

RADIO Engineering

A Magazine of Technical Accuracy for the
Radio Set Builder, Engineer and Manufacturer



Edited by
M.B.SLEEPER



NOVEMBER 1923

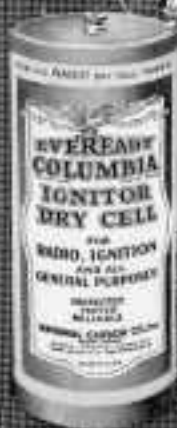
VOL. V NO. 11

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RADIO ENGINEERING

Edited by M. B. SLEEPER

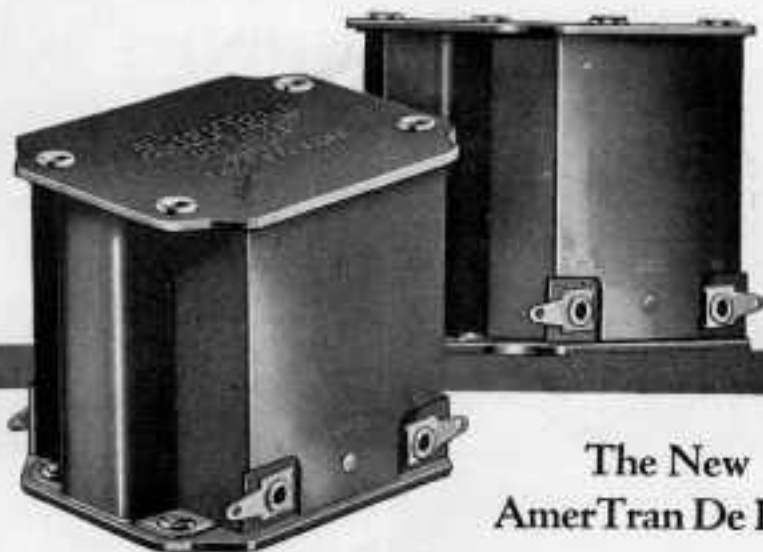
Fifth Year

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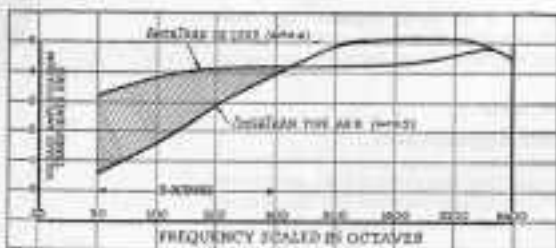
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The New AmerTran De Luxe

The new De Luxe model AmerTran audio transformer possesses an unusually straight line frequency characteristic extending the range below the lowest note now being broadcast. While the AmerTran AF-6 and AF-7 have, for years, been considered the leaders in audio frequency amplification, this new De Luxe AmerTran 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. It is for those who are satisfied only with



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The AmerTran De Luxe is made in two types, one for the first stage and one for the second stage, and plainly marked

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The AmerTran Power Transformer Type PF-45, 65 VA-60 cycles 110 volts primary, 450-8/4-8/4 secondary



The New AmerChoke Type 854

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; one for 450 volts with a current capacity of 60 milliamps, and two 8 volt windings each with a carefully balanced center tap and a current capacity of $2\frac{1}{2}$ amperes. The windings 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 incorporated in commercial power transformers.

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TYPE 854 is a scientifically designed impedance or choke coil having a no-load inductance of approximately 100 henrys at 60 cycles and a maximum DC capacity of 60 milliamps. The DC resistance is approximately 600 ohms.

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AmerTran Power Transformers at \$15.00 each
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And we found, as everyone else does who is actually selling radio parts or sets, that while the merchandise man or the purchasing agent is easy to see, there was another man behind the guns who had to be sold, not on the appearance of the product, or the dealer's franchise, or the advertising support, but on the technical excellence.

He was the dealer's or jobber's technical man, the one who looked over the samples and tried them out after we had gone—when the goods stood entirely on their own merits, supported only by whatever confidence the manufacturer had been able to sell the technical man in the quality, accuracy, stability, and engineering skill built into his products.

Radio Engineering is the only radio publication which fits into the frame of mind of the technical men in the jobber, dealer, and manufacturing organizations. There are plenty of magazines which reach the merchandising men whom your salesmen call on, but only Radio Engineering goes to the technical men whom your salesmen can't see.

Radio Engineering readers absolutely control the buying power of the Radio Industry

This is the fourth of a series of six advertisements published to show frankly and truthfully, the exact status of Radio Engineering as a publication—its circulation, range of influence, editorial policy, class of readers, position as an advertising medium, and why it has been accepted as the leading technical magazine of the Radio Industry.

4

To unscramble
the stations



To get the
Finest Tuning



To
save your Tubes
and Batteries



The new AMSCO ALLOCATING CONDENSER

(STRAIGHT LINE FREQUENCY)

SPREADS the stations evenly around the dial according to their frequency in kilo-cycles. Eliminates the crowding on low waves and simplifies tuning.

And unlike previous S. L. F. designs, its "half-a-heart" rotor plates save space in the cabinet. Three sizes—single or Stamese.

The new AMSCO VERNIER DIAL

AS easily installed as an ordinary dial—and as easily manipulated. But—each turn of the dial is translated to 1/13th the motion—giving finesse to your fingers. A precision instrument, without momentum or back-lash. There is no vernier like it for distance-getting. Low in price.

The new AMSCO RHEOSTATS AND POTENTIOMETERS

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AMSCO PRODUCTS, Inc., Dept. B
Broome and Lafayette Sts., N. Y. City
Makers of the Major Supreme Radio Receiver

Your set at its best *always* with a **Super-Ducon**

-the "B" Battery Substitute

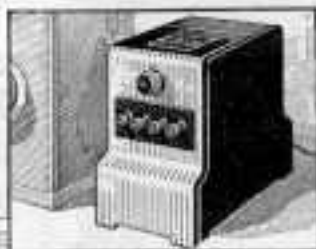
When guests come in, your set is ready. No run-down "B" batteries—no "B" batteries being recharged. There's the Super-Ducon plugged into the light socket—ready to deliver a steady, silent flow of current.

It's the perfect substitute of "B" batteries—equipped with a specially designed RCA tube (Rectron UV-196) that has an average life of more than 1000 hours. It's a thoroughly efficient device—made and backed by Dubilier. And it *keeps* your set at its best!

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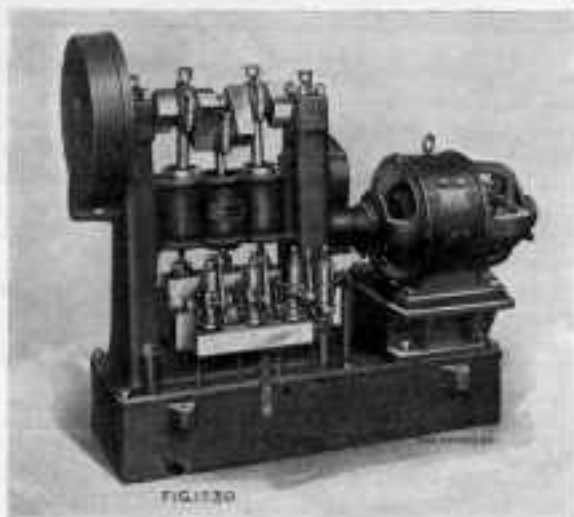


Fig. 1. Motor driven hydraulic pumps which serve the accumulators shown in Fig. 3.

Equipping a Bakelite Molding Shop

Part 2. Suggestions concerning the machinery and its installation—By H. E. Eddy*

In the September issue *Radio Engineering* presented to its readers details covering the equipment necessary for the molding of dials, knobs, rheostat backs and similar parts on a small scale.

For quantity production, however, somewhat different equipment is necessary, although the presses which were recommended for small production are of sufficient size and capacity to be incorporated as part of a battery of presses that are used for quantity production.

Quantity production may be divided into two classes; first,—the production of many different pieces without any great quantity of any one piece, and second,—the production of one or more pieces running into large quantities.

Where a great variety of parts must be made, without the total number of any given part being sufficient to keep an automatic press in operation over a reasonable period, hand molds will be found the most economical to use in connection with the standard single opening type of press.

On the other hand, where thousands of a given part are to be made, the automatic press, such as will be fully described in the January issue, will result in the greatest production at the lowest cost.

In the average molding shop will be found single opening presses of the type described in this article, in which are used ordinary hand molds.

An economical molding department having presses operated by the accumulator system may consist of four single opening presses up. Fig. 4 illustrates a layout of a molding room having eight single opening presses. These presses each have a capacity of 118 tons and platen size 20 by 20 ins. They permit the molding of approximately 118 square inches or less of bakelite per operation. This capacity is rarely required even with three hand molds, except when very large pieces are being molded. However, by providing this extra capacity, additional pressure over the conventional ton per square inch is available for such parts as require it.

* Hydraulic Press Mfg. Co.

The production of a single opening press may be based upon the number of hand molds of a given part used, times the number of cavities per mold, times the number of molding cycles that can be made per hour.

If four hand molds are available they would be used in pairs, two being in the press while two are being stripped of the finished pieces and refilled.

The average molding cycle required for radio parts is from 3 to 5 minutes, depending upon the construction of the piece and molds.

The press room layout in Fig. 4 is for a battery of eight single opening hot-plate presses and the necessary auxiliary equipment. This layout can be varied according to shop practice. It is however, taken from the molding room of one of the largest radio manufacturers in this country who operates a battery of over fifty single opening presses in addition to many presses of the semi-automatic type.

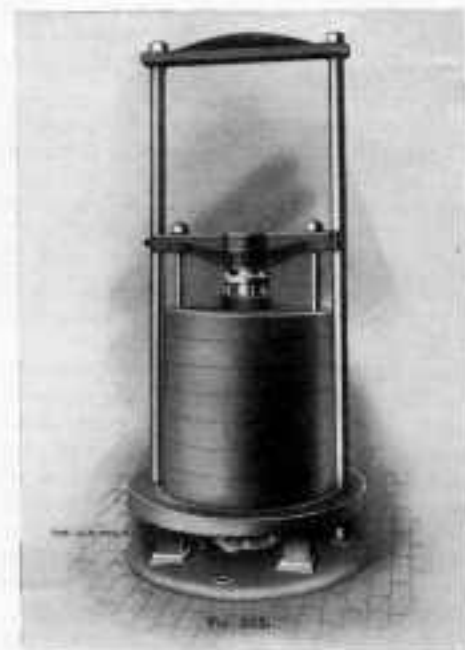


Fig. 5. Compact accumulator, loaded with cast iron weights

Hot plates are shown opposite the presses in the illustration, with tables on one side and small arbor presses on the other.

For the molding of certain parts, heating of the mold on a separate hot plate is no longer considered necessary, and in such cases some of the extra hot plates could be omitted and the table space increased. The arbor press is used for separating the mold and pressing the fin-



Fig. 6. Types of valves used to control the hydraulic pressure

ished pieces from it. It is an inexpensive press of the lever type.

The hydraulic presses can be equipped with steam heated, gas heated, or electrically heated plates. The electrically heated plate is comparatively new in molding practice but eliminates the necessity for a steam boiler with an operating engineer. Gas plates are not recommended because of the difficulty in controlling the temperature. The electrically heated plate is equipped with an automatic control for regulating the temperature and may be set for any temperature within a given range.

This is a marked improvement over the older method of attempting to regulate the molding temperature by means of the steam pressure.

Each press is equipped with high and low pressure control valves. Economy and molding practice, dictates the use of low pressure water to raise the platen and close the molds, and high pressure for the actual pressing of the piece. It is therefore, necessary with a battery of presses to provide both a high and low pressure accumulator. This may be similar to the tandem type, as shown in

RX-1 NOTICE

The demand for copies of *RADIO ENGINEERING* for September, 1925, in which the construction data on the RX-1 receiver was published, has exhausted our supply, but a reprint of the article will be sent you, upon request, without charge. The technical data on the RX-1 appeared in the July and August issues. A few copies are still available.

Fig. 3. This type of accumulator is equipped with a high pressure cylinder which will deliver high pressure water at approximately 3000 lbs. and a low pressure cylinder for water at 450 lbs. Either of these pressures can be varied, depending upon the amount of weight of the loading material placed upon the accumulator platform. This loading material can be concrete or rocks.

Two small electrically operated hydraulic pumps similar to Fig. 2 are installed by the accumulator. There are connected to the accumulator cylinders by means of by-pass valves which prevent the accumulator platforms being raised above a predetermined point, and which also prevent damage to the equipment due to over pressure.

The high and low pressure valves, with which each press is equipped, may be of the hand operated type similar to Fig. 6, or if automatic operation is desired, may be similar to Fig. 2. The advantages of the automatic control for applying high and low pressure and timing the cycle are obvious. The human factor in the timing is eliminated together with the chance for error, thus preventing defective parts. It has been found also that a marked saving in high pressure water results from automatic operation.

The automatic control can be applied to any molding press and for the application of high and low pressure requires only 3 units. It is driven by a motor and is entirely automatic, the operator merely throwing a small lever to start it. The motor stops at the completion of the cycle.

When the low pressure valve is opened, the water from the low pressure accumulator immediately enters the press cylinder,

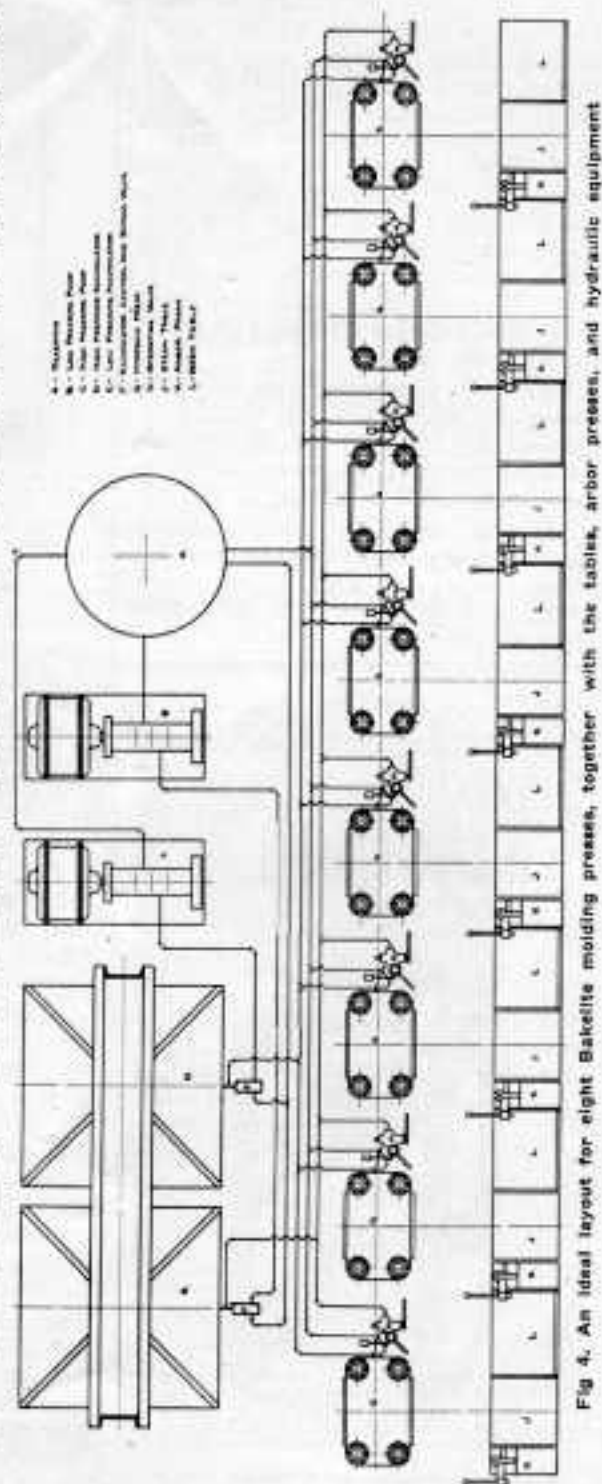


Fig. 4. An ideal layout for eight Bakelite molding presses, together with the tables, arbor presses, and hydraulic equipment

raising the platen, and closing the molds. The low pressure valve is then closed and the high pressure valve opened. During the low pressure cycle, the bakelite powder, with which the molds are filled, softens and flows into the crevices of the molds. Under the action of heat and the high pressure, the bakelite changes from a powder or from a semi-fluid material into a hard composition, which cannot afterwards be softened by heat. If the molds are made with a very high finish, a similar finish will be imparted to the molded pieces.

Radio dials are molded with the graduations and figures and the accuracy of the dial depends very largely upon the workmanship and design of the molds and the care used in molding.

For the purpose of illustration, the high and low pressure accumulators and pumps shown in Fig. 4 are represented as being on the same floor as the press equipment.

