X open, to which is connected the unknown capacity unit.

As the unit stands it has two definite limitations, the fact that the calibrated condenser has a maximum of 500 micromicrofarads (.0005 mfd) and that no means of determining the dielectric resistance of the unknown condenser is incorporated. The maximum capacity limitation can be overcome, and the method of so doing will be discussed later. The dielectric resistance is not so much of a defect, since approximations can be obtained, and radical losses discovered.

Let us assume that we have on hand a variable condenser rated as .00035 mfd. We are desirous of determining its maximum capacity value. This condenser is connected across the posts designated as X (unknown capacity). The buzzer is set into operation and the standard condenser manipulated until the sound becomes minimum in the phones. The capacity of the unknown is equal to that capacity of the standard required to produce this condition of absence of sound in the phones. If there is a marked difference in efficiency of the two condensers, that is, the unknown has much greater losses, it will be impossible to obtain complete silence in the phones, a weak signal being audible. However the minimum sound indicates equal capacity values. It should be observed that the grounded sides of the condensers under test are connected to the point M.

To determine the minimum of an unknown it will be necessary to use two unknowns, due to the high minimum calibration of the 247 E condenser. One unknown is checked for maximum, and left connected. The other unknown to be tested for minimum capacitance is set at minimum and connected across the first unknown. The additional capacity required to produce the balance is the minimum of the second unknown condenser.

If it is desired to increase the range of the standard, a condenser is calibrated by means of the unknown and placed in shunt to the standard. For this purpose, it is best to use a condenser of equal efficiency; one with which absolute silence in the phones was obtained during the calibrating process. If not available, a small fixed condenser can be checked and used as a shunt to the standard.

Following along the lines set forth, it is possible to check the various sections of multi condensers; one section at a time. There is, however, another method, more rapid but likely to confuse. This arrangement is to replace the standard by one section of a double condenser and place the other section in the position of the unknown, as in Fig 2. This can be accomplished since point M is connected to the common rotor. If both units are alike in capacitance value throughout the range, no signal will be audible in the phones throughout the range of the condensers. If however a variation is existent at any one point, it will be manifest by a note in the phones.

Radio, the Great Interpreter

By Douglas Wakefield Coutlee

IS there a Santa Claus? I'll say there is. And so will you when you read this true story.

Every story, like every sermon, must have a text; and this one is no exception to the rule.

Having selected a text, the author must decide upon a theme; then he should cast his characters, assign to them the respective parts which they are to assume, provide a medium through which to interpret the plot and gradually build up a climax that will not only exemplify, but justify the text upon which the story is based.

In this particular case my task is quite simple, for, being a true story, these necessary elements are all available and I need only relate the facts in order that you may know the complete story.

The text which forms the basis for this story is taken from the thirteenth chapter of Corinthians, the fourth verse:

"And now abideth faith, hope and charity—these three; but the greatest of all is charity."

The theme, appropriate for this season of the year is—Christmas.

The characters consist of a group of busy (*but not too busy*) business men, a dying mother, an invalid father and a *boy*.

The parts which these characters assume are *human* parts.

The medium through which the plot is interpreted is *radio*.

The climax that examplifies and justifies the text is *happiness*.

The scenes wherein this story was enacted are laid in two places that would appear to be widely separated, theoretically, if not geographically—the beautiful and expensively furnished Advertising Club of New York and a drab and poverty-stricken tenement in Bridgeport, Connecticut.

But in both of these two widely separated habitations there dwelt faith, hope and charity—and between the two came radio, the great interpreter, and provided that great gift of Happiness which we all should share at Christmas time.

For several years it had been the custom of the Advertising Club of New York to hold a Christmas party for the children of its own members. On a certain day during the holiday week the members would bring their children to the Club to participate in the joys of an elaborate festival, including a huge Christmas tree, music, entertainment and a generous distribution of toys, ice-cream and candy. And all this, despite the fact that every child in the party had previously enjoyed the very same things, and more, at home on Christmas day.

Selfishness? No one had ever thought about in that way until President Charles C. Green announced this year that instead of giving *another* Christmas party to *our* children, we would give a party to a group of poor children who would not otherwise have one.

And so it was decided that the Advertising Club of New York would play Santa Claus to the poor children of New York—would in fact, go beyond the limitations of its own members for support and enlist the cooperation of as many people as possible in order to provide a generous supply of gifts for distribution.

Having decided upon this worthy program, the next problem was that of reaching those people in and about New York who would be apt to respond to such an appeal for support. Someone wisely suggested radio. Inquiries were made and permission was granted to the Club by the Radio Corporation of America to broadcast its appeal from Station WJZ.

One of the Club members, John Martin, well-known to children the country over as the publisher of John Martin's Book, was selected to assume the role of Santa Claus and broadcast the Club's message and appeal.

On a Monday night, two weeks before Christmas, John Martin as Santa Claus went "on the air" from WJZ and in his own characteristic way told of the Advertising Club's promise to support him in distributing gifts to poor boys and girls who would not otherwise receive any. He directed his appeal chiefly to children who already had toys which they could spare and asked them to have them wrapped up and sent to the Advertising Club, to be delivered from there to the poor on Christmas Day.

No one knows how many children and grown-ups heard this Christmas appeal—and no one will ever know. But there was one who heard—and heard and responded; and if in place of the hundreds of letters, checks and packages which were received at the Club, this one response alone had come in, the undertaking would have been called a success. For this one response gave unmistable proof to two thousand busy business men that there "now abideth faith, hope and charity; but the greatest of these is charity."

In a little room of the drab tenement at 265 Olive Street, in Bridgeport, Connecticut, on a Monday night, two weeks before Christmas, John Cormack sat in a wheel chair and with his crippled hand, the only part of his paralyzed body that he could move, patiently manipulated the dial on his amateur one-tube set and finally succeeded in "tuning in" on WJZ. At a table in the corner of the pitifully bare little room Wesley Cormack, age nine, worked diligently at his lessons.

Suddenly Wesley's father announced that Santa Claus was broadcasting. Adjusting the ear phones eagerly, Wesley prepared to listen. And this is what he heard: That there were numerous poor children in the big city of New York who, despite the efforts of the charitable organizations, would not receive any gifts for Christmas unless the people in the radio audience would provide such gifts, or the money with which to buy them. He also heard Santa Claus announce that the Advertising Club of New York would receive such contributions, distribute them to the poor children on Christmas Day, and thus provide a little bit of happiness to those who would otherwise have none at all.

Wesley heard the appeal—and something in his heart told him he must answer it. He looked about him and noted the few objects of furniture in the room that he called "home." He glanced at his father, helplessly confined to an invalid's chair as the result of a fall seven years before. He thought of his mother who for three years had lain in the hospital (he didn't realize that this would perhaps be her last Christmas on earth) and he thought of his six-year-old brother who was living with "some good people in Boston." *He* thought of the things he would like for Christmas and of the few little things which he already had; and then he thought of those "poor" children who had nothing, and who would have nothing on Christmas Day—unless he helped.

