RADIO Engineering

The Technical Magazine of the Radio Trade ~ *Edited by* M. B. SLEEPER

FEBRUARY 1926

VOL. VI NO. 2

20c

The Eveready Hour

LIKE the fabled ship in which Jason brought home the enchanted fleece of gold, the Eveready Hour brings a rich treasure of entertainment to charm the harbor-homes of its hearers.

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WSAI–*Cincinnati*
WWJ–*Detroit*
WOC–*Davenport*
WEAR–*Cleveland*
WCCO { *Minneapolis* / *St. Paul*
WGN–*Chicago*
KSD–*St. Louis*

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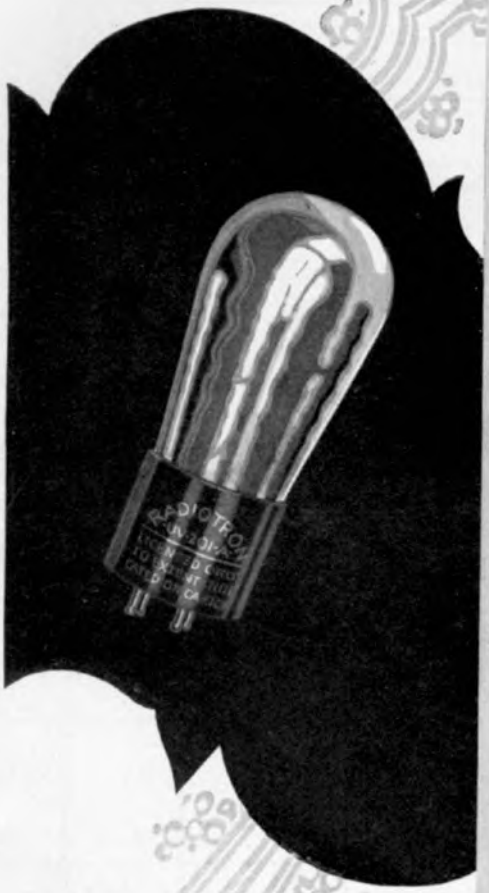
who tests your tubes?



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MADE BY THE MAKERS OF RADIOLAS

RADIO ENGINEERING

Edited by M. B. SLEEPER

VOL. VI | FEBRUARY, 1926 | No. 2

Sixth Year of Publication

CONTENTS

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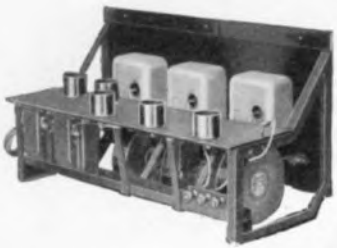

The first finished receiver to bear the name ALL-AMERICAN is, as might be expected, a notable piece of engineering. It exemplifies, above all, the many excellences which can be built into a set by a well-equipped factory, but which would be impracticable at any price for the home builder.

For example, the three condensers (ALL-AMERICAN 360° S.L.F. shielded type) are operated by two dials; no cords or gears are used, but the sliding members of the second and third condensers are joined by a straight connecting rod, adjusted permanently at the factory to exact length.

Compartments in each end of the cabinet house the necessary batteries. With this feature, together with a good speaker located for best acoustic effect, the Model R represents indeed an installation which any far-seeing dealer may well view with satisfaction.

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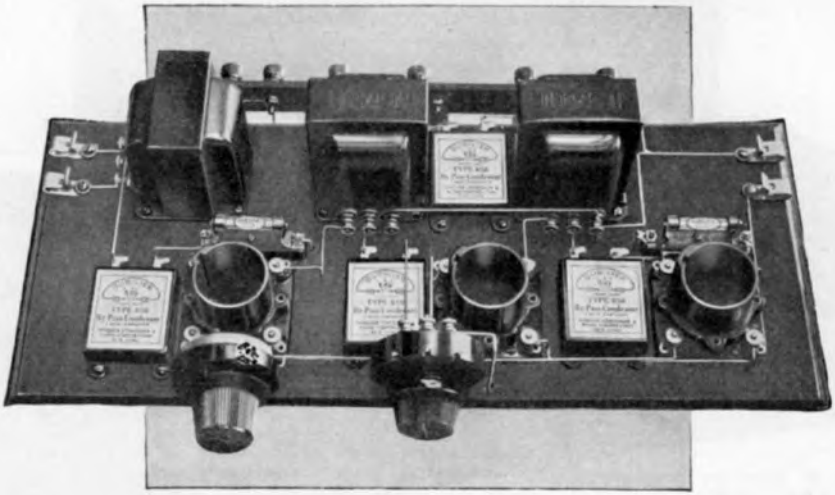

Distortionless Amplification

In impedance coupled Amplifiers (which evenly amplify all the notes in the musical scale) as well as in most of the latest developments in audio amplification, fixed condensers and grid leaks are essential elements of the hook-up.

Unless the accuracy and reliability of these parts is above question, the results from the unit will prove disappointing.

The set-builder who uses *Dubilier By-Pass Condensers* and the silent *Dubilier Metaleak* in constructing this unit, works with the assurance that comes from the use of parts whose performance has been tested and guaranteed by the best known manufacturer of condensers in the world.

Dubilier

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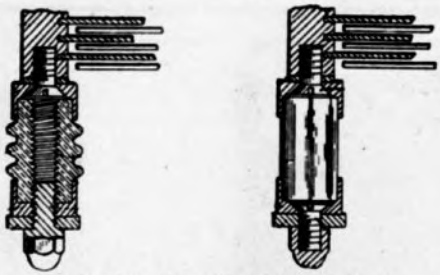


Illustrating the pillar method of insulating low-loss condensers

The First Low-Loss Condenser Patent

Patent 1,555,634 is probably the first to be granted on low-loss condenser construction

ON September 29th, 1925, patent 1,555,634 was issued to Samuel Cohen, Assignor to the General Instrument Corporation, of New York.

The exact significance of this is not yet clear, altho it will undoubtedly affect many manufacturers, for the method of insulating covered by this patent was was used this year by an increasing number of concerns.

The following claims are reprinted from the application, selected as covering the most important points of the invention.

1. A variable condenser construction comprising in combination a pair of end plate portions, a plurality of stator plates positioned between said end plate portions, spacer members at opposite ends of said plates for positively spacing each of said plates one from another and a plurality of pedestal insulators interposed between said end plates and said spacer members for supporting said stator plates apart from said end plate portions.

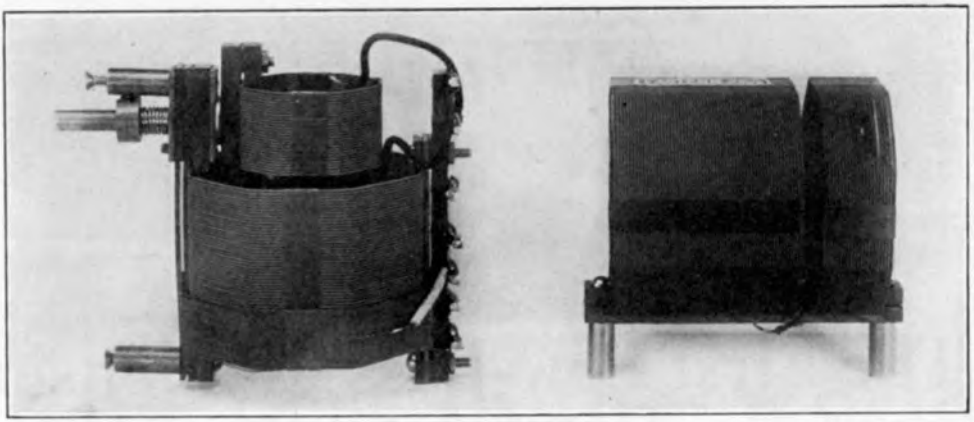
2. A variable condenser construction comprising in combination a pair of end plates, a plurality of posts interconnecting said end plates forming a frame, a plurality of stator plates carried within said frame, a pair of plates positively spacing said plates apart and a plurality of insulated posts interposed between said spacer members and said end plates.

3. A variable condenser construction comprising in combination a frame, a plurality of stator plates centrally located within said frame, a spacer block at opposite ends of said stator plates and insulation means interposed between said spacer blocks and said condenser frame and maintained under compression for securing said stator plates in position intermediate said end plates.

7. A variable condenser construction comprising in combination a frame, a plurality of stator plates centrally located within said frame, a spacer block at opposite ends of said stator plates and short cylindrical insulators interposed between opposite ends of said spacer blocks and said end plates for securing said stator plates intermediate said end plates.

9. A variable condenser construction comprising in combination a frame, a plurality of stator plates centrally located within said frame, a spacer block at opposite ends of said stator plates, a vitreous post interposed between said spacer blocks and said condenser frame and maintained under compression for securing said stator plates in position intermediate said end plates and means binding said end plates together.

13. In a variable condenser construction a frame comprising a pair of end plates, a rotor, bearings for said rotor comprising a ball pivot carried by one of said end plates and a spring collet chuck carried by the opposite end plate and having means for adjusting said chuck longitudinally on the axis of said shaft whereby said rotor plates may be centrally positioned between said end plates.



Another type of winding which is used in making coils for the Roberts receiver

Notes about the Roberts Receiver

Some interesting points concerning the efficiency of this set and the methods by which it is obtained—*By S. W. Nichols*

THE original Roberts circuit had one stage of neutralized R. F. amplification, regenerative detector, and one stage of reflexed A. F. The unique feature is the R. F. transformer with its neutralizing system, one that is used in several commercial receivers, but best known to set builders thru the Roberts hookup.

To obtain efficient amplification without instability of the circuit in the way of A. F. howling, Roberts employed a method of balancng similar to that of the usual neutrodyne, except that the counter-voltage for the neutralizing condenser is not tapped off from the R. F. secondary, but from the end of an extra coil wound closely coupled to the primary. The neutralizing winding needs to be closely coupled to the primary or output coil of the R. F. tube, so in this case it is unnecessary to couple the secondary very closely to the primary. Separating these coils slightly makes the receiver tune more sharply, and what is most important, reduces the capacity between them, a capacity which would feed back enough A. F. energy to cause uncontrollable howling, or at least to spoil the quality, which is bad enough anyway in a reflexed receiver.

Now that reflexing has been abandoned in the interests of better reproduction, the straight Roberts is one of the best of the deservedly popular class of tuners having a stage of really efficient R. F. plus a regenerative detector. When the object of an R. F. transformer is to couple the primary and secondary inductively, any accidental coupling by condenser effect between the layers of wire, bucks against it and partly cancels the step-up of the amplifier.

As it is possible to separate primary and secondary of the Roberts transformer, such capacity is minimized and the loss prevented. It is further possible to use a large enough primary to do good work way to the top of the broadcast scale. Capacity between the primary and neutralizing coils is also bad because at the lower waves, it tunes the plate circuit to resonance, or nearly so, killing all amplification, and making more trouble than an over-size tickler coil on low waves. Therefore, instead of a double coil in the plate circuit, a single continuous winding is used, and a double coil effect obtained, for the purpose of neutralization, by tapping off the "B" battery connection halfway from the plate end, and connecting the other end to the balancing condenser.

The primary coil must be connected

with opposite polarity to whatever coil furnishes the neutralizing back-voltage, and since here the secondary is not called on for this, the filament end of the secondary can be placed adjacent to the low end of the primary—the B battery end with by-pass condenser to filament.

In other R. F. transformers, where the plate must be connected to the end of the primary which is directly under the filament end of the secondary, there is a leakage of valuable R. F. energy from the first few plate turns to the filament turns of the secondary, not because of poor insulation but from capacity between the wires. This capacity by-passes R. F. current back to the filament, which should go thru the entire primary, and energize the secondary by induction. Some loss due to this effect also occurs from the high end to the low end of the primary. If a bunched primary is used, there is practically no separation between the ends. The capacity is reduced, of course, by winding the coil with fine wire.

So efficient is the amplifier that it always has a surplus of power to feed back and produce oscillation, even with wide separation of the coils and with a low capacity tube. It must, therefore, be carefully laid out and neutralized. Neutralization of the tube capacity, moreover, increases the amplification very greatly. The grid coil of the R. F. tube and the R. F. transformer must be so placed as to have no coupling between them. Roberts coils are not usually mounted on the backs of their tuning condensers, so if the one with the tickler is located directly on the front panel, the other should also be on the panel and at the same height, in order to keep their axes centered in the same line. They must be set at least 7 inches apart from nearest edges and turned at right angles to each other.

For maximum amplification of all but the weakest signals, a C battery should be used, of the same voltage required for an audio amplifier with like B voltage.

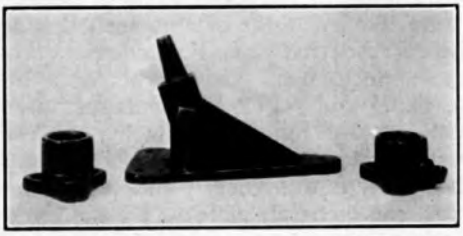
The process of neutralization is very simple. When the R. F. tube is perfectly neutralized, the tuning of its grid circuit has no effect upon the tuning of the detector.

To prove this condition, tune in some carrier wave by making the detector oscillate. The stronger carrier waves will come thru and be audible on the detector regardless of where the R. F. tuning condenser is set. Now turn the R. F. condenser and note what happens. If the neutralization is very far off, when the condenser passes thru resonance the carrier wave will be lost and the detector will probably stop oscillating. If the neutralization is perfect, the pitch of the carrier wave whistle will not vary; on strong signals it may dip slightly at resonance, but the station can then be brought in by merely turning the tickler back until the detector stops oscillating.

Roof Mounting for Pipe Masts

Wherever a mast is to be mounted on the roof, particularly if it is the sloping part of the roof, the Kimes mast support will be found particularly convenient. As the illustration shows, there is a socket to hold the bottom of the mast, made with an adjustable point of the correct size to fit inside a ¾-in. pipe. The ring at the right provides a means for fastening guy wires half way at the mast. The ring is fitted with a set screw to keep it firmly in place. At the left is shown the fastening for guy wires at the top. This part fits over the top of the pipe, serving not only to hold the wires but to keep water from rusting the inside of the mast.

A good iron pipe mast put up in this fashion is not expensive. In fact, it is a good investment for many of the flimsy wooden sticks used to support antennas



are an absolute menace to public safety, to say nothing of the very unattractive appearance which they make. Probably much of the objection raised by landlords is due to the unsightliness of so many installations.

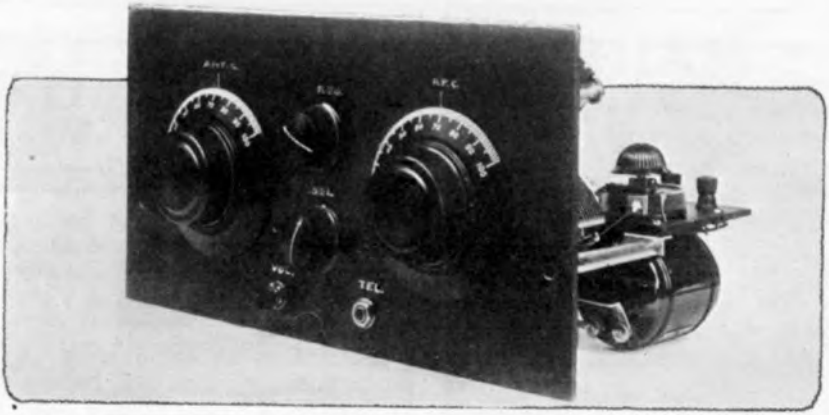


Fig. 1. The front panel, tho only 14-ins. long, carries the double-rotor coupler and two S. L. F. condensers

Ideas from the Redesigned New Yorker

A splendid example of compact construction worked out around the design of the New Yorker—*By F. A. Ryder

WHEN the description of the New Yorker appeared in RADIO ENGINEERING for December 1925, I made up my mind that this was exactly the sort of an outfit needed to overcome conditions of interference in Chicago.

Listening in at New York City the interference problem seems very simple compared to what we are up against in trying to get through Chicago stations to any sort of distance. Accordingly, I put in a little spare time making myself a Chicago model of the New Yorker set.

Just for fun, however, I changed the design, partly for no better reason than to make it different and partly to demonstrate that an outfit of this sort, despite the criticism that S. L. F. condensers take up so much room, could be put on a 14-in. panel and S. L. F. condensers used without any unusual crowding of the parts. The accompanying photographs show how it was done. The design follows the general pattern of the New Yorker. However, I did take the neutralizing condenser and rheostat off the front panel, putting them on the tube panel where they seemed to be a little more accessible. The location of the tubes has been changed, and the transformers and antenna coupling coil put under the tube panel. It saved a little room to take the neutralizing condenser and rheostat from the front panel. At the same time, if the panel had been kept to 18 ins. in length there would have been plenty of room for those parts and the S. L. F. condensers as well.

By carefully locating the tube panel the right distance up on the front panel, the transformers are made to rest on the inside of the cabinet. Therefore, the tube panel is not required to carry the strain of their weight. This arrangement left plenty of room for the antenna coupling coil under the tube panel, and somewhat simplifies the appearance of the set as it is seen from the top.

Other than the changes in the transformers and condensers, the parts are the same as in the original New Yorker.

You may wonder at the appearance of the sockets, for, in the photographs, they don't appear at all. What I did was this —I bought four Pacent sockets, and then

* Sales Engr. Karas Electric Co.

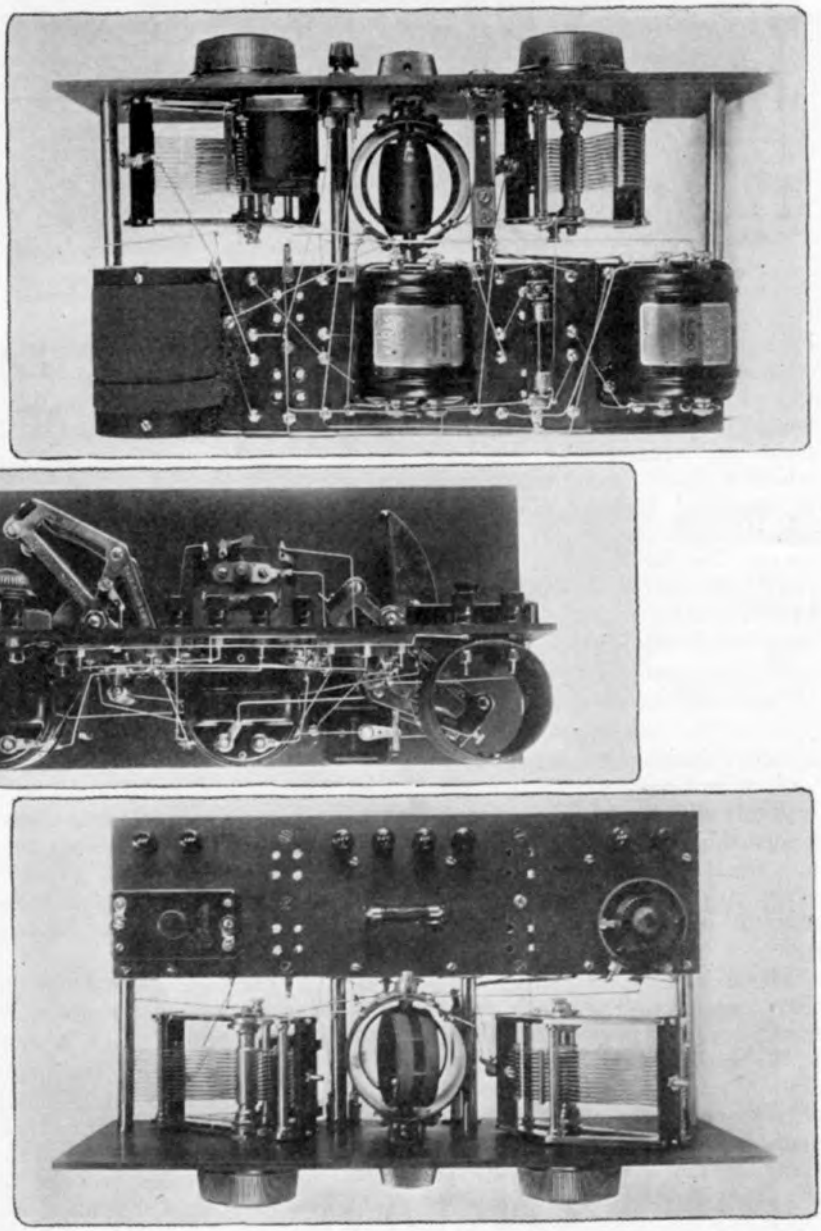


Fig. 2. Bottom, rear, and top of the redesigned New Yorker. Note the arrangement of the S. L. F. condensers, the novel construction used for the U X sockets, and the convenient location of the neutralizing condenser. All connections are made with lastites

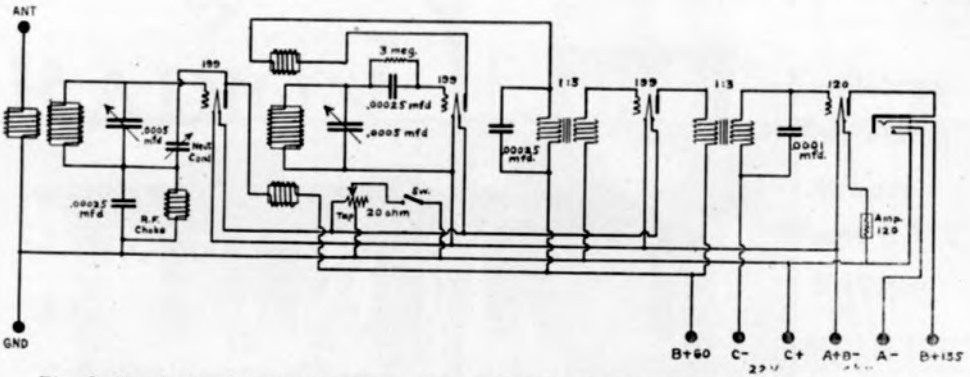


Fig. 3. No change has been made in the original New Yorker circuit, and the operating characteristics are the same. Running from dry cells, this makes a splendid portable set

broke them apart, simply taking out the contact springs. On the original sockets, the springs are clamped between an Isolantite disc and the base. These two parts are replaced by the tube panel, which is above the contact springs, and a rectangle of Bakelite which is mounted beneath the tube panel. Each rectangle serves for two sockets. These extra pieces are clamped beneath the tube panel by the screws which also serve as contacts for the springs.

The result is quite satisfactory, both in operation and in appearance.

As to the operation—on local stations I was thoroughly satisfied with the volume and quality. In fact, the quality was everything that anyone could ask of a set using UX-199 tubes. Since it was not necessary to use regeneration to bring up the volume on the locals, there was no distortion whatever from that source.

When it came to getting outside stations, silencing the locals was just a matter of reducing the coupling of the R. F. transformer. Then a little regeneration, making up for the loss in signal strength when the coupling was reduced, made it possible to tune in DX stuff with a facility that I have not experienced in any other type of receiver.

The feature that appealed to me particularly was that these results were possible with dry cell operation. I have never had any particular objection to the use of a storage battery, but I think it will now be very hard to win me away from dry cell operation because my first set of dry cells has already lasted several times as long as the storage battery did, between chargings, on 0.25 ampere tubes.

You may be interested to know something about the way the set was installed, also. At first I set it up rather crudely, and I had the loud speaker just set on top of the cabinet. As a result, on very strong signals mechanical vibrations were carried from the loud speaker to the elements of the tubes, setting up a very objectionable howl.

As soon as I determined that this was the only cause for that trouble, I took out enough books from the bookcase which is near a particularly comfortable easy chair, and put the set into the bookcase. On the shelf below, there was plenty of room behind the books for the A and B batteries. Then I got an N & K loudspeaker, the bell-shaped type, and set that up on the opposite side of the room.

It is very seldom that anyone who has not seen this loudspeaker before can find out where the music is coming from.

A little later, as a matter of experiment, I connected a regular choke coil, designed for an impedance coupled amplifier, across the leads to the loudspeaker, and then connected the loudspeaker in series with a 1.0 mfd. fixed condenser around the choke. This gave quite an improvement in the quality of strong local signals, for it takes all the steady pull from the plate battery current from the magnet and allows only the audio component to flow through the 1.0 mfd. condenser and into the loudspeaker.

RADIO ENGINEERING

M. B. SLEEPER, Editor
F. A. SKELTON, Managing Editor

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EDITORIAL

IT IS customary, in the first issues of a new year, for radio magazines to review the past and make predictions for the future. This year, however, RADIO ENGINEERING, with a conservatism due, perhaps, to the fact that the editorial conscience was originally developed in New England atmosphere, waited to see the whites of the eyes in the situation which is developing for 1926.

To say that the important factor in radio equipment will concern quality of reproduction, ease of control, or such things is to start adding in the middle of a column. That is only half the picture. Moreover, magazines can only criticise and suggest—while the manufacturers go right ahead in their own way.

The real conclusion to be demonstrated this year is the success of engineering versus cheap-eneering.

Line up fifty radio sets, excluding a few standard makes, and you will find that there is not a single indication of engineering thought or effort represented by the lot. The only reason they are at all different is that the designers of some were more optimistic about getting by with a little more cheap-eneering.

Look at those sets, look at the kind of organizations which produced them, and you will understand why the people who complain that it requires more new ideas to stay in radio than in any other business are all wrong.

Radio requires of those in it only a reasonable amount of constructive thinking. But you can't get ideas from concerns operated by men who, in any other business, could only hold down jobs as salesmen, clerks, or laboratory assistants.

Do you remember what kind of a car, ten years ago, sold at five thousand dollars? You wouldn't have it today. Standard cars now on the market are far superior, tho they cost half as much.—They have been engineered to lower prices. In fact, cheap-eneering is difficult in the automobile business.

Radio sets, on the other hand, have lent themselves to cheap-eneering. We want sets to be low in price, but they must have a high rating in satisfaction. We shall have quality, ease of operation, dependability, and all those things, but when we get them they won't be designed by some engineer who learned his profession by measuring miles gain for the telephone company, nor will they be produced by a production manager who was previously a foreman in a tin can factory.

There isn't any way to beat the game. Problems of radio set design won't be licked this year or next year, but 1926 will demonstrate that the profitable manufacture and sale of radio equipment is more than any other one thing dependent upon engineering, in contrast to cheap-eneering.

It is unfortunate, in many ways, that the courts have so definitely decided the status of kits in a way that is embarrassing to set builders, and the dealers and manufacturers who have supplied them. On the other hand, there may be other developments from individuals or commercial organizations for which they will require the same protection.

One of the great failings of the executives in radio concerns is the tendency to blunder along, trying to get by in whatever way seems easiest, rather than to determine the limitations of a situation and meet them accordingly.

The development of the radio business is not a matter of doing many things with the blind hope that some of them will have to be the right ones. It is a matter of finding what things, among those which should be done, are possible to do successfully.

M. B. SLEEPER,
Editor.

Sell 'Em Headsets

Dealers who have put a little thought into the sale of telephone receivers are moving them in quantities.— *By J. B. Price

DEMANDS for radio accessories go thru the strangest cycles. As soon as loudspeakers became the accepted means of reproduction, telephone headsets went dead. Now, as suddenly, they are coming back, not to replace the loud speaker but as an auxilliary to it.

There are reasons, as always, for the change, due partly to consumer demand but more to dealer salesmanship.

One reason that phones are coming back is a result of the constant development in the selectivity of receiving sets. I have been told by dealers that they had failed to appreciate the DX ability of some makes of sets because they tuned so sharply that they passed stations without hearing them in the loudspeaker. Substituting phones they caught faint stations which could then be tuned in at loudspeaker volume.

Service men have had some interesting comments to make, also. Perhaps the hardest man to handle is the customer who, thru lack of patience or understanding, wants to return a set which is actually all right, because he can't get but two or three stations. Almost invariably a pair of phones gives the answer. A novice can learn to tune a set with phones, when he has given up in disgust thru his inability to catch the sound of stations as he tunes by them.

It's a capable service man who can turn a complaint into an extra sale.

Every dealer should push headsets in preparation for the Trans-Atlantic Tests, January 24 to January 30, for they are absolutely essential to DX reception. Even tho the European stations can be brought up to loudspeaker strength, once they are heard, the adustments are so critical that, more than likely, they will not be picked up by listening to the loudspeaker.

"Don't let the loudspeaker keep your family awake!" is a slogan used by one dealer to move headsets. There is many a wife or mother who would be glad to buy the assurance of quiet after nine o'clock at the price of a pair of telephones if only someone would suggest it to her.

And the nice thing about selling phones is that it doesn't cut into loudspeaker sales.

Another thing to consider is the matter of quality. With all the varying opinions as to the virtues of the different loudspeakers, everyone agrees that phones give the most perfect reproduction. The public generally realizes this point, but many people object to the weight and the hair-pulling propensities of the headset. That is an important consideration, and dealers must select types which are exceedingly light, and so made that they can be worn with comfort. Better take advantage of the new demand — sell 'em headsets.

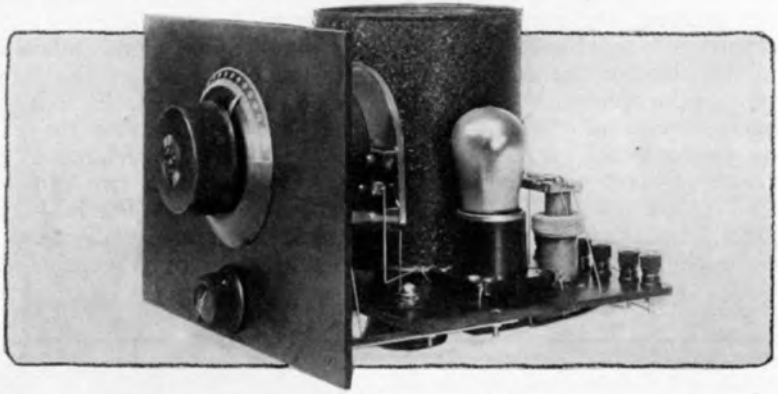
* Pres. T. H. Goldschmidt Corp.

Transmitters Run From B Batteries

SINCE the introduction of heavy duty B batteries, many experimenters have built small telephone or telegraph transmitters, operating from 5-watt vacuum tubes. Three or four heavy duty 45-volt B batteries provide ample power for transmitting over a considerable range. In fact, at very short waves, communication has been maintained over several hundred miles.

It is a very easy matter to build a telephone transmitter capable of talking 5 to 25 miles. Some B. C. L.'s who have built telephone transmitters use them to talk to people who have oscillating receivers. This is done simply by adjusting the transmitter to the wavelength of the oscillating receiver.

Fig. 1. This front view shows also the dummy antenna, mounted at the rear which allows the Penetrola to be connected right to the antenna and ground posts of the set



A Real Idea for the Man Who Wants More

Distance and Selectivity

The Penetrola, now put up inexpensively in kit form, is the very thing for those whose sets are not quite sharp or sensitive enough—*By Byron Minium

There have been many units on the market for sharpening the tuning and preventing radiation when connected before a receiving set. Some of them, mostly in the R. F. amplifier class rather than in wave-traps, have been very good. Others, while accomplishing their purpose, radiate worse than the set alone and make the tuning so complicated that the operator gets lost and runs across distant stations only by chance.

The Walbert Penetrola is a highly practical and desirable supplementary R. F. unit. It is a useful addition to any type of set as demonstrated by tests made in the laboratory and on receivers in congested localities.

One of the best features is that the unit absolutely prevents radiation from the aerial because it employs the Isofarad balanced circuit together with the shielded coil. Should the receiving set proper oscillate, no energy can reach the antenna and input inductances by capacity coupling, for in the balanced circuit there is none, and no lines of force, magnetic or static, will penetrate the shield. Of course, the balanced circuit itself does not oscillate. The tuning inductances are mounted in the center of a copper can, about the size of a two-quart vegetable can, with the terminals brought out thru heavy insulation at the bottom. The shield to be effective must be grounded. At first thought, this sheet of metal surrounding the coil would seem to be at variance with all the principles of "low-loss" but, on the contrary, the shield, in addition to preventing undesirable feedback, actually adds to the efficiency of the coil. The size of the can allows a liberal spacing from the windings, and such of the magnetic field as strikes the copper, causes less loss than if it went free, probably to intersect some other part of the circuit or the framework of the set. It is important to use material of low resistance for the shield, as its resistance is reflected in the H. F. resistance of the coil. A negative bias is necessary on the grid of a good R. F. amplifier. In this circuit the grid is automatically kept negative with relation to the filament for there is no D. C. return to either A+ or A—. When the circuit is balanced, the grid accumulates just enough negative charge for efficient operation, but never so much as to block the tube.

* Chief Engineer, Walbert Mfg. Co.

To make the amplifier adaptable to any type of receiver, the output post is connected thru a large fixed condenser directly to the plate of the tube. This post is wired to the antenna binding post of the receiver with which it is used. Thus there is no direct current circuit and no chance of short circuiting the B battery. The plate voltage is supplied in parallel to this output circuit thru an R. F. choke shunted by a fixed condenser which also completes the antenna circuit of the original set.

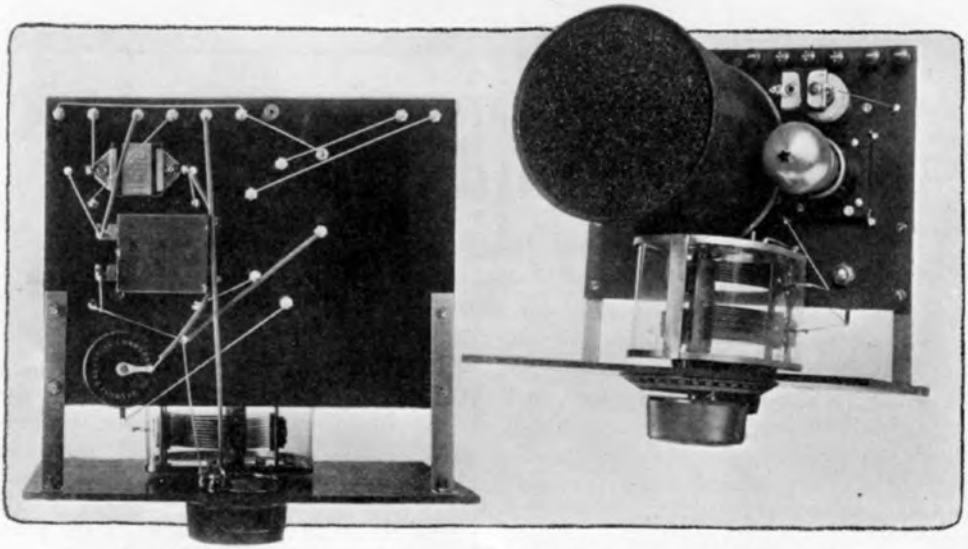


Fig. 2. Looking at the assembled Penetrola Kit from the bottom and top. All the parts shown, except the tube, are furnished in the kit

The Penetrola was used with the RX-1, the New Yorker, and the 1926 model Three-Circuit set. Naturally, the added selectivity showed up most on the three-circuit set, but in all cases an immense increase in volume and distance-sensitivity was obtained. It makes practically a Browning-Drake set in combination with the three-circuit, plus the advantage of variable coupling in the double rotor coupler, and freedom from local pickup by the R. F. coil. It was found better to turn the upper rotor over so that the antenna coil was at the top. As the three-circuit is practically a one-control set, with the Penetrola there is a dial for each hand and none left over. The tickler does not need adjusting even as much as when the set is connected directly to the aerial.

Nor is tuning at all difficult with the two-dial sets, such as the New Yorker and RX-1. The R. F. unit gives such good amplification that the background noise is sufficient guidance to keep it in resonance with the two controls of the RX-1 very easily. The RX-1, of course, retains its perfect quality and the combination was found capable of cutting thru local interference to such an extent that practically any station in range could be selected easily.

Ahead of the New Yorker, operation is easier still by reason of the oscillation control for the detector. It is a very short process to pick up a carrier wave on the inside or detector tuning condenser and then swing the two R. F. dials into tune. You can tell by the intensity of the whistle whether the station is loud enough to be worth listening to. If it is, turning back the tickler brings it in, and with perhaps a slight advance of one dial, the adjustment is perfect. Oftentimes the whistle becomes unbearably loud and the detector must be retarded before lining up both the R. F. tuners. In this case, it is not really necessary to use the detector in an

oscillating condition, but each R. F. stage has such a large gain that if they happened to be tuned to a nearby station, it comes in together with the one to which the detector may be tuned. The carrier wave is an immovable guide post to the station.

A list of stations logged is tedious and sometimes slightly incredible. Many will appreciate the results obtained when it is stated that in mid-town New York or Chicago, stations are brought in from 500 to 1,000 miles distant immediately after dark, not merely logged, but with no background of local stations, and many of them well worth listening to for entertainment.

For those not familiar with receiving conditions in Chicago, it might help to explain that the New Yorker was used in a location within half a mile of five big stations. One of these is within a quarter-mile, and has a notoriously broad wave. With the aerial disconnected, the exposed coil of an ordinary set picks up enough energy to operate a loud speaker from the detector output.

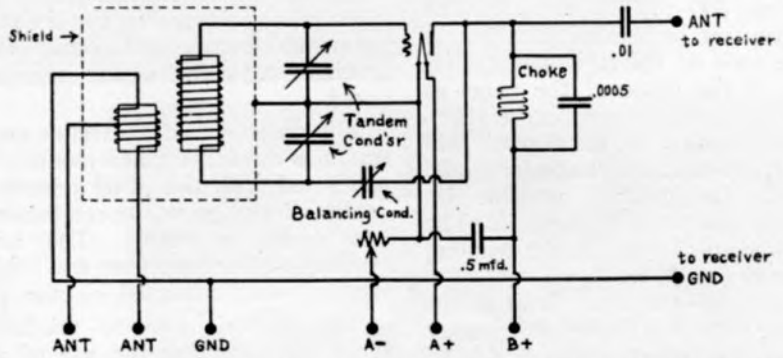


Fig. 3. Unlike other circuits, there is no D. C. return from the grid to the filament. That is not essential, however, because there is an R. F. path thru the lead taken from the center, a common point of the double condenser

A Suggestion About Demonstrating Receiving Sets

THE most important thing to sell a prospective customer for a radio set is confidence in the ability of the set to perform. Bearing in mind that so many people who have not bought sets already have hesitated about it because of unfortunate experience of their friends, it is easy to understand the necessity for clean-cut performance if the customer is to be sold by demonstration, which is convincing, instead of by explanation, which carries no more weight than most kinds of excuses.

Even the best sets have their little tricks which mean nothing to the customer after he has learned the knack of handling his set, but if, in the first demonstration, he is allowed to see that there are any tricks at all, he will lose interest.

In other words, he wants quality, reception, and the ability to pick out a reasonable number of local programs. While he may become a DX hound later, most beginners think they want only local reception which can be brought in without any trouble.

Remembering this, the next time you are going to demonstrate a set, find out the dial settings for the local stations. When the customer comes in, have the tubes turned off. After your preliminary talk say to him, "WJZ comes in at this adjustment." Set the dials and turn on the filaments. Turn the tubes out again, reset the dials for another station. Repeat this process, turning the tubes out between each station, until you have gone over the various locals.

If you doubt that this kind of a demonstration is more convincing than fishing around for one transmitter after another, try it out on yourself and you will be surprised to see how much more you think of the set.

Radio Frequency Resistance and Metal Instrument Panels

A report of tests made at Washington University on the use of metal panels—*By R. S. Glasgow

AN ordinary cylindrical type of radio-frequency transformer as is commonly used in tuned R. F. sets was used for the tests to be described, carried out in order to determine the effect of metal panels upon the R. F. resistance of coils.

The resistance of this coil was accurately measured at various wavelengths from 300 to 700 meters. The coil was then set on one of the bronze panels, the axis of the coil being perpendicular to the plane of the panel as shown on the accompanying curve sheet. Under this condition the metal panel will act as a short-circuited secondary and will produce the greatest possible increase in the resistance of the coil. The distance between the end of the winding and the panel was ½-in.

At 550 meters—the upper limit of the broadcasting wavelengths—the increase in resistance was found to be only 2.22%, while at 300 meters the resistance of the coil when resting on the panel was actually lower than when the panel was absent. This is due to the reduction of the natural period of the coil, as its inductance is decreased owing to the presence of the panel.

The substitution of a brass panel caused a larger percentage increase in the coil resistance, it being 5.95% at 550 meters.

Curves showing the variation of resistance with wavelengths are shown for both types of panels, together with the resistance of the coil by itself. It will be noted from the accompanying data that the effect of the panel is to also reduce the inductance of the coil.† This is shown by the increased values of condenser capacity required to produce resonance when the coil is placed next to the panel.

The various panels were then located 3 ins. away from the nearest portion of the coil and were inclined so as to make an angle of approximately 56° with the axis of the coil, this position being about the usual location of the coils with reference to the panel in the average present day receiving set. With the panel at this distance away no increase in coil resistance could be determined for the various types of panels, within the limits of experimental error, nor could any appreciable reduction in the inductance be noted.

The resistance of a variable condenser was also measured when mounted on the panel and with the panel removed. No detectable change in the condenser resistance could be noted. The minimum capacity of the condenser was slightly increased when mounted on the panel.

The conclusions to be reached from these tests are that the use of a metal panel in a receiving set produces no measurable increase in the resistance, and hence in the losses, of the coils and condensers used when they are mounted in the usual manner. In fact the coils can be mounted directly behind the panel with only a slight increase in resistance, provided the panel material is of high conductivity. The reason for this is readily seen, since the eddy current losses in the panel material are proportional to I^2R, where I is the current and R is the resistance. As R approaches zero, the losses likewise approach zero, so that if the panel were a perfect conductor it could produce no losses whatever in the apparatus mounted in its vicinity. The use of an alloy of very high conductivity is of secondary importance if the coils are located several inches away from the panel.

There has been considerable discussion concerning losses from metal panels, tho a number of receiving sets on the market to-day have had losses deliberately introduced into their circuits to render them stable and easy to adjust, while in

* Dept. of Electrical Engineering, Washington University.

† This has been noted also by Byron Minium in the development of the shielded coil for the Penetrola.

other portions of these same circuits considerable pains have been taken to eliminate losses so far as possible.

The use of metal shielding has been thought to introduce considerable loss in receiving sets by virtue of the eddy currents set up. The above tests, however, show that the losses due to its use are quite negligible. Most of the tuned radio frequency sets on the market at the present time have the coils mounted on the variable condensers, so that the condenser plates are much closer to the coil than a metal panel would be. Since the nearer solid metal objects are to the coils, the larger the losses become, it seems obvious that the loss due to the proximity of the condenser will be much greater than any effect a metal panel might have. As a matter of fact, the condenser plates will shield the coil from the effect of the panel.

Resistance of Coil Resting on Panel

Wave length	*Resistance of coil alone*	*Resistance of coil with brass panel*	*Per cent increase*
300	23.6 *ohms*	24.1 *ohms*	2.12
350	19.7	20.7	5.08
400	17.4	18.3	5.20
450	15.7	16.4	4.45
500	14.5	15.1	5.50
550	13.5	14.1	5.95
600	12.5	13.3	6.40
700	11.1	12.2	9.90

Resistance of Coil 3" Away From Panel and Inclined at 56° Angle

Wave length	*Resistance of coil with bronze panel*	*Resistance of coil with brass panel*
300	23.5 *ohms*	23.5 *ohms*
350	19.7	19.7
400	17.4	17.4
450	15.7	15.7
500	14.5	14.5
550	13.5	13.5
600	12.5	12.5
700	11.2	11.25

Tuning Capacity Required for Coil (Same for Various Panels)

Wave length	*Coil alone*	*Coil resting on panel*	*Coil 3 inches away from panel at 56° angle*
300	.000064 mfd.	.000073 mfd.	.000065 mfd.
350	.000092	.000105	.000093
400	.000123	.000139	.000125
450	.000155	.000193	.000156
500	.000192	.000218	.000194
550	.000231	.000265	.000233
600	.000278	.000321	.000279
700	.000386	.000445	.000388

It is significant that almost all of the receiving sets furnished for the government are entirely shielded, indicating that the advantages of this practice must more than offset any losses that are produced.

The chief electrical advantages of metal panels over the forms ordinarily used are that:

They prevent any variations in tuning due to the movements of the hands of the operator on the tuning dials. The elimination of the effect of body capacity is an exceedingly important feature.

They afford some simplification in the circuit wiring as the panel can be used as a common conductor. A convenient use of this is in connection with sets employing several stages of tuned radio frequency which have one side of the variable condensers connected to a common lead. By using condensers which have their movable plates grounded to the frame, the mounting of these condensers on a metal panel automatically ties all of the movable plates together and does away with the need of a connecting wire for this purpose. This is likewise a common filament lead, so that one side of the filament rheostats may also employ the panel as a portion of the filament circuit.

Metal panels are quite free from warping, with the resulting absence of the likelihood of stresses being set up in the variable condensers mounted on them, which might cause the plates to become short-circuited, or the dials to rub on the panel.

Of course, metal panels are inconvenient to use where switch points are required, but the vast majority of present day sets no longer use them, but perform all tuning operations with variable condensers. Binding posts are also no longer located on the front of the panel, but are being mounted on a strip of insulating material in the rear of the cabinet, so that the objection to a conducting panel owing to the necessity of insulating all binding posts is no longer serious.

Effect of Distributed Capacity

Showing by theory and practice that distributed capacity does not cause appreciable losses in the form of R. F. resistance

*—By Glenn Browning**

THERE has been a great deal written about the resistance of coils and circuits at the wave lengths used in broadcasting. There has also been some discussion on the effect of distributed capacity in increasing the high frequency resistance. However, the idea seems to be prevalent that R. F. losses are introduced by distributed capacity, and a coil wound in such a fashion as to have the least amount of distributed capacity, operates the most efficiently in a radio set.

The writer has seen very little data published on the actual effect of distributing capacity, and consequently made some study of its effect on high frequency resistance.

In measuring high frequency resistance, a coil must be used in conjunction with a condenser as shown in Fig. 1. Consequently the measured resistance is the total circuit resistance, rather than the resistance of the coil itself. However, variable condensers as constructed to-day have very little loss at radio frequencies, and consequently most of the loss in the circuit may be laid to the coil. The causes for this loss are—the inherent resistance of the wire itself which makes up the winding, the skin effect, due to the high frequency current crowding toward the outside of the wire, and the unequal distribution of the current in the wire due to the effect of the other turns being present, the distributed capacity also has some effect upon high frequency resistance. It is extremely hard to separate the component parts, but by making some assumptions the approximate magnitude of the loss due to distributed capacity can be calculated.

Let us assume that we have measured, at various wavelengths, the loss or resistance in the circuit shown in Fig. 1. We shall assume this loss has occurred in the coil alone and that the condenser used was perfect. This is not a radical assumption as the resistance of a good condenser may be .5 to 1. ohm while the coil has a resistance of from 10 to 15 ohms. Having taken the data suggested above in the laboratory, we are ready to measure the distributed capacity inherent in the coil. This can be done most easily by means of the reaction on short wave oscillator. The coil is disconnected from all circuits and simply placed close to the oscillator whose setting is then varied until resonant reaction is obtained, and

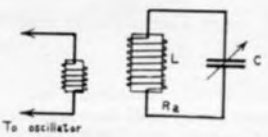


Fig. 1. Tuned circuit coupled to an R. F. oscillation. Fig. 2. A typicial R. F. tuning circuit

the natural period of the coil is then known. Simple calculations then give the distributed capacity C_0 shown in Fig. 2.

Having determined the distributed capacity C_0, and assuming that the measured resistance in the circuit Fig. 1 was due to the coil, we can calculate what the resistance of the circuit would have been had there been no distributed capacity.

Looking at Fig. 2 as a parallel circuit with an e. m. f. or voltage impressed across the coil, the impedance of the system Z may be seen to be

$$Z = \frac{\frac{-j}{C_0 \omega}\left(R + jL\omega\right)}{R + jX}$$

Where R is the resistance of the coil due to all other effects except the distributed capacity, C_0 is the distributed capacity in farads, L is the inductance of the coil in henrys, $\omega = 2\pi f$ where f is

*Chief Engineer, National Company, Inc.

the frequency of the impressed e. m. f.,

$$X = \left(L\omega - \frac{1}{C\omega}\right) \qquad j = \sqrt{-1}$$

The impedance given by equation 1 may be broken up into two parts, a reactance, and a resistance term. Separating these two components and simplifying the equation we obtain

$$Z = \frac{R}{R^2 C_0^2 \omega^2 + (1 - L C_0 \omega^2)^2} + j\frac{L(1 - L C_0 \omega^2) - C_0 R^2}{C_0^2 \omega (R^2 + X^2)}$$

We are interested in only the first term as this gives the resistance which we have already obtained by experiment. This resistance we shall call R_a.

As $R^2C_0^2\omega^2$ is extremely small compared to $(1—LC_0\omega^2)^2$ it may be neglected in making subsequent calculations so that

$$R_a = \frac{R}{(1 - L C_0 \omega^2)^2}$$

The coil taken for experimental work was a single-layer selenoid consisting of 75 turns of No. 20 D. S. C. wire on a 3-in. bakelite form. Its inductance was .315 mh. and the distributed capacity was found to be 3.4 mmf. The total resistance was measured at various wavelengths from 300 to 600 meters. This was called R_a, the apparent resistance of the coil. From equation 2, R, or the resistance due to other factors than distributed capacity, was then calculated. The results of this work are shown in Fig. 3, where curve A gives the total measured resistance and curve B shows what the resistance would have been had there been no distributed capacity.

The reader can now see for himself that the effect of this distributed capacity in increasing the losses of a coil are comparatively small if the inductance is correctly designed for the wavelength spectrum. However, it is only fair to state that had we used the above coil for a band from 75-150 meters, the resistance due to distributed capacity would have been appreciable. However, in practice this coil would never be used for such a range.

To summarize the whole situation, the distributed capacity of a good single-layer solenoid is a relatively unimportant factor in increasing the high frequency resistance. Its effects are greater on the short wavelength than on the longer waves.

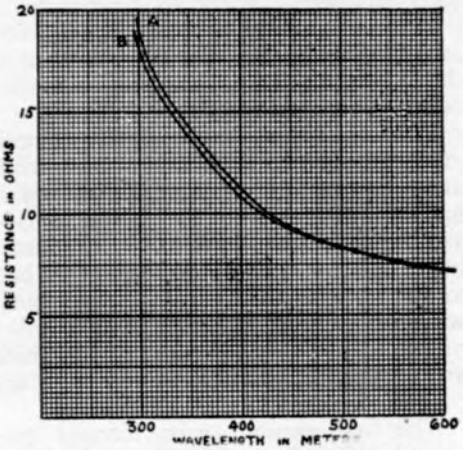


Fig. 3. The absurdity of claiming high efficiency for a coil merely because of low-capacity winding method is illustrated by this curve, showing that any ordinary amount of capacity has a negligible effect on R. F. resistance

New Use for the RX-1

THERE is one chauffeur in New York City who finds it easy to pass away the time when he is not occupied.

Mounted beneath the dash of the Lincoln which he drives is an RX-1 receiver. The tubes are operated from the storage battery of the car and a B battery tucked away out of sight.

While he is waiting, the chauffeur gets out the headphones, plugs them in, and tunes to any of the local stations, picking them up with only the body of the car as a ground connection. No antenna is required.

Owners of RX-1 receivers will be particularly pleased to see the publication of some entirely new data on an A and B battery eliminator design for this set. It is an extremely simple affair, using a tube which has shown, in tests made during the last three or four years, an almost unlimited life. The current drain from the A. C. mains is less than that from a small electric light.

A-B-Common Lead

There are important reasons for connecting the A- and B- leads together—*By J. H. Miller

In the course of designing various types of meters for radio manufacturers, the Jewell Electrical Instrument Company has been confronted repeatedly by the precedent until now so widely followed of connecting the B— terminal to the A+ terminal of vacuum tube circuits.

The easiest and least expensive circuit arrangement where a double-reading voltmeter is specified to show the A and B battery voltage is to use A— and B— as the common terminal. Engineers have, in some cases, objected to this but, to our surprise and theirs, we have found while discussing the matter a number of objections to the old method which are eliminated when A— and B— are connected together.

The first vacuum tube circuits employed soft tubes, and were so critical that it was necessary to provide a variable plate potential in order to obtain the best B battery voltage. An easy way to obtain this control was to connect the B— terminal to the arm of a potentiometer which was, in turn, put across the A battery terminals. By swinging the arm from one side to the other a variation in plate potential of several volts could be obtained. Now, however, that is no longer necessary. Accordingly, we might as well connect B— to A— or A+, whichever is more convenient. If we connect to plus, a few volts are added to the B battery voltage. However, that is of no consequence since the tubes do not need it.

If we connect B— to A—, the full potential of the B battery is applied to the tubes. At the same time, it provides a common lead of zero potential which is of great value in wiring up the circuits and for meter connections. The former is particularly important in shielded sets or those using metal panels, since the number of wires can be reduced greatly by having the shield or panel as a common lead for the circuits. Measuring instruments can be switched from the A to the B circuit very simply, and tests for faulty wiring can be made quickly because the panel is a common negative for all circuits. When this is done, the rheostats should be put in the positive filament leads, in order to measure the voltage actually applied to the tubes.

In the majority of tuned R. F. sets, the grids of the radio frequency tubes are returned to the negative filament. When B— is connected to A+, an accidental short between the grid and plate circuits will burn out the filaments of the tubes. With B— and A— common, such an accident will short circuit the B battery, but will not affect the filaments.

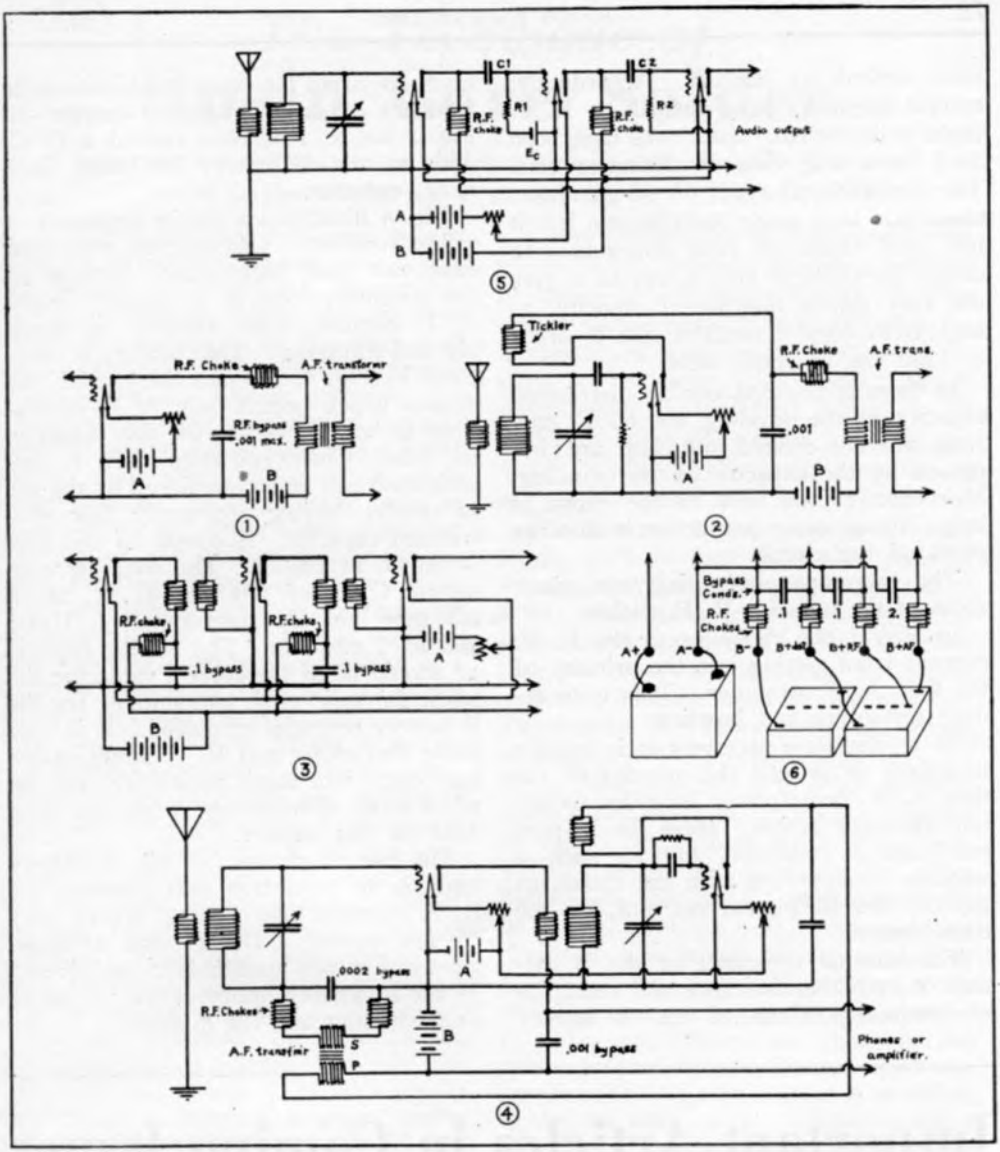
The use of shields around individual oscillating circuits or R. F. inductances is rapidly gaining in favor. Correct practice requires that the shields be connected to the negative filament. When B—is connected to A+, if a B+ lead should happen to touch the shield, the tubes will be burned out. Such damage cannot be done when B— and A— are common.

The only useful purpose served by the old method is to provide biasing for the grids. It is not good practice to depend upon the drop in the rheostats for biasing, however, because a given bias is obtained only when a given amount of resistance is used in the rheostats. Any change in rheostat settings alters the grid bias.

Now that power tubes are being used in practically all receiving sets, a C battery is required for the last tube. At the same time, the C battery can be employed as well for producing any other bias values required in the R. F. or A. F. circuits.

Thus it has come about that, while arguing for the common B— A— method in order to simplify the wiring for filament and plate battery meters, we have unearthed arguments in favor of the new method which are also of great importance in sets where no meters are employed.

* Chief Engineer, Sewell Electrical Inst. Co.



Uses for R.F. Chokes

Engineers are now discovering the importance of keeping R. F. currents from A. F. circuits—*By R. W. Cotton

A FEW of the manufacturers have been experimenting with neutralized A. F. amplifiers, designed in such a way as to balance out R. F. currents. This work has been undertaken as another step in improving audio quality, for the presence of radio frequency oscillations in the A. F. amplifying circuits are responsible for a considerable amount of distortion.

While the neutralizing methods have been fairly satisfactory, they are some-

* Radio Sales Engr., Samson Electric Co.

what difficult to handle. Accordingly, several engineers have turned to R. F. choke coils instead. Such coils have been used for a long time in Reinartz sets. The conventional type of single layer choke has been fairly satisfactory, but it has been found of vital importance to design the choke in such a way as to give the very lowest distributed capacity, as well as to keep it small in size in order to limit the magnetic field.

If there is any appreciable distributed capacity in the winding the R. F. currents are not choked out but are by-passed by the capacity of the winding. Moreover, if the field of the choke is large, it may cause interaction with other parts of the circuit.

The accompanying diagrams show some of the uses for R. F. chokes.

In Fig. 1 the choke keeps the R. F. current from getting into the primary of the first A. F. amplifier. This is to reduce instability and howling.

In regenerative receivers it is usually necessary to by-pass the primary of the first A. F. transformer in order to obtain feedback action. Here the by-pass condenser is employed, but in such a way, in combination with the choke, as to keep the R. F. current out of the transformer.

The internal resistance of the B battery or even the resistance and reactance of common portions of the B battery leads are often the cause of objectionable feedback of radio frequency energy. In Fig. 3 the R. F. chokes furnish a D. C. path to the B battery but keep back R. F. currents.

Fig. 4 illustrates a 2-tube regenerative reflex receiver. Circuits of this type have not been satisfactory because of the instability from R. F. currents in the A. F. circuits. This resulted in howling and squealing. That feature is overcome in Fig. 4, through the use of two chokes which permit only A. F. oscillations to be returned to the first amplifying tube. Choke coil coupled R. F. amplification can be accomplished by the use of chokes having extremely low distributed capacity. A circuit of this sort is shown in Fig. 5. The coupling condenser C_1 is of 0.005 mfd., R_1 about 0.3 megohm, C_2 approximately 0.0005 and R_2 1 megohm. The biasing battery, E^c should be of the correct value for the particular tube used, and suitable for the B battery potential employed. It is very likely that choke coil R. F. amplification may come into much popularity later on when more development work has been done on this subject.

The use of chokes in all B battery leads is an advantage that prevents the R. F. currents from going where they are not wanted. The general arrangement in Fig. 6 is applicable to any set and its use invariably improves the operating characteristics and the quality.

Important Articles in Coming Issues

SEVERAL special features are being planned for the coming issues of RADIO ENGINEERING. Everyone will be interested in the special features of the KB-8 set to be described in the March issue. This is a non-regenerative Browning-Drake receiver, employing the new Browning-Drake coils, without the tickler, and fitted with S. L. F. condensers. A special type of impedance coupling is employed in a circuit which has never been shown before. In appearance this is by far the handsomest set which has ever been shown in RADIO ENGINEERING and its operating characteristics do justice to the mechanical design.

With the April issue, RADIO ENGINEERING will be of the large size, 9 by 12 ins., with the standard type page 7 by 10 ins. This will enable us to make the magazine more attractive in appearance and to give larger illustrations. In April the special feature will concern B battery eliminators.

June will contain a special section on complete receiving sets, showing the new fall models which set manufacturers will be ready to announce at that time.

The Technique of
Rosin Core Solder

Information on rosin core solder which is not generally known even to those who use it most—*By P. C. Ripley

SOLDER is an alloy, composed usually of the two metals, tin and lead. These two metals are combined in variable proportions, which reflect certain well defined characteristics in the alloy, and are a controlling factor in the selection of the solder for specific purposes.

One of the vagaries of nature is manifested in solder, for it possesses a lower melting point than either of its component metals. Other metals may be added which will bring about a further lowering of the melting point; but, in doing this, we effectually destroy some of the desirable attributes of ordinary tin and lead mixtures, so we may at once dismiss from our consideration solders of a lower melting point than are obtainable with tin and lead combinations.

In your purchase of solder, it will be wise to select a product that the manufacturer endorses for radio use, developed by exhaustive experiments to determine the correct proportions of tin and lead. Beware of cheap solders for, often times, they are made from reclaimed metals, and may contain metals other than tin and lead. These may raise the melting point, render the alloy brittle, or detract from its flowing quality.

The more common forms in which this commodity is offered for sale are bars, wire, and ribbon. The bars usually weigh from a pound to a pound and a half, and present a form that is not readily apaptable to the uses of the radio set builder. We would not recommend the purchase of solder in this form for the average radio construction. Next, we have solder in the form of a wire which will be found much more convenient to handle. The ribbon type will probably meet with the approval of every enthusiast, and is a most adaptable form of solder for radio construction. One advantage in the purchase of the wire or ribbon type is that it may be secured in smaller amounts when purchasing solder. Both wire and ribbon solder may be purchased which contain their own flux, rosin.

Under the heading of fluxes comes one of the most important factors of success or failure in soldering. Flux is the substance whose duty it is to dissolve the oxides which occur on the surface of the parts to be joined with solder. When these oxides are dissolved, it enables the solder to enter the minute pores of the metal surface, effectually sealing it against the penetration of oxygen.

Fluxes range in character from very strong acids to very mild acid bearing substances. For radio use, we must have a flux which is noncorrosive, and which in its use will leave a residual matter that will have no tendency to collect moisture, dust, or other foreign material. There have been some ineffectual efforts to neutralize the stronger acids and use them, but to do this is to court disaster. Simply because you incorporate alcohol or ammonia, in these stronger acids to the point where they appear neutral, does not assure that the residual matter will be neutral after the heat of the soldering operation has driven off the alcohol or ammonia. So, let us at once forget the stronger acids as being entirely unsuited to radio use. Next, we come to the pastes or semi-viscous fluxes, which are another form of compromise in an effort to use the sharp acids. These contain a more or less limited amount of the strong fluxing material, suspended in some organic grease or wax. The popular idea is that the presence of these greases will prevent corrosion on the work. Unfortunately, this is not true, as the acid content of these compounds will corrode even if enveloped in grease, as the heat of the soldering operation does not change their chemical structure. Some manufacturers of these acids bearing pastes have advertised their wares as being absolutely noncorrosive and adaptable to radio use. This is misleading, and the radio enthusiast should view all pastes with suspicion when purchasing a flux for radio work. To test the manufacturer's claims regarding the corrosive

* Research Engineer—Chicago Solder Co.

action, simply heat a small amount of the paste and some solder on a piece of German silver and set aside for thirty days. The result will be startling.

Still another bad feature in the use of paste is the fact that the organic greases or wax, universally employed in its manufacture, eat the insulating material. This breaks down or rots the insulation, and manifests itself in no uncertain manner at a later time. The active acids in these pastes usually have an affinity for moisture and, as they are deposited in a thin film over the parts during the soldering operation, induce dielectric losses. To attempt to remove them with alcohol simply tends to spread them over a greater area, often into the parts themselves. Grease forms a very efficient collecting agency for dust and foreign matter, which may bring about still further losses through leakage of the radio currents.

Leading manufacturers and radio engineers have spent large sums in experimental work, and have conducted exhaustive tests to determine the best flux for radio use; and, they are almost unanimous in acclaiming rosin the safe and sure radio flux. Contrary to popular belief, rosin is acid—or rather contains acid in its natural structure; yet, its physical characteristics are such that it is non-corrosive in action. Rosin is a rather complex mixture of a number of different substances, and these undergo certain changes when subjected to heat, light, age, and atmospheric contact. The action of these forces will materially alter or destroy entirely, the good fluxing qualities of a rosin. The United States Department of Agriculture recognize some twelve standard grades of rosin. Of these, there are only a few which have the necessary qualities to make them efficient fluxes. This, of course, presents a problem to the novice in the selection of a rosin which will serve as a flux.

Here is where a rosin-cored solder will lead the way out of the difficulty. The manufacturer of this solder, in either the ribbon or wire type, carefully tests all rosins which enter into his solder, and uses every precaution to maintain and insure the retention of its highest fluxing qualities. Should the radio enthusiast purchase bulk rosin, he must remember that age is detrimental and should demand fresh rosin. Also, that the darker grades are the least active as fluxes.

Next, let us consider the proper handling of our iron. We must bring it in contact with the work in such a manner that a maximum of surface is presented for heat transmission. Fig. 1 illustrates a correct contact, while Fig. 2 shows a poor one.

When applying solder and flux to the article to be soldered, the flux must come in actual contact with the joint or object to be soldered. The sole reason for the flux is to dissolve the oxide film that is on the surface of the work, and if we destroy our flux before we have accomplished the soldering operation, we are certain to fail in securing a well soldered joint. Now, rosin is disintegrated with heat, so you see there is a time limit which must not be overlooked in applying our flux and solder. Do not apply solder and flux to the iron; apply it directly to the work after it has attained a temperature where it will melt the solder. We are not interested in melting solder and flux on the iron; what we want is a securely soldered piece of work, and the easiest way to secure this is to apply the solder and flux directly to the heated joint.

Parts presenting nickel-plated or brass soldering contacts should be avoided as much as possible, as the oxides of these metals do not respond to rosin flux readily. In the case of nickel-plating, this can be removed with a file, and then you will find that the base metal will solder much easier. Should it be necessary to solder on these metals, remember that it will require a great deal of patience to make a good joint.

Often, you will be presented with the problem of soldering enameled, lacquered or rubber insulated wires. Before making any attempt at soldering these, we must first clean them thoroughly. In the case of the enameled or lacquered wires, all that is necessary is to scrape or sandpaper until all the covering material is removed, and the surface is bright and clean. For rubber insulation, simply cut this way and treat as you did the enameled wires.

Antenna Constants

Data obtained on 4-wire antennas from tests made at U. S. Signal Radio School, College Park, Md.

IT will be observed that the capacity of the antenna does not decrease necessarily with increased height. Due to the fact of increased thickness of dielectric, the capacity of the flat part of the antenna alone does decrease with increased height. However, the data will show that for short antenna the capacity of the lead-in, which increases almost directly proportional to length, more than makes

40 feet long

Height from ground in feet	C	L	in meters
30	.000186	22430	80
40	.000190	28900	93
60	.000213	42180	119
80	.000241	55410	145
100	.000268	69000	171

60 feet long

30	.000252	28230	108
40	.000258	35000	121
60	.000276	48800	147
80	.000300	62400	173
100	.000325	76260	198

80 feet long

30	.000334	34010	132
40	.000324	41100	145
60	.000337	55460	171
80	.000360	69300	197
100	.000382	83500	224

up for the decrease of capacity of the flat part. Hence the capacity of the whole system, flat and lead-in does not decrease with increase height.

It will be also observed that the T-shaped antenna has a shorter wave length for the same heigth and length antenna. This can be seen for the following reasons:

When the lead-in is connected to the center of a flat top antenna, the inductance and capacity of each part are connected in parallel. The total inductance then is one half that of each part or one fourth of entire inductance of flat top. The capacity of the two in parallel is the same as for the entire top. Therefore one might expect that the wave length of a T-antenna would be one fourth that an equivalent length L-antenna. However, the effect of the lead-in does not make this possible.

Rough therefore, the wave length of a flat top L-antenna is not changed by adding another section to that already existing and extending in opposite direction. This would result in halving the inductance and doubling the capacity. This

60 feet long

Height from ground in feet	C	L	in meters
30	.000252	15050	76
40	.000258	21000	96
60	.000276	33790	120
80	.000300	46530	149
100	.000325	59870	178

100 feet long

30	.000395	18000	106
40	.000392	24150	121
60	.000400	37150	151
80	.000418	49850	188
100	.000439	63430	212

140 feet long

30	.000555	20900	133
40	.000528	27300	148
60	.000522	40500	179
80	.000538	53600	210
100	.000553	67180	242

180 feet long

30	.000702	23900	165
40	.000664	30500	181
60	.000645	43860	212
80	.000654	57190	243
100	.000667	70840	275

would, of course, keep the product of these two factors the same. For short antenna, however, where lead-in contributes considerable to the natural wave length, this is not true.

C and L of the L type antenna including lead-ins four wires two feet apart, L

New Pacent products—A. F. transformers, Bakelite rheostat, dial. porcelain rheostat, and S. L. F. condenser.

THE Dongan Electric Manufacturing Company, Detroit, Michigan, has grown, since the organization of the Company in 1909, to a point where it is one of the largest if not the largest manufacturer in the world of bell-ringing transformers. In addition, Dongan manufactures oil burner transformers, special power transformers, audio transformers, and produces an enormous volume of ammeters for the automobile trade.

In 1923, this Company went into production on A.F. transformers for set manufacturers and for the retail trade, A.C. tube step-down transformers, and is now building transformers and chokes for B battery eliminators. At the present time, more than forty set manufacturers are using Dongan audio transformers, and a rapidly increasing number of concerns are using Dongan meters, power transformers, and chokes in their equipment. In the last two years, this Company has expanded more rapidly than in the previous thirteen years of its existence.

In addition to the Canadian branch recently organized, the Detroit plant is being enlarged by the purchase of a group of two-story buildings adjoining the present factory. The new plant is now in operation, practically doubling the floor space previously available. Plans now under way, however, call for razing the present buildings, and replacing them by a much larger modern factory building. Dongan is one of the radio companies that has very little sympathy for the complaint too often voiced this fall that the radio business is not coming back as it should.

American manufacturers have been somewhat resentful of the publication in one of the English magazines of a letter, appearing under the title "American Poaching" from the Narmat, the British Organization of radio manufacturers. This letter states in part—"Agents of American wireless firms who have offered to supply American pattern receiving kits, or in the ordinary cabinet form, completely constructed. The low price at which this apparatus is offered could never be reached by British manufacturers.

"Reports from America make it perfectly clear that the manufacturers there considerably over-produced during 1924, so that, at the end of the season, they were left with very heavy stocks of receiving sets and boxes of parts, particularly those of the Neutrodyne pattern.

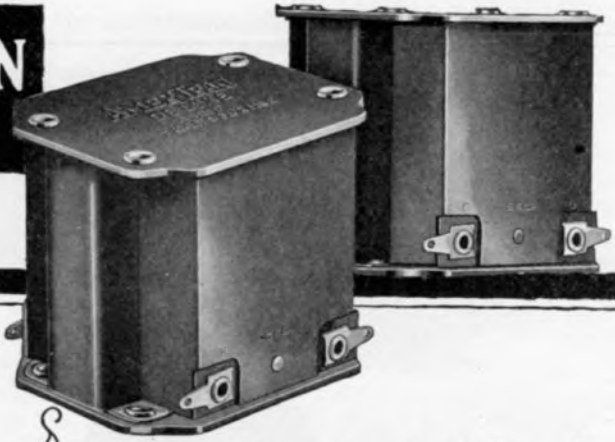
"I am also informed that receiving sets and boxes of parts of the Neutrodyne pattern are rapidly losing favour in America, and, in fact, will not sell there during the coming season in any quantity, so that the dumping of sets of this pattern is particularly active.

"As far as this country is concerned, I can assure our dealers that if the Neutrodyne type of receiving set were a suitable proposition for sale in the British market, there is no doubt that British manufacturers would have made arrangements to produce it. Manufacturers, however, are of the opinion that the set is entirely unsuitable for this market owing to its limitations on wavelength range and also the difficulties which arise when valves have to be replaced.

"Finally, I would urge your readers to keep the British wireless Trade in British hands. Do not send unnecessary dollars to America. The British manufacturers know exactly what is wanted to please the British public, and they can produce enough—and some to spare."

This statement has rather antagonized some of the American manufacturers. It is not as serious as it sounds, however. In the first place, English magazines have published volumes of material of neutrodyne and superheterodyne sets, and these outfits as well as many others which bear the distinct ear-marks of British design have been built from American parts. English manufacturers in all lines are very quick to urge upon their public the exclusive use of things made in England, but the tremendous success of American Products, including radio equipment, shows that English people respond to their own judgment rather than taking "Made in England" propaganda at its face value. At the same time, American manufacturers should be very careful to determine the suitability of their equipment to conditions in England, for there are certain features that must be considered in order to market radio products successfully abroad.

AMERTRAN
TRADE MARK REG. U.S. PAT. OFF.
DE LUXE



AMERTRAN
Types AF-7 and AF-6

AmerTran audio transformers Types AF-7 and AF-6 have been considered for years among the leaders in audio amplification. These popular and efficient models may now be purchased at a considerable saving in cost (*ratio 3½ : 1*)—*AF-6 (ratio 5:1)* *Types AF-7* $5.00 *each*

The AMERTRAN Power Transformer
Type PF-45, 65 Va-60 cycles 110 volts primary, 450—8, 4-8, 4 secondary

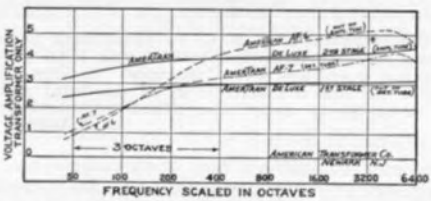
Type PF-45 is intended for use on the standard 110 volt, 60 cycle house lighting circuit. It has three separate well-insulated secondary windings. These are enclosed in a strong metal case provided with mounting feet. The secondary leads are standard code flexible wires left long enough to reach the terminals in the average set without splicing. This transformer is well suited for supplying AC power for filter circuits, and is designed with the usual margin of safety . . . . . $15.00 *each*

The New AMERCHOKE
Type 854

Type 854 is a scientifically designed impedance or choke coil of general utility, designed primarily for use in filter circuits. As an output impedance for by-passing direct current from the loudspeaker it is just as efficient and more economical than an output transformer. When used with a 1 mfd. (or greater) fixed condenser, the tone quality equals that of the best output transformer. DC saturation is prevented by two adjustable butt joints in the core. $6.00 *each*

A New Standard of Excellence in Audio Amplification

THIS new audio transformer has been developed for those who are satisfied only with the utmost in quality. It possesses an unusually straight line frequency characteristic extending the range below the lowest note now being broadcast, and actually shows a gain of about three octaves below that previously obtained.



The AmerTran De Luxe is a transformer of moderate size and weight, enclosed in a strong metal case with mounting holes at both top and bottom so that it may be inverted, affording simplified connections. While the AmerTran De Luxe will improve any set, appreciation of its uniform amplifying qualities can best be realized when operated in conjunction with straight line frequency loudspeakers, such as the best cone and disc types, and with a tube in the last stage capable of handling the output.

The AmerTran De Luxe is made in two types, one for the first stage and one for the second stage, and plainly marked as such. The chief difference between these two types is that the first stage transformer has approximately 50% greater primary inductance than the second stage transformer, thus more nearly corresponding to the operating impedances of the tubes out of which they work. For this reason it is advisable to purchase and operate these transformers by the pair!

PRICE, EITHER TYPE, $10.00

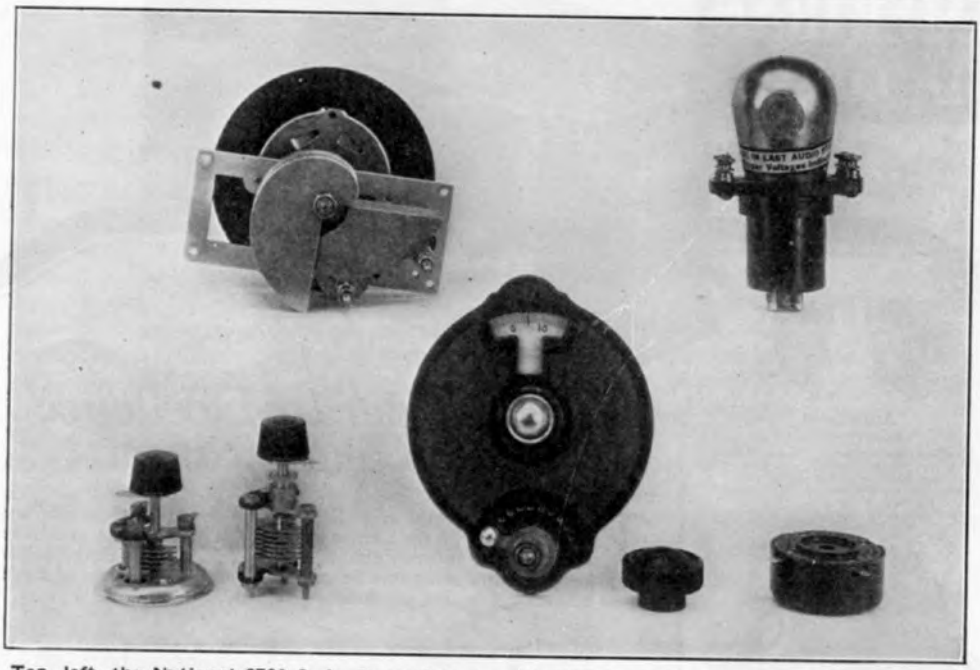
Write for descriptive booklet on AMERTRAN Radio Products

American Transformer Company

178 Emmet Street, Newark, N. J.

"Transformer builders for over twenty-four years"

SOLD ONLY AT
AUTHORIZED AMERTRAN DEALERS



Top, left, the National 270° S. L. F. condeenser with the rear end plate removed to show the shape of the plates; right, the Van Horne high power amplifying tube, fitted in the binding posts for extra B voltage and C battery. Bottom, left, base and panel mounting midget condensers built by the Gleason Corp. of Chicago; center, National variable ratio vernier with the knob removed to show the offset adjustment; right; the non-skid Amsco socket for U X tubes

Shakeproof lock washers are now being made for radio equipment. Manufacturers are invited to write the Shakeproof Lock Washer Company, 2501 No. Keeler Avenue, Chicago, for samples of these devices. The types for radio equipment are of spring phosphor bronze, stamped out in the form of an integral lug and lock washer.

Joseph Kucera, 212 Center Street, New York, well known as a manufacturer of high speed precision winding equipment, is now building machines for winding loud speaker and telephone magnets, running at the amazing speed of 10,000 RPM.

The machine is entirely automatic. The only hand operation necessary is inserting the form to be wound and turning a switch. The device stops automatically after the required number of turns have been wound. The time required for an average coil is forty seconds.

Elwood Manufacturing Company, New York City, is now producing a hydrometer receptacle which will appeal to anyone who has much to do with storage batteries. The receptacle, mounted on the wall, holds the hydrometer and, with a glass cup at the bottom, prevents acid from dripping on the floor.

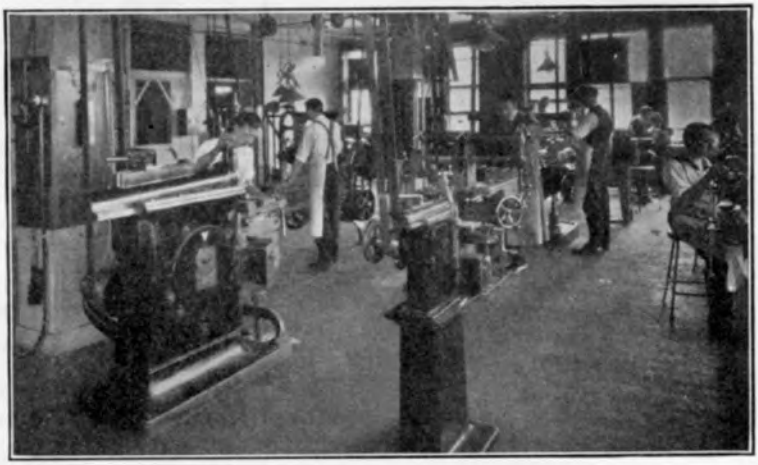
Amsco Products, Inc., has added to its line a universal socket for UX tubes. Connection can be made in only one way, and the tube locks into place automatically. Very wisely the socket was designed for a minimum amount of panel space. A novelty has been introduced in the form of a non-skid base, making it possible to use a one-hole mounting. The list price is 75c.

DIVIDENDS have been announced by Zenith and R. E. Thompson. The Zenith Radio Corporation, on November 4th declared its regular annual dividend of 6%, plus an extra 4% payable on January 2nd, 1926, to stockholders of record, December 1st, 1925. The report of operations for the year just closed shows that the net profits for 1925 exceeded the profits of the preceding year by 175%.

The R. E. Thompson Manufacturing Company has declared a dividend equal to two dollars per share for the third quarter ending September 30th, 1925, and a dividend equal to two dollars for the fourth quarter ending December 31st, 1925, or a total dividend of four dollars per share on this first preferred stock, payable January 15th, 1926, to stockholders of record as of December 31st, 1925.

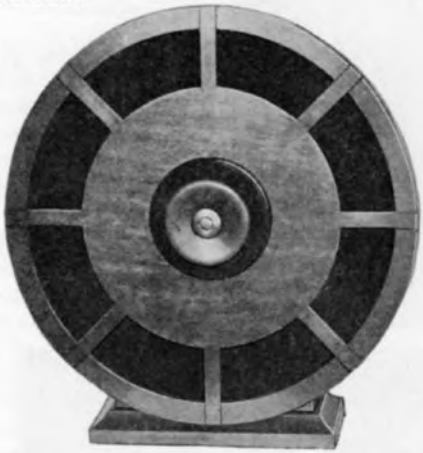
Silver-Marshall shared the honors with C. Wood Tatham in the first prize for home-built sets, awarded at the Chicago Radio Show. The outfit built by Mr. Tatham was a special type of Silver 6.

The Bureau of Standards again calls attention to the frequent misuse of its name in connection with the sale of dry batteries for radio receiving sets. Dealers and factory representa-



Three views in the Erla factory at Chicago. The top picture illustrates the activities in one of the set assembly rooms. At the center is the machine shop and tool room where special devices, experimental apparatus, and stamping and molding dies are made. Below is a photograph taken in one of the parts assembly rooms.

tives have claimed that the superiority of their particular brands of dry cells has been demonstrated by tests at the Bureau of Standards. The Bureau does make tests in accordance with Government specifications but these are made for the Government Department only and the results are not published. Therefore, statements that any brand of battery is superior as shown by tests made at the Bureau are entirely unfounded.



Maron Mfg. Co., of New York city, is now producing an all-wood loudspeaker, made of singing spruce. The reproducer is of the adjustable type.

Atwater Kent started construction on October 1st of a factory addition which will increase the original space of twelve acres to fourteen. The building is scheduled for occupancy at the end of April. Beneath the factory level will be a basement covering one acre, planned as a garage for the company's trucks and automobiles. Also, another siding from the Pennsylvania Railroad will be built in to use for receiving materials, while the existing siding will be for shipping.

This is probably the most convincing answer that the Atwater Kent Company can give to recent reports that operations have been stopped owing to the over-production of Atwater Kent receiving sets.

A Three Point Wiping Contact

at all times with the EBY Spring Socket

List Price **60c**

This ingenious EBY Spring Socket provides a positive three point wiping contact at all times regardless of the size of the prong or the amount of solder on the prong tip.

The design of this socket permits the tube to actually "float" when in service. This reduces microphonic noises to a minimum and is a protection against tube damage.

This socket takes the new UX, CX and UV tubes and permits interchangeability and other desirable features. We will gladly send complete information upon request.

H. H. EBY MFG. CO.

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Manufacturers of

EBY BINDING POSTS

In your "B" Supply Unit use

Potter FILTER Condensers

(An American-Made Product)

All sizes—All specifications—Meet all requirements—Made in 3 voltage ranges.

Full specifications and details at your dealer's or direct

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North Chicago, Illinois

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Compare the DeJur Rheostat with any other on the market. You will find that the DeJur is different—better—more efficient. Fourteen exclusive features make the DeJur superior to all other Rheostats and make it the ONLY RHEOSTAT WITH A POSITIVE CONNECTION PLATE. We guarantee them absolutely.

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Manufacturers — Write for sample and prices

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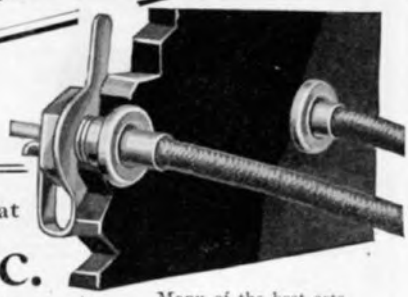
Now is the Time to Feature and Sell

UNION RADIO TIP JACKS



Retail at **25c.** a pair

Many of the best sets on the market use these tip jacks as standard equipment.

SET builders recognize the simplicity, advantages and superiority of these dependable tip jacks over binding posts. They assure a positive contact at all times—no parts to loosen—or lose. Ideal for permanent as well as temporary connections. ALL PARTS ARE HEAVILY NICKEL PLATED.

Firmly grip all wires from No. 11 to No. 24 B & S gauge. Three sizes for all panels. TYPE A (Standard) for 3/16" to ¼" panels. TYPE B (Special) for panels, cabinet walls and partitions from 5/16" to ½" thick. Type C (Special) for panels up to ⅛" thick.

They Are Specified In The HAMMARLUND-ROBERTS RECEIVER

Fans everywhere are now building this famous Receiver—its parts are in big demand. Union Radio Tip Jacks are specified in place of binding posts in this set. Base panels are drilled to accommodate these Tip Jacks only and Dealers are being called upon by set builders to supply them as a part of the outfit. Packed in boxes of 5 pairs specially for this set, also in "self-selling" counter cartons of 1/12, ½ and one gross pairs.

Other Guaranteed Radio Products

VERNIER DIAL ADJUSTERS—In demand by fans for finer tuning. Permits instant adjustment of the dials. Retail price 60c.

IDENTIFICATION TAGS—There is a ready sale at all times for these labels. Made of hard, red fibre ovals. Prevent shorting battery, or blowing tubes. Marked with proper identifications of battery connections such as A-, B-; B67, B90, etc. Two holes, will take any wire up to ⅛". Packed 100 to a box of one designation only. Retail price $1.00. Also in set of nine. Retail price 10c.

TO ALL BRANCHES OF THE TRADE

Send for literature and samples of our reasonably priced Guaranteed Radio Products. Get details of our attractive proposition.

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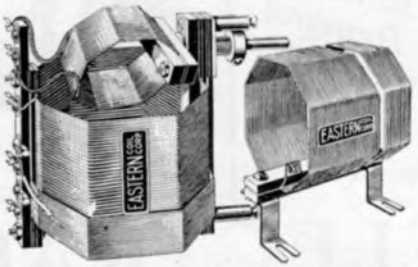
EASTERN



Knockout Coils (Type-R)

For the EASTERN KNOCKOUT Circuit (**The Original Unreflexed Roberts**)—the most efficient **Roberts** Circuit yet designed, using the most efficient coils—**$8.50 per set**

EASTERN PICKLE BOTTLE coils for Radio Broadcast's marvelous new

UNIVERSAL

CIRCUIT, ARE NOW READY!

Type UV Coils—Per set $4.50

Eastern Coils are all in the efficient low loss **Pickle bottle** form of winding, designed by **M. B. Sleeper**, guaranteed incomparable, for the M. B. Sleeper RX-1 ($6.00 per set), BROWNING-DRAKE, (Type B-D, $8.00 per set), EASTERN CLASSIC (Type EB, $6.00 per set of three), THREE CIRCUIT SET, (Type 3-C Coupler, $6.00), and for other leading circuits. Circular on request.

At your dealers or direct, postpaid.

EASTERN COIL CORPORATION
22 Warren St. Dept. R.E. New York

Less wiring— Fewer losses

Full, clear, rich tone depends on more than on just good apparatus. It depends, first of all, upon careful, compact wiring. AMPERITE eliminates complicated wiring, avoiding leaks and losses. Requires no attention. Controls the filament perfectly, bringing the utmost out of each individual tube. Permits use of any tubes or combination of tubes. Used in all popular construction sets. Price, $1.10.

There is an AMPERITE for every tube

Write for free hook-ups

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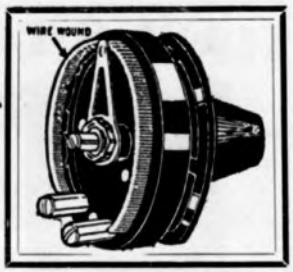
Dept. R.E.-2 50 Franklin St., N. Y. City

AMPERITE
REG. U.S. PAT. OFF.
The "SELF-ADJUSTING" Rheostat

Set Builders Demand



The

ELECTRAD

Royalty Variable High Resistance

IN EVERY sense a precision instrument giving fine, gradual, smooth, noiseless control and same resistance is always found at same spot on the dial.

Highly desirable as a dependable tone and volume control in resistance coupled or transformer coupled audio amplifiers and ALSO AS A FLEXIBLE CONTROL FOR DETECTOR PLATE CURRENT IN B BATTERY ELIMINATORS.

The "Electrad" Royalty Variable High Resistance has a guaranteed safe current carrying capacity of 10 milliamperes without temperature change. Being wire wound it is practically indestructible. Resistance element remains uninjured regardless of frequent adjustment and is not affected by temperature changes.

Attractively finished and moulded of solid bakelite—adapted to panel or base mounting.

ELECTRAD ROYALTY VARIABLE GRID LEAK (Type A) is similar in appearance and has a range of 1/10 to 7 megohms, sufficient for any type of standard vacuum tube.

Electrad Variable High Resistances come in types. Type B—1,500 to 100,000 ohms. Type C—500 to 50,000 ohms. Special types furnished on order. Type D—Specially designed for B eliminators, 10,000 to 700,000 ohms. Type E—Compensator 500,000 ohms. Potentiometer $2.00.

Type A, B, C—Price $1.50
Type D and Type E—Price $2.00

Other "Electrad" Products are Audiohms, Variohms, Certified Mica Condensers, Certified Fixed Grid Leaks, Lead-Ins, Lightning Arresters, Resistance Coupled Amplifier Kits, etc.

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The Product of 38 Years' Experience

The Amplion is the creation of Alfred Graham & Co., London, England, the originators and oldest makers of loud speaking devices—**thirty-eight years' experience!** Six models, $12 up. Nationally advertised. Write for proposition and "Amplion Pedigree".

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Chicago Branch: 27-29 No. Morgan St.
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Amplions are equipped with cords and panel plugs.

The World's Standard Loud Speaker

Test These Coils

TRF Kit
LIST $12.00

Scientific measurement of an Aero Coil shows it to have a much lower high frequency resistance than other types of inductances.

Comparative broadcast reception tests show Aero Coils capable of performance in exact accord with their electrical characteristics.

Substitute a set of Aero Coils in any set now using other inductances. You will note an immediate tremendous increase in power, a degree of selectivity which is almost unbelievable and a quality of tone which is perfect—despite the very narrow and sharp resonance peak which Aero Coils show at each frequency.

Manufacturers interested in improving their sets or fans desirous of getting the very limit of performance out of any circuit will do well to look into the Aero Coil proposition at once. There is an Aero Coil for every type of circuit.

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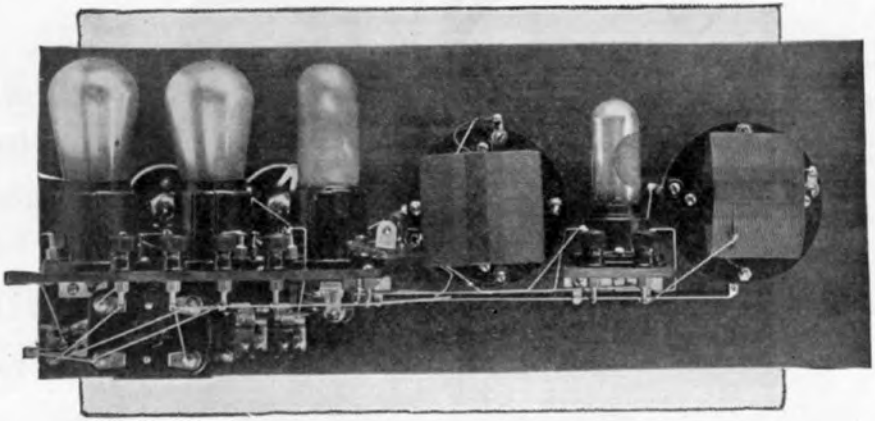

ENGINEERING OR SUBSTITUTION?

WHICH DO YOU WANT TO DETERMINE THE THE PRICE OF YOUR SET?

Nothing so clearly proves the difference between the RX-1 and other kinds of sets than a comparison of the price and the parts used.

Anyone can cheapen the price of a set by substituting flimsy parts — but a set made that way is expensive, no matter how low the price.

RX-1, on the other hand, has achieved the price of $32.50 for a kit comprising the finest standard equipment by pure engineering development, eliminating unnecessary parts and at the same time procuring greater efficiency by an entirely unique form of circuit.

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RX-1 kit, ready for assembly, postpaid			$32.50
Add $1.00 west of the Mississippi or for Canada			
D-21 Sodion, postpaid	$5.00	Set of 4 RX-1 tested tubes	$12.50
3-VA Van Horne tube	$2.50	Daven MU-20 tubes	$ 4.00
Baldwin Lyric Walnut Finished Horn Loud Speaker			$27.50
Baldwin Standard Black Finish Horn Loud Speaker			$22.50

Baldwin Loud Speakers are recommended for the RX-1

DURRANT RADIO, Ltd.

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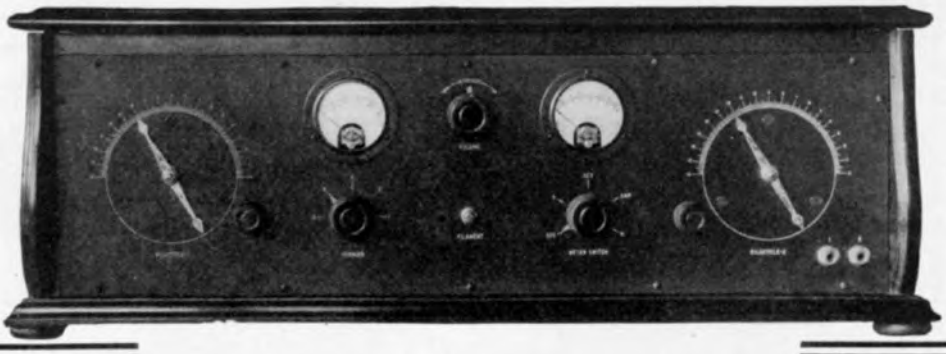

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Model A
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The Amateur or Experimenter with his ultra-modern high-powered receiver is years ahead of Commercial Radio.

It is significant that unsolicited testimonials are constantly being received from even the far corners of the earth, where Norden-Hauck Engineers have furnished the finest radio apparatus known to the art today.

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The Daven Super-Amplifier used with any set or circuit carries through the full, clear tones of the broadcasting station programs. If you prefer to assemble the Amplifier, obtain the Daven 3-stage Kit, which includes all parts except sockets.

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PURE tones, beautifully clear and full, go out from the broadcasting station. They reach your detector still pure and clear. But what then?

From the detector your amplifying apparatus operates. Distortion arises unless you take advantage of a method of amplifying that far-sighted manufacturers and thousands of set builders are now adopting—Resistance Coupled Amplification. Resistance Coupling is not new, *but Resistance Coupling with real volume amplification is new.* It is the most approved method of letting pure tones through.

The Daven Super-Amplifier costs little. It is easily and conveniently installed in any set made. Buy it complete to save hook-up labor. For those preferring to assemble, the Daven 3-stage Kit gives all the necessary parts except sockets. You will join hundreds of others who have written to thank us for the improvement Daven has given.

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THE BIG LITTLE THINGS OF RADIO

INDEX OF ADVERTISERS

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IT takes many manufacturers to supply the tremendous demand for condensers and transformers in this vast radio market of ours. If all home set builders were ready to pay the price which *real* quality commands, a big proportion of them would necessarily be disappointed — the Karas factory could not begin to take care of all. Karas parts are designed and built for the select few—you builders who want the utmost in quality, in quiet operation, in appearance. You who take pride in your workmanship —whose sets have that "professional" appearance which is the envy of all your radio friends.

Just as water quickly finds its level, so did Karas Harmonik Transformers and Orthometric Condensers quickly find the exclusive market for which they were intended.

The most skillful home radio set builders the country over, discovered Karas Harmonik Transformers soon after they were placed on the market in 1924. When Karas Orthometric Condensers appeared a year later they were snapped up far too quickly for our own comfort. Perhaps it was because they were the first to meet the demand for a Straight Frequency Line tuning instrument. More likely it was because of the enviable reputation created the year before by Karas Harmonik Transformers. At any rate, it was months before we could fully supply the insistent, clamorous demand that came to us from all sides.

We begin to think now that the number of set builders who want the very "Best that Money Can Buy" is far greater than we first imagined. Our production has been greatly increased to provide for the growing numbers who demand Karas parts and will accept nothing else.

WE have been assured by Mr. Sleeper that Karas Harmonik Transformers and Karas Orthometric Condensers may be used with the greatest satisfaction in nearly all of the circuits he designs. These parts have been tested and approved by Mr. Sleeper and his associates.

In many places, good dealers who wanted a stock of Karas products could not be supplied. If *you* are still unable to find them in your local stores, tell your dealer that we are now able to take care of his requirements. Or, if you wish to get Karas parts in the quickest possible time, we will be glad to send them to you direct.

However you buy Karas Harmonik Transformers or Orthometric Condensers, you do not run the least risk of their not performing up to your highest expectations. If there is the slightest cause for disappointment during a thirty days' test, you are invited to return the parts to the dealer from whom you bought them, or to us if you buy direct. Your money will be promptly refunded without question or quibble.

Karas radio parts are the pride of an organization that has been making precision electrical apparatus for more than thirty years. We believe we are making the finest transformers and condensers possible to produce and we are glad to back them up with this, the strongest guarantee we know how to write.

THE KARAS HARMONIK "ALL-STAGE" RATIO AUDIO FREQUENCY TRANSFORMER

Price $7 each. Shipped direct where dealers cannot supply, cost plus a few cents postage paid to postman on receipt. Parcel post is prepaid where payment accompanies order. Our 30-day Money Back Guarantee applies, wherever and however purchased.

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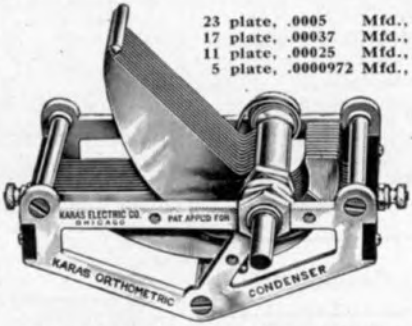

THE KARAS ORTHOMETRIC (STRAIGHT FREQUENCY LINE) CONDENSER

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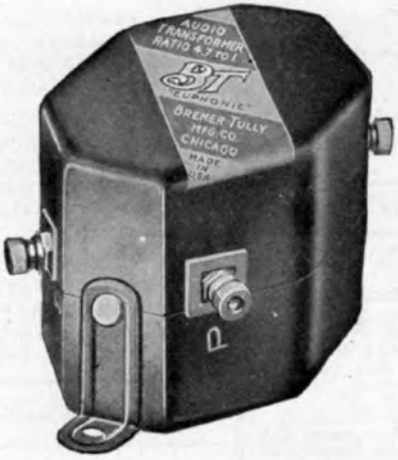

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