This, however, is not the usual prac-

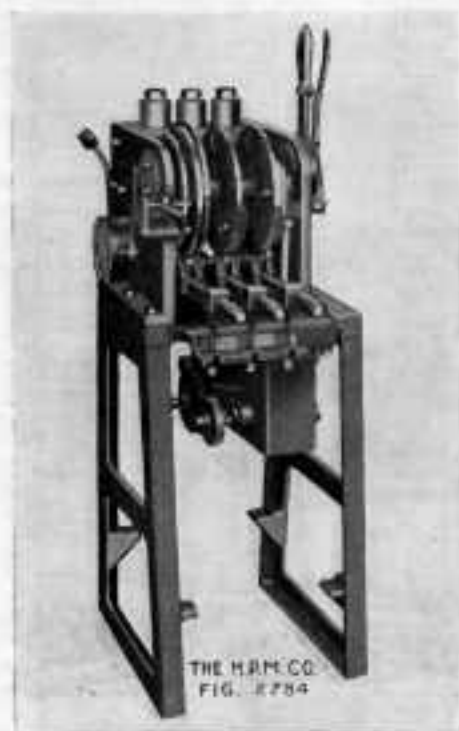


Fig. 2. Automatic motor-driven control for operating valves



Fig. 3. High and low pressure accumulators which serve the molding presses

tice. Due to the weight of the loading material, it is necessary to locate accumulators on solid ground, which in many cases would be in the basement of the building. There is an added advantage in locating the pumps and accumulators in the basement and the presses on a floor above, in that proper drainage of the return water can be secured to the reservoir from the press cylinders.

Both high and low pressure pumps draw their supply of water from a common reservoir and as the water is returned at the press stroke, water consumption is a negligible factor.

Many different types of accumulators are on the market. Those shown are of the simpler and least expensive type and give very satisfactory service over a long period of years.

Perhaps a more accurate name for them would be high pressure reservoirs, as their use makes high pressure water available by merely opening a valve.

Where space is limited, it is sometimes necessary to use smaller accumulators. The accumulator as shown by Fig 5 is loaded with cast iron weights and will take up much less room for a given pressure than an accumulator loaded with concrete. Its first cost, however, is much higher than of the concrete-loaded accumulator and the efficiency is the same.

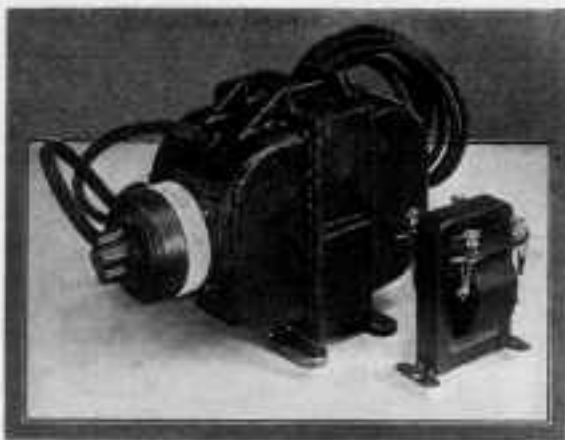


Fig. 1. The power transformer for the amplifier, with a regular A. F. transformer as a comparison of size

Building a UX-210 Amplifier

This power amplifier, using a UX-210 and a UX-216B, can be used for any set, altho it was designed specially for the RX-1—By *S. W. Nichols**

The wonderful quality of the RX-1 receiver sent me in quest of a power amplifier circuit which would preserve the quality and at the same time provide sufficient amplification to bring weak signals up to full volume, and make the nearer stations strong enough for almost any requirements.

With the UX-210 power tube, and the UX-216B rectifier tube already available, the remaining items of special design were the chokes, power transformer, and input transformer. The new Amertran de Luxe measured up to the requirements for the input transformer.

Altho it is very expensive, due to the cost of the recently discovered alloy used for the core, this amplifying transformer measured up so beautifully—at 50 cycles only 15% below the maximum of the curve—that what might appear extravagance seemed justified.

It might be explained that the effect of the new transformer design, accounting for its efficiency, is to increase the primary inductance with the necessity of using a big winding, thus maintaining

a relatively high value of inductance at the very low audio frequencies.

From the same Company I was able to get a power transformer of exactly the right characteristics. The primary has three taps connected to a porcelain-base switch mounted on the case, allowing the use of 110, 118, or 125 volts, 60 cycles A. C. The secondary winding comprises a single coil giving 450 volts, and two others, each of 8 volts, with center taps. There was my power transformer.

Then I got three Amerchokes. They are suitable for any kind of a filter circuit. With these parts I started to work. They are shown all together in Fig. 2, and the transformer alone in Fig. 1. The regular Amertran A. F. transformer was put beside the power type just to give a comparison of the size.

Fig. 3 gives two circuits, both entirely satisfactory, and accomplishing the same thing. The power transformer supplies the plate voltage to the UX-210 and UX-216-B, and, by the use of some Lavite resistances, is made to furnish 22 volts and 100 volts for the tubes in the RX-1 set or any other receiver with which the

* Chief Engineer, Durrant Radio, Ltd.

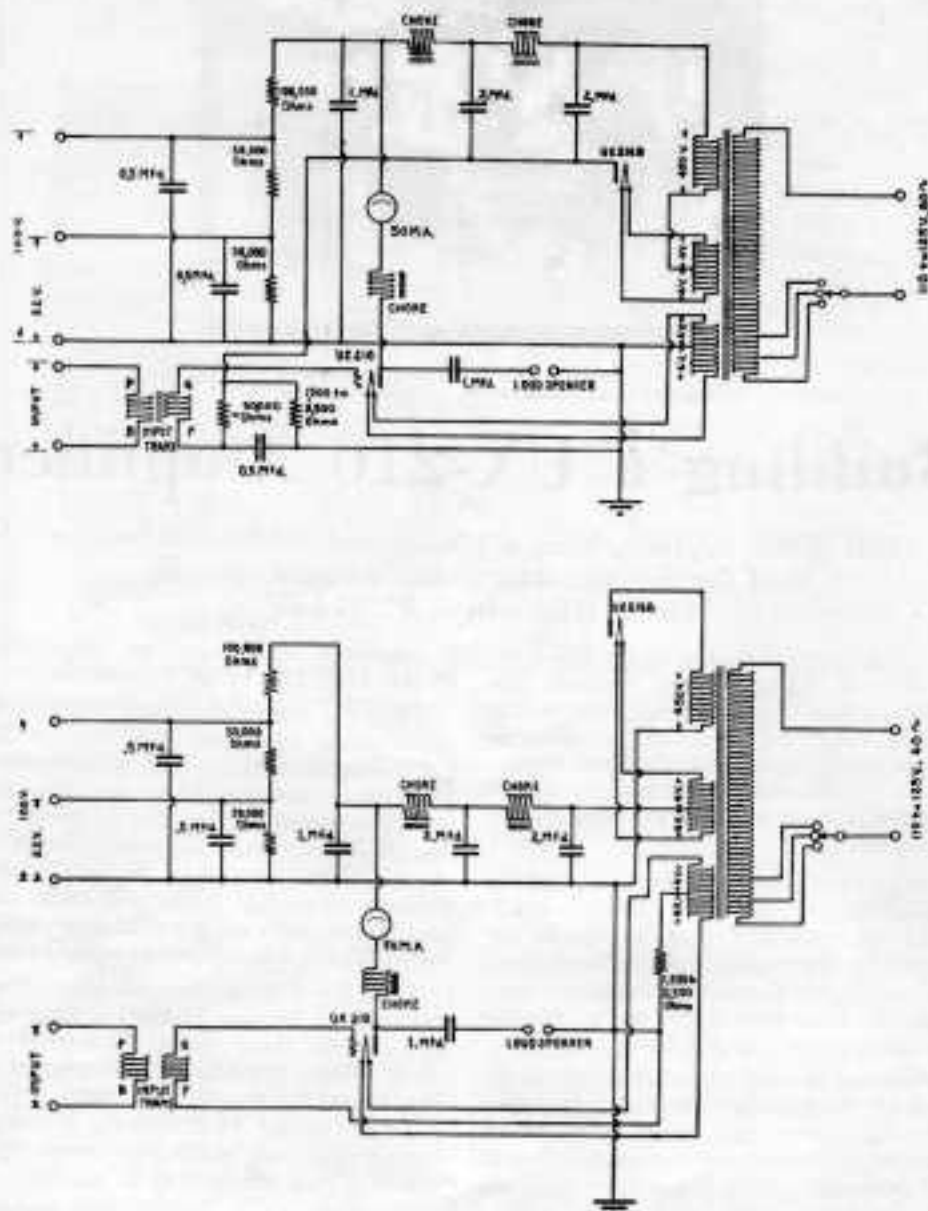


Fig. 3. Two circuits for the amplifier unit. The input terminals should be plugged in on the set where the phones go ordinarily

power amplifier is used. Thus all B batteries are eliminated. In case it seems better, however, to use B batteries on the set, the resistances and extra terminals can be omitted.

During the course of the experiments made with the power amplifier, it was simply assembled on a board, all parts be-

ing fastened securely and thoroughly insulated, because 450 volts, tho far lower than the potentials used in amateur transmitters, is dangerous stuff to handle carelessly.

A little later, I want to build an RX-1 with the power unit made right into the set, but, for the present, the separate

amplifier is all right, and I have it down below in the battery section of my cabinet, where it cannot get mixed up with the receiver.

In addition to the transformers and chokes, there are two condensers of 0.5 mfd., three of 1.0 mfd., and one 2.0 mfd., four 50,000-ohm Lavite resistances, a Ward-Leonard resistance of 2,500 ohms, and 0-50 milliammeter.

Any condensers of reliable make, capable of withstanding 600 volts, are all right.

The 2,500-ohm resistance is used to supply the negative C for the UX-210.

connected to the set, I tuned in. Beautiful music, perfect reproduction. And then I cut in the power amplifier! Why, I couldn't believe my ears! The volume was increased, of course, but the quality was an absolute revelation.

The best way to describe the results from the power amplifier is to say that, however satisfactory a set may have seemed to be, you will never know how much you aren't hearing until you have operated the set with the power amplifier. The rattle of the cone is entirely eliminated, and there is a feeling that the cone is doing its full work. The low



Fig. 2. The power transformer and set of three choke coils

It may be necessary to vary this value slightly, for the milliammeter should show a normal plate current of 20 mils. A variation of 1 or 2 mils. is all right. Of course the needle fluctuates very slightly during reception. That is the only adjustment on the entire outfit, making it extremely simple to set up.

Now you have all the construction data necessary, but I haven't told you about the results, which are much more interesting.

You know that a Western Electric cone doesn't sound so very well on an ordinary set. It always seemed to me that the mechanism was only half working. Other cones give better quality.

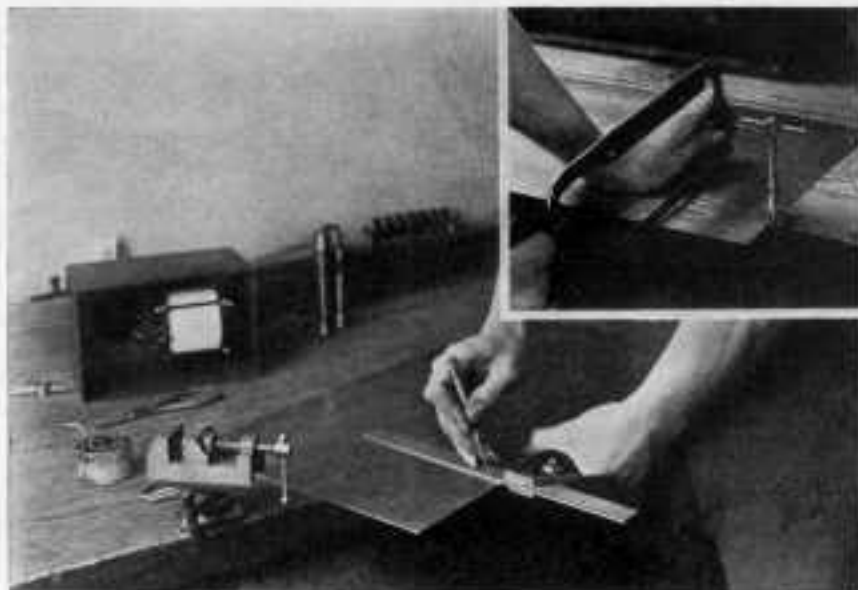
On the RX-1, however, the Western Electric did very well. I was perfectly satisfied, for it was so much better than anything else I had heard.

Well, I made a change-over switch, to connect the jack on the set to the input transformer on the power amplifier or to the cone directly. With the cone con-

nection, musical notes and the drums come in in a way entirely missing with the RX-1 receiver alone. This is equally true of any other set using a 2-stage audio amplifier. I refer to the RX-1 simply because that has come to be a standard of comparison in the matter of quality, and no one will ever complain of the reproduction from this set, but the results are so amazingly different with the power amplifier that, having heard it, you will never be satisfied with the RX-1 alone or with any other receiving set.

The comment is frequently made that music from a good radio set is vastly superior to that from a phonograph, but the improvement effected by the power amplifier is many times greater than the difference between an ordinary set and the phonograph.

Add to this the advantage of having the power amplifier supply the plate voltage for the tubes in the receiving set, and you can understand my enthusiasm for this new unit.



Figs. 1 and 2. Laying out the brass sheet, and sawing it.

Suggestions on Making Shields

Details of shield construction which will help those who are experimenting with shielded R. F. amplifiers

A SUBJECT for experimental work which offers some particularly interesting possibilities is that of shielding. When metal panels first came into use, they were met generally with disfavor. Objections to copper, brass, or aluminum panels have been pretty well cleared away now, by research work done in one of the western Universities for the Crowe Name Plate Company. The purpose of the tests were to find out what effect metal panels had upon the overall efficiency of receiving sets and particularly on the high frequency resistance of coils. The report, recently made public, shows conclusively that there are no electrical objections to the metal panel. Some manufacturers have gone further, in the use of shielding, by enclosing coils and condensers completely. Examples of this are found in the Radio Frequency Laboratory's receiver, the new Kellogg receiver, the Music Master-Ware loop set, and the Stromberg-Carlson neutrodyne. In the case of the Radio Frequency Laboratory and Kellogg sets, the high efficiency of the cascade amplification is attributed

directly to the isolation of each tuning circuit from the others by complete shielding.

This subject has not been under investigation long enough to be entirely settled. The Walbert Manufacturing Company claim that their shielded inductances show an efficiency comparable to that of the very best unshielded coils. This is, of course, at variance with the prevailing ideas about the use of metal within the field of a tuning inductance. Some time ago, in *RADIO ENGINEERING*, a curve was given to show the increase in resistance of a coil when a variable condenser was mounted at the open end. Later on, however, it was discovered that the data was not strictly accurate, inasmuch as the reduced deflection of the thermoammeter needle was caused partly, at least, by detuning, as the proximity of the condenser not only increased the resistance but changed the inductance of the coil and, consequently, put the test circuit slightly out of resonance with the oscillator.

The accompanying illustrations give



Figs. 3 and 4. Because the heat was conducted away so rapidly by the large area of the brass sheet, it was necessary to melt the solder with an electric iron while the brass was heated with an alcohol torch. The parts were mounted on the front and back before the shield was soldered together.

Leads were brought out from the instruments thru holes just big enough to take the varnished tubing which insulated the wires.



some suggestions for those who want to use brass or copper shielding. This is recommended because the soldering is less difficult than when aluminum is used.

We have found No. 16 gauge half-hard brass the most satisfactory to use. It come in flat sheets and is heavy enough

to hold its shape and to saw easily. At the same time, it is light enough to be soldered without difficulty.

The first experiments with brass shields were made with thin brass sheet. The edges were turned over for soldering tabs. Afterward, however, we used the

No. 16 gauge, sawing and filing it accurately to shape, and soldering the sides together for butt joints, without the use of tabs.

Fig. 1 illustrates the method of laying out the brass sheet. It is necessary to work very accurately, in order that the parts may fit together. After a line has been made with the scriber, the brass sheet should be clamped down and sawed with a fine-tooth blade. The saw should be held almost horizontally, as indicated in the insert, Fig. 2.

After that, the edges must be filed smooth and straight with a fine file. Fig. 3 shows how the boxes were soldered. First, two sides were held together temporarily by solder at each end of the joint. Then, using soldering paste as a flux, the solder was melted right across with an electric soldering iron backed up by an alcohol blow torch. The torch shown in Fig. 3 is very inexpensive and most satisfactory to use since it supplies its

own air pressure. Plenty of heat must be used in order to get a strong and perfect joint. With two sides finished, one of the ends is put on, held temporarily, as before, with drops of solder at each corner.

We did not solder the tops of the boxes in place. Instead, the boxes were made so that the front and back extended above the sides by $3/32$ -in. Then the cover was snapped in between the upper edges of the front and back plates.

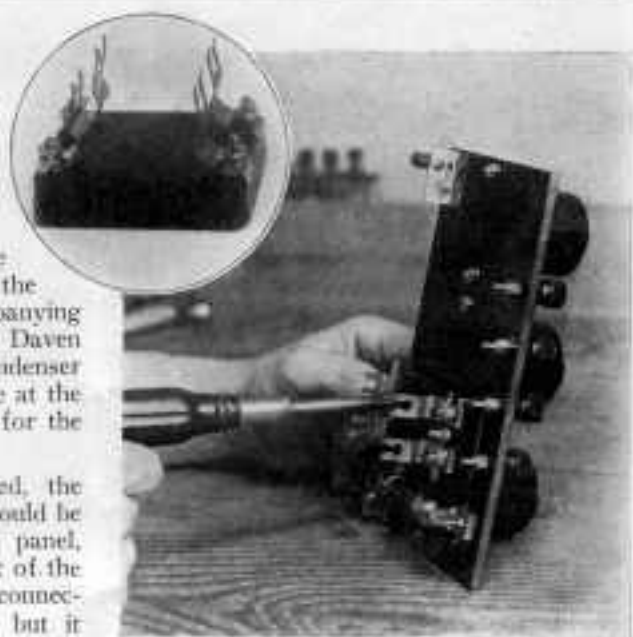
Fig. 4 illustrates two units, one an antenna coupling coil for a stage of tuned R. F., and the other a regenerative 3-circuit device for the detector.

Tests on the shielded units are not completed, so that it is impossible to give a definite report as to the results obtained. However, these suggestions may be useful to other experimenters or set builders working on this subject for it took us considerable time to find the best methods and materials.

Mounting the Resistance Unit on the RX-1

THERE has been some misunderstanding about the method for mounting the resistance coupling unit on the RX-1 receiver. In the accompanying illustration is shown the new Daven unit with the stopping condenser mounted inside the base, while at the right is the large tube panel for the RX-1.

When the unit is mounted, the terminals marked P and G should be toward the rear of the base panel, and B and F toward the front of the base panel. This makes the connections appear to be reversed, but it does not in any way affect the operation of the unit. However, the 1.0 megohm resistance should be put into clips P and B, while the 0.1 megohm leak should go between clips G and F. As a



matter of fact, the resistances are not at all critical, and we have found some sets with the leaks reversed, altho the operation of the set was in no way affected.

RADIO ENGINEERING

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Vol. V NOVEMBER, 1925 No. 11

EDITORIAL

IT MAY not be pleasant, but it is no less necessary to stand off, once in a while, to look at this fall's business with enough perspective to include next spring's conditions on the horizon, for next April will show whether the winter's effort has been well spent or wasted.

Most everyone in the radio business ought to make money this year. There is plenty of interest, and plenty of competition to maintain interest. The development and improvement of radio sets, as disclosed at the New York shows, indicate that the manufacturers have at last interpreted radio in its relation to the home.

Radio is established as a public utility. It is no longer a technical hobby—it is a service to the people.

Which automatically brings with it a service responsibility devolving upon the manufacturers. This service responsibility has been recognized and accepted by the telephone, gas, electric light, and water supply companies. It is being met by automobile manufacturers, and now the radio companies are faced by it. Always it follows the mechanical perfection of a public service. If we sell the public on the idea that a thing does work, we must be willing to keep it working.

Last year's experience taught the manufacturers how to design receiving sets to overcome characteristic faults which developed in transit and in use. Practically all equipment made this fall by established reputable manufacturers is safe to buy, the price indicating quality and completeness rather than service to be expected.

Nevertheless, faults do develop in transit and in use. Therefore, manufacturers must realize that, having brought their equipment to the present state of perfection, the attainment and maintenance of their good will is now in the hands of the dealers who will sell and service their equipment.

In Boston there are two automobile agencies, both selling cars in the same price class, one backed by a tremendously wealthy manufacturing organization which is building a very fine automobile. The other agency represents a smaller concern of only moderate means, making a car of only average quality. Yet the latter agency outsells the former probably 3 to 1. They sell people who would rather have the other car because they think it is a better one, but, in the long run, they are influenced by the reputation for service and maintenance, believing and rightly, that a car not quite as good but properly serviced is a safer buy than a better car which will not be properly serviced.

On the same basis, radio manufacturers can only realize the full benefits of their engineering and production skill by choosing dealers who realize that their future sales depend on present service.

In this connection, manufacturers will have to revise their policy concerning circuits and construction details. Just as there are no secrets concerning the mechanism of an automobile, for the entire machine is laid out in the most elaborate charts, manufacturers must follow suit in order to educate the dealers service men into the maintenance of radio equipment.

M. B. SLEEPER,
Editor.

Selenium and Photo Electric Cells

Chapter III. Concluding the description of cell construction and methods of assembly—By Samuel Wein

GROUP II.

IN actual practice, the following forms of cell construction has been found to be superior in many respects to the foregoing types. That is because the embryo cells can be duplicated, and the likelihood of short circuiting of the terminals during the process of annealing is entirely eliminated. It might be stated further that cells made according to any of the processes to be described are

the glass. A second method referred to in the patent text is that of pasting metallic foils on the glass plate. It is thereafter divided into the forms shown.

The writer has found by actual experiment that the process of fusing the metal into the glass gives the most satisfactory results. This latter process is identical to that now in common use by firms depositing silver on glass-ware.

Strange as it may seem, the foregoing types of cell construction has also been



Figs. 10, 11, and 12, showing the design of the Bell and Tainter cells

superior in their physical characteristics than any of the other types.

The method of preparing these cells is quite tedious, and a little more difficult in formation, but once the idea has been mastered, it will well repay the experimenter with cells of superior physical characteristics.

Bell and Tainter²¹ coated a glass plate—porcelain or similar material can be used as well—with a film of silver, and divided the latter into two electrical portions by means of a sharp tool. This divided film may be in the form of a zig-zag arrangement as shown in Figs. 10, 11 and 12.

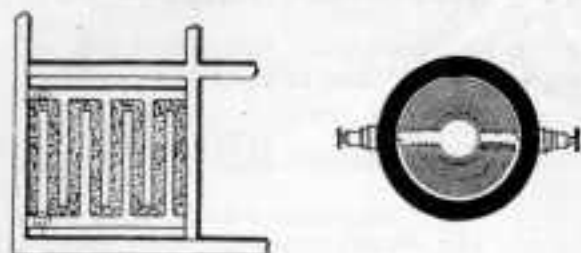
The deposition of metals on the glass plate as mentioned by these early investigators refer to the precipitation of the metal from its aqueous solution, as in the case of mirror making. Such a process in actual practise has been found to give unsatisfactory results, because the silver, being too thin, does not adhere to

resuggested by Liesegang²², Ocampo²⁴, and Presser²⁵.

Liesegang divide the silver by means of a needle point. Ocampo pasted tin foil on the glass plate and divided it with a sharp tool, Fig. 13. Presser divided the metal film in concentric lines, about 0.5 mm. apart, the completed cell is shown in Fig. 14.

A method as just described is patented by Ribbe²⁶, which consists of dividing the glass plate either by means of a sharp tool or etching with hydrofluoric acid. The grooves are filled in with graphite powder, and the excess removed. This is subjected to electrolysis of a copper sulphate solution, and the deposited copper fused into the glass plate by the aid of a muffle furnace. The selenium is applied and annealed. A description is also given of a cylindrical form as well, but the process of manufacturing the cell remains the same.

In actual commercial manufacture, the



Figs. 13 and 14. The Liesegang cell, made with tin foil, pasted on glass plate, and the Presser type, somewhat similar in design

cells made by Gripenberg²⁷, Fig. 15, has been found to be the best. The grating consists of a film of gold or platinum, with 20 bars per mm., each bar is 0.025 mm. apart, this operation being accomplished with a dividing engine. Very thin films of selenium are formed on glass or mica plates, this is pressed up against the grating by a small screw press. A drop of vaseline oil is placed between the capillary space between the electrodes and the selenium plate, so as to exclude the atmosphere.

Cells using contact by pressure are found to be much more constant, elimi-

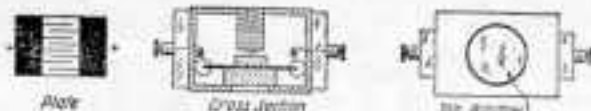
ing, and finally closed in a glass tube.

GROUP II.

Fritts²⁸ made cells of a different type. This he did by melting selenium on a piece of tinned copper, 2 ins. square. On the film of selenium he placed a highly polished steel plate, which he then put thru the annealing process, and at the same time subjected the cell to a high pressure. The selenium cell thus formed was suddenly cooled. On removing the steel plate, a thin plate of selenium was found adhering to the tinned copper.

The selenium then had on one side a good electrical connection. On the other

Fig. 15. Quite different from the others is the design employed by Gripenberg. Here are three views of the completed cell



inating the difficulty experienced as a result of the selenium film tearing away from the contact as a result of a difference in the expansion and contraction between the materials. A further fact is that cells can be made with much lower dark resistance and greater ratio between dark and light. One such cell has a ratio of 1000 to 1, the highest on record.

With the foregoing type of cell, a selenium plate can be replaced easily.

d'Albe²⁹ rubbed soft graphite over a sand blasted or etched glass plate. This was then divided in any of the manners already described for separating the graphite film.

Pfund³⁰ cast the selenium film into discs about 1.5 cm. in diameter, and 1.5 mm. thick, and annealed them. These discs were ground smooth on crocus cloth, after which silver tape electrodes were fastened with celluloid. A film of gold was next deposited by cathode sputter-

side was applied a transparent conductor of electricity in the form of a film of metal, such as gold, silver, or platinum foil. The whole was then mounted in a convenient container with binding posts.

The annealing of the cell was done by simultaneously subjecting the cell to heat and a pulsating current, to polarize the selenium. In this manner, a cell having a remarkable light sensitiveness between light and dark can be made.

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Impedance Coupled Amplifier

Some laboratory tests made to determine the effect of
Impedance Coupled A. F. Amplifiers

By G. H. Brocning*

ALMOST every part of a radio receiving set, from the R. F. amplifier to the loud speaker, distorts the signals somewhat, but the audio amplifier is still the most serious offender in this respect. There are three types of audio amplifiers—transformer, resistance, and impedance—which can be used to magnify the very weak impulses coming from the detector to a volume sufficient to be heard comfortably. But though they all increase or magnify the signals, we have the effect of blurring the original electrical picture to contend with, just as a poor telescope, or one which is out of focus, blurs the physical picture.

With a view of determining the best type of amplifier, a series of laboratory tests were made with the result that some exact data on different systems was obtained. Transformer coupled audio amplification has several distinct advantages: two tubes with transformers; ample signal strength on most sets, 90 volts plate battery is sufficient for loud speaker reception, and the transformer type is easy to construct. However, the disadvantage of poor quality reception generally offsets these good points, with the result that engineers are seeking for more satisfactory methods.

For the last few months, the attention of the radio public has been called to the fact that resistance coupled amplifiers give almost perfect reproduction and their efficiency in this respect accounts for the increasing popularity of this type of amplifier. However, it has been my experience that there are several inherent faults with that system: three vacuum tubes are necessary to give the amplification formerly obtained by two, the plate battery, for best results, should be of 120 to 200 volts, and the tubes are worked below their highest efficiency.

The first objection is not so serious, as vacuum tubes are comparatively cheap now, but the second and third can be

overcome in the amplifying system to be proposed.

The impedance amplifier uses choke coils instead of resistances in the plate circuits of the tubes. This method is not new, but it has not been brought forcefully to the attention of the radio public.

The advantages of this system of amplification are: the quality of reproduction is equal to that of a resistance coupled amplifier, the vacuum tubes are worked at very highest efficiency, and a plate battery of 90 volts is entirely sufficient.

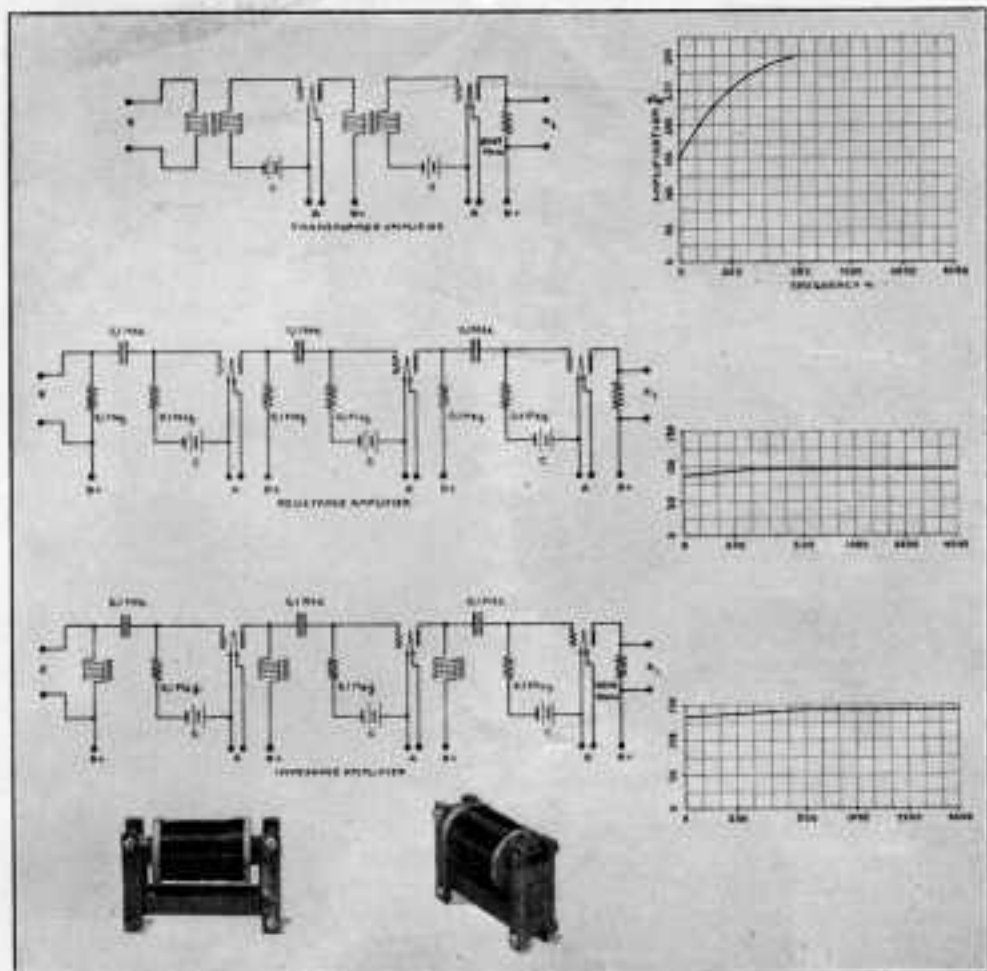
In order to ascertain the difference between the three types of amplifiers, curves were drawn to show the performance of a 2-stage transformer coupled system, a 3-stage resistance amplifier, and a 3-stage impedance amplifier. The amplification constants of the vacuum tubes used were 8 in each case, so that the comparison between the systems is entirely fair.

The tests were made with a calibrated audio frequency oscillator having, in the output circuit, a fixed resistance, the potential across which was the input voltage. One side was connected directly to the transformer, as from the filament of a tube, and the other side of the resistance was connected to the transformer through a 15,000-ohm General Radio resistance, to supply a value equal to the plate impedance. The voltage across the input resistance was determined by a Rawson thermo-voltmeter, and at the output by a vacuum tube voltmeter.

A resistance equal to the plate-filament resistance, was connected in the plate circuit of the last tube instead of a loud speaker. This was done because different loud speakers have different impedances and, consequently, cause a variation in the amplification.

The page opposite shows the circuits employed. It should be noted that the same stopping condensers and gridleaks were used in the resistance and impedance

* Chief Engineer, National Co., Inc.



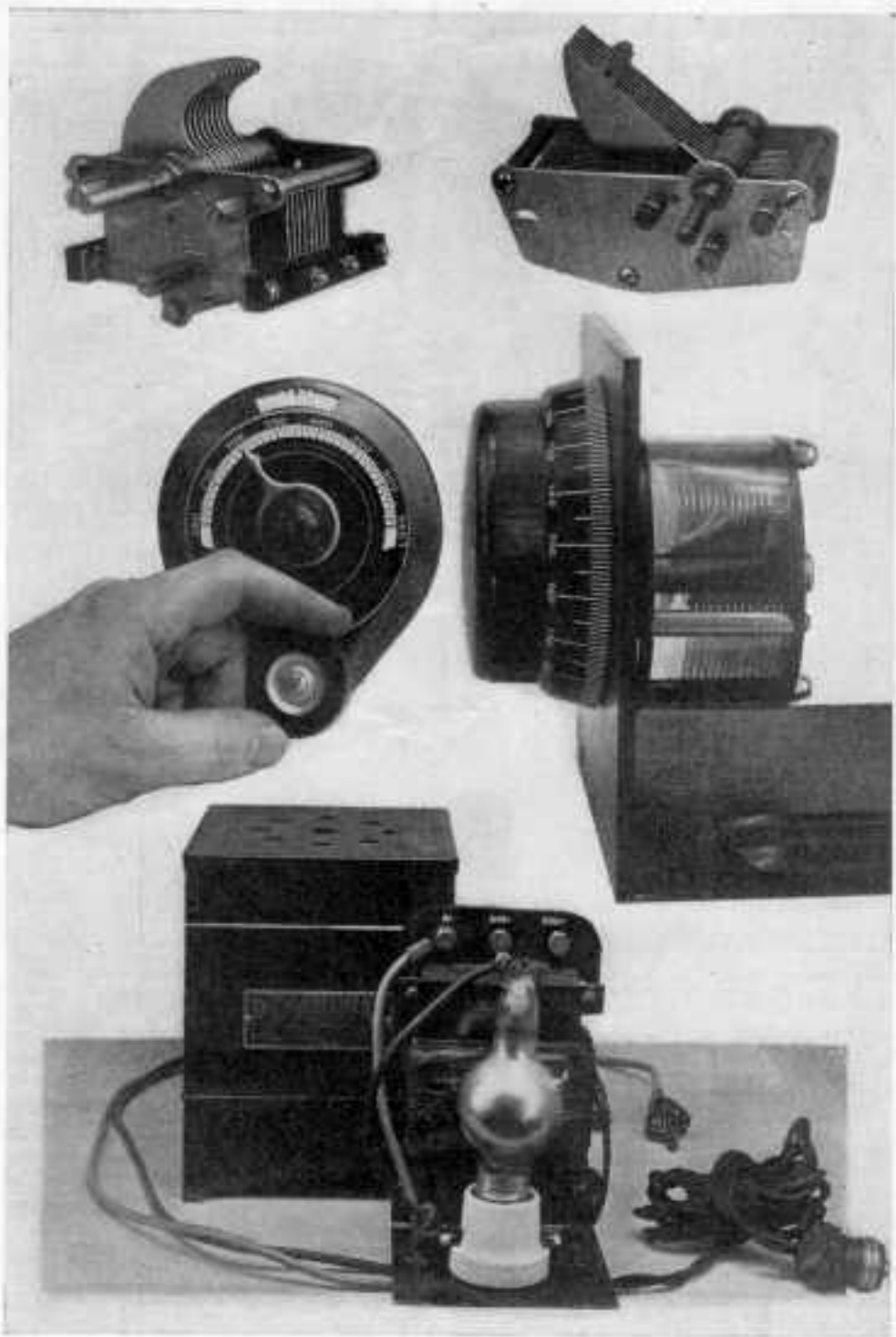
The three types of A. F. Amplifiers, with the amplification curves obtained from them. Below are shown two experimental impedances of 150 henries inductance.

coupled circuits, so that there would be no difference in the quality due to differences in the condensers or gridleaks.

The three curves reproduced show the amplification as the ratio of the voltage measured across the output and input of the three types of amplifiers. These curves are drawn in such a way that the harmonics are equally spaced on the horizontal scale, instead of spacing the frequencies equally. This method of drawing amplification curves was described in *RADIO ENGINEERING* previously. Consequently, distortion represented by curve A, from the transformer coupled amplifier, looks much worse

than if it were drawn with the frequencies spaced equally, but the comparison with resistance and impedance is fair since those curves are drawn by the same method. Other A. F. transformers might have produced better curves, although the transformers employed in this test were of a type generally conceded to be among the best.

The quality of signals obtained by the different systems depends upon whether the low and high frequencies are amplified equally. Suppose the letter C is being received on a radio set, this single letter has a certain amount of energy at 100 cycles, and a less amount at 500
(Concluded on page 587)



New products for this fall—Cardwell S. L. W. and the U. S. L. type S. L. F. condensers, Bremer Tully vernier dial and Rathbun S. L. F. converter, and the silent Dynamic charge for A and B storage batteries. In this illustration the unit is removed from the case.

Using the UX Tubes

The addition of new types and type numbers to the series of radiotrons has been somewhat confusing but it is easy enough to select the correct tubes for various purposes once you understand what the changes mean

THE UV-199, UV-200, UV-201-A, WD-11 and WD-12 will be made as before. These same tubes, with the new bases will be made also, except the WD-11. If a 199, 200, 201-A, or WD-12 has the new base, the type number is UX-199, UX-200, UX-201-A, or WX-12.

The UX-199, however, has a base of smaller diameter than the other UX tubes, altho the size and arrangement of the contact pins are the same so that any UX tubes fit in the same socket. The Radio Corporation refers to the UX-199 as having a small standard UX base, while the UX-200, UX-201-A, and WX-12 are referred to as having the large standard UX base.

The three new tubes of most importance are the UX-112, UX-120, and UX-210. The UX-120 has the small standard UX base while the other two have the large standard UX base.

The UX-120 is a low-filament current tube to use only in the last stage of a set which has previously employed a UV-199. The UX-120 takes twice as much filament current as the UV-199, operating at 3 volts across the filament terminals. The plate voltage should be 135, although it will operate at 90 volts. An important difference is that the UX-120, with 135 volts B battery, should have 22½ volts negative C. For this purpose a small size 22-volt battery is recommended. The voltage amplification of this tube is 33, against 6.25 for the UV-199.

The UX-120 can be used in other sets instead of a UV-201-A, for the last amplifier tube. There it is necessary, however, to change the rheostat so that the voltage on the tube will be only 3 instead of 5. The C battery must be added, also.

UX-112 is a detector or amplifier tube designed to have a very low output

impedance. The filament current is 0.5 ampere, or twice as much as the UX-201-A. Operated as an amplifier with 90 volts on the plate and 6 volts negative C, the plate current is slightly lower than the UV-201-A with 90 volts B and 4½ volts C, but the output impedance is 8,800 ohms against 12,000 ohms for the UV-201-A. The voltage amplification is practically the same. At 157 volts on the plate and 10.5 negative C, the plate current is fairly high, 7.9 milliamperes, with an output impedance of 4,800 ohms, and voltage amplification of 8. This tube will not be widely used, except for R. C. A. equipment, until transformers and loud speakers are available to match the impedance of these tubes.

The UX-210 is designed as a power amplifier. It takes 6 or 8 volts on the filament terminals and draws 1.1 or 1.25 amperes respectively. The plate voltage can be varied from 90 to 425 volts with the negative C running from 4.5 to 35 volts. With 8 volts on the filament, 425 volts on the plate, and 35 volts negative C, the plate current is 22 milliamperes. Under these conditions the output impedance is 5,000 ohms with a voltage amplification of 7.5. This tube, also, calls for many variations in the circuit design, not only because of the high filament and plate voltage but because of the high plate current. Very few transformers now available will carry much over 12 milliamperes in the primary.

The special advantages of the UX-120, UX-112, and UX-210 is that their design insures perfect modulation without overloading. All these tubes takes a very high negative C potential, so that there is no chance for the grid to become positive as is so often the case with the UV-201-A when extremely strong signals are being received. It is predicted that these tubes will give us an entirely new idea of quality in radio reception.

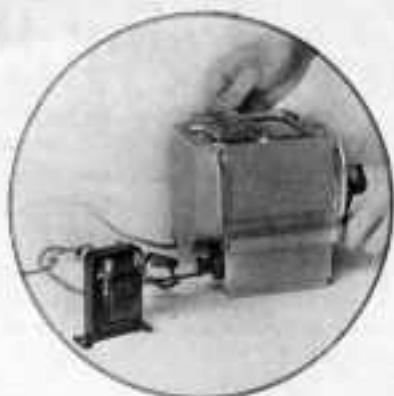
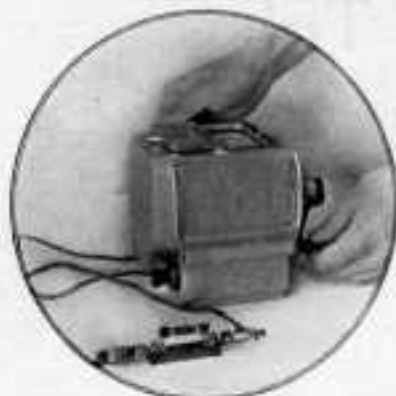


Fig. 1. The hand-operated Megohmmeter, set up for testing grid leaks and mountings, and for measuring the resistance between primary and secondary coils of a transformer

Checking up With the Megohmmeter

The Megohmmeter is an essential instrument in routine tests in order to maintain production standards

MANUFACTURERS of electrical measuring instruments report this summer and fall a decided increase in the sale of their equipment, due to the fact that radio manufacturers are realizing at last the absolute necessity of knowing accurately what they are doing.

One of the first measuring instruments to reach real volume of sales is the Megohmmeter, an instrument which reads directly in megohms. Made in England, the Megohmmeter, is distributed by James G. Biddle, of Philadelphia.

Up to the present time, most of the Megohmmeters have been purchased for testing gridleaks. These have been of the type designed for use with direct current supply, generally from three 45-volt B batteries. Unlike other methods previously employed, the Megohmmeter does not require an unvarying source of potential as the supply voltage can vary 20% above or below the rated voltage without affecting the accuracy of the meter.

For routine tests, however, some manufacturers prefer the hand-driven type shown in the accompanying illustrations. This is fitted with a generator

and crank which is turned at about 120 R. P. M.

This fall, a large number of concerns have purchased Megohmmeters for checking factory production. That is, when parts are ready to deliver to the assembly room, perhaps two out of every hundred are sent to the laboratory to be measured on the Megohmmeter. This applies to all parts which have R. F. insulation.

It is well known that a great many faults developed in radio sets after they reach the consumer are due to insulation which is good enough to stand up under the inspection tests but not good enough to hold up permanently. All molded insulation should be given the one-in-fifty test. On such things as mountings for gridleaks, this is very important. Occasionally, by accident or intent, the quality of the molding is changed with the result that gridleak mountings have been found to show as low as 25,000 ohms across the terminals. Obviously, it is useless to put a 2-megohm leak in a low resistance mounting.

Manufacturers who buy gridleaks on contract should test at least one out of every fifty.

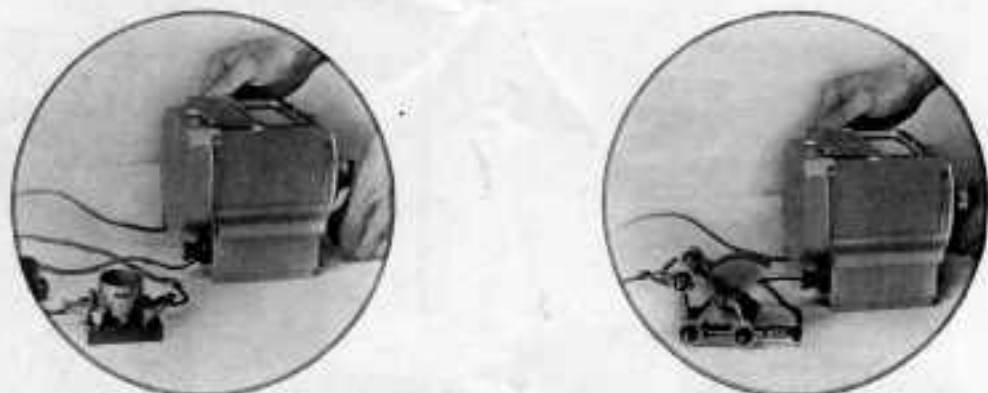


Fig. 2. Testing sockets and variable condensers. A remarkable feature of the Megohmmeter is that it is not damaged when the terminals are accidentally short circuited.

This also applies to fixed condensers. For example, if a fixed condenser of low resistance, due to defects or deficiencies in the insulating material, is put across the primary of an A. F. transformer, the low frequency current will be divided between the transformer and the condenser.

A. F. transformers should be watched for insulation between the primary and the secondary windings.

Some concerns, in the final tests, are measuring the resistance across variable condensers. This is not done particularly to check up on the resistance of the insulation. Sometimes a condenser at one particular setting shows practically infinite resistance across the insulation. As the condenser is revolved, however, even though the plates do not actually touch they may come close enough so that the resistance of the condenser is brought down to a few thousand ohms by contact between dust particles on the plates.

The accompanying illustrations indicate some of the ordinary measurements to which the parts of any set may be subjected. However, there are many special uses to which the Megohmmeter can be put, depending upon the particular type of circuit used. For example, it is important to maintain perfect insulation across the terminals of neutralizing condensers. If soldering paste is used in assembling, faults can be discovered from that source if they are present, or low resistance caused by burning the insulation on telephone jacks when the leads are soldered.

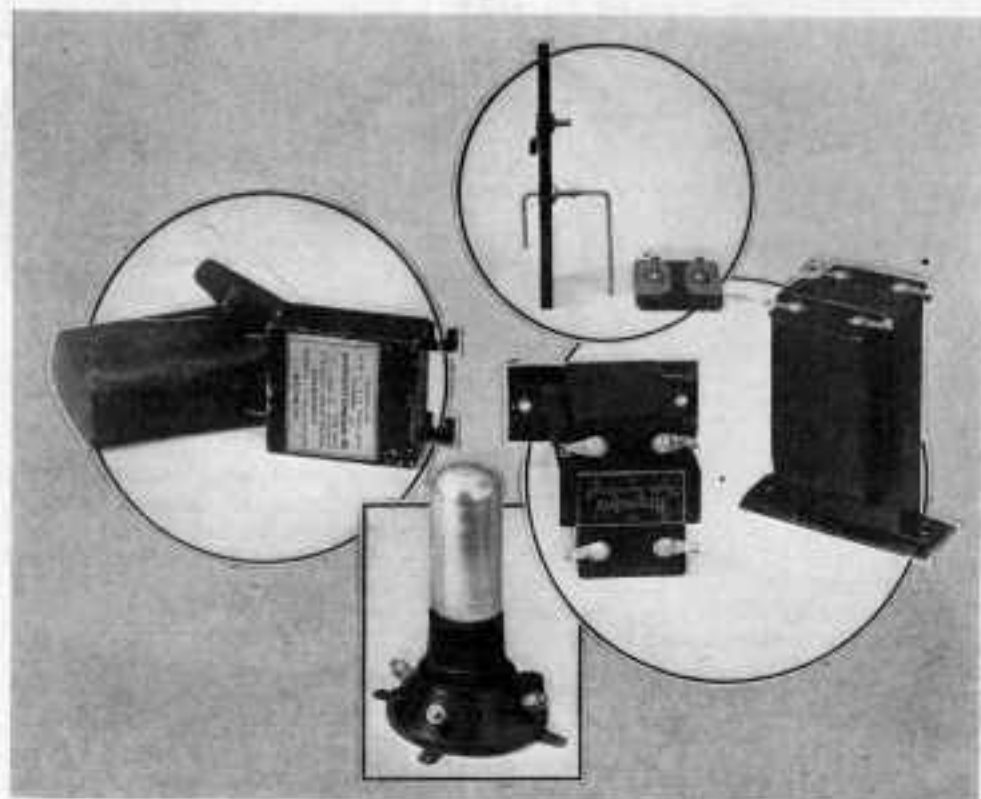
Unlike most other instruments, the Megohmmeter is not damaged when it is short circuited, so that it can be used for tests of all kinds without fear of burning out the instrument.

Impedance Amplifier

(Continued from page 583)

cycles, etc., up to 8000 cycles. Now, if all these different frequencies are not amplified the same amount C may sound like T, because T has practically the same frequencies in it, but the distribution of energy in each is different. Therefore, the more constant is the amplification given by a system from 100 to 10,000 cycles, the better tone quality received. In the chart shown, where amplification is plotted against frequency, the transformers have much the greatest amplification, but the quality is poor. Both resistance and impedance give almost perfect quality, but as may be readily observed impedance gives nearly twice as much signal strength as resistance though not as much as the transformers.

With two high μ amplifying tubes and a power tube in the last stage, it is possible to get as much or more volume out of a three stage impedance amplifier than has been formerly obtained with two transformers, and still retain the wonderful tone quality inherent in the latter system.



Four new items of interest to manufacturers—the high capacity condensers from the Condenser Corporation of America; U X socket from the American Hard Rubber Company; William Stevens' new eyelet Lastite for set manufacturers; and the Brandes A. F. amplifying transformer

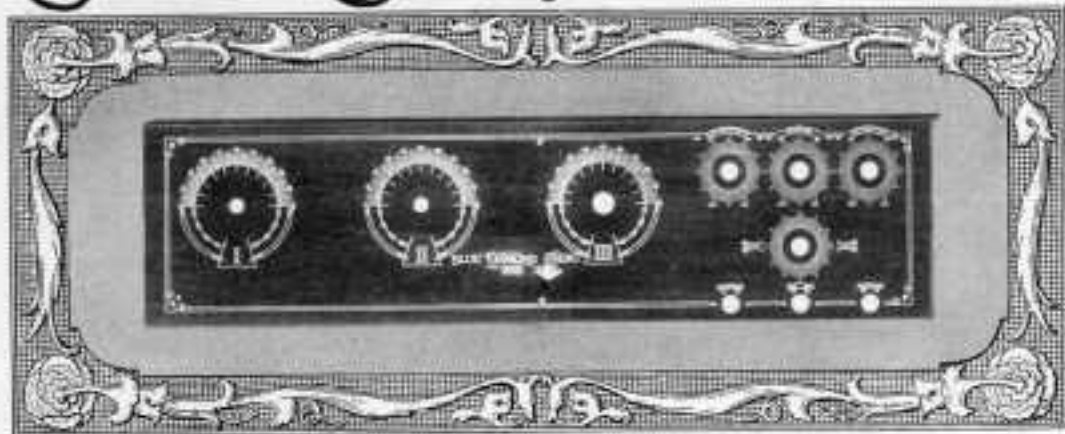
The Electrad Company is having much success with the sale of Royalty variable resistances, particularly since they have come into much demand in connection with battery eliminators. These resistances, somewhat similar in appearance to wire-wound rheostates, are made in twelve different sizes, ranging from 1,000 to 50,000 ohms maximum resistance. The safe continuous current carrying capacity varies from 32 milliamperes for the 1000-ohm size to 7.5 milliamperes for the 50,000-ohm size. The capacity and inductance between terminals at the position for maximum resistance for any type is 2 mmfd. and 0.05 microhenry.

From the Acme Apparatus Company, Cambridge, Mass., comes the announcement of several interesting items. There is the double free-edge cone speaker, designed to have a natural period of vibration below the audible range, in order that the quality will not be distorted by the tendency of the diaphragm to vibrate at its own period. This is made in two types, the round model listing at \$25.00 and the square model at \$35.00. The Acme

B-Eliminator is particularly interesting in view of the fact that it supplies 50 milliamperes at 137 volts. Two amplifier voltages and a variable detector voltage are available. The eliminator is designed for use with the new Raytheon tube a new type which has no filament to burn out or break prematurely. A list of new Acme products would not be complete without something in the way of transformers. The MA2 is made with a heavy core and a greatly increased primary impedance. The ratio is 1 to 5. For those who prefer impedance coupling there is an impedance coil having an inductance of 200 henrys. The new transformer lists at \$5.00 and the impedance at \$4.00. Manufacturers will be interested in the special transformers for B-Eliminators and the 30-henry, 50-milliamper choke coils. The transformers are made in two types, B4 for full-wave rectification and B3 for half-wave rectification. The chokes and transformers list at \$5.00, \$6.00, and \$7.00 respectively.

From Philadelphia comes the news that the production of Philco batteries and A and B Socket Powers has required the addition of

Crowe Quality Metal Panels



offer you
many performance and sales
Advantages!

This panel finished in exquisite brown packaging with its workings done in matched brass, recently fabricated in the Crowe plant for the Electrical Parts Corporation, Cleveland, manufacturer of Blue Diamond Radio Receivers.



"The Perfect Panel"

This trade mark on Crowe panels means that the set manufacturer is adhering strictly to quality in the construction of his product.

The advantages of broose as a panel medium are obvious. Complete elimination of body capacity—great simplification of wiring by using the panel as a conductor—reduction of extraneous pick-up effect—rigidity and permanence—no breakage—and, no limitations for expression of individuality in design and decoration!

But—the advantages of CROWE Quality Etched Metal Panels are still more obvious from a production standpoint. They reach your factory completely and accurately pierced and machined—ready for assembly. Tuning scales etched directly on panel, permit the use of knob and pointer in place of dials, and facilitate other manufacturing economies.

Send your panel specifications to us. Let us make you see preparation which has already been taken advantage of by many of the leading QUALITY set manufacturers.

CROWE NAME PLATE & MFG. CO.
1749 Grace Street Chicago, Illinois



Quality **CROWE**
ETCHED METAL PANELS

a five-story concrete building for the Philadelphia Storage Battery Company. It is reported that 1000 Socket Powers per days have been produced up to the present time, altho this rate will be greatly increased with the new facilities. September was the largest month in the history of the Philadelphia Storage Battery Company.

The Dongan Electric Manufacturing Company of Detroit and Walkerville, Canada, is supplying many of the B-Eliminator manufacturers with transformers and chokes. Dongan is producing transformers and chokes for both half-wave and full-wave rectifiers for Raytheon, R. C. A., and several other types of tubes. Descriptive literature and circuits can be obtained by writing to this company.

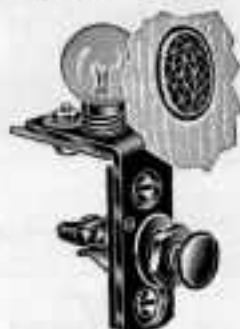


This Elwood device is for testing sockets for correct wiring

Mydar Radio, of Newark, N. J., has added several products to their regular line of Accuratune dials. The Accuratune indicator is a pointer, eliminating the necessity for an engraved line, which can be fastened to the panel without screws or nuts. This lists at \$2.25 for three. The A. J. vernier is an all-bakelite vernier dial, 4 ins. in diameter, with a 100 to 1 ratio. There is also the fixed knob, arranged in a way similar to that on the regular Accu-

tune dial, for a quick setting. This lists at \$2.25. The knob on the rheostat dial has been redesigned so as to match the style of the Accuratune knob. The price list also shows a station recorder which can be put on the panel under the dial. For a 3-in. dial, the recorder lists at \$3.50 or \$7.75 for the 4-in. type.

The new price bulletin from the Alden Manufacturing Company is very helpful in selecting



Metro switch and bull's eye

sockets or adapters suitable for the new or old style tubes. The Alden Manufacturing Company, Springfield, Mass., has a complete line of small and large UX sockets, adapters for using UX tubes in UV sockets, and several special types of spring-mounted sockets as well as plain types designed particularly for the use of manufacturers.

The Radiall Company, New York City, is just starting delivery on the Tune-Rite dial, a S.L.F. dial for use with S.L.C. condensers. Manufacturers who have been using Amperite automatic filament controls will be glad to hear that the Radiall Company is making special units for the new R. C. A. tubes. Consequently, those who have been using Amperites for the last stage of an A.F. amplifier can get the new types so as to put UX-120, or UX-112 tubes in the last stage.

A patent license has been granted to the Patent Electric Company, New York City, by



The Mohawk single-control construction kit consists of a triple condenser, vernier knob, and three R. F. transformers



The real solution to the tuning problem!

MAKE your radio a 1926 model. Replace your present Dials with Rathbun Straight Line Frequency Converters which spread all stations within the range of your receiver uniformly around the whole circle of 360°. All stations are a uniform distance apart on these new Converters which is the ideal tuning condition.

Why be satisfied with Dials or Condensers which are limited to 180° or only half the dial? Why stop at 180° when there are 360° in the circle? No gears with their back lash, no friction with its slippage in Rathbun Straight Line Frequency Converters—only two moving parts, a variable cam and a lever.

Easily and quickly installed on any set—it is not necessary to cut Condenser shafts or drill panels.

The Rathbun Straight Line Frequency Converter is one of the few really new things in Radio during the past three years.

Don't forget that we build the Rathbun Single Hole Mounting Condenser with genuine Bakelite ends. This year's models are all enclosed with transparent pyralin dust bands which preserve their high efficiency for life. Small, light, rugged, handsome and none lower loss or higher in efficiency. Reasonably priced.

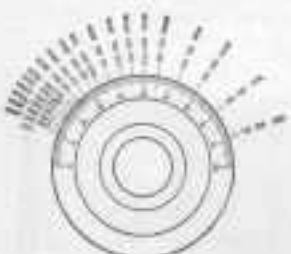
Ask your dealer for Rathbun Straight Line Frequency Converters. If he has not yet stocked them, he will quickly obtain them.

PRICE \$3.50

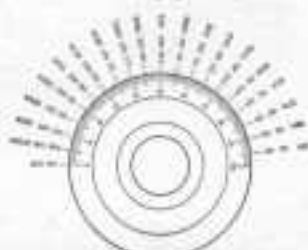
**Rathbun
Manufacturing Co., Inc.
Jamestown, N. Y.**



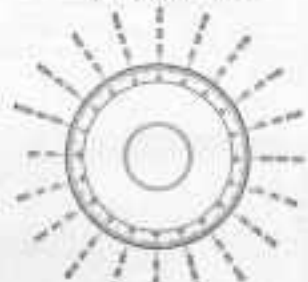
Stations indicated in kilocycles and wave lengths showing crowding with an ordinary capacity condenser



Stations partially separated and tuning slightly improved with a Straight Line Wave Length Condenser



Practically even separation over half the dial with a Straight Line Frequency Converter

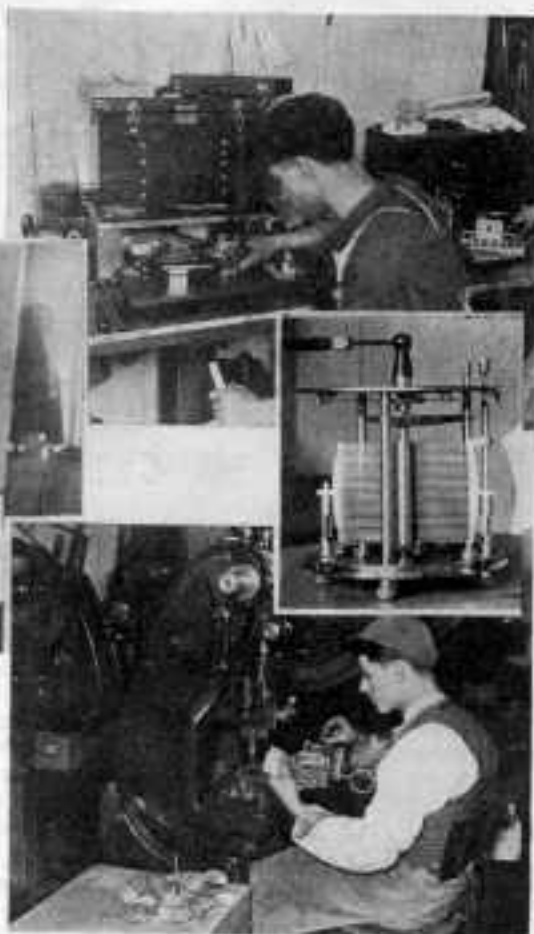


Complete and equal separation of stations over the entire dial with the Rathbun Straight Line Frequency Converter

Since the General Instrument Company has gone into production on their Six-Seventy-One receiver, the entire production of the Broome Street factory is being devoted to parts, while the set assembly is being done in an enormous factory on Broadway. These illustrations show



steps in the manufacture of condensers, while the insert shows a special job of Bureau of Standards type condensers. The General Instrument patents on low loss type condensers and S. L. F. design have just issued, by the way.



the U. S. Navy, whereby the Pacont Company is permitted to make use of patents controlled by the Navy. In return, the Navy is granted certain patent rights owned by Pacont.

Kellogg Switchboard and Supply Company, Chicago, Ill., is producing a new rheostat for sale to radio manufacturers. The particular

feature about this device is its noiselessness. Until a year ago, everyone assumed that a rheostat had to click and scrape when it was adjusted. Now, however, people object to the noise itself and, what is worse, to the noise caused by vibration transmitted to the tubes. This is particularly true on outfits using UV-199's.



Dengan transformer and choke coils for power amplifiers and eliminators



**B-T "Euphonic" Transformers—
"Pleasing to the Ear"**

B-T Engineers have felt for a long time that better audio transformers were necessary. The result of their work is the B-T Euphonic.

A leading testing laboratory reports that this product gave better results than any audio transformer they had ever tested.

With the B-T Euphonic there is no necessity for howling or distortion caused by crossed leads. The Euphonic can be mounted in almost any position, bringing the terminals where they are required. This adjustable mounting is an exclusive B-T feature.

The Euphonic, as its name indicates, is "pleasing to the ear." We believe it is the best transformer available.

Ratio 2.2 to 1..... \$5.00.

Ratio 4.7 to 1..... \$5.75.

No Loose Contacts With B-T Sockets

No loose contacts are possible with the B-T Universal Socket. Phosphor bronze springs maintain positive side grip on tube prongs. Connections are direct to contact springs or to binding posts keyed in position to prevent loose screw head contact.

Extremely low capacity.

Takes all Navy Base and new UX tubes without an adaptor.

Price.....\$0.75



B-T S.L.F. Condensers

Examine a B-T Condenser. Note the rigid frame and die cast construction of rotor and stator. See how easily and quickly the bearings can be adjusted for wear without disturbing plate alignment of changing capacity.

Reflect on the care in design and construction evident in this condenser and your choice is sure to be a "B-T."

B-T Straight Line Frequency Condensers.

SLF-13, Capacity .00025.....Price \$5.50
 SLF-17, Capacity .00035.....Price \$5.75
 SLF-23, Capacity .0005.....Price \$5.75



An Oversize Edition of "Better Tuning"

A bigger and better edition of "Better Tuning" than ever—the 8th Edition, 80 illustrated pages of sound discussion on up-to-the-minute radio topics. Hook-ups, diagrams, building help and tuning hints. Send for your copy. Price 10 cents.

BREMER-TULLY MFG. CO.

532 S. Canal St.

CHICAGO, ILL.



Views of the Gold Seal Tube exhibit at the Radio Show, where a complete tube manufacturing equipment was set up that the visitors might see the various processes employed. These illustrations show the assembling and welding machinery, and the apparatus for exhausting the tubes.



A tube rejuvenating device is being given free to radio dealers by the Gold Seal Products Corporation, New York City, manufacturers of the Gold Seal Radio Tubes. The device is sent with the first order for 100 tubes. This is an excellent opportunity for radio dealers because of the increasing demand for this service on the part of B.C.L.'s who so often overload their tubes unintentionally.

Metro Electric Manufacturing Company, New York City, have announced a combination switch and bull's eye. The switch, very small in size, is in the form of a bracket, carrying at the top a horizontal arm for the electric light bulb. With the switch a red lens is provided to be mounted on the panel directly

in front of the light bulb. The lamp does not act as a fuse, so that if the lamp burns out the set will still operate. This device is listed at \$95.

DeJur Products Company, New York City, has announced a new socket for UX tubes. The original models are being displayed and production will start right away.

A handy device for use in the factory testing room or for service and maintenance men is the Bezar tube protector, consisting of a tube base which carries a small incandescent bulb. This is to insert in a vacuum tube socket in order to determine whether or not the wiring has been done correctly. If there are mistakes in the wiring or short circuits putting the plate potential on the filament, the bulb discloses the fault by burning at more than normal brilliancy. This device is made by the Elwood Manufacturing Specialty Company of New York.

The Condenser Corporation of America, of New York City, is putting out a special line of paper condensers for A and B eliminators. They are made in capacities ranging from 1 to 4 mfd. These condensers are designed particularly to reduce the current leakage. Moreover, the layers are wound in such a way as to make the condensers a non-inductive. Each turn of the foil can be short circuited, providing a quick discharge. All condensers are tested for a continuous current of 600 volts D. C. The 1 mfd. size measures 1-3/8 by 2-11/16 by 13/32-in. thick while the 4 mfd. unit measures 2-11/16 by 1-1/8 by 2-1/8 ins.

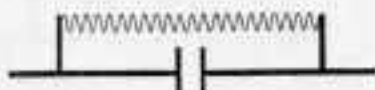


Mydar's latest addition to the Accurate line

THE DAVEN LEAKANDENSER



EQUALS



SOLVES A DUAL PROBLEM

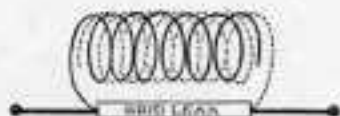
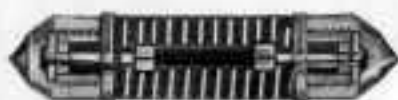


Diagram of the Leakandenser. There are two coils of wire, each forming one of the "plates" of a tiny condenser.



Assembly of the Leakandenser.



The cross section above shows construction and assembly of the Leakandenser.

A pair of wires, coated with a special insulating material are wound in parallel, in a single layer, upon the Bakelite bobbin. To distinguish these in the illustration, one is shown dark, and the other light. The dark wire is connected to cap "A" in the illustration, and the light wire to the cap "B." Each wire therefore has one open end and one connected to a terminal, thus forming two plates of a condenser.

The method of winding insures that the spacing between them can vary only the smallest fraction of a percent. This gives extreme uniformity. This is a great stride forward, as grid condensers in the past have been known to vary in capacity as much as 300 percent.

And now, the Grid Leak. One of permanent and constant value is absolutely essential. Daven's reputation for manufacturing precision Grid Leaks needs no comment here.

The Leak is suspended in the center of the Bakelite cylinder on which the condenser is wound. The ends of the leak are connected to the caps which are also the terminals of the condenser.

Manufacturers are invited to send for a sample.

The Best of All!

DAVEN RADIO CORPORATION

Radio Specialists

Newark Res. U. S. Pat. 102 New Jersey

Daven engineers have produced an innovation so simple and effective that you will wonder it was not thought of before.

Leading engineers and radio manufacturers have asked us repeatedly if we could not improve the old-fashioned combination grid leak and grid condenser which is (1) unattractive and cumbersome, (2) often inaccurate.

The Daven Leakandenser Contains No Mica

Grid condensers (particularly those of the mica type) often lack uniformity in capacity, especially in lower values; are susceptible to injury during soldering operations, and change capacity frequently after installation.

The Daven Leakandenser contains no mica and delivers all the efficiency the name Daven implies. It is a great step forward, both electrically and mechanically.

Manufacturers—you will instantly recognize the convenience and practicality of this new device. *Set Builders*—the Leakandenser will make your set more attractive and save you time and trouble. *Jobbers and Dealers*—here is something new. Show it to those of your customers who know radio. The Leakandenser is precision-built, like all other Daven products, moisture proof and rugged. It takes up less space, is better looking. Made with five different values of grid leaks; 2, 3, 4, 5 and 7 megohms. The condenser is known as type "D" and is correct for all makes of detector tubes. Price \$1.00, including clips.

CLIP THIS COUPON

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115-160 Summit Street, Newark, New Jersey.

Please send me the following:

Check Leakandenser Bulletin.
 Here: Resistor Manual. 30¢ (enclosed).
 Complete Catalog (free).

Name

Address

Get the Handbook of Inductance, Capacitance and Amplification. 40¢. U.S. Pat. 1,012,826. 24 pages.

THE BIG LITTLE THINGS OF RADIO



EPOM

ELECTRICAL PRODUCTS OF MERIT

"B" Battery Eliminator

DESIGNED ON SOUND ENGINEERING PRINCIPLES.

The EPOM B-BATTERY ELIMINATOR meets the demand for a steady, reliable source of plate current from the light socket through the correctness of its engineering design. It embodies all the essential features—full-wave rectification with its maximum efficiency, a two-stage filter with its suppression of all hum, and controllable output on both detector and amplifier voltages to meet all operating conditions.

The EPOM tube, which is the result of long study and research, overcomes the drawbacks of other rectifier tubes. It has no filament to burn out or lose emission. Its three sturdy electrodes operating in a rarefied atmosphere of an inert gas insure absence of tube troubles.

Leading jobbers and dealers throught the country endorse and are distributing the EPOM "B" battery eliminator.

EPOM CORPORATION (Dept. Q.)

114 East 47th St., New York City.

Manufacturer	Over-all size (height, width, depth)	Cycles and voltages	B voltage taps	B voltage adjustments	Maximum current drains recommended	Chemical or tube rectifier	What requires initial adjustment	What requires replacement
Fansteel Products Co., Inc., North Chicago, Ill.	8x8 3/4 x 9 3/4"	60-110 to 120	Two	None	20 mls.	Chemical	Nothing	Distilled water, every 6 months
	9x9 1/2 x 7 1/2"	60-110 to 120	Three	None	40 mls.	"	"	Distilled water, every 6 months
Forest Electric Co., Newark, N. J.	8 1/2 x 6 x 6"	25-110	Three	Detector & amp.	50 mls.	One tube	Detector	a n d Rectifier tube, amp. volt.
	40-110							
	60-110							
Freshman Co., Inc., Charles, New York, N. Y.		60-110 to 120	Three	Detector & amp.	30 mls.	One tube	Detector	a n d Rectifier tube, amp. volt.
Gold Storage Battery Co., New York, N. Y.	Combination A and B storage batteries and chargers							
Gandy-Grunow-Minds Co., Chicago, Ill.	11 x 8 x 7	50-120 cycles				One 2-amp. Tung		Supplies A also
		100-125 volts				Two U Y 201-A's		
Magnus Electric Co., Inc., New York, N. Y.	7 1/2 x 7 1/2 x 5 1/2"	60-110	Two		60 mls.	One tube		Rectifier tube
Marlin Co., Glass L., Newark, N. J.	8 1/2 x 5 1/2 x 5 1/2"	40 to 90-110 to 120	Three	Detector & amp.	30 mls.	One U V 201-A or U X 213	Detector	a n d Rectifier tube, amp. volt.
	10 1/2 x 6 x 8"	60-110	Two	None	25 mls.	One or two tubes	None	Rectifier tubes
Radio Corp. of America, New York, N. Y.	8x17 1/2 x 28 1/2"	60-105 to 125	Four		10 to 30 mls.	One UX 97A One UX 213		Tubes
Radio Products, Inc., Richmond, Ind.	6 1/2 x 4 x 10"	60-110	Three	Detector	45 mls.	One tube	Detector voltage	Rectifier tube
				Special Supply also				
Radio Receptor Co., Inc., New York, N. Y.	7 x 15 x 8"	60-100 to 120				Two 2-amp. Tung		Supplies A also
Rhansonia, J. Thos., Detroit, Mich.	6 1/2 x 6 1/2 x 6 1/2"	60-110 to 120	Two	Detector & amp.		One UV201-A	Detector	a n d Rectifier tube, amp. volt.
Valley Electric Co., New York, N. Y.		60-110	Three	Detector & amp.	25 mls.	One tube	Detector	a n d Rectifier tube, amp. volt.
Walta Electric Co., Louisville, Ky.	7 1/2 x 6 x 7 1/2"	60-110	Two	Detector & amp.		One tube	Detector	a n d Rectifier tube, amp. volt.



Artistry

What is the secret of the marvelous superiority of Rauland-Lyric reproduction, as compared with any other system of "coupling"? The answer is no mystery. Rauland-Lyric does indeed bring out the low frequencies or bass notes—which can also be accomplished by other methods. But it also does what only an ultra-fine transformer can do—it puts extra power into the higher harmonics transmitted by the modern broadcaster. In effect, it actually extends the frequency range of the loudspeaker. There is no amplifier like Rauland-Lyric.



Rauland-Lyric is a laboratory-made audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. All-American Radio Corporation, 4201 Belmont Ave., Chicago.

Rauland-Lyric
ALL-AMERICAN
TRANSFORMER
The Choice of Noted Music Critics

YOU don't need "B" Batteries if you use the FRESHMAN MASTER "B" Battery Eliminator

A. C. Model
illustrated
6 inches
square;
weighs
7 1/2 pounds



Connects from any electric light socket right to your radio set;—that's all there is to it.

With the Freshman Master "B" Eliminator your set will always be supplied with constant and uniform power. Noiseless in operation; your reception will not be marred by the snap and crackle due to chemical action in "B" batteries.

*Costs less than one-tenth of
a cent per hour to operate.*

A. C. Model **\$20.00**
For Alternating Current

Freshman Rectifying Tube is required for
operation of the A. C. Model. Price . . . **\$2.50**

D. C. Model **\$17.50**
For Direct Current

Sold by AUTHORIZED FRESHMAN DEALERS Only

*Write for 24 page illustrated booklet full
of useful information for radio fans.
Also the name of our dealer nearest to you.*

Chas. Freshman Co. Inc.
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Chicago, 2626 W. Washington Boul.

No Backlash in this New Dial



FYNUR VERNIER CONTROL

And that's only one of the Fynur's many mechanical superiorities. The dual control permits of a quick, general setting as well as infinitely fine vernier adjustment.

It's beautifully made—and so simple in construction that a child could take it apart and re-assemble it.

It operates by traction (not gears) so there can be no possible backlash or lost motion.

The Fynur is a quality dial for those who want the best. If not obtainable in your vicinity, we will gladly mail the desired quantity on receipt of price, \$3.50 each.

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HARD RUBBER PUNCHED GOODS CO.

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Manufacturers of

BINDING STRIP PANELS
BLOCKS AND STRIPS
BUSHINGS
CONDENSER END PLATES
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PANELS
PICTURE FRAME BACKS
AND EASELS
PHONE JACK INSULA-
TIONS
ROD
STRIP INSULATIONS FOR
CONDENSERS
TRANSFORMER INSULA-
TIONS
TUBING
WASHERS AND OTHER
ELECTRICAL INSULA-
TIONS.

If it's made from Sheet, Rod or Tube we make it



No Back Panel Fussing

Genuine
Bakelite
Throughout

DeJUR RHEOSTATS

ONE HOLE MOUNT

The one hole mount, one of the many exclusive features of the DeJur, makes it the easiest of all rheostats to mount, and when mounted it sets fixed and rigid. No screws to get loose, no back panel fussing. Compare the DeJur. You will readily recognize its difference and superiority.

Sold by all dealers.
Manufacturers — Write
for sample and price

**DeJUR
PRODUCTS Co.**
LAFAYETTE & BROOME STS.
NEW YORK



PATENTS APPLIED FOR

B Eliminators Assured Success With New Type Tubes and

DONGAN

Transformers



Designed especially for operation with the new Filament and Non-Filament Tubes, Dongan Transformers and Chokes are most essential parts of the remarkable new B-Eliminators. These new Eliminators are thoroughly indorsed by Cockaday and other authorities.

Names famous in the industry are found on these new type tubes. Likewise Dongan—long a leader in the production of quality transformers—shares in this achievement.

Chokes



Order by number

Prices and Specifications

No. 509 Full wave	For Raytheon Tubes	List \$7.00
No. 537 Full wave UX 213	For R.C.A. Tubes	
No. 537 Full wave CX 313	For Cunningham Tubes	List \$5.00
No. 538 Half wave UX 216-B	For R.C.A. Tubes	
No. 538 Half wave CX 316-B	For Cunningham Tubes	

Chokes

Specifications:		
No. 514	20 henry	
No. 506	30 henry	
No. 539	50 henry	

Other Special Transformers and Chokes for both A and B Eliminator Requirements.

Build your B-Eliminator with Dongan Transformers and Chokes. See your dealer or send check or money order. New. Shipments made same day order received.

Dealers

Get your share of this business.
Full details upon request.

Manufacturers

We can serve you in any quantity. Prices on request.

DONGAN ELECTRIC MANUFACTURING CO.
2995 Franklin Street, Detroit, Mich.
Transformers of Merit for 15 years.

EASTERN *pickle bottle* COILS

for the

RX-1

Build this new four-tube M. B. Sleeper non-regenerative set that is taking the country by storm!

A revelation in tone quality! Powerful — distortionless — smooth working — selective —

Non-oscillating. No neutralization required.

The reproduction of the RX-1 is so faithful that you will not want to turn it off — but just listen and listen to the musical concerts, etc., that can be truly enjoyed in all their pure naturalness with this remarkable receiver.

EASTERN PICKLE BOTTLE COILS (type RX-1) are specified and exclusively licensed by M. B. Sleeper for this circuit.

Price Per Set, \$6.00

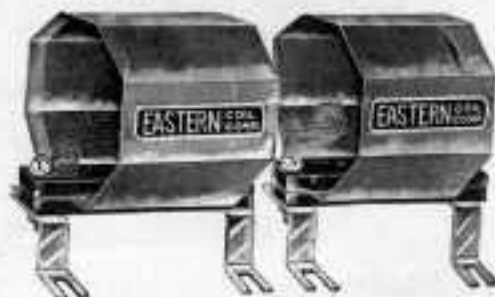
EASTERN COIL CORPORATION

22 Warren Street

Dept. R. E.

New York

Trade Mark



EASTERN PICKLE BOTTLE COILS are also designed for perfect performance in the ROBERTS CIRCUIT (\$4.50 per set), BROWNING-DRAKE (\$8.00 per set), DX SUPERDYNE (\$8.50 per set), 3 CIRCUIT (\$6.00), and for Tuned R. F. for .0005 or .0015 condensers (\$2.00 per coil).

At your dealers or direct, postpaid.

“ACRACON”

— a New Name in Electrical —
Condensers

- 1 Acracon is built to the special operating requirements of “A” and “B” Battery elimination.
- 2 Current waste is reduced to minimum due to the high dielectric resistance and improved method of impregnation.
- 3 Method of winding layers eliminates inductive effects.
- 4 Each turn of foil can be “shorted”, providing instant discharge and lowered R. F. resistance.
- 5 Every unit tested under 600 DC volts for 1 minute.
- 6 Compact construction — Perfect Performance, for use in either set construction or current-tapped devices. Units also built to special manufacturing specifications.

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**THE CONDENSER CORP.
OF AMERICA**

25 Waverly Place

New York, N. Y.

SPECIAL PARTS

For A. C. Filter Circuits

The high capacity Mershon condenser that cannot puncture is ideal for use in filter circuits, now in vogue.

20 M. F. \$4.00

40 M. F. 4.50

Several circuits specify tapped resistances.

1000-2000-3000 ohm resistance \$1.25

C. J. BROWN

R 213, 52 Vanderbilt Ave.,
New York City

Music by the "Room-ful"

NUMBERLESS radio set owners have been waiting for a popular priced speaker combining tone quality with volume. This new speaker offers this combination in a remarkable way.

Attach it to your radio set and tune in. Immediately a flood of clear pure tone issues from this little speaker, penetrating to the farthest corner of the room. For the New Model S has the advantage of being "all-directional." You can stand on any side and hear the broadcasting as loud as everyone else in the room hears. This alone puts this speaker in a class by itself.



Constructed of balsa, a scientific substance that eliminates false tone vibrations. 2 1/2 inches high on a 6 1/2 inch square base. Neat black finish harmonizing with any surroundings.

\$12.50


The New **Imported**
LOUDSPEAKER

If the store where you ordinarily go for radio equipment is not yet showing this speaker, send us your address and we'll send you full description and tell you where to hear it.

NEUFELDT & KUHNKE DIV.
The Goldschmidt Corporation
Dept. K11 15 William St., New York



N & K IMPORTED
PHONES

4000 Ohms. Extra large diaphragms of specially sensitive metal, producing clear true tone. Unusually comfortable to wear. Price \$8.50.



N & K IMPORTED
PHONOGRAPH UNIT

All the N & K qualities of tone and volume. Attaches instantly to victrola or other standard phonograph without wires. Price \$7.50.

As Near As Your Mail Box

DURRANT Radio is an organization made up of successful engineers and business men who understand the requirements of radio set builders and experimenters. As engineers they know that Durrant must sell only things which are thoroughly dependable. As business men, they know that orders must be filled within 48 hours after they are received. It is on this basis that Durrant, during the last two years,

has shown thousands of set builders and experimenters that it is safer and surer to buy from Durrant than from local dealers, for, by experience and conscientious study Durrant has learned to give better service by mail, than dealers can give in person, while the simple guarantee—if it isn't right your money will be refunded without argument—is more than you can expect from a radio store.

HERE are some of the special items which are now in great demand, on which Durrant can make prompt shipment. Note that 10c. must be added if you want shipment insured. Durrant pays all postage.

Amertran Power Transformer.

Type PF-45 transformers specified for A.F. power amplifier. Supplies A current for UX-210 and UX216-B, and B for UX-210 and all tubes in receiving set. . . . Price \$15.00

Amer Choke

Type 854, 100 henries, 60 milliamperes, for any rectifier or B-eliminator circuit. Three are required for power amplifier. . . . Price, each, \$6.00

Amertran DeLuxe

An A. F. transformer for those who require the ultim-

ate in quality. Has laminations of the new alloy. Price \$10.00

Samson D. R. Coupler

Double-rotor coupler for exceptional selectivity. Used in the 1926 model receiver shown in Radio Engineering for October. . . . Price \$7.50

Samson T. C. Kit

For T.C. set described in Radio Engineering, August issue. Has double-rotor coupler, fixed coupler, R. F. choke, neutralizing condenser. . . . Price \$14.75

Stevens Lastites

The only correct soldering terminals. Replaces lugs and nuts. Cannot come loose. Self-locking.

Price, per 25, \$5.50

Selenium Cells

McWilliams type 6A Selenium cells, developed for audio amplification and transmission of photographs. Complete instructions furnished. No measurable lag at 10,000 cycles. Price \$15.00

Pacent Universal Sockets

No. 82 isolantite sockets, take both UX or UV tubes, four wiping contacts on each pin. . . . Price \$6.60

All Pacent Products

Durrant is the authorized sales and service station for all new Pacent products.

B-D 5 Complete Kit

Complete B-D5 construction kit, all parts, with panels drilled and engraved. Full instructions with photographs and diagrams are provided.

Price \$59.90

Address your orders to A-52 Vanderbilt Ave., New York City

DURRANT RADIO, Ltd.



RX-1* Results Cost Less

To quote reports from RX-1 owners might make you doubt, until you have actually operated this set, if any outfit could be so truly different, altho, understanding the engineering principles involved, you would expect new results from the new methods employed.

But it is clear enough that RX-1 presents outstanding values which not only give you greater value for the money you spend but values in operation and performance which are not exceeded in any other set at any price.

Look at the parts in the RX-1 list shown in the illustration above.

You will see that nothing has been spared to bring the RX-1 up to the very peak of efficiency, that the finest parts obtainable have been used.

Then note the price—\$32.50—a price which could not be met, with any other type of circuit, except by substituting the cheapest parts.

Here is another demonstra-

tion of the advance in design represented by the RX-1, in its ability to produce RX-1 results with such economy of construction.

Nor is economy limited to first cost. There is the natural question—Will the set go dead after a while, break down in the hidden parts? The original laboratory models, now six months old, are still operating on a six-hour-a-day lifetest schedule, yet the condensers, coils,

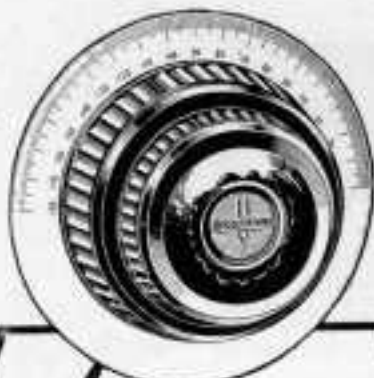
transformers, resistances are as sharply responsive to-day as they were last April.