Sitting down at his little table he wrote this letter to Santa Claus, in care of the Advertising Club of New York:

265 Olive St.,
Bridgeport, Conn.,
December 14, 1925.

"Dear Santa Claus:

"I am nine years old. My mother has been ill in the hospital for over three years and my daddy is an invalid. For that reason I was not able to send any brand new toys but sent you some old ones I had hoping that some little boy or girl would like them. I listened to your talk last Monday night and tonight. Daddy could not tune it in right and I only got some of it. Some boys and girls in my school do not believe in you but I do. They told me that their mothers or fathers fill the stockings and put the gifts around the tree. I sent my package to you when I got home from school this afternon. I have got a brother in Boston. Hope you will make many sad hearts glad on Christmas Day.

"Love and kisses from
"WESLEY CORMACK."

Having written that letter, and little realizing that it would be published far and wide in newspapers and magazines, Wesley began the task of getting together his con-

(*Concluded on page* 27)

U. S. Has 536 Stations; 250 Applicants on List

WASHINGTON

At the beginning of the new year there were 536 broadcasting stations, 408 of which were class A and 128 class B. There are also pending before the Department of Commerce around 250 applications for new broadcasting station licenses, and around 100 applications for increased power.

The stations in existence are classified by power as follows:

Class A: 6 stations of 5 watts; 53 stations of 10 watts; 9 stations of 15 watts; 9 stations of 20 watts; 1 station of 25 watts; three stations of 30 watts; 79 stations of 50 watts; 122 stations of 100 watts; 5 stations of 150 watts; 4 stations of 200 watts; 29 stations of 250 watts, and 88 stations of 500 watts.

Class B: 56 stations of 500 watts, 6 stations of 750 watts; 36 stations of 1,000 watts; 8 stations of 1,500 watts; 2 stations of 2,000 watts; 2 stations of 2,500 watts; 1 station of 3,000 watts; 2 stations of 3,500 watts; 1 station of 4,000 watts; 13 stations of 5,000 watts, and 1 station of 10,000 watts.

Twelve Stations Quit

WASHINGTON

Twelve stations were discontinued. Classified according to power, the discontinued stations follow:

500 watts—KDPM, Cleveland, and WLB, Minneapolis.

100 watts—KFUM, Colorado Springs, Colo., and WTAT, Boston.

50 watts—KFJX, Cedar Falls, Ia; KFRM, Ft. Sill, Okla; KFUJ, Breckenridge, Minn; KWUC, Lemars, Ia; WHBY, West De Pere, Wisconsin; and WPDQ, Buffalo, N. Y.

10 watts—KFWP, Brownsville, Texas, and WOCG, Sycamore, Ill.

A THOUGHT FOR THE WEEK

SEVERAL years ago one autoist asked the other: "How fast can your car go?" Today the query is: "How does your car stand up?" In 1922 the principal query in radio was: "How's your set for distance?" In 1926 the same questioner wants to know: "How clear is your reception?"

RADIO WORLD

The Link Connecting Radio Fan, Dealer, Jobber, Distributor and Manufacturer

Radio World's Slogan: "A radio set for every home."

TELEPHONES, BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
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M. B. HENNESSY, Vice-President
FRED S. CLARK, Secretary and Manager
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Paris, France: Brentano's, 38 Avenue de l'Opera
Chicago: A. T. Sears & Son, Peoples Gas Bldg.
Cincinnati Office: Radio World, 304 Provident Bk. Bldg., 7th and Vine Sts. Telephone, Canal 753 and 379.
San Francisco: Lloyd B. Chappell, 658 O'Farrell St.

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard

SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowlegment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address also. State whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 3¼" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Times Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum, 10 words. Cash with order. Business Opportunities ten cents per word, $1.00 minimum.

Entered as second-class matter, March 23, 1922, at the Post Office at New York, N. Y., under the act of March 3, 1879.

JANUARY 16, 1926

"Remember" Most Popular Song on Radio

"REMEMBER" is the most popular song on the radio to-day. This is proven by the great preponderance of requests received by stations and orchestras for the rendition of this number, composed by Irving Berlin. Last Spring the most popular song was "I Wonder What Became of Sally."

While America, both in its radio and cabaret aspects, is now regarded as being "crazy for jazz," it is significant that the most popular two songs on the radio within the last eight months have been waltzes. These do not rate jazz chevrons.

As is only natural, both of these waltzes, "Remember" and "Sally," are sentimental songs. "Sally" dealt with the devilish girl of the alley who suffered a wanderlust so strong that it twirled her out of her homely environment into the mysteries of a career among strangers in strange places. The burden of the song was that her girlhood sweetheart still was waiting for her and would accept her, no matter what had happened meanwhile, and he seemed to have some misgivings.

"Remember," on the other hand, is more natural and not so melodramatic in verbal theme, although it is a soliloquy of bitterness by a disappointed feminine sweetheart. This sex identity is not plainly given in the words, as it is supposed to enhance the popularity of a song to have it versatile in that respect, but the words draw a picture of quick and aggressive courtship applicable to the more reckless sex.

While the music of the song "Sally"—not to be confused with the musical comedy of that name—had a ready attraction and easy flow, it was of cheap execution and lacked finesse or any sign of real musical touch, while "Remember," like so many of Berlin's compositions, rises to heights like those scaled by Victor Herbert. Songs, like people, often ride high because of circumstance of birthplace and environment. So "Remember," had it been born in the pivotal cradle of an opera, or embedded therein after less noble birth, might have become almost classic, like "The Last Rose of Summer," the thematic piece of the opera "Martha."

The position of first honors, enjoyed by "Remember" in the radio field, naturally means that the song is the most popular one in America, because of the identity of preference between the radioists and the body politic of which they are an imposing number. "As radio goes, so goes the nation," one might say, without detracting any political glories from Maine.

Aside from the swinging sweetness of the music of "Remember," the lyric, also by Berlin, is sound. It stresses the loving promises ruthlessly forgotten by the suitor. Don Juans the world over will find in this lyric reminders of the heart-broken harangues of the women to whom they promised a lot, even though all the promises made may not have been so serious as to be classed as matrimonial. Even a simple diamond lavalliere mentioned in a fluid moment some years ago will generate feminine currents of prodding and disgust, showing that the woman too often ascribes to the man the same sincerity that she feels. Berlin has capitalized this with fine skill, yet quite simply, and the theme has universality, without which no composition can be great.

Berlin is 37 years old. He was born in Russia and came over here in his mother's arms. In the lower East Side of New York City, amid the squalor that has yielded some of the finest fruits of American intellectual and professional development, he knew the biting pangs of poverty very well. For a long time he was a singing waiter in drinking and eating places of indifferent culture, and then branched out as a composer, whereupon his rabbinical father and toiling mother learned how sweet in contrast are the luxuries of life. Irving's successes multiplied. The war found him drafted. He produced for the canteen fund the musical show, "Yip, Yip Yaphank," in which Sergt. Berlin's "Gee, How I Hate to Get Up in the Morning" was the biggest hit.

Most recently he took as his bride Ellin Mackay, the attractive 22-year-old daughter of Clarence Mackay, president of the Postal Telegraph Co. The couple were married in the Municipal Building, New York City, following a sudden decision by telephone. Mr. Mackay constrained his fury. He had opposed the match.

Berlin is rated a millionaire, an honor that his unencouraging father-in-law has enjoyed for more than twenty years. But he says he will have to work still harder to support his wife.—H. B.

A GOOD REASON —By Dan Napoli

Radio Service Needs Funds; Plea to Congress to Aid Public

By Thomas Stevenson

WASHINGTON.

FINANCIAL recognition by Congress of the importance of the radio industry to the American people would result in improved service and save the public thousands of dollars.

Money is badly needed by two branches of the Government which are engaged in radio activities of benefit to the public. These are the Radio Inspection Service of the Department of Commerce and the Radio Laboratory of the Bureau of Standards.

The public is more familiar with the work of the Radio Inspection Service. Summed up, it is the duty of radio inspectors to examine and license operators and stations, inspect the radio equipment of ships, check up on stations to see that they operate on the wavelengths assigned them, and to investigate cases of interference of radio and non-radio sources.

Since the advent of broadcasting, the duties of the radio inspectors have multiplied.

Not Paid for Overtime

Originally intended only for the inspection of ship and commercial radio equipment, the additional burden of looking after broadcasting stations and thousands of interference complaints has made it necessary for most of the inspectors to work from 12 to 18 hours a day.

In spite of the overtime services of the inspectors (for which, incidentally, they are not paid extra) many of the reports of interference are not investigated because the time cannot be found.

The one remedy is to increase the inspection force to such proportions that satisfactory service can be rendered to the entire country. But to do this would call for money and there is where Congress enters into the picture.

For the fiscal year 1927 (which begins July 1, 1926) the Budget Bureau recommends an appropriation of $354,000, which is an increase of approximately $125,000 over the appropriation for the fiscal year of 1926. Generally the recommendations of the Budget Bureau are heeded by the House Appropriations Committee and passed through Congress.

Why the Amendment Was Lost

One of the few exceptions in recent years applied to radio. Last year the Budget Bureau recommended $220,525 for the radio inspection service, and shortly thereafter recommended a supplemental appropriation of around $100,000. The first recommendation was approved. Chairman Martin Madden (Illinois) of the House Appropriations Committee, was responsible for the defeat of the second recommendation.

Mr. Madden's opposition to the second recommendation was based on the theory that radio inspectors should not poke their noses into the business of street railway and electrical companies which create interference with their equipment.

These industries are doing their best to cooperate with radio inspectors to eliminate interference.

The appropriation for the radio inspection service will be taken up by the House Appropriation Committee late this month.

The work of the Radio Laboratory of the Bureau of Standards is also of great importance to the public. There are several highly important radio investigations which should be made immediately by the Radio Laboratory but which cannot be attempted until more money is available. For instance, methods and apparatus should be developed for measuring high frequencies.

Other Important Work

Also, the Laboratory should go to work on the measurement of receiving sets and on methods and apparatus for the measurement of the power of transmitting stations. These and other important investigations will help tremendously in the standardization of equipment which will mean thousands of dollars saved to the public through cheaper and better sets.

One of the present undertakings of the Radio Laboratory is an investigation of the causes of static and fading. This and other equally important investigations are moving very slowly because of lack of money.

The recommended appropriation for the Radio Laboratory for the fiscal year 1927 is around $50,000. To do justice to several investigations which should be started immediately, the Radio Laboratory should have at least $200,000.

The only thing fans can do about it is to write their Senators and Representatives in Congress, expressing their wishes in the matter.

Naval Laboratory Sets Records for DX

WASHINGTON

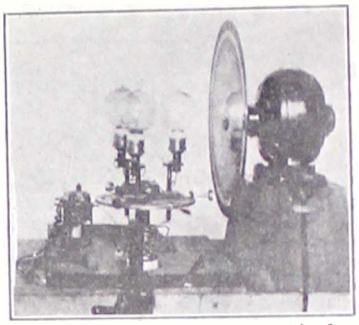
New distance records are constantly being established by the U. S. Naval Laboratory at Bellevue in its experimental high frequency work. Recently two-way direct communication was established between the Bellevue Laboratory and the Naval Vessel Scorpion in the Mediterranean on 71 meters.

Frequency Test Schedule

WASHINGTON

Announcement is made by the Radio Laboratory of the Bureau of Standards that standard radio frequency signals will be transmitted by the Bureau Laboratory and 6XBM. Stanford University, Calif., on the 5th and 20th day of each month for the next three months, between 10 and 11:32 p.m. The frequency range to be covered will be between 50 and 2400 meters.

Radio Warns of Fogs



A NEW SYSTEM of automatic fog signals, operated through the medium of wireless, is the latest boon to the shipping industry in London. Until now, the dense fog kept the lighthouse keepers on watch over their fog horns and guns, constantly day and night. The photo shows the disc, three lamps and an automatic relay used in the dence.

(International Newsreel.)

Paris Programs Lack Americans' Variety

Radio entertainment in lands beyond the sea is not nearly so varied as in almost any large American city. As an illustration, here is an announcement of radio programs for Paris:

"EIFFEL TOWER (wavelength 2,650 m). 6:15 p.m. concert. Weather reports and signals at the usual hour.

"RADIO PARIS (wavelength 1,780 meters). 12:30 p.m. concert. 1:45 and 1:50 p.m. news bulletin and exchange rates. 4:30 p.m. exchange rates. 4:45 p.m. concert. 5:45 p.m. news bulletins and exchange rates. 8:15 p.m. medical bulletin. 8:30 p.m. news bulletins and exchange rates. 8:45 p.m. Italian music festival.

"ECOLE SUPERIEURE (wavelength 458 m). 3 p.m. concert. 8 p.m. scientific bulletin. 8:30 p.m. Italian gala opera "Rigoletto" fr m the Grand Theatre, Geneva, performed in honor of the League of Nations.

"PETIT PARISIEN (wavelength 345 m) 9:15 p.m. popular scientific lecture 'What is Life' by Prof. R. Dubois.

"RADIO-GENEVA (wavelength 1,100 m) 8:15 p.m. concert."

German Statesmen Heard Here As Records Are Broadcast

By means of a new ingenious electrical instrument, used in connection with the Panatrope, the voices of Germany's leading statesman, Dr. Karl Stresmann, Minister of Foreign Affairs; Dr. Paul Loebe, President of the German Reischstag; State Secretary Bredow; Dr. Hugo Eckener, expressing the fact that peace should be maintained, were heard Christmas night through WRNY, the "Radio News" Station and at the same time through the Westinghouse chain of stations, in Pittsburgh, Chicago, Springfield, Mass., and Hastings, Neb.

Clare Dux and Cornelius Bronsgeest of the Berlin State Opera sang solos and duets, while J. Berger, famous cellist, played.

These messages were actually delivered in the laboratories of the Vox Company, in Berlin on December 9 and recorded on a specially prepared wax disk. The Panatrope was developed by the General Electric Co. in conjunction with the Westinghouse Electric and Mfg. Co., and the Brunswick-Balke Collender Co. Through the Foreign Institute in Stuttgart, arrangements for this new type of record to be broadcast were made by Stanley McClatchie, an American Radio Engineer, residing in Germany at present. These records arrived in this country December 23, by special mail.

With the aid of this new device, it is possible to take the original sound nd cause it to be changed to electrical waves. When it finally is reproduced again, the loss is so small, that it is not noticeable. The reproduction was so perfect that it was impossible for the listener-in to detect the fact that the speakers and the singers were not before the microphone in the studio. It must be remembered that the wax records proper were rebroadcast.

THE RADIO TRADE

Wheatstone Bridge Used In Two New Crosley Sets

CINCINNATI—Four new radio receiving sets, incorporating many unique improvements, including a "Crescendon," which gives control of volume by the turning of a small knob, and the recently perfected R. F. L. circuit, have just been announced by Powel Crosley, Jr. Three five-tube and one four-tube sets are included in the new models for 1926, which are now in production in the plants of The Crosley Radio Corporation. In keeping with the policy of manufacturing the Ford class of merchandise, they will be moderately priced. Mr. Crosley said:

"We have incorporated for the first time in a radio set a true Wheatstone bridge, a laboratory measuring instrument for balancing, in each radio stage of the R. F. L.-60 and R. F. L.-75 five tube receivers, which employ the circuit developed and perfected by Stuart Ballantine and Dr. Louis M. Hull. This makes it possible to obtain great cascade amplification at long wavelengths (a result heretofore unattained with balanced, or neutralized sets) and at the same time, to secure perfect balancing at all wavelengths. It is just possible, that the use of the words 'Wheatsone bridge' will become a household word used by radio fans, where heretofore it was known to only a few hundred radio engineers."

Antenna Coupler Aids DX On a Super-Heterodyne

In a new antenna-coupler developed by the Superadio Co., the Super-Heterodyne enthusiast will find an effective and efficient unit with which to "link" his set to an inside or outside antenna. This has long been the goal of the Super-Heterodyne fan who has sought some means of utilizing the superior DX qualities of the antenna over the loop. When one stops to consider how sensitive a Super-Heterodyne must be to maintain its reputation as the Rolls-Royce of radio, he can realize what a great improvement in range and volume will be had by replacing the loop with an outdoor aerial.

To equal the pick-up of an ordinary 75 foot aerial, a specially wound loop at least 30 feet square would be necessary. Therefore an efficient means of coupling the receiver to an outside antenna or a good indoor aerial affords many advantages over the loop. Of course, the antenna cannot be connected directly to the loop terminals of the set, nor will an ordinary coil suffice, for with such sensitive sets the ordinary coupling coil would act as a miniature loop and the selectivity would be greatly impaired.

The new type G coupler provides an efficient link. It is a laboratory product, constructed of the highest grade materials. Its special three circuit coil and the tuned circuit not only maintain selectivity, but improve it. The complete instrument is furnished in a handsome hand-rubbed mahogany cabinet. Each one is tested separately before being sent out, and is accompanied by an individual calibration chart and blueprint.

Tested by a member of RADIO WORLD'S staff who is a Pressley fan, on a home-built Pressley Super-Heterodyne, it gave a 20% increase in DX, fully 40% increase in volume and a 50% improvement in selectivity. When this set was built last February it was very selective in the location, but with the increase in power by many stations it had become quite broad. With the addition of the coupler, it brings in WFAA while WEAF is on, which it is unable to do with the loop. Many DX stations were obtained which can not be brought in with loop tuning, while the great increase in signal strength effects quite a saving in current. This coupler is marketed by the Superadio Co., 136 Liberty Street, New York City, who are laboratory specialists.

20,000,000 Listeners; 5,000,000 Sets Used

The radio audience at the opening of 1926 totaled 20,000,000, according to an estimate complied by "Radio Retailing" in an inventory of the radio industry. The number of receivers in use is calculated at 5,000,000. The total retail value of radio equipment sold during 1925 is placed at $450,000,000. Sales were divided as follows: Complete sets, $180,000,000; parts, $70,000,000; accessories and replacements, $200,000,000. Dry batteries "A," "B" and "C" are figured as accessories and their sales were $75,000,000; storage batteries, $18,000,000.

There are approximately 2,000 radio manufacturers, 1,000 radio jobbers, 31,000 radio retailers.

Coming Events

JAN. 24 to 30—International Radio Week. Trans-Atlantic tests.

MARCH 8 to 13—6th Annual Radio Show and Convention, Executive Radio Council, 2nd district, Hotel Pennsylvania, N. Y. City.

NO BATTERY ELECTRIC SET

For those who are interested in operating their set from the electric light socket and who have failed, it might be of surprise to learn that there has been some real development along these lines and that one may now either build a set of this kind or rewire their present set so that it can be operated from electric light sockets. A very interesting and practical booklet has been issued by the Powerola Radio Corp., of 1845 Broadway, New York City, giving a complete history of past and present effort along these lines, with some very valuable information.

SUN SPOTS WILL AFFECT RECEPTION, SAYS ASTRONOMER

"Sun spots are rapidly increasing," says Breading G. Way, secretary of the department of astronomy of the Brooklyn Institute. "Eventually, I think, they will affect telegraphic communication and radio broadcasting all over the world."

The largest group of sun spots now to be seen is 25,000 miles wide and 175,000 miles long and comprises more than a dozen spots.

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

Trade Service Editor,
RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....
City or town.....
State .....
Are you a dealer?.....
If not, who is your dealer?
His Name .....
His Address .....

E. J. Messeck and Co., Bricknell, Ind. (Yes).
J. Sandors, 445 Emory Ave., Trenton, N. J.
George Koch, R. R. 6, Station A, Box 132, East Toledo, O.
R. H. Bartlett, Kennebago, Me. (Dealer).
John Wines, Akron, O.
F. Woodall, Wilkinsburg, Pa.
A. J. Peshenka, Wilkinsburg, Pa.
E. P. Jarrell, Palestine, Tex. (Dealer).
B. W. Gaugler, 515 East 27th St., Erie, Pa. (Dealer).
Leslie C. Hewitt, Exchange Block, Endicott, N. Y.
B. G. Richards, Lockport, Ill. (Dealer).
W. L. Converne, Route 3, Local Gables, Fla.
M. Miller, 321 Hopkinson Ave., Brooklyn, N. Y. (Dealer).
George T. Atwood. 1103 20th St., Rockford, Ill. (Dealer).
Armold C. Marx, 434 King Ave., Detroit, Mich.
Holton Produce Co., Holton, Kans. (Dealer).
F. M. Wilson, 7801 Marshfield Ave., Chicago, Ill.
D. Briggs, 403 Parkview Ave., Dallas, Tex.
James Hulett, 118 East Campbell St., Frankfort, Ky.
Tom Rowlenson, P. O. Box 296, Baltimore, Md.
W. A. Melvin, 727 Edgewood Ave., Atlanta, Ga. (Dealer).
Clarence Perry, 130½ South Malabar St., Huntington Park, Cal.
John B. Tillery, Appleby, Tex. (Dealer).

Col. Mapes Resigns to Fill a New Post

Col. Herbert S. Mapes, formerly vice-president and general sales manager of the Joseph W. Jones Radio Manufacturing Company of New York, has resigned to supervise a new enterprise in the radio industry. While details of the new connection have not yet been released, it has nevertheless been definitely stated by Col. Mapes who is staying at the Union League Club, that he will be president of a new company to be incorporated in the very near future which will carry on new phases of radio work. Much interest attaches to the new connection since it has been stated that men prominent in the business and financial world are backing the project.

Since leaving the United States army six years ago, Col. Mapes has been identified with the growth of the radio industry in this country. He is recognized throughout the United States as one of the most important sales executives in the field.

As Vice-President and Eastern Sales Manager of the Federal Tel. & Tel. Co., he was in charge of merchandising in 1923 and 1924. In October of 1924 Col. Mapes joined the Jones Company.

Business Opportunities Radio and Electrical

Rates: 10c per word; Minimum, $1.00; Cash with order.

FORMER WESTERN ELECTRIC ENGINEER has patentable radio device of great merit; $5,000 needed; manufacture and sales already arranged. P. O. Box 545, Newark, N. J.

METAL MANUFACTURER, one capable of financing production up to $100,000, may learn of fine opportunity. Box L, Radio World.

LOCAL BROADCAST STATION DESIRES to lease 90 per cent. of broadcast to responsible parties. Box LL, Radio World.

Coast-to-Coast Reception On Diamond in Good Weather

DIAMOND EDITOR:

I have constructed the Diamond of the Air. There is no need of emphasizing the marvelous results I have obtained from this wonder.

JESS DAGENHARDT,
Box 123, Ridley Park, Pa.

* * *

DIAMOND EDITOR:

I have built the Diamond and it is a peach. On the first test I made, WBZ, WFI, WJZ, WCAP, WLIT and WFI came in on the loud speaker. All this reception was as clear as a crystal. Since the first test made, I have logged WMBF, WLW, KDKA, WMC, WOC, WSB, WTAS, WGY, WGN and WBAP. Regards to Bernard for the hookup of the Diamond of the Air.

H. L. CHRISTMAN,
521 Chew Street,
Allentown, Pa.

* * *

DIAMOND EDITOR:

I have built the 1926 Diamond of the Air. It is a wonderful set. I'm getting stations from coast to coast very easily, with great volume and clarity. I have often heard WEAF, and just while writing this letter I'm listening to WRW. I have tried out the loop and have reached with it, as far as New Orleans and Atlanta, on the speaker.

JAMES PECHAR,
5428 So. 21st Street,
Omaha, Nebr.

* * *

DIAMOND EDITOR:

I have built your 1926 Diamond as far as the first stage of amplification and it sure is some baby. I have received 120 DX stations to date. I have received stations from the Atlantic coast to the Pacific coast.

F. L. HIMBURY,
195 Willibroed Avenue,
Verdun, Montreal, Canada.

* * *

DIAMOND EDITOR:

Several weeks ago I procured the parts and started to build the Diamond of the Air. When completed I was very much surprised to find that I could not get a sound out of it. The parts were all of high grade material. On checking over the wiring I found that it was correctly done and could find no open circuits or reason why it should not work. I finally gave it up as a bad job, but recently decided to make another try at making it work. I rearranged the parts, put on a battery cable and separated the coils. When hooked up, I found I could get stations so loud that I could not keep the receivers on, even as far away as Chicago. Last evening I had WJAX, Jacksonville, Fla., on a loop, down in the cellar, loud enough to be heard up stairs, when using a loud speaker. It surely is a pleasure to operate this set. It has a fine tone, is easy to operate, and very selective.

H. J. SMITH,
82 Chestnut Street,
Oswego, N. Y.

* * *

DIAMOND EDITOR:

I cannot keep but give a few of the wonderful accomplishments of the Diamond of the Air. Since I built this set, I have had to rebuild four sets for my friends and I have got four more to build. Every one who has heard the Diamond proclaims it the best yet. With my own set, that is wired up temporarily, west coast stations come in with wonderful loud speaker volume. The selectivity is great. I can separate WSMB, of New Orleans, and WGR, of Buffalo. As for volume, I don't think there is a set made today that will give the volume that the Diamond gives.

HENRY CENTNER,
749 Park Avenue,
Dunkirk, N. Y.

* * *

DIAMOND EDITOR:

You will no doubt be interested to know that I am a reader of your great magazine every week. My health is poor and therefore I am unable to go to work. My pastime, therefore, has been radio, without which my health would be impaired to a greater extent. I built the Diamond of the Air. It works great.

GEORGE A. PRICE,
436 9th Avenue,
New York City.

* * *

NAMEPLATES

The demand for name plates for the 1926 model Diamond of the Air is still increasing rapidly. This receiver was described by Herman Bernard in the Sept. 12, 19 and 26 and Nov. 21, 28 and Dec. 5 issues of RADIO WORLD. *Herewith is part of a new list of nameplate applicants:*

Paul Schlek, 4237 Barnes Ave., Bronx, N. Y.
Wm. F. Gregory, 1267 Broadway, Flint, Mich.
Thomas E. Norman, 181 Barlow St., Fall River, Mass.
John E. Chanderline, 846 E. Thayer St., Philadelphia, Pa.
T. C. Harlow, Keego Harbor, Mich.
Rudolf Herr, 54 Cutler St., Clifton, N. J.
James W. Longworth, 105 Bark St., Fall River, Mass.
Chas. Ihlenfeld, 2227 N. Colorado St., Philadelphia, Pa.
W. G. Hunt, 277 Union Ave., Belleville, N. J.
Nick Spinelli, 10 Norwood St., Newark, N. J.
Wm. T. O'Brien, 2339 S. 8th St., Philadelphia, Pa.
Richard Thompson, Box 450, Cristobal P. O. Canal Zone.
C. F. King, 221 Natchez St., Mt. Washington, Pittsburgh, Pa.
P. C. Donero, c/o T. W. Grant Co., Canton, Ohio.
V. Lindemann, 308 Lake St., Union City, N. J.
E. Foster, 245 W. 134th St., N. Y. C.
Frank J. Wollek, 357 42nd St., Brooklyn, N. Y.
J. Merritt Oberholtzer, Box 195, Mifflintown, Pa.
S. Skinner, Prospect Ave., Meriden, Conn.
W. J. Stevens, 1017 Peniston St., New Orleans, La.
Max Getz, 1010 Intervale Ave., Bronx, N. Y.
Chas. McCauley, Versailles, Ky.
Richard Martle, 567 Minnesota Ave., Buffalo, N. Y.
Harry Clark, 99 4th Ave., West Haven, Conn.
Joseph P. Lewis, 3826 Dennison Place, N. W. Washington, D. C.
J. F. Attwood, Box 337, Lima. O.
Fred Bittner, 9731 108th St., Richmond Hill, L. I., N. Y.
Clarence E. Bell, 618 Main St., Wellsville, Ohio.
Ray W. Smith, 71 Plank Rd., Waterbury, Conn.
Irwin E. Burdick, 84 River Ave., Norwich, Conn.
William V. Hagerty, 317 Oak St., Perth Amboy, N. J.
J. W. Weir, 166 Arlington Ave., Ottawa, Ont., Canada.
L. D. Pritchard, 63 Cowan Ave., Parkdale, Toronto, Canada.
Joe E. Brockway, 316 Dodge St., Jonesville, Wis.
Fred F. Norris, Nevada, Mo.
A. Nice, 1 Trenholme Ave., N. D. G., Montreal, Canada.
Joseph Kershaw, 71 Swindell St., Fall River, Mass.
Fred Mesch, 212 S. 5th, Ponca City, Okla.
Arnold Koontz, 48 Willow St., New Bedford, Mass.
R. Knowlton, 40 Pine St., Pawtucket, R. I.
Elton Vail, 139 W. Holly Ave., Pitman, N. J.
Wm. Burke, 1163 Clinton Ave., Irvington, N. J.
J. W. Keating, 2223-35th Place, N. W., Washington, D. C.
B. T. Cavanagh, P. O. Box 154, Saunderstown, R. I.
A. Braun, 32 Paterson St., Jersey City, N. J.
L. C. Williams, Box 1504, Atlanta, Ga.
A. A. Grillott, 608 E. Wyandotte St., Freeport, Ill.
E. Lees, 1766 Ontario St., Toledo. Ohio.
E. Kreutzweiser, 231 Ave. H. N., Saskatoon, Sask., Canada.
L. Siegel, 561 E. 1st St., Salt Lake City, Utah.
E. J. Messick, 816 Charles St., Bricknell, Ind.
William O. Murphy, 109 Mountain St., Asheville, N. C.
H. R. Mason, 5 Brookside Drive, Toronto, Ontario, Canada.

An Emergency Form

THE round cardboard containers sold in drug stores come in handy for experimental coil winding. If previously used for their real purpose be sure that the form is dry before you wind any wire on it.

Efficiency Data On Radio Coils

(*Concluded from page 7*)

advantage and the single-layer coil can not be used on account of excessive size.

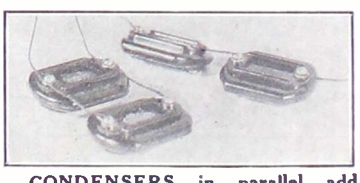
"There appears to be little reduction of resistance at the lower frequencies in spacing the turns, so that the advantage of getting a smaller resistance is small compared with the disadvantage of requiring a coil twice as long.

The use of Nos. 32-38 litz gives coils of somewhat lower resistance than coils wound with solid wire of the same cross section. No. 24 AWG solid wire has less resistance than No. 28 wire, and No. 16 wire for a certain range has less resistance than Nos 24 and 28 wire. If solid wire is used it does not appear necessary to use wire larger than No. 24 AWG. This conclusion can not, of course, be extended outside the broadcast frequency range; for instance, No. 16 solid wire would be better for frequencies above 5,000 kc."

The study of coil construction and the measured effects of different types of windings and sizes of wire is one of the most interesting in radio. Hence the Bureau of Standards report is of great importance and fascination. The coils in a set, under practical conditions, are even more important than the condensers.

The fact that the Bureau constructively reported on six different types of winding does not preclude other types. For instance, the single-layer coil, with form removed, but held together by a binder, was not studied, yet it is clear from an interpretation of the report that such a coil would rank high, as would such coils as the pickle bottle, the quartzite, etc. Hence while few manufacturered coils are loose basket weave, single layer on hard rubber, or spiderweb on hard rubber, the general run of low-loss coils is along the line of efficiency verified in the report.—Editor.

Parallel and Series



CONDENSERS in parallel add their capacities directly (left), while condensers in series result in a reduction of capacity (right).

Market Reports Sweetest "Melodies" to the Farmers

In spite of the reputed universal appeal of broadcasting as a medium of entertainment, the radio tastes of Western farmers are widely different from those of city people. Whereas the majority of urbanites overwhelmingly prefer music in one form or another to speeches or lectures, the majority of agriculturists are inclined to disregard melody and to tune-in on educational features, weather forecasts, and particularly market quotations. This is the conclusion voiced by Kenyon W. Mix, Western district manager for the Sleeper Radio Corporation, who has just returned to New York after an extensive study of the great farming districts of the central and north central West.

Music, states Mr. Mix, is what the farmer turns to only after he has obtained from his set more valuable and important items like market prices of farm products. He works late and goes to bed early, so when he does listen-in he selects something of material and immediate interest, like the price quotations, weather forecasts, and bits of practical farming advice; music is entirely incidental to him.

Confirmed by Experience

"The experience of a popular broadcasting station in the West bears out this observation," says Mr. Mix. "The management mailed out statements to more than 18,000 farmers saying that the station would find it necessary to subdivide its time, and requesting that listeners voice their preferences in program material. Fully 75 per cent. of the farmers replied, in effect: 'Cut out the music and give us the educational features and market quotations. We must educate our children, and we must know what our products are worth.'

"The city man listens with mild amusement to an announcer's recitation of a long list of prices on hogs, corn, wheat, butter, eggs, cream and potatoes, but the farmer listens with deep concern, for it affects his personal welfare. This was brought home to me when I personally witnessed the following incidents:

"A hog buyer from Kansas City visited a farmer at nine o'clock one morning and offered him a certain price for a quantity of his hogs. The farmer and his wife demurred, complaining that the figure was too low. The buyer excused himself and rode off to another farm.

Profitable to Him

"Two hours later the farmer tuned his radio set and caught the eleven o'clock market quotations. The broadcast price for hogs was below the one offered by the departed buyer, so the farmer did some quick thinking. He knew the man was at another house a few miles up the road, so he called up by telephone, got in touch with him, and after saying that he needed some money and had decided to sell at the quoted terms, he closed a profitable deal. The buyer did not know of the sudden price change, and was held to his original quotation by the ethics of the business.

"In another case I met a farmer who

(Concluded on page 26)

BEAUTIFUL

EFFICIENT

AMERICAN INTERSTATE RADIO SERVICE — NEW YORK

$34
FIVE TUBE
Tuned Radio Frequency
Attractive Cabinet with Piano Hinge

$40
FIVE TUBE
Tuned Radio Frequency
Two Tone Cabinet
Sloping Mahogany Colored Panel Gold Engraved

SELECTIVITY—DISTANCE
VOLUME—TONE QUALITY

All Combined in these AIR SERVICE 1926 MODEL RADIO SETS together with beauty of cabinet

The front panel is Bakelite, with the dial calibrations and design engraved in gold. The three beautiful tuning knobs are used to indicate the numerical setting of stations. The sub-panel also is Bakelite. No refinement was omitted that would add to the sturdiness of the receivers. The two tone cabinet is an imposing furniture effect.

These sets unite low price with the highest quality of performance and alluring beauty of appearance and are without question the best value in reliable, dependable, radio receiving sets. If your local dealer cannot show you this entire line for your selection, write us direct.

$45
FIVE TUBE
Tuned Radio Frequency
Art Design Cabinet
Straight Line Frequency Condensers

$50
SIX TUBE
Resistance Amplification
Two Tone Cabinet
Sloping Panel
Straight Line Frequency Condensers

$70
SIX TUBE
Resistance Amplification—
Double Deck Built in Loud Speaker Semi Console

$90
SIX TUBE
Rambler Six
Portable—
Smallest—
Lightest

American Interstate Radio Service
183 Greenwich St. New York

Dealers-Jobbers Write Now

$125
CONSOLE
SIX TUBE
Resistance Amplification

$150
CONSOLE
SIX TUBE
Louis IV Design
Resistance Amplification

(*Concluded from page 24*)

had for a neighbor a man he intensely disliked. The first farmer had a radio set, and the neighbor didn't. One day, while the former was listening to his receiver, he learned that the price of cabbages had gone up $20 a ton. Thereupon he went out, bought from his neighbor all the latter's available cabbage, then resold at a healthy profit. The other man now also has a radio receiver in his living room.

"I could recount hundreds of instances in which radio has afforded farmers direct benefits, in the form of hard cash. They have learned the value of accurate price and weather information, and they look forward to broadcasts of this nature. Music is just music, and unless it comes from New York or some other big city through a network station, they care little for it."

Enlarging on the educational feature of radio for the farmer, Mr. Mix brings the interesting information that some of the mid-western agricultural colleges go so far as to award degrees to radio students who have followed broadcast lessons arranged by them, and who attend the school in person for three days for an examination.

WHEN you have scraped the wire off flexible leads the silk or cotton covering remains fuzzy and is often an obstacle to making a perfect contact. To prevent this apply collodion at the end of the insulation. This will stiffen the covering.

Station for Paraguay

WASHINGTON

The erection of a broadcasting station has been proposed in Paraguay, according to a report to the Department of Commerce. The report says that the southern republic is displaying great interest in radio and that the Ministry of War and Marine has decided to purchase the necessary equipment for a station.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 Cents a Word. 10 Words Minimum. Cash With Order.

(*Concluded from page* 19)

tribution for the "poor" boys and girls of New York. Two days later his package, carefully wrapped and tied with a stout cord, arrived at the Club; and this is what it contained: three 5-cent packages of butterscotch; two games which he had received on the previous Christmas; two pencil boxes; a partly used writing pad and four books which he had undoubtedeedly received at Sunday school and whose torn and soiled covers he had repaired with paste and paper. Each of these treasured gifts had been carefully wrapped and tied with colored twine.

In the meantime inquiries were made to verify the true status of Wesley's home life and it was discovered that conditions were far worse than the boy's letter had depicted.

Wesley's letter was published on the front page of the Advertising Club News and featured as the Christmas Editorial. During the week that followed checks ranging from $100 down to a single dollar came in from members and packages were delivered daily at the Club in such quantity that it finally required two trucks to distribute them.

One of he leading members of the club, James N. Kelly, caught an early train for Bridgeport and brought Wesley back with

When he arrived at the Club, luncheon was in progress, and the special holiday program, including selections by the Glee Club, was being broadcast direct from the main dining room by Station WJZ. Wesley was introduced to the members and treated to a generous portion of "turkey and fixins'." But delighted as he was with the trip, the luncheon, the kindly greetings of the members, the music and the general holiday terpreter, stood ready to serve him.

Of course Wesley didn't know that his father's little one-tube set was "tuned in" on the Advertising Club through WJZ. But it was, for that was part of the plot arranged by President Green. And no sooner had Wesley expressed his wish than he was lifted to the microphone and, coming across the great expanse of space that tonly radio can span, his father heard these welcome words—"Hello, daddy! Here I am in the Advertising Club safe and sound and having a wonderful time."

And when Wesley went home to Bridgeport late that night, after a tour of the big city, he carried with him a set of Erector, an electric train with tracks, switches, station and semiphores, candy, checks and enough money to insure a real old-fashioned Christmas and a Happy New Year.

But more important perhaps than what Wesley Cormack took home with him that night was what he left behind—particularly that portion of faith, hope and charity which filled to overflowing the hearts of all who had come in contact with this wonderful boy, who, having little, was willing to give what he had, and in so doing gave much.

Backers of Radio Relief Bills Gauge Strength of Opposition

WASHINGTON

ALL-IMPORTANT radio legislation holds the center of the stage and will continue to do so until final action is taken by Congress.

Hearings were begun in Senate and House committees on bills introduced by Senator C. C. Dill (Washington), and Representative Wallace White, Jr., (Maine), which incorporate most of the recommendations of the Fourth National Radio conference. In substance both bills have the approval of Secretary Hoover and his radio administrative staff.

There has been considerable speculation on all sides as to the chances of radio bills getting through Congress and as to the form legislation will take.

Likely Prospects

The following can be accepted as an official view of the situation:

There will be some opposition to the kind of legislation favored by the Department of Commerce and the radio industry generally.

The White radio bill is being considered by the House Merchant Marine and Fisheries committee. Action on the floor of the House on the White radio bill will depend almost entirely on the Committee report on the bill. If there is a unanimous committee report on the bill, it will go through the House with little or no difficulty and with few changes. If there is considerable dissent in the committee, almost anything is likely to happen to the bill on the floor of the House.

Radio legislation is not new to the House Merchant Marine and Fisheries committee. It has had the subject under consideration for several years, and most of the members of the committee have a fairly good grasp of actual conditions. It is too much to expect that the White

bill will be unanimously reported with no changes. But it is not believed there

Points of Opposition

Most of the opposition to the bill will be predicted on three points, which are:

(1) The belief of some that the bill would give too much authority to the Secretary of Commerce.

(2) The disappointment of commercial interests which have been refused the broadcasting privilege because of the congested condition of the ether.

(3) Sectional influences, which assert that certain localities should be given a larger representation on the air.

To offset this opposition is the desire to improve conditions in the ether and increase service to the public. It is pretty well recognized that broadcasting will be in a bad way unless legislation is enacted, and that the public may decide to punish those who try to stand in its way.

Politics Not Expected

It is not believed support or opposition to the radio bill will follow political lines. Republicans and Democrats alike in the House are very much inclined to follow the advice of their party members on committees when legislation is brought up in the House. If both Republican and Democratic members of the committee favor some specific bill, individual opposition to it on the floor of the House will be easily swept aside.

In addition most members of the House realize that Representative White probably knows more about radio conditions than any other man in Congress. They know he has been studying the situation for a number of years and they are more likely to follow his guidance than that of any other man in the House.

The odds are that a radio bill, in a form acceptable to Secretary Hoover, will be enacted into law before April 1.

5 New Stations Licensed

WBAL, Baltimore, has been transferred to 246 meters where the station will now operate permanently. The new Baltimore station started in experimentally on 375 meters, but because of interference the change to a lower wavelength was necessary.

Five new broadcasting stations have been granted experimental licenses by the Department of Commerce. They follow:

KMMJ—M. M. Johnson Co., Clay Center, Neb. 229 500

KFXR—Classen Film Finishing Co., Okla. City, Okla.....214 15

WAGM—R. L. Miller, Royal Oak, Mich. 225 50

WDAH—Trinity Metr. Church El Paso, Texas 268 50

WJAX—Voice of Jacksonville, Fla. 337 1000

WGN Chicago and WJJD Mooseheart have exchanged wavelengths. WGN is now on 303 meters and WJJD on 370 meters.

KFQB, Ft. Worth, Tex., has transferred to class B and increased its power to 1,000 watts. The station will continue to operate on 263 meters.

KFDJ has changed its call to KOAC.

CHANGES OF ADDRESS

should be sent to Subscription Department at least two weeks in advance of publication in order to insure early and proper attention. RADIO WORLD'S subscription list is so large that it is necessary that changes be sent in as requested. Address, Subscription Department, RADIO WORLD, 145 W. 45th St., New York.

The Raytheon Power Unit

By Lewis Winner

(*Concluded from page* 11)

post. The left off terminals of C4 and C5 connect to the tapped portion of the secondary winding. This same terminal goes to B— post, and to one terminal of the fixed resistance R2. The other terminal of this fixed resistor goes to the arm of R1. The arm goes to the B+ Det. post. C6 is shunted across the high resistance R1. You will note that leads which go to B— are common. This lead is brought to the metal baseboard, grounding all the leads.

The tube is so made, that when used in the standard navy base, the anodes are connected to the filament terminals. The cathode goes to the plate terminal. The grid terminal is left open. It is a good idea to mark the terminal posts on the socket, A for the anodes and C for the cathode, so that you will make no error when connecting it up. Use No. 14 rubber covered wire for making all connections.

Operation

Connect the flexible leads to the AC line. Connect B— and B+ terminals to set. Pull the knife switch over so that a complete circuit is made. Put the switch tap so that the full load is in the circuit. You will notice that a peculiar blue light is seen coming from the cathode. The tube itself will vibrate also. Do not place the eliminator near the receiver. Turn the variable resistance until the maximum volume is obtained from the receiver. If a small hum exists, place a .5 megohm resistor across the B— and the B+ Det. terminals.

Thousands Hear England Through Rebroadcasts Here

Original American Programs Picked Up in London, Paris and Other Foreign Cities — Britain Hears Its Own Program After It Makes Excursion Trip Across Atlantic by Receiving WJZ's Rebroadcast — Experience Points to Great Success During International Week, Jan. 24.

Music and speech broadcast from London were heard by thousands throughout the United States New Year's night. WJZ picked up the program and rebroadcast it. Also, programs from America were heard in foreign cities, London, Paris and Buenos Aires included.

McCormack Heard

The WJZ program heard abroad—either in part or in full—included John McCormack, tenor, and Lucrezia Bori, soprano. Hymns on the carillon bells of the Park Avenue Baptist Church, New York City, Associated Press news dispatches from all over the world, and "international New Year's greetings," extended by Consuls General of various countries in New York, also were on the international program from WJZ.

Early in the evening poor atmospheric conditions prevented the pickup here of Big Ben's tolling.

Message from London

At 7:30 P. M. atmospheric conditions had improved, and the American stations rebroadcast New Year's greetings from London and music from the Club Ciro at Charing Cross for about twenty minutes. Listeners here heard the radio announcer in London say:

"This is 2LO calling America and sending New Year's greetings. We have received word that the American stations are rebroadcasting this program, and we hope that it is being relayed successfully."

Reception on "Echo" Plan

It was KGO who picked up the wave and rebroadcast it.

The following cablegram was received from A. G. D. West, asistant chief engineer of the British Broadcasting Company, in England:

"We listened ourselves to your rebroadcasting of our program."

Radio officials said that this was the first time in the history of radio communication that a rebroadcast program had been heard across the Atlantic at the point where it had originated.

An earlier cablegram showed that the beginning of the American program had been transmitted successfully across the ocean:

"BBC advises WJZ was heard OK Chelmsford, Essex and London."

The American program began at 6:15 o'clock with an address by David Sarnoff, Vice President and general manager of the Radio Corporation of America, broadcast from the WJZ studio.

Looks Good for Jan. 24

The experiences of this one night point to successful trans-Atlantic broadcasts during the week of January 24 (International Radio Week.)

WEAF Gets Extension from Composers' Society

The contract between the American Telephone and Telegraph Company's radio station WEAF and the Society of Authors, Composers and Publishers, which technically expired Jan. 1, was extended until the broadcasters and music writers can come to an agreement regarding the basis on which to establish the license fee, according to E. C. Mills of the society.

Mr. Mills said that WEAF's contract expired in July, but had been renewed until Jan. 1 with the hope that a definite agreement would be reached between the parties.

"There are so many factors involved," he said, "that it has been difficult to arrive at a definite policy. The broadcasters have asked Congress to set the copyright fee. We are naturally opposed to this and doubt very much if the present Administration would attempt to stipulate a copyright fee."

1925 BACK NUMBERS OF RADIO WORLD WANTED

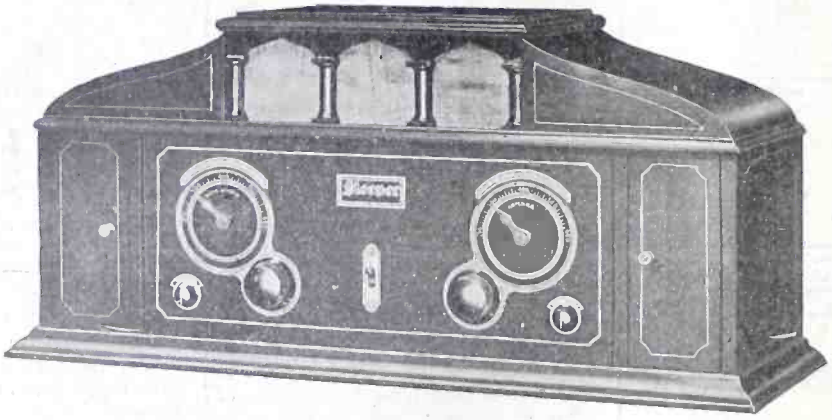
Mail us copies of any of the following 1925 issues of RADIO WORLD, and we will send you a copy of a current issue for every copy sent us: January 10, March 28, April 4, 11, 18, 25; May 2, 9, 16, 23, 30; June 6, 13, 20; July 4, 11, 18, 25; August 1, 8, 15, 29; September 5.

HAVE YOU SEEN RADIO WORLD'S HOOK-UP NO. DATED NOV. 7?—Full of hookups and picture diagrams. 15c per copy, or start your subscription with that issue. RADIO WORLD, 145 W. 45th St., N. Y. C.

DO YOU WANT TO BUILD ONE OF THE BEST CRYSTAL SETS? See Herbert E. Hayden's article, "One of the Best Crystal Sets," that appeared in our Hookup Number, dated Nov. 7. RADIO WORLD, 145 W. 45th St., New York City.

Here is the New
SLEEPER SERENADER

$115.00 with built-in loud speaker



Five Tubes, Tuned Radio Frequency

RELY UPON EXPERIENCE TO PRODUCE QUALITY AT LOW COST

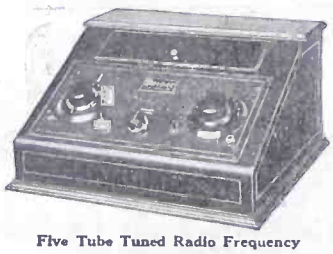
Sleeper

REG. U. S. PAT. OFF.

RADIO RECEIVING SETS

—are better built of better materials to the most exacting specifications by an organization that has engaged exclusively in the manufacture of fine radio equipment since 1919.

The New Sleeper Troubadour $65



Five Tube Tuned Radio Frequency

A notable example of the inherent value that characterizes all Sleeper Radio apparatus. In all the new Sleeper models provision has been made for Ux 112 power tube operation.

ONLY experience and "pride of product" could have built such a set as the Serenader at so low a cost. For this is a new kind of radio set. Not until now has a receiver combined such tonal quality with such volume, selectivity and sensitivity. Your first twenty minutes with the Serenader will give you a wholly new conception of radio reception.

TURN the switch and the softened glow of the concealed visored lights illuminate the tuning controls. Move the silver pointers to the designated wave length of your favorite station and you will hear it loud and clear, as distinctly and as naturally as though the artist were at your side—then, and only then, you will realize what Super Radio Reception means.

The New Sleeper Scout $90

Five Tube Tuned Radio Frequency

Deservedly the fastest selling set of the season. By every standard of comparison there are no better radio sets.

If the Authorized Sleeper Dealer in your community has not yet received his quota, write us for descriptive literature and catalog "W"

SLEEPER RADIO CORPORATION

438 WASHINGTON AVENUE, LONG ISLAND CITY, NEW YORK