Evereadys have long-lasting power

The long-lasting power of Evereadys more than justifies their price. It is false economy to buy batteries that may be cheaper in first cost, but which are much shorter lived. Considering price and size, Evereadys are the most economical batteries there are, and in addition they are most satisfactory. Buy Eveready "B" Batteries. To light the filaments of all radio dry cell tubes, use the famous Eveready Columbia Ignitor.

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, Inc.
New York San Francisco
Canadian National Carbon Co., Limited
Toronto, Ontario

EVEREADY Radio Batteries
— they last longer
Do you believe in Names?

Do you buy things by name because the name tells the quality? Do you ask for a RADIOTRON, instead of just a "vacuum tube"—demand the standard by the name that marks it as genuine?

The most important part of a radio set is the tube, and you can’t get the best out of any set without putting the best tubes into it. There’s a Radiotron for every use, in every kind of set. Look for the name—and the RCA mark—and be sure it is genuine.

Radio Corporation of America
Sales Office: Suite No. 716
231 Broadway, New York
10 So. La Salle St., Chicago, Ill.
28 Geary Street, San Francisco, Cal.

Radiotron
PRODUCED ONLY BY RCA
Contents — June, 1925

Summer Camp Set ........................................... 285
Regulating the Filament Voltage .......................... 292
Transformer Curves ......................................... 293
Editorial ......................................................... 295
Production Type Hydraulic Press ......................... 296
Cages for Receiving ......................................... 297
Working Data on Standard Radio Products ............... 299
With the Manufacturers ..................................... 300
Data on Dials, Sockets, and Transformers ............... 301
Storage Battery Panel ....................................... 309
Does It Help to Tune the Antenna? ......................... 310
New Method for Making Connections ..................... 312
Stations Don't "Bunch" On the Dials

The location of the same stations on the same dial using Ultra-LowLoss Condensers—"spread"—simplifying tuning.

Tuning Simplified Now!

The day of tedious fumbling about for your stations is past—science has been brought into play. Now, with the Ultra-LowLoss Condenser you can instantly tune in any station as easy as turning the hands of a clock to the hour.

With one station of known wavelength located on the dial, all others can be found instantly. Each degree on a 105 degree dial represents approximately 3½ meters difference in wave length. This applies to both high and low wavelengths. Other than 100 degree dials vary accordingly.

This simplification of tuning is made possible by the new Cutless Stator Plates to be found only in the Ultra-LowLoss Condenser. Every feature of the Ultra-LowLoss Condenser was developed with one predominant purpose—in overcoming those common in other condensers. Designed by R. E. Lazard, originator of the famous Ultralux Receivers and Ultra-Vernier Tuning Controls.

At your dealers, otherwise usual postage price and you will be exalted postpaid.

Design of lowloss coils furnished with each condenser for amateur and broadcast wavelengths showing which will function most efficiently with the condenser.

TO MANUFACTURERS WHO WISH TO IMPROVE THEIR SETS

Mr. Lazard will gladly consult with any manufacturer regarding the application of this condenser to all circuits for maximum and possible efficiency.

ULTRA-LOWLOSS
CONDENSER

PHENIX RADIO CORPORATION
116-D East 25th Street, New York City
By-Pass Condensers do a double job. They filter the fluctuating "B" battery current. They provide a free path for the radio frequency currents around the high internal resistance "B" battery.

The first function tends to remove disturbing noises—the second increases efficiency by reducing losses and properly routing the available energy.

The tone quality of every set will be greater in strength—purer—smoother—with a By-Pass Condenser.

Dubilier
CONDENSER AND RADIO CORPORATION
Summer Camp Set
A Set Designed to Meet the Special Summer Requirements Which Our Readers Have Specified

With the advent of warm weather, special sets appear automatically—types which, in most cases, reflect the ideas of the designers as to the way in which they think radio sets should be used, rather than the way most people want to use them.

Bearing this in mind, the type 7600 set was planned in accordance with specifications which we obtained from our readers. From the information and suggestions received, it appears that the most popular use for a radio set in the summer time is as a semi-permanent installation in a summer camp. Apparently the photographs showing people dancing to radio music on the beach, listening in on picnics, and installations for automobiles are simply posed for news pictures.

There is a real use for radio sets at summer camps where, out of touch with news from the cities and at some distance from the theatres, radio does serve a real useful purpose.

Design of the 7600 set was planned in accordance with specifications which we obtained from our readers. From the information and suggestions received, it appears that the most popular use for a radio set in the summer time is as a semi-permanent installation in a summer camp. Apparently the photographs showing people dancing to radio music on the beach, listening in on picnics, and installations for automobiles are simply posed for news pictures.

There is a real use for radio sets at summer camps where, out of touch with news from the cities and at some distance from the theatres, radio does serve a real useful purpose.

Design of the 7600 set was planned in accordance with specifications which we obtained from our readers. From the information and suggestions received, it appears that the most popular use for a radio set in the summer time is as a semi-permanent installation in a summer camp. Apparently the photographs showing people dancing to radio music on the beach, listening in on picnics, and installations for automobiles are simply posed for news pictures.
a 2-step audio amplifier so that distant stations can be brought in with loud speaker volume.

Consequently, we chose this circuit for the summer camp set as it is capable of bringing in distant stations, even with the dry cell tubes, with splendid volume. The set is not recommended for use in the city because it is of the single circuit regenerative type and radiates considerably. Out in the country this is not an objectionable feature as it is not liable to interfere with reception at other stations.

As you will see from the accompanying illustrations, two vario- meters are provided for tuning, one to regulate the wavelength and the other to make the set regenerative. On the tube panel are sockets for three UV199 tubes with the A.F. transformers mounted below. Instead of using a vernier dial for the tuning variometer, a vernier condenser of the low-loss type is connected across the variometer for fine adjustment. A single rheostat controls all three tubes.

The antenna for this set can be a single wire perhaps 100 ft. long and 10 to 40 ft. high. A fence will serve admirably as an antenna, or a length of insulated wire, 50 to 100 ft. long, can be thrown up into a tree. To allow the use of such a wide variety of antennas a 0.0001 mfd. Mica- don is put in series with the antenna lead inside the set. This is shown in Fig. 4.

The ground must be the best you can get. If there is a pump handy, a wire can be run to it, fastened with a ground clamp on the pipe where it has been thoroughly scraped of rust or paint. Otherwise a wire should be soldered to several tin cans dropped in the water. If there is a fence nearby in which the horizontal wires are not connected together, the top wire can be used for the antenna and the bottom wire for the ground.