To fully realize that only RX-1 can give RX-1 results, buy a set of RX-1 coils, now reduced in price to \$6.00 and assemble an outfit from the parts you have on hand or, better, take full advantage of the RX-1 engineering and get the complete set of parts and panels at \$32.50. RX-1 kit, as above, with genuine tested D-21 Soudion, \$37.50.

**Trade mark registration applied for. These parts are sold under M. B. Slesper license.*

Address your orders to A-52 Vanderbilt Ave., New York City

DURRANT RADIO, Ltd.



Pat.
April
11, 1934

Other
U. S. and
Foreign
Patents
Pending

The last word in tuning devices

When a micrometer control is so delicately geared that it brings in the most elusive stations within the scope of your set with deadly accuracy, and with ease, it fully deserves to be referred to as "the last word in tuning devices." Such is the Accuratune.

Volume and clarity are matters of course to a set equipped with Accuratune, because, geared on an 80-to-1 ratio for either coarse or infinitely fine tuning, it functions with precision and accuracy, with little or no effort on your part.

Easily substituted for ordinary dials without alteration of your set.

MYDAR RADIO CO.
11 CAMPBELL STREET, NEWARK, N. J.

Geared
80 to 1

ACCURATUNE

REGISTERED TRADE MARK U. S. PAT. OFF.



THE NEW MULTISTAGE MELOFORMER

A new audio frequency transformer scientifically combining tone and volume in correct proportions.

Construction radically new. Will work three stages

Factory type requires only 1 3/4" of space. **THINK THIS OVER.**

ROBERTSON-DAVIS CO., INC.
412 ORLEANS ST. CHICAGO, ILL.

DURHAM—for looks, convenience, and Results.

Variable Grid Leaks



\$1.00 A neat 1/4" nut on the panel, the famous DURHAM plunger control at your fingertips—and any set will perk up! Use for both detector and audio tubes.

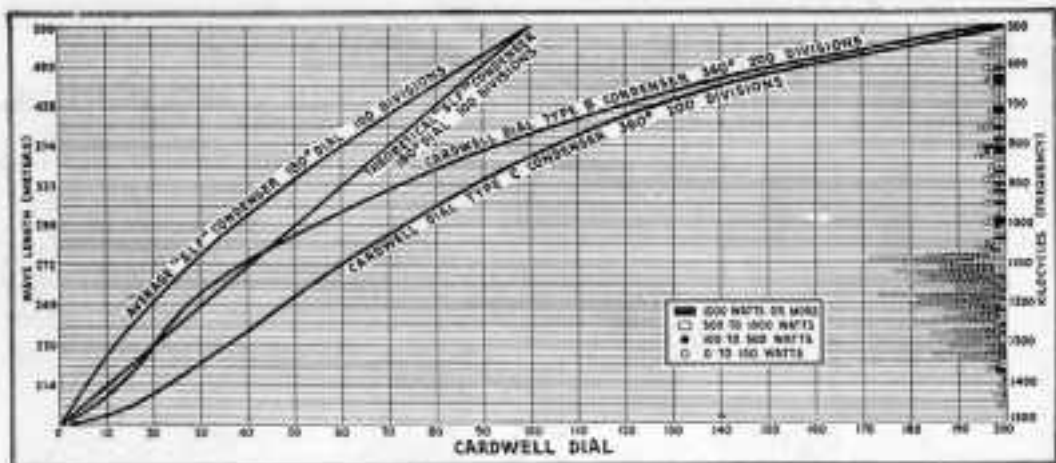
75c. Standard type—

for all standard or DURHAM tubes and grid condensers having clips.

Both types in these sizes
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No. 101—0.1 to 5 megohms
No. 201 A—2 to 10 megohms

DURHAM Boxes—three styles, 10c. to 45c.
Use DURHAMS in all sets
Order by type and size number

DURHAM & CO., Inc.
1030 Market St., Philadelphia



FROM SLC TO SLF



TYPE B WITH EQUITROL



TYPE B



TYPE C



TYPE D

A CONDENSER to possess a real efficiency, must have negligible losses and retain its calibration at all times. These are the cardinal virtues of Cardwells. That they were the original "low loss" type, suggests that they must be so excellent in all other respects that they are perfection in condenser art.

Because of their inherent efficiency, they are readily adaptable to straight-line design, which affords conveniences at the dial in logging. Thus, without resorting to peculiar looking construction, the Cardwell can be made in SLW, or SLF without sacrificing its basic advantages: extreme rigidity and constant calibration. (Note curves of all types shown above.)

Note that Type B (SLC) is converted into SLW by using the Cardwell Equitrol dial. This is shown in terms of frequency above and in terms of wavelengths in the small graph. Type B is more "selective" than most SLF types. With the Equitrol, you have more dial visibility than with any 180° SLF condenser. Type C gives semi-SLW tuning. Type D is for SLF service,—No. 217 being a dual, balanced type recommended for all TRF circuits.

Write for Booklet C-77.



SERIES B

Type	Cap.*	Price
154E	150	\$1.00
141B	250	4.25
152B	300	4.80
150B	350	4.75
123B	500	5.00
137B	1000	6.00

SERIES C

Type	Cap.*	Price
192C	150	\$1.00
178C	250	4.25
182C	300	4.25
175C	340	4.50
173C	380	5.00
178C	1000	7.75

SERIES D

Type	Cap.*	Price
217(D)	250	\$3.00
173D	240	5.00
174D	250	5.50
182D	340	6.00
194D	400	6.50
178D	1000	7.00

* MPP. Specify "H" for aluminum, "L" for counterlockets. Add "V" to any type number for built-in ventiler, add \$2.00 to list price of plate type. † Dual. ‡ Insulator. Over 25¢ above type list total.

THE ALLEN D. CARDWELL MFG. CORP., 81 Prospect St., Brooklyn, N. Y.

CARDWELL

MATCHED AERO COILS



T. R. F. Kit
Matched Coils
\$12.00

Will make your set
more **POWERFUL**
more **SELECTIVE**

Set Manufacturers? Send us one of your sets. We will replace your insulation with Aero Coils—and leave the rest of your set as you like.

Set Builders: Aero Coils, by reason of their matched construction—95% air dielectric and deep-drawn aluminum windings, are more powerful and more selective than other types of inductances. And Aero Coils are perfectly matched!

T. R. F. Kit, including brackets \$12.00.
At your dealer or direct.

Write for Free Aero Booklet.

AERO PRODUCTS, INC.
217 N. Desplaines St., Chicago



NEW! The Chelten Straight-Line Frequency Condenser (Modified)

Uniform separation of stations over the entire tuning range. No crowding on any part of dial. Scientific design—proved out by repeated tests in actual operation. Standard frame; soldered brass plates.

Write for authoritative free booklet on straight-line frequency tuning.

CHELTEN ELECTRIC COMPANY
4850-65 Steuten Ave., Phila.

The beauty of Radion
*is an added advantage
for set manufacturers*

FROM a purely *practical* angle, Radion Panels possess the two qualities which make it meet the set manufacturer's requirements 100 per cent:

(1) *It is very easy to drill,
saw or cut*

EDGES are smooth and even; holes are trim and clean-cut. Does not chip as do many other panel materials.

(2) *It has the highest
insulating qualities*

COMPARED with all commercial insulations, Radion has (1) lowest angle phase difference; (2) lowest dielectric constant; (3) highest resistivity (megohms cm.); (4) lowest moisture absorption; (5) lowest power factor loss.

IN ADDITION to these important advantages, Radion Panels have a high-polished, satin-like finish that adds wonderfully to the attractiveness of any set. Radion takes engraving beautifully.

We invite manufacturers to send us samples or specifications of panels and other insulated parts of radio instruments or sets. Radion is used on the leading makes of condensers.

AMERICAN HARD RUBBER COMPANY
Dept. M N 7, 11 Mercer St., New York City

RADION
The Supreme Insulation

When the Loos Brothers Sing from W.E.B.H.

Robert Loos sits at home and hears them as naturally as though they were singing in the same room.

For over 30 years
makers of
PRECISION
Electrical Apparatus.

Karas Harmonik Transformers

Amplify Radiocast Music with Absolute Fidelity!

No sooner had Karas Harmonik Transformers been introduced than letters began to pour in from all over the country. Exacting set builders could not restrain their enthusiasm.

"Now I know radio as I never knew it before."

So Mr. E. M. Lubeck of Kokomo, Indiana, expressed himself. "Karas Harmoniks bring in every voice and every instrument as distinctly as one could get them in the room," wrote the Rev. Wm. Steinhorn of Columbus, Ohio. "I consider your transformer a real musical instrument. Like a good violin, it has fine tonal qualities of all pitches covering the musical scale." That was the comment of Mr. Walter Krause of 7807 Burnham Ave., Chicago.

These few reports—picked at random from scores of letters—tell you more convincingly than we can tell you, the wonderful results YOU can obtain through installing Karas Harmonik Transformers in your set.

Here, for your enjoyment, is an audio transformer, scientifically designed to reproduce through your speaker all of the beauty of radiocast music—exactly as it is rendered in the studio.

High, low, and medium audio frequencies are amplified to an equal degree. Sonorous bass notes pour forth from the speaker in full strength and rich tone quality. The vital harmonics and rich overtones are brought out in their true beauty by this marvel of audio transformers.

Dear Sirs: I take great pleasure in praising your wonderful Karas Harmonik Transformers. I am using two of them in a three-tube Live-Loss set which I built. I have two brothers singing from Edgewater Beach, WEBH Station. Well, their singing comes in so natural and clear that at times we think they are right in the same room with us. They also tell me mine is the clearest set they have ever heard.

Robert Loos, 1840 N. Leavitt St., Chicago, Illinois

All last season, home set builders—the most discriminating class of radio enthusiasts—bought Karas Harmoniks and enjoyed a musical quality of radio reception that owners of factory-built sets knew nothing about.

If YOU want the utmost musical enjoyment that radio has to offer, get a pair of Karas Harmonik Transformers at once. It is

very simple to install them or, if you don't care to do it for yourself, any radio repair man will do it for you at small expense. Why not make up your mind right now to have the best music your set is capable of giving?

Most good radio dealers carry Karas Harmoniks. If your dealer is out of them, order direct of us. Send no money. Just pay the postman \$7.00 each on delivery.

Karas Electric Co., 406 N. Rockwell St., Chicago, Ill.

Please send me pairs of Karas Harmonik Audio Frequency Transformers. I will pay the postman \$7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 30 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

Name

Address

If you send cash with order we'll send Transformers postpaid



The Best in the World

No Batteries

are required over to operate the most powerful 10-tube receiver illustrated above, if you use the new Laboratory Type

Model A
Power Unit

One Customer Telegraphs: "Receiver assembled, performing like a thoroughbred."

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 Nord-Hauck Engineers have furnished the finest radio apparatus known to the art today.

Quotations gladly furnished on radio parts and apparatus having non-infringing uses.

Write for Literature

NORDEN-HAUCK, INC., Engineers

1617 Chestnut St., Philadelphia, Pa.

Oh boy
KESTER
Rosin Core
Radio SOLDER

Sure is Safe and Simple
APPROVED BY RADIO ENGINEERS
A GEORGE HILSON
CHICAGO SOLDER COMPANY
4234 Wrightwood Ave., Chicago, U.S.A.

Manufactured and Sold by George Hilson
Successors of Fred Hilson, Inventor
U.S. PATENT 1,000,000

*To-day
-in every
good set!*

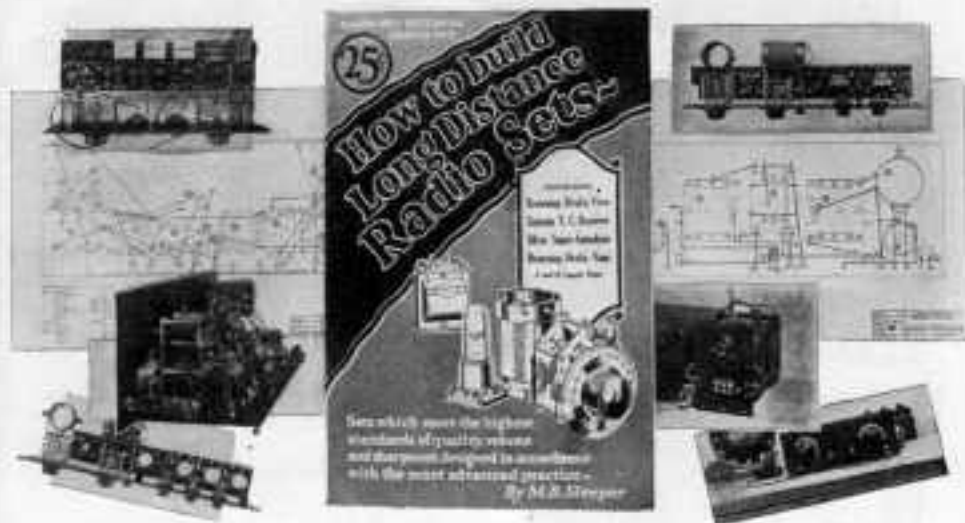
**Tone Clarity
Beyond Expectation**

Just pull the switch and note the clarity and richness of tone any Amperite-equipped set gives you. Amperite is the automatic rheostat which does away with hand rheostats and filament meters. No guessing. No uncertainty as to correct tube current. Tubes last longer. Makes any novice a master operator. Insist upon Amperite when you buy or build. Price \$1.10.

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AMPERITE
The "SELF-ADJUSTING" Rheostat



RADIO DEALERS—

Do you need something to stimulate your parts business? M. B. Sleeper's new book, *How to Build Long Distance Radio Sets*, will start your customers building and buying again.

The designs shown are tremendously popular, unusually successful, and the parts required are all standard merchandise which you have on hand.

These books sell at 25c, with a discount of 50% in quantities of 24 or more. This is a profitable book to sell, not only because of the generous discount but because it makes much bigger sales in parts.

PUT 24 COPIES TO WORK FOR YOU

M. B. SLEEPER, Inc. Technical Publisher
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No. 95 Radio Test Set

Jewell No. 95 Radio Test Set

— has had a helpful influence over radio for the past two years.

The checking and matching of tubes has become a common practice among radio dealers, jobbers and manufacturers.

The Jewell No. 95 was the first radio test set put on the market and today it is considered a standard.

Order from Dealer

Jewell Electrical Instrument Co.

1650 Walnut St., Chicago

Send for Special 95 Circular



3-Stage Resistance Coupled Amplifier Kit No. 1-C

Price **\$6.75**

Contains 3 "Electrad" Resistor Couplers, 1-00225, 1-003 and 3-005 "Electrad" Certified Mica Condensers, 1 Condenser Mounting, 2 "Electrad" certified Grid Leaks, 4 "Electrad" Certified Resistors. Only other parts needed are sockets, one rheostat, binding posts and bus bar.

ELECTRAD ^I _N _C

428 Broadway, New York City

EBY ^{PATENTED} BINDING POSTS

After you have put time, money and labor into the building of your set, don't jeopardize its efficiency with doubtful binding posts.

Ask your dealer to show you why EBY Quality Posts are the choice of over 150 radio manufacturers.

6 types—25 different markings—and the tops don't come off!

The H. H. EBY MFG. CO.
Philadelphia, Pa.



Ensign Engraved



15c
each



Ed the Stasco man, says:

You can't go wrong if you play a "Stasco Rheostat" to win. It's a sure bet.

The feature of a *spring contact plate* makes permanent contact possible. Flickering of tubes becomes a "back-number." That puts "Stasco" a length ahead in radio reception.

Don't take my word for it! Add one to your set and convince yourself of its merits.

Made of Bakelite only. In five different styles; with either black or mahogany knobs. One and two hole mounts.

Dealers, write for this 100% profit-maker.

Sheffield Trimming & Stamping Corp.
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Also manufacturers of Beasle, Vernier
Dials, Potentiometers, etc.

Leading Manufacturers
Save Space With

DUPLEX



CONDENSERS

Leading manufacturers realize that straight line frequency condensers are a necessary selling point—and many manufacturers incorporate this feature without sacrificing compactness by using DUPLEX S.L.F. CONDENSERS, with the cut-out slatter. There are no odd-shaped plates to cause short-circuiting (a DUPLEX feature that saves servicing). And the same DUPLEX distinguishes parts that are fitting components of the finest radio receivers.

Correspondence from Set Manufacturers
Invited

DUPLEX CONDENSER & RADIO CORP.
44 Flatbush Ave. Extension, Brooklyn, N. Y.



Quality—the Key to Permanent and Profitable Patronage

APEX VERNIER DIALS

RADIO purchasers are more conscientious on a progressive basis. Buyers are constantly searching for improved equipment. Quality receives the greatest consideration. Display of meritorious apparatus features development of profitable trade. APEX Vernier Dials stand for the greatest attainable value in dial construction and actual delivery of satisfactory service. They eliminate undesirable elements and present outstanding improvements in desirable features. Make tuning positive—bring in a greater number of distant stations—simplify locating—and greatly enhance the beauty of any set. Ratio 10 to 1. Adjustable to any 1/4 inch shaft. Clockwise and counter clockwise.

ROYAL BRASS FINISH
4 inch—\$2.00 list 3 1/4 inch—\$1.65 list
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You'll find that H-P-M Presses Pay for themselves QUICKLY



Approximate Three-Plank Molding Presses for Bakelite, Celluloid, etc.

H-P-M Presses have demonstrated themselves one of the best paying investments in the Plastic Molding field.

They are readily adaptable to any pressing problem and soon pay for themselves in increased production.

When you install H-P-M Presses you add 50 years of press engineering experience to your working equipment. Put this experience to work for you today. You will soon be repaid plus good dividends on your investment.



Hot plate press of the upward-stroke QUAM Molding Machine, etc., with plate band moulds also for Molding and vulcanizing rubber goods.

THE HYDRAULIC PRESS MFG. CO.

*There's a type and size for
your service.*

MOUNT GILEAD, OHIO

QUAM CONDENSERS— with the Pyrex end plate are WORLD BEATERS!



THIS IS AN ACTUAL STATEMENT OF FACT:

Pyrex is the best insulating material known. It is used by the U. S. Navy, Bureau of Standards and the majority of the broadcasting stations of the world. The Pyrex end plate is one of the features that makes the QUAM the lowest loss and highest quality condenser built—showing even less resistance than the laboratory standard. As a matter of actual fact the QUAM is used as a laboratory standard in many experimental and testing laboratories, not only in America but in all parts of the world.

Furnished in Straightline Frequency and Straightline Wavelength.

PRICES

.00025	\$6.00
.00035	6.50
.0005	7.00

With 4" Bakelite 360° Dial, Add \$1.00

Quam Audio Transformers, \$5

QUAM Radio Corporation
1925 S. Western Ave.
Chicago

Balkite

Radio Power Units

the ideal power supply for any radio set



**Balkite
Battery Charger**

This popular battery charger is entirely noiseless. It can be used while the radio set is in operation. Charging rate 2.5 amperes. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles. Also for 25-40 cycles with 1.5 ampere charging rate.

Price \$19.50

West of Rockies, \$20
In Canada, \$27.50



**Balkite
Trickle Charger**

Charges both 4 and 6 volt radio "A" batteries. Will furnish more current than is used for 6 dry cell or 2 storage battery tubes, if used only while the set is in operation. If allowed to "trickle" charge continuously will also furnish enough current for as many as 8 dry cell or storage battery tubes. Size 3 1/4 in. long, 2 1/4 in. wide, 5 in. high. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles. Price \$10

West of Rockies, \$10.50
In Canada, \$13

Balkite Radio Power Units are the ideal power supply for any radio set. They simplify and improve radio reception. They reduce the amount of attention you must give your set. With their use your current supply is always exactly what is required for each circuit.

For the "A" circuit there are the Balkite Chargers. The popular Balkite Battery Charger is entirely noiseless and can be used while the set is in operation.

For sets of smaller "A" current requirements there is the Balkite Trickle Charger. With a low capacity storage battery it enables owners of sets now using dry cells to make a most economical installation.

For the "B" circuit there is Balkite "B." It eliminates "B" batteries entirely and supplies plate current from the light socket. It fits any set of 6 tubes or less. For sets of 6 tubes or more there is Balkite "B" II.

Noiseless—No bulbs—Permanent

All Balkite Radio Power Units are entirely noiseless in operation. They have no moving parts, no bulbs, and nothing to adjust, break or get out of order. Each is a permanent piece of equipment with nothing to wear out or replace. They require no other attention than the infrequent addition of water. They require no changes or additions to your set.

Manufactured by
FANSTEEL PRODUCTS COMPANY, Inc.
North Chicago, Illinois

FANSTEEL
Balkite
Radio Power Units



Balkite "B"

Eliminates "B" batteries. Supplies plate current from the light socket. Operates with either storage battery or dry cell tubes. Keeps "B" circuit always operating at maximum efficiency. Requires no attention other than adding water twice a year.

Will serve any set of 6 tubes or less. Occupies about same space as 45 volt dry "B" battery. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

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Balkite "B" II

Same as the new Balkite "B" but will fit any set including those of 8 tubes or more. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

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In Canada, \$73

The Quail Unitpower is equipped with a special Balkite Radio Power Unit

BALKITE BATTERY CHARGER • BALKITE TRICKLE CHARGER • BALKITE "B" • BALKITE "B" II

ALL BALKITE RADIO POWER UNITS ARE BUILT AND LISTED IN ACCORDANCE WITH THE INTERNATIONAL LABOR AGREEMENT



COMPENSATED MULTIPLE AND STRAIGHT LINE FREQUENCY CONDENSERS

Only Real, Practical One Dial Control Unit.

A straight line, low loss product, combining maximum selectivity with simplicity of tuning. Can be built into any T. R. F. circuit and cuts down space and panel requirements. Evenly matched and balanced, and electrically and mechanically perfect. Genuine Bakelite dial and two knobs.

Capacity—
.00015 mfd. per unit.

A Perfect Straight Line Frequency Job

Separates the stations and distributes them evenly over the dial. It will materially improve the selectivity of any set, and make the sharpest tuning quick and easy. Low minimum with uniform maximum capacities. Made in all standard sizes.



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A plug and socket between the radio and the batteries is as essential as the plug and socket on an electric iron. Buy a Multi-Plug for the set you now have or are building. Used as standard equipment by over thirty American manufacturers.

See our dealer or write for descriptive circular G.

Type BM for set builder... \$4.50
Type BP for any set..... 5.00

HOWARD B. JONES, Chicago



Jones
MULTI-PLUG
THE STANDARD SET CONNECTOR

MOUNTFORD

PLUNGER TYPE

VARIABLE GRID LEAK



Fits any Mounting

50c

"An Asset to any Set"

The perfect graduation of Mountford Plunger Type Grid Leaks makes it possible to obtain all fractions of a megohm from 1/8 to 20, inclusive. Its fine graduation is especially valuable in helping in distant stations and increasing selectivity. Mountford Grid Leaks are individually tested for accuracy of range, consistency of resistance, and perfection of construction. They are unaffected by heat or cold and when properly adjusted, are guaranteed to maintain their efficiency.

At your Dealer or Postpaid upon Receipt of Price.

MANUFACTURERS

Special Grid Leaks to order in any quantity and of any resistance value as used in resistance-coupling; also Grid Leak Mountings.

C.E. MOUNTFORD

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\$60.85

CABINET TYPE

The United Achievement of Ten Radio Engineers

THE Hammarlund-Roberts is a composite of the individual achievements of ten leading radio engineers. The transformers were selected by a transformer engineer familiar with every reliable make. The condensers were similarly determined on by an engineer whose special study has been condenser characteristics. A man whose whole effort has been on resistance research selected the resistance units. Even the smallest units were made the object of scrutinizing study. Never before has so much extraordinary thought been given to every detail of a receiver.

This combination of these harmonizing units in the most desirable circuit is a receiver that is truly the ultimate of five-tube reception. And now,—you can build this remarkable receiver with the aid of a most comprehensible "How to Build It" book. You can equal the quality of a factory made receiver costing for as much as \$170.

Write for descriptive folder.

HAMMARLUND-ROBERTS, 1182-G Broadway, N. Y.



Radiant Lyric
No. 2021/2
TRANSFORMER

All-American Radio Corp.



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Bathell Co.

NEW



UNION

Union Radio Co.

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Manufacturers
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Foundation Unit
Complete Bakelite Panel,
enamel; Bakelite sub-
strate, drilled; sockets and
wire \$9.00

**Hammarlund
Roberts**

Construction Book
Write for this most valu-
able book giving complete
details on assembling, wiring
and operating the Hammar-
lund-Roberts Receiver 25c

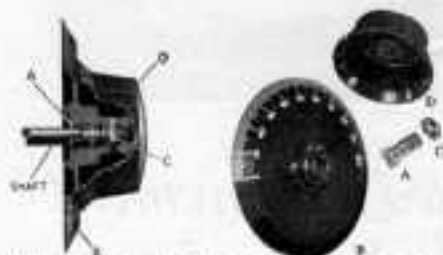




KURZ-KASCH

Aristocrat Line

"Aligns rite—Holds tite"



A—Split Bushing B—Dial C—Fastening nut for tightening locking on shaft D—Knob

The Kurz-Kasch patented split bushing method of mounting at once became popular. Over two hundred Radio manufacturers and thousands of set owners, appreciating these products, have purchased them in ever increasing quantities. The high quality and workmanship have earned for Kurz-Kasch products the position of leadership. They are the acknowledged best.

Kurz-Kasch
bear this
—insist on



Products
Trademark
the genuine

Write for illustrated literature on complete Kurz-Kasch line—Dials, Knobs, Sockets, Potentiometers, Rheostats, etc.

The Kurz-Kasch Company

Largest Exclusive Moulders of Bakelite
Factory and Main Office, Dayton, Ohio.

LAST AS TITE

CENTERED
TERMINAL

Lastite

If your object is to attain excellence in radio structure, the basic importance of the Lastite will interest you as much as it does us.

The Lastite is the only radio terminal that eliminates any possibility of imperfect contacts.

As Mr. M. B. Sleeper has said:

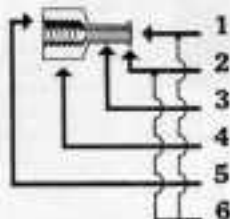
"With a bus wire soldered to it, the Lastite is its own lock nut."

There can be no structural element in radio more basically important than this feature of the Lastite.

Lastites hold the bus wires and, so, help you while you arrange them.

The Lastite is easier to solder to than a lug, is easier to put on, is stronger and looks incomparably better than any other kind of terminal.

Being more than just a contact, the Lastite is the only radio terminal which can be advertised and recommended, on its merits, for the service it performs.



- 1 Tube in which bus wire is inserted preparatory for being soldered. Tube will hold any size bus wire up to No. 14.
- 2 Thin, circular flange to which bus wire is soldered. The Lastite is thoroughly flamed, inside and out.
- 3 Thin wall of bus wire tube conducts little heat. Tube tapers toward the flange.
- 4 Quarter-inch hexagonal base nut.
- 5 Terminal base nut is threaded to fit 6-32 and 8-32 screws.
- 6 The tube and flange of the Lastite, being centered, vibration cannot act as leverage to work it loose. A bus wire locks it permanently.

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Manufacturers and Distributors,
write or telegraph for samples

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BAKELITE



The completed Caldwell Socket is shown at the left. At the right is the one-piece Bakelite molding ready for insertion of contact springs. The spring construction differs from the usual practice in that these pass through slots in the central ring, making contact with the sides and not the bottom of the tube pins. Sockets manufactured by Knox Corporation, Galeburg, Ill.

Caldwell designed an improved socket— Bakelite made production practical

To make an extremely low loss socket, one that was a single piece of molded insulation requiring no assembly operations other than slipping into place the electrical contacts, was the aim of the Knox Corporation, manufacturers of the Caldwell Socket. Because of its strength and the ease with which it is molded into intricate shapes, Bakelite was used. The makers say that through the use of Bakelite the socket is "very light yet amply strong to meet the requirements, and losses are reduced to a minimum."

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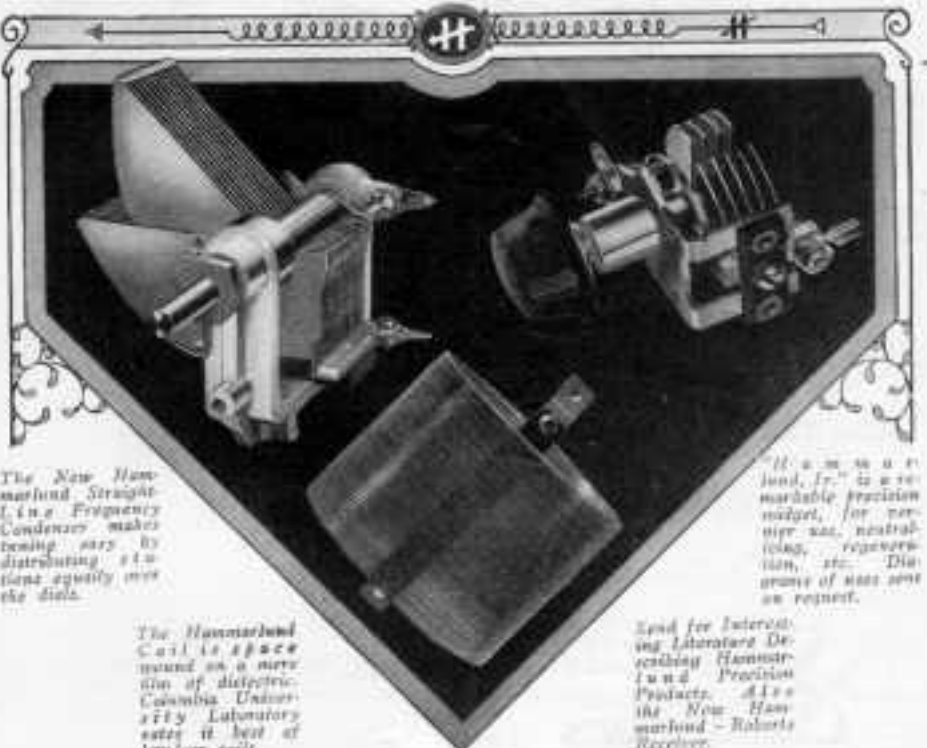
STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 21, 1911, OF 1910

ENGINEERING
Published monthly at New York, N. Y., on October 1, 1925.

State of New York)
County of New York)
Before me, a Notary in and for the State and county aforesaid, personally appeared Francis A. Shelton, who, having been duly sworn according to law, depose and say that he is the Business Manager of RADIO ENGINEERING, and that the following is to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24th, 1912, mentioned in section 442, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, M. B. Hooper, Inc., 22 Vanderbilt Avenue, New York; Editor, M. B. Hooper, Division, Custom; Managing Editor, Francis A. Shelton, 21 Vandewater Avenue, New York; Business Manager, Francis A. Shelton, 22 Vandewater Avenue, New York. 2. That the owner is M. B. Hooper, Inc., whose stockholders are: Anne F. Hooper, Dorien, Connecticut; Milton B. Hooper, Dorien, Connecticut; Francis A. Shelton, 17 East 52nd Street, New York, N. Y.; and Max A. Marston, Railroad Avenue, Harrison, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1% or more of the total amount of bonds, mortgages, or other securities are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the full and complete names and addresses of those who appear upon the books of the company but also, in each case where a stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements concerning affairs full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in capacity other than that of a bona fide owner; and that affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) Francis A. Shelton, Business Manager
Sworn to and subscribed before me this 1st day of October, 1925.

(Seal) F. N. BUNAGER, Notary Public
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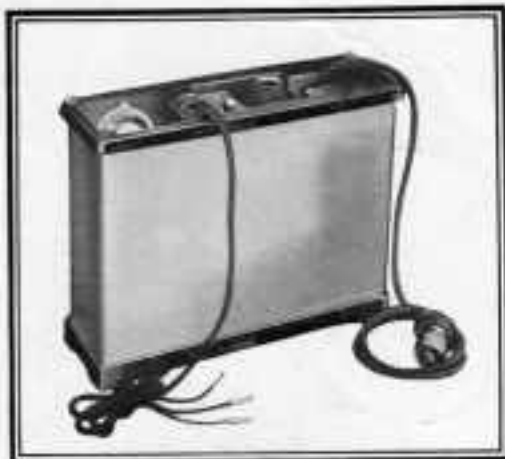


Illustration at left shows Acme B-Eliminator. Made in two types. Type E-1 (110 Volts 60 cycle) \$30. Type E-2 (110 Volts D. C.) \$20. 2 amplifier coils and a variable detector coilage that will operate even a 10 tube set, coils as high as 150 and 25 millamps.

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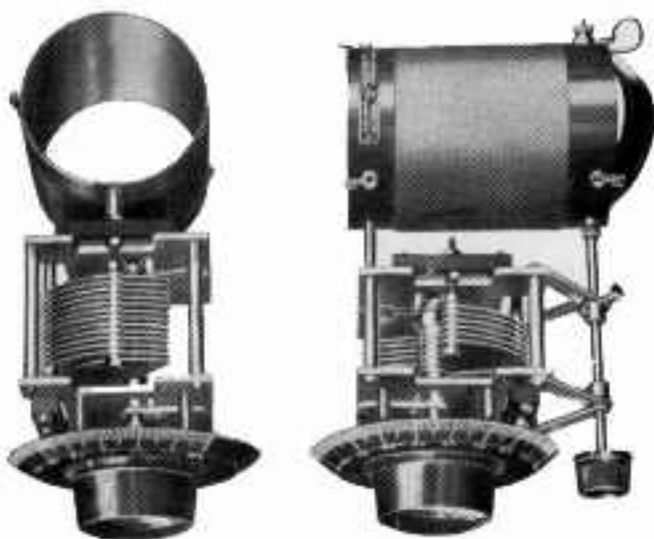
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