A medium size 45-volt B battery is recommended, with four dry cells connected in series for the A battery. Usually only three dry cells are used, but, for this set, four are better. The rheo- stat, of 20 ohms, takes care of the extra battery. If there is any place where a storage battery can be re- charged every two or three weeks, it may be more satisfactory to use the little 4-volt Philco glass case battery. This is a small light unit designed especially for 199 tubes. The Philco battery is equipped with two small colored balls. When the battery is fully charged, both of the balls are at the top of the electrolyte, when the battery is partly discharged, one ball drops, and at full discharge, the second ball drops. In this way ample warning is given that recharging is necessary.

No cabinet is shown for this set because the individual builder may want to incorporate the batteries in the cabinet or put them up in a separate box. Both the batteries and the set should be protected from moisture particularly if the outfit is to be operated near salt water. This factor has been considered in working out the details of the design. Moreover, the construction is very rugged in order
that the set may withstand a reasonable amount of rough handling.

The General Radio variometers work very nicely into this circuit because of their small size. If you change the construction of this set, be sure to keep the variometers about the same distance apart, for the operation of the set depends in part upon a coupling effect between the antenna, variometer, and the plate variometer. Also, metal objects should be kept away from the open end of the stator coils.

The New Following up the announcement of the new panel sizes, this set has been worked out in accordance with the two-level plan. That is, a panel 12 ins. high is used, with the tubes in one row across the top, the transformers below, and the tuning instruments on the lower level. This makes the arrangement much easier to work out, and allows the location of the tuning dials at the center of the panel instead of at the left hand side, where they are ordinarily placed. Thus they can be easily regulated with the right hand.

On this particular set, a sub panel, 3½ ins. wide, is used to carry the transformers and tube panel supports. Then the sub panel is fastened to the front panel with only four screws. This is done simply to reduce the number of screws showing on the front panel.

Other sets of various types, built on the 2-level system, will be described subsequently.

Standard A complete list of the standard parts is given separately. Required Special makes have been specified wherever other makes of similar instruments would require special drilling.

The set as made originally at the Darien laboratory was made up on Radion panels for we wanted to find out whether or not, on a set of this sort, there would be any difficulty from warping. Of course, any insulating material is liable to warp if it is subjected to a considerable strain. In this outfit we tried to arrange the design so that the load was well distributed and, we were glad to see, the hard rubber did not warp at all. The front panel measures 8 by 12 by 3/16-in., while the tube and sub panels, each 7 ins. long, were cut from a strip 3½ by 14 by 3/16-in. Strips of this width have become practically standard for tube panels.

For instruments, there are two General Radio variometers, 1 to 3½ and 1 to 6...
National A. F. transformers, a 20-ohm General Radio rheostat, three Naald UV-199 sockets, Walbert lock switch, six Eby Ensign binding posts, 0.0001 and 0.0005 mfd. Micadons, a 0.00025 mfd. Micadon with gridleak clips; 2-megohm Durham gridleak, Continental Junior vernier condenser, open circuit Carter jack, and two 3-in. Kurz-Kasch knobs and dials. Two Naald tube brackets are used to support the tube panel.

Drilling The picture wiring diagram, in Fig. 4, is drawn to a scale of -in. to the inch. You can scale off the dimensions from that drawing or, if you want the full size dimensions, you can get the blue print panel patterns for the type 7600 receiver. In the blue prints all holes which are not marked otherwise are to be made with a No. 18 drill. Concentric circles indicate that the hole must be countersunk for a flat head screw. Holes of special sizes are marked accordingly.

To transfer the dimensions from the blue prints to the panels, hold the print in position on the panel and mark through with an automatic center punch. This is more satisfactory than a plain punch and hammer, and since it requires only one hand, the other hand is free to keep the blue print in position. Radion or Bake-lite panels are made with such a highly polished surface that most people prefer to leave them bright. If you want to rub down the panels, use No. 1 sandpaper and oil. The oil prevents the sandpaper from becoming clogged up with dust.

Suggestions The assembly and wiring instructions have been planned so carefully, in conjunction with the picture wiring diagram, that there is no excuse for not making a neat job of the wiring. The connections should be made with Wirit. Do not use this wire as it comes from the spool, but unwind 10 or 15 ft. and stretch it until all the kinks are taken out. Then cut it up into 18-in. lengths. With this clean, straight wire, even a beginner should be able to make the connections look attractive.

Use tinned lugs, not the nickel plated kind. Tinned lugs are stamped from copper or brass sheet which is tinned before stamping. Put the lugs on each instrument as it is assembled, and make sure that each lug is pointing in the right direction, as shown by the short heavy lines in Fig. 4 before the nuts are tightened.

Assembly Altho the real purpose of the sub panel is to carry the transformers and panel supports, so that only four screws will appear at the front of the front panel, the arrangement helps greatly to simplify the wiring of the set because the sub panel and tube panel can be put together and wired up before the sub panel is fastened to the front panel. The instructions follow this procedure, covering first the assembly and wiring of the sub and tube panels and then the additional work of mounting and wiring on the front panel.
1. Fasten the center socket to the tube panel, using \(|\frac{3}{4}\)-inch 6-32 R. H. screws. Then fasten the two outside sockets and the Naald mounting brackets on the underside, putting \(|\frac{3}{4}\)-inch 6-32 R. H. screws through the socket, panel, and bracket. Looking at the set from the rear a lug should be put under the head of each left hand socket mounting screw, pointing directly toward the plus socket binding post. Also, lugs pointing to the rear should be put under the nuts of the three socket mounting screws on the underside. These are numbered 1, 2, and 3.

2. In the picture wiring diagram, Fig. 4, the tube panel is shown tipped up in order to make the wiring more clear. The lugs under the heads of the socket mounting screws are numbered 4, 5, and 6. Put lugs under each plus terminal on the sockets, and solder them to the lugs under the heads of the socket mounting screws. This makes connection 4 to 7, 5 to 8, and 6 to 9. Run a wire from 1 to 3, on the underside of the panel, and connect lug 2 to this wire. Put lugs on each minus socket binding post. These are numbered 10, 11, and 12. Run a wire from 10 to 12 and solder it to lug 11.

3. Mount the five Eby binding posts on the tube panel, having the lugs point in the direction shown by the short heavy lines in the picture wiring diagram. Note that the A + and A — binding posts require two lugs.

4. Connect 13, on the A + post, to 14, on the GND post. This wire must be insulated with varnished tubing.

5. Fasten the sub panel to the supporting brackets with \(|\frac{3}{4}\)-inch 6-32 F. H. screws but do not put screws through the lower inside legs of the transformers. See that the \(|\frac{3}{4}\) to 1 transformer goes to the left, looking at the set from the rear, and the 0 to 1 transformer on the right.

6. Connect 15, and G post of the socket, to 16, the G post of the transformer. This wire goes through a hole in the tube panel. Connect 17, the P post on the socket, to 18, the P post on the transformer. This wire also goes through a hold in the tube panel. Connect 19, the G post on the socket to 20, the G post on the transformer. This wire goes through a hole in the tube panel. Connect 21, on the A — binding post, to 22, the F— terminal of the right hand transformer, and also to 23, the F— terminal on the left hand transformer. Connect 24, on the + 45V binding post, to 25, on the + B transformer terminal. This wire must be insulated with varnished tubing.

7. Mount the rheostat on the front panel, putting a lug on the center binding post, pointing straight to the rear, and a lug on the left hand binding post, pointing to the side. Mount the open circuit jack with the frame at the top, put the vernier condenser on the panel, and mount the two variometers, using \(|\frac{3}{4}\)-in. 6-32 R.H. screws. Make sure that the terminals of the variometers are at the top. Put a lug under the nut of each upper variometer mounting screw. You can see these connections in Fig. 2.
Put a 3⁄8-in. 6-32 R.H. screw through one terminal of a 0.0001 mfd. Micadon and secure a lug, pointing to the side, under the nut. Then put the antenna binding post on the front panel, fasten it with a nut, then put the other terminal of the Micadon on the binding post screw, and clamp the Micadon with a nut at the top. This arrangement can be seen in Fig. 3. Finally, mount the lock switch with the terminals as shown in Fig. 4, but do not bend out the soldering tabs.

8. Connect 26, on the variometer mounting screw, to 27, the rear lug on the vernier condenser. Put a lug on the front terminal of the variometer, pointing upward, and bend it to the right. This is terminal 28. Connect 28 to 29, the forward terminal of the vernier condenser which is connected to the fixed plates. Connect 28 to 30, the lower lug of the Micadon, and solder the left hand terminal of a 0.00025 Micadon with gridleak mounting clips to 28. This arrangement can be seen in Figs. 2 and 3.

9. Mount the sub panel on the front panel by putting 3⁄4-in. 6-32 F.H. screws through the front panel, the sub panel, and the inside holes of the mounting brackets, and through the front panel, sub panel, and lower inside legs of the A.F. transformers.

10. Bend the terminals of the lock switch outward and connect 31, on the A+ binding post, to 32 on the lock switch; connect 32 to 27; connect 33, a connection on the wire running from 1 to 3, to 34, on the lock switch; and 35, the P terminal of the socket, to 36, the upper contact of the jack. This last wire must be insulated with tubing.

Connect 37, the +90V binding post, to 38, the lower terminal on the jack, soldering the wire to 39, the +B post on the transformer; 40, on the rheostat, to 41, the other lug on the A— binding post, insulating the wire with tubing; 42, a point on wire 10 to 12, to 43, the center terminal of the rheostat; 44, the P terminal on the socket, to 45, the lug on the upper mounting screw of the variometer; 46, the P terminal of the transformer, to 47, the top terminal of the variometer; and 48, to G post on the socket, to 49, on the grid condenser.

Solder 1-in. lengths of wire to the B+ and P terminals of the 6 to 1 transformer, pointing straight to the rear. Then, solder these wires to the terminals of a 0.0005 mfd. Micadon, making connections 50 and 51.

Set the rotors of the variometers exactly inside the stators so that the lead from the rotor winding to the shaft at the front of the left hand variometer is at the left, and the lead on the right hand variometer from the rotor winding to the shaft at the front is at the right.

Then put the dials in place so that the zero lines coincide with the lines on the panel. If this is done, increasing the dial reading will increase the wave length or the regeneration. Fasten the knob and pointer to the vernier condenser so that the pointer is up when the variable plates are half way inside the fixed plates. Have the pointer of the rheostat down and to the left when the contact arm is in the open circuit position.

When you have completed this work, check the wiring carefully against the schematic circuit shown at the bottom of Fig. 4.

**Testing and Operating**

Every set builder should have a good volt meter reading up to about 10 volts. It must be of the high resistance type, not the ordinary pocket voltmeters, for they draw more current than a vacuum tube. An instrument such as the Jewell model 53 type has 600 ohms resistance, so that at 3 volts the meter draws only 5 milliamperes.

Connect the A battery to the set and adjust the rheostat until the voltmeter, connected directly to the filament binding posts on the socket, reads 3 volts. At this setting you will not overload the tubes.

The importance of this test is indicated by the fact that an overload of 0.15 volt reduces the life of the tube 50%, while an overload of 0.3 volt reduces the life of the tube 75%.

Next, with the switch closed, connect the A battery from the A— terminal to +45V, and then to +90V. If the tubes light at either of these connections there is a mistake in the wiring.

Put the A battery connections back
Fig. 4. Picture and schematic wiring diagrams of the type 7600 set. Dotted lines represent the wires on top of the tube panel.
Regulating Filament Voltage

Do you know whether the results from your set are due to its efficiency, or if they are obtained by overloading the tubes?

The results of comparative tests of radio receiving sets vary as widely as audibility measurements, and for much the same reason—the human element. On tests it is natural to push the tubes far beyond their normal operating voltage. In this way the volume is increased in the R.F. circuits by introducing a tendency to oscillate, and in the A.F. circuits by overloading the tubes. Obviously this is unfair, not only because the increase in volume is achieved at a sacrifice of quality but because, under these conditions, the tube and B battery life are greatly reduced.

At the Darien laboratory when a set is being tried out we have made a practice of letting the demonstrator adjust the controls for what he considers best results. Then we measure the voltage across each tube and the total current drawn from the B battery.

Invariably, we find 5.5 to 6 volts on the filaments of UV201-A tubes and 4 to 4.5 volts on UV199's, while the B battery current is usually 20 to 50% greater than the value with 5 and 3 volts respectively on these types of tubes.

From this you can see that tests to be of real usefulness must be made under real operating conditions, for no one would knowingly buy a set that, to get satisfactory results, required the tubes to be operated at a filament voltage and plate current that fairly eats up both tubes and B batteries. Another thing—some sets tend to oscillate more readily than others when the tubes are overloaded. Therefore, a set which does not come up to another under normal conditions may give greater volume when it is forced.

To test the voltage across the tubes, run leads from the voltmeter to the terminals on each socket. Be sure to use a high resistance voltmeter. If the brilliance of the filament changes when the voltmeter is connected, the meter is not suitable and does not give a true reading.

Remember that the B battery consumption is greatly increased when the filament voltage is allowed to exceed its named value. By putting the correct voltage on the filaments you can save 20 to 50% of the B battery current, which will quickly pay for the cost of a good meter.
Transformer Curves and the Piano Scale

As amplification curves are ordinarily drawn, they do not give a true picture of the results.

Gradually we are learning to translate radio from the specialized science which it appeared to be at first into terms of everyday science with which we are all familiar. Transformer, resistance, and impedance amplification are being straightened out gradually, with the prospect that we shall have this very important part of radio reception boiled down to a real starting point, even though much remains to be done before we can accept any one method as the ultimate development.

The following curves may come as a shock to those who feel that transformer design has brought amplification close to perfection, but the purpose of the data presented is to show how much remains to be achieved rather than to show how poor good transformers really are.
Perhaps the best picture of amplification can be obtained from the piano scale. Transformer manufacturers generally consider the high audio frequencies, from 400 to 4,000 cycles, as those of importance in the reception of music. On the piano, 400 cycles is four notes above middle C, while 4,000 is a little beyond the upper end of the scale. Imagine what kind of music you would get from a piano if it had no keys below middle C. The lowest key on the piano vibrates at a frequency of 27.

The lower curve in Fig. 1 is a typical amplification curve of a very good transformer. It looks, at first glance, as if it is doing excellent work. But it seems that way because the frequency is evenly divided. Middle C is shown on the bottom line, and the octaves above and below indicated by short marks.

Above is the same curve, also covering a range of 2,000 cycles, but laid out with the octaves evenly spaced. Taking 256 cycles as middle C, the frequency is doubled at each octave. This is slightly different from the frequencies to which the piano notes are adjusted, but only by a few cycles. The amplification at each frequency is exactly the same as is on the curve below, yet how different it looks! Now you can see clearly that, at middle C, the amplification is only 77% of the maximum; at an octave lower, the amplification drops to 46%, and another octave down, 23%. To put it differently, the amplification at 512 cycles is 24% greater than at middle C, and 36% lower at 128 cycles. That looks like considerable distortion.

With some musical instruments it is, and with some it isn't, for the peculiar qualities of different instruments is determined by the harmonics. The distortion, then, depends upon the amplification of the harmonics as well as the fundamental frequency.

If, however, we are to get a practical picture of amplification the curves must be drawn with the octaves evenly spaced.

---

**Next Month: Article of Startling Importance**

**PASSING** over the developments of the last six years which have been hailed as "revolutionary," we have the rise and fall of super-regeneration, the neotrodyne degenerated into a tuned R. F. losser, the super-heterodyne has not produced results that simpler sets cannot equal, battery eliminators have not eliminated batteries, the A. C. filament tube, the latest of the amazing inventions, is after all only a vacuum tube with a different kind of heater.

For all the straining of thousands of radio workers, there has not been produced an idea that is fundamentally new or different, representing an advance that could startle us, puzzle us, make us wonder how it can be done, or amaze us by the temerity of the inventor who had the idea that he could do it successfully.

It is to be expected, perhaps, because **Radio Engineering** has always pioneered in introducing things of practical importance, that we shall have the privilege of bringing out in the July issue the full details of an invention which is fundamentally new, which represents an improvement of vital importance, and which introduces a principle never before employed in radio reception. In fact, the entire physics and chemistry involved are almost unknown to science.

In addition to this construction article, **Radio Engineering** will have a series of exclusive articles, written by the inventor, covering the complete theory, design, and application of his achievement.

Although other publications will have articles on this subject, only **Radio Engineering** will have the original data from the inventor.
IF YOU think the age of superstition is over, listen in on some of the conversations in the radio stores and you will change your mind. Superstitions are mistaken ideas based upon a misconception or ignorance of the truth, whether they concern spilled salt or oscillations.

Today, the pet radio superstition has to do with neutralizing. Professor Hazeltine developed the neutrodyne receiving circuits on sound, logical principles. However, for all the articles explaining the truth of his neutralizing method, comparatively few people took the trouble to understand this system. Instead, most everyone simply assumed that “neutralizing” a set meant stopping the oscillations.

Hence the neutralizing superstition which came about through ignorance of the neutrodyne principle.

It is extremely difficult to build a tuned R. F. receiver with low-loss tuning circuits and to make it non-oscillating, by means of neutralizing condensers, over the entire wavelength range. With the possible exception of the Howard Radio Company, not one of the neutrodyne licensees obtains the full efficiency which a neutrodyne circuit is capable of giving because they depend as much on losses in the tuning circuits as on the neutralizing condensers to prevent oscillations.

The manufacturers of plain R. F. sets are entirely dependent upon losses. Sets advertised as being "self-neutralized," or coil and condenser combinations "self-neutralized," are not neutralized in any way at all. They are so constructed as to have high resistance in the coils. Low resistance—high efficiency—circuits oscillate readily. If the resistance is high—the efficiency correspondingly low—oscillations will not take place. One of the easiest ways to increase the losses, or resistance, is to mount the coils so that their fields cut the metal plates of the condensers. This was explained in the November 1924 issue.

The tuned R. F. set owes its existence largely to the fact that the majority of radio manufacturers do most everything for no better reason than that everyone else does it. They thought they were making "self-neutralized" sets. They didn’t know they were making sets so full of losses that oscillations couldn’t take place! They thought they were doing a real job when they connected low-loss condensers to coils of such high resistance that the oscillations were choked out.

Occasionally we get a letter from a set builder who complains that, with low resistance pickle-bottle coils, it is impossible to neutralize the set. He really means that the losses are too low to choke the oscillations.

That is why four-tube radio sets using low-loss coils and condensers in circuits that do not depend upon the introduction of losses to stop oscillations can out-perform any of the five-tube sets in which an extra stage of R. F. is necessary to make up, in part, for the low efficiency of the high resistance tuning circuits.

Why not turn the light of knowledge on this neutralizing superstition and do a little constructive thinking?

In the next issue of Radio Engineering you will find some preliminary data on a set which, without the use of a regenerative circuit, potentiometer, or even the readjustment of a rheostat, gives an efficiency equal to that of a regenerative set, yet it does not oscillate over the entire range from 250 to 600 meters.

M. B. SLEEPER,
Editor.
Production Type of Hydraulic Molding Press

Features of the Hydraulic Press Manufacturing Company's plastic molding press, designed for high speed production of Bakelite parts

The hydraulic molding press, as it has been built, is a rather cumbersome affair, and not well adapted for working at a high rate of speed. The action of the press itself is slow and a great deal of hand work is required on the part of the operator.

With this in mind, the new H-P-M universal automatic press has been developed to reduce the amount of attention required by the operator, the idle time between molding operations, and the number of defective parts.

Essentially the improvement in this type of press is in the design of the revolving head and the sliding arrangement for the table which carries the lower half of the molding die. Fig. 1 shows the press in the open position. Comparing it with the illustration on the right, you will see that the table moves forward and the head is thrown up at the end of the operating cycle. These movements are controlled automatically.

To go through the sequence of operations, with the lower half of the die forward and in a position easily accessible, the operator cleans the dies, puts in new inserts, and reloads with raw compound. Then he throws a small lever which starts...
a motor mounted just inside the left hand forward leg. Thereupon the table slides back, the head turns down, and takes up the closed position while steam is applied to the chambers of the upper and lower dies. Low hydraulic pressure is applied to the main press cylinder for closing the dies fully. After the Bakelite has become plastic and has had an opportunity to flow in every corner of the die, high hydraulic pressure is applied to the main press cylinders. Then the steam supply to the die chambers is cut off. Next, cold water is circulated through the die chambers for chilling and setting the molded pieces. High pressure is cut off from the main cylinder which is then connected with a return line. The main ram is withdrawn through the action of auxiliary rams, thus separating the two halves of the die. In the final movement the head, carrying the upper part of the die, is revolved through an angle of about 120 degrees while the table moves forward again. At the same time an ejection mechanism is automatically operated simultaneously in the head and on the table. This permits the use of ejection pins in both halves of the die or in either one, as may be required. This concludes the cycle of operations. A simple electric cutout mechanism is actuated by a cam and the motor stopped until the operator is ready to start it again to put the press through the next series of operations. It should be noted that the ejecting mechanism does not operate during the return movement.

Different kinds of pieces require different timing, of course. This factor is taken care of by the design of the controlling mechanism. The total time for an operating cycle can be increased from the minimum by 500%. The nine steps are regulated by individual speed change mechanisms and any one stage can be altered in its sequence by adjusting the position of the corresponding cam, or it can be eliminated altogether.

The valve cams are designed as units so that, when the die equipment is changed, the entire set of cams can be changed also, if the new piece of molding requires an altogether different timing. The making of the cams is so simple that they can be turned out easily and cheaply by the maintenance department of any molding plant.

From the description you will see that no attention to the press is required except for removing the pieces, cleaning the dies, and reloading. Moreover, the timing is not dependent upon the attention of the operator. Therefore, one man can handle two or more machines. In addition, defective pieces resulting from the lack of attention on the part of the operator to the timing are entirely eliminated.

Cages for Receiving

An increasing number of cage antennas are to be seen now-a-days at stations of the better sort. Unlike the cages for transmitting, these are of small diameter, about 6 ins., with hoops made of 3/8-in. brass rod which have been hammered around wooden mandrels.

The accompanying illustration shows a typical installation using a Hull mast for support at the far end. For receiving, six or eight wires should be used, each one soldered to each ring or hoop. Not only does this type of antenna give increased efficiency, due to its lower resistance, but it provides great mechanical strength. In combination with the Hull mast, which is tested for 500 lbs. pull at the top, it gives a storm-proof strength which ordinary antennas do not have.
64. NATIONAL VERNIER DIAL: This vernier dial, which has a 5 to 1 ratio, represents a distinct departure from the ordinary type employing reduction gearing. The vernier depends for its action upon friction discs held in place by springs. The entire friction disc mechanism is enclosed in a box made of stamped brass. This box is fastened to the front panel with four round head machine screws. The movable face of the box fastens to the 4-in. or 3-3/8-in. diameter dial which has graduations on it. A knurled knob fastens in front of the dial by means of a set screw. The collar which receives the condenser shaft goes through the front panel and is fastened to the shaft with a set screw. When using this dial with other than National variable condensers, the shafts must be cut off so they just barely reach to the front face of the front panel when mounted.

65. FEDERAL BUZZER: This instrument was especially designed for radio work and is very rugged and compact. The buzzer mechanism is mounted on a hard rubber base which has two countersunk holes for mounting, with the two 5/8-in. F. H. wood screws provided. A black enameled brass cover encloses the buzzer mechanism protecting it from dust and mechanical injury. Three holes are provided in the base for bringing connections to the instrument. Hole A goes to one side of the winding. Hole B goes to the frame. Hole C goes to the contact arm.

66. THORDARSON A. F. TRANSFORMER: This transformer is made in both 3 ½ to 1 and 6 to 1 ratios. The coils are square in cross section, and fit over a liberal sized silicon steel core made up of very thin laminations. This is responsible for the excellent tone quality for which these transformers are noted, and makes them exceptionally suitable in sets having a large output. The windings are shielded by an aluminum case. The binding posts are at the top and are marked as shown. Four mounting holes are provided at the base.

67. BRACH-STAT: This device is an automatic filament current regulator for use on radio sets in place of the ordinary rheostat. The resistor element is enclosed in a fibre cartridge having metal end caps for snapping into a holder. The Code B type is designed for use with a UV201-A or C301-A tube, on 6 volts. Other types are made for various tubes and A battery voltages.

68. GRAY LIGHTNING ARRESTER: This item represents a new design of lightning arrester which can be connected directly across the antenna and ground binding posts of the set. The two small plates are assembled with Micarta on the outside, the entire unit being held together tightly by six eyelets. Two lugs are provided for connection and they have center holes large enough to permit their being slipped directly on ordinary binding posts. The arrester is very compact and is out of sight when placed at the rear, or inside of any set.

69. WALBERT SOCKET: The Walbert socket is an all-bakelite socket with a reinforced rim of nickled brass to prevent chipping and breaking out at the tube slot. The contact springs are unique in that they make contact with the tube prongs both at the bottom and side. Each spring is made of a single piece of metal, terminating in a soldering lug at the corner of the socket. This construction eliminates any possible resistance arising from poor contacts through binding posts. Two mounting holes are provided in the base, as shown. The springs are permanently fastened to the socket base with eyelets.
EVERYONE who is interested in tube tests should have a copy of the new Jewell circular which describes the use of the Jewell radio test set No. 95. In addition to some very interesting information on vacuum tube testing in general, there is some important special data on the quick determination of mutual inductance, amplification constant, and plate resistance. Another circular describes the super-heterodyne voltmeter panel, a panel identical to that used at the front of the right hand battery box, on which is mounted a 0 to 5 volt meter. Leads with special terminals are supplied for connecting to the batteries.

A special type of tube, designed with a high amplification factor for use in resistance coupled amplifiers, has been brought out by the Cleartron Company. Tests which we have made show that, with these tubes, greater amplification can be obtained from a 3-stage resistance coupled amplifier than from a 2-stage transformer amplifier. The introduction of these special tubes indicates the increasing popularity of the resistance coupled amplifier.

The Aerodyne Company of New York has been appointed the exclusive sales agent for the Tridot Electric Company, manufacturers of gridleaks. Mr. E. P. Chalfant, head of the Aerodyne Company, is also the president of the Motor Accessory Manufacturers Association, and of the Rotary Club of New York.

A new receiving set has been announced by the Sonora Phonograph Company, Inc., of New York City. The outward appearance is unusually attractive, and the price of $90.00, without accessories, puts it in a class to compete with the moderate priced outfits built by other concerns.

Apparently the Jewett Radio and Phonograph Company, of Pontiac, Michigan, decided to make the very finest of cabinets when they designed the Jewett Highboy. As a piece of furniture, it is suitable for any home. From the radio point of view it is all-complete, for it contains a built-in loud speaker and ample space for batteries or an eliminator.

The Brach Manufacturing Company of Newark have brought out a coupling unit for resistance coupled amplifiers. It is fitted with the usual clips for the resistance elements but incorporates an improvement in the mounting for the condenser. Instead of fastening it between clips, the Micadon is held by machine screws and nuts which are connected under the base to the resistors.

A complete line of radio equipment is in process of development by the American Bosch Magneto Corporation whose works are at Springfield, Mass. No information has been given out as to the details of the line but it should contain some excellent features for the most thorough planning has been in progress for some time.
Manufacturers' and Designers'
Reference Data on
Sockets, dials and switches

The data presented have been carefully compiled with the assistance of the manufacturers represented. By removing these pages from the magazine you will have a complete reference file on sockets, dials and switches. Next month this section will be devoted to Batteries, Eliminators, and Chargers.

![Erla Lock Switch](image)

Simplest, sturdiest constructions, pleasing appearance, and double utility unite to give the Erla Lock Switch preference. The smooth, easy movement of the key controls the flow of all currents within the set, putting the receiver into operation or shutting it off complete at a single movement. If desired, the key may be removed altogether, providing a simple but effective lock for the receiver, and preventing damage or abuse by those unfamiliar with its operation.

Phosphor bronze springs of excess carrying capacity insure permanent efficiency. Plunger and shell are heavily nicked brass. The switch mounts like a jack, only one hole being needed.

*Literature, prices and data on request.*

**Electrical Research Laboratories**
2536 Cottage Grove Avenue, Chicago, Ill., U. S. A.
Gets DX—
SLOW MOTION
Tuning

Remember, how the "slow-motion" picture helped you see details that were unnoticed in the usual running?

In a similar way the "slow-motion" (up to a minute of the slow UNIVERSIER) helps you find dozens of stations that are missed if "searching" is done with the usual course adjustment (as you are compelled to do with many so-called vernier dials which merely duplicate the action of the absolute vernier condenser.)

With its经营管理 "slow motion," the UNIVERSIER first finds the station you want—then clears it up. That's why it's such a record-breaker for locating those hard-to-get distant stations and bringing them in as easily, quickly, clear and loud. Promise yourself a real surprise—re różne your dials with UNIVERSIERS tonight!

At your dealer's or send stamped on receipt of purchase price (Please mention dealer's name.)

Mahogany Knob and Gold-plated dial . . . $1.50
Black Knob and Silver-plated dial . . . $1.25

Jobbers and Dealers: Write for Discounts

WALBERT MFG. CO.
911 Wrightwood Ave., Chicago, Ill.

FREE!
Send us stamp for FREE copy of
UNIVERSIER LOG BOOK

Easy to drill and cut

A valuable quality of Radion for set manufacturers

One reason why set manufacturers find Radion by far the most satisfactory panel material is its ease of working. Radion Panels cut, saw and drill perfectly.

Edges are smooth and even; holes are trim and clean-cut. Radion does not chip or peel as do other panel materials. Workmen's time is saved and the finished job is much more attractive.

The beautiful finish of Radion Panels (with Radion Dials to match) enhances the appearance of any set. They are strong. They resist warping. And in these five important insulating qualities Radion is acknowledged to excel:

- Lowest angle phase difference
- Lowest dielectric constant
- Highest resistivity (megohm cm)
- Lowest power factor loss
- Lowest absorption of moisture

Manufacturers: Send us your specifications

We are always glad to co-operate with manufacturers in meeting their requirements. We invite them to send us samples or specifications of panels and other insulated parts of radio instruments or radio parts. Radion is used on the leading makes of condensers.

AMERICAN HARD RUBBER COMPANY
Dept. M N 2, 11 Mercer St., New York City.

Radion
The Supreme Insulation
Here are three models from the new Kurz-Kasch Aristocrat Line of Dials and Knobs. No matter what set you own or manufacture, or what kind of panel it has, or what kind of condensers you use—

The Kurz-Kasch Aristocrat Line will make that set more beautiful and more efficient.

Genuine Kurz-Kasch products bear this trademark on the back of each part—Accept no substitutes.

The Kurz-Kasch Co  Dayton Ohio.
### Specifications for Dials, Sockets, and Switches.

#### INSTRUMENT DIALS

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Outside diameter (inches)</th>
<th>Diameter and depth of hole (inches)</th>
<th>Color</th>
<th>Material</th>
<th>Divisions &amp; Direction</th>
<th>Screw</th>
<th>Fastening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate Products</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W., C. C. W.</td>
<td>80-1</td>
<td>S. S.</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>5</td>
<td>3/4 x 1/4</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>4</td>
<td>3/4 x 3/4</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>3</td>
<td>3/4 x 1/2</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Amsco Products, Inc.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Amsco Products, Inc.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Ajax Electric Specialty Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Amsco Products, Inc.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Apex Electric Mfg. Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Brass, Silver, Gold</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>12-1</td>
<td>S. S.</td>
</tr>
<tr>
<td>Ballantine Insulating &amp; Comp. Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Ballantine Insulating &amp; Comp. Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Ballantine Insulating &amp; Comp. Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Chas. J. Branson, Inc.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Bremer Tully Mfg. Co.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Electrical Research Laboratories</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Gold, Silver</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>General Instrument Corp.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Gold, Silver</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>General Radio Corp.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Brass, Silver, Gold</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>General Radio Corp.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Haward Mfg. Co.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Heilman Electric Co.</td>
<td>4</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>International Insulating Corp.</td>
<td>3</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>International Insulating Corp.</td>
<td>3</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>International Insulating Corp.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Kellogg Swb’d. &amp; Supply Co.</td>
<td>2</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
<tr>
<td>Kellogg Swb’d. &amp; Supply Co.</td>
<td>1</td>
<td>3/4 x 1</td>
<td>Black, Mahogany, Walnut</td>
<td>Bakelite</td>
<td>100 – C. W., A. W.</td>
<td>None</td>
<td>S. S.</td>
</tr>
</tbody>
</table>

---

**Vernier**

**Fastening**
<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Type of tube</th>
<th>Height, width, length (inch)</th>
<th>Material</th>
<th>Type of Contact</th>
<th>Contact Material</th>
<th>Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alden Mfg. Co. (Panel mfg. brackets supplied)</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Side &amp; Bottom</td>
<td>Phosphor Bronze</td>
<td>Base or Panel</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Side &amp; Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Side &amp; Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Side &amp; Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Alden Mfg. Co.</td>
<td>W D-11</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Side &amp; Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Amoson Products Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Ballston Insulating &amp; Compo. Co.</td>
<td>Standard (single)</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Ballston Insulating &amp; Compo. Co.</td>
<td>Standard (triple)</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>Standard</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>109</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>109</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>109</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>109</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>109</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>109</td>
<td>$1\frac{1}{2} \times 2\frac{3}{4} \times 2\frac{1}{4}$</td>
<td>Bakelite</td>
<td>Bottom</td>
<td>Phosphor Bronze</td>
<td>Base</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Movement</td>
<td>Max. diam. behind panel</td>
<td>Over-all depth behind panel</td>
<td>Diameter hole in panel</td>
<td>Front finish</td>
<td>Knob</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------</td>
<td>-------------------------</td>
<td>----------------------------</td>
<td>------------------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>Allen-Bradley Co.</td>
<td>Push-pull</td>
<td>1 in</td>
<td>1 in</td>
<td>1 in</td>
<td>Nickel Plated</td>
<td>Black Fibre</td>
</tr>
<tr>
<td>Benjamin Electric Mfg. Co.</td>
<td>Push-pull</td>
<td>1 in</td>
<td>1 in</td>
<td>1 in</td>
<td>Nickel Plated</td>
<td>Black Fibre</td>
</tr>
<tr>
<td>Carter Radio Co.</td>
<td>Push-pull</td>
<td>1 1/4 in</td>
<td>1 1/4 in</td>
<td>1 1/4 in</td>
<td>Nickel Plated</td>
<td>Black or Mahogany</td>
</tr>
<tr>
<td>Carter Radio Co. (Jack switch)</td>
<td>Push-pull</td>
<td>1 in</td>
<td>1 in</td>
<td>1 in</td>
<td>Nickel Plated</td>
<td>Black or Mahogany</td>
</tr>
<tr>
<td>Central Radio Laboratories</td>
<td>Push-pull</td>
<td>1 in</td>
<td>1 in</td>
<td>1 in</td>
<td>Nickel Plated</td>
<td>Nickel Plated</td>
</tr>
<tr>
<td>Consolidated Instrument Co.</td>
<td>Push-pull</td>
<td>1 in</td>
<td>1 in</td>
<td>1 in</td>
<td>Nickel Plated</td>
<td>Nickel Plated</td>
</tr>
<tr>
<td>Walbert Mfg. Co.</td>
<td>Push-pull</td>
<td>1 in</td>
<td>1 in</td>
<td>1 in</td>
<td>Nickel Plated</td>
<td>Nickel Plated</td>
</tr>
</tbody>
</table>
For Natural Reproduction

Even a genius cannot draw flawless music from an untuned violin. Just so—even the best radio receiver cannot reproduce clear, natural music if it is not sharply tuned.

Every detail of Accurature Micrometer Controls is designed for extremely close, precise tuning... with perfect ease! Sensitive sets are simpler to handle—DX stations can be tuned-in easier—locals much clearer with more volume. Replace ordinary dials without set alterations.

At your dealers, otherwise send price ($3.50) and you will be supplied postpaid.

Write for descriptive folder.

1. Friction Dials—the heart of Accurature Controls. Automatically locks gear trains for sure admissions and three train inter-cocking for fine adjustment.

2. Large sector bushing gives maximum shaft-bearing surface and prevents all wobble.

3. New gear mesh arborizes perfect alignment of the new brass gear train.

MYDAR RADIO COMPANY
9-E Campbell St., Newark, N. J.

EASTERN Pickle bottle COILS

To get the last bit of energy—the bit that makes DX stations come in and ring the bell—use EASTERN Pickle Bottle Coils, designed by M. B. Sleeper. They are endorsed by leading radio editors and engineers as the most efficient low loss winding in existence.

EASTERN Pickle Bottle Coils for the ROBERTS circuit $8.50, for the SUPERDYNE $8, for the THREE CIRCUIT $6, and TUNED R. F., $2 each.

At your dealer’s or direct, postpaid!

EASTERN COIL CORP.
22 Warren St. Dept. R. E. New York
The Spring's the Thing!

Irritating microphonic distortions caused by the transmission of all sorts of outside vibrations to tube filaments, one of radio's most troublesome shortcomings, have been ended. Cle-Ra-Tone Sockets have stopped these tube noises—by "floating" the tubes above all jars and shocks in a spring suspended socket. This exceptional feature, necessary in every radio set, has gained nation-wide popularity since its inception.

Leading radio authorities, radio engineers and widely known radio manufacturers recommend and install them in their finest radio creations.

There are no easily deteriorating parts in the Cle-Ra-Tone Socket. Bakelite is used wherever possible to insure high insulation, sturdiness and long life. Contact points to tube terminals are perfect and permanent. Four lugs make soldering easy. Stiff bus wiring does not affect the flexibility of the supporting springs.

Benjamin Electric Mfg. Co.

247 W. 17th Street
New York
120-128 S. Sangamon Street
Chicago
448 Bryant Street
San Francisco

Manufactured in Canada by the Benjamin Electric Mfg. Co. of Canada, Ltd., Toronto, Ontario

CARTER

Pat. 7-10-23

Rheostats

The latest in Rheostat construction.
No scraping or jerking;
No friction bearing connection;
One hole mounting.
Clock spring pigtail connection insures smooth positive reliable operation.
Vernier control all the way with one knob.
For those who demand and expect precision instruments of demonstrated quality.

Potentiometers

200 or 400 Ohms
$2. Each

3-6-10-20-25-30 OHMS
$1.75 Each

Write for Catalogue of Other CARTER products

Carter Radio Co.
209 S. State Street
Chicago

Any
dealer
can
supply
Better Battery Service

A convenient arrangement for setting up the storage battery and the charger

From all outward aspects, a storage battery, fully charged or empty, is still a storage battery. In our laboratory we originally used a 120 ampere-hour battery, choosing a large one with the idea that, once charged, it would last a long time. Actually, it didn't work out that way because, since it lasted so long on each charge, we never expected it to run down until it suddenly failed at some inopportune time.

Therefore, we went to the other extreme, and made up the panel shown above. This is a little 50 ampere-hour Exide rubber-case battery, mounted on a wooden base board which carries the front panel. At the top of the panel is a little O-7 voltmeter, with a D.P. D.T. Marco switch below.

Two binding posts are provided on each side, at the left for the charger leads, and at the right for connections to the top of the laboratory bench. The charger posts, positive at the top, are wired to the left hand clips of the switch, another pair of leads go from the battery to the center of the switch, while the output posts are connected to the right hand clips. A fourth set of leads go from the voltmeter to the right hand clips.

When the battery is in use, the switch is thrown to the output side. This connects the battery to the wires running up to the bench, and puts the meter on. It is an easy matter to keep an eye on the needle. As soon as it falls below 6 volts, we put the switch to the left, and turn on the charger. At night, when we close up, we open the switch. Then we are sure that none of the tubes will be left lighted. You will note that the meter is across the battery only while it is in use.

As a precautionary measure, if the battery is working hard all day long, we usually throw it over to charge during the night. Battery manufacturers tell us that the life is greatly reduced if it is run regularly from full to empty, and that batteries last much longer if they are not allowed to go below 50% discharge. We haven't had the little Exide long enough to make any comparisons, but it is certain that, with the small size, we manage to get better storage battery service and to give the battery better attention than we had the big one.

Another thing, frequently it is necessary to put one of these units on the portable bench, or to put it up on a board during special tests. Then the case with which it can be moved around is an important factor.
Does it Help to Tune the Antenna?

Showing by actual results the effect of capacity and inductance tuning in the antenna circuit

Until the advent of the neutrodyne type receiver, practically all sets were arranged for antenna tuning, either by means of a variable condenser, tapped inductance, or both. Radio Engineering was the first publication to show the fixed coupler applied to various types of circuits, April 1923, particularly the three-circuit regenerative tuner, which was shown in May 1923.

To quote from that issue, "That it is unnecessary to tune the primary circuit can be demonstrated by setting the inductance switches at any points and tuning in signals. Then change the switches, readjust the secondary condenser, and the signals will come in as before. Change the switches again and you will find that the signals can be brought back by the secondary condenser. This is conclusive evidence that switches, too, are unnecessary."

But someone raised the question recently about possible advantages that we may be overlooking in accepting the untuned primary as final. Accordingly we made a series of tests to bring out the practical value, if any, of the tuned antenna circuit. There are various ways to get at this information, but we tried to choose the most direct means of finding out what tuning in the antenna circuit mean in terms directly applicable to receiver design. Here is the method:

A radio frequency oscillator using a UV201-A, with 90 volts on the plate, was set up on one bench. Four turns of small wire were wound around the oscillator inductance to provide coupling. One lead from this four-turn coupling coil was run to a calibrated variable condenser,* and the other side of the condenser to a 30-ohm Carter rheostat. Leads were then run from the other side of the rheostat and of the coupling coil to the 6-turn primary of an Eastern pickle-bottle coupler.

This circuit served as a dummy antenna, the variable condenser and rheostat providing the antenna capacity and resistance, and the leads and the rheostat winding sufficient inductance.

The secondary of the pickle-bottle coil was connected to a variable condenser, with a Weston thermo-galvanometer in series to indicate the current in the secondary circuit. The complete layout represents the equivalent of a transmitting station, antenna, and tuner, with the meter to show the current in the tuning circuit.

You will see in Fig. 1 a diagram of the oscillator. The coil L1L2 is a General Radio inductance with a center tap. All the other parts were selected from odds and ends around the laboratory. The

* See Radio Engineering, January 1923, page 12.
six sets of curves represent six different wavelengths transmitted by the oscillator—300, 350, 400, 450, 500, and 550 meters—covering the broadcasting range. Since the output of any oscillator varies with the frequency, or wavelength, the curves are grouped as they were made at each wavelength, so that the transmitting conditions would be the same for each group.

With the oscillator set at 550 meters, the antenna condenser was set at 0.0001 mfd. This represents a small in-door antenna. When the secondary condenser was adjusted, the meter read 25. With 0.00015 mfd., the meter stepped up to 31; at 0.0002 mfd., 38; at 0.0003 mfd., representing a large antenna, 54. The secondary condenser was readjusted each time. This shows an increasing current in the receiving circuit as the size of the antenna is increased.

Next, without changing the oscillator, we inserted a coil of 10 turns of No. 24 S.S.C. wire, wound on a 3½-in. Formica tube, in one of the leads to the primary of the pickle-bottle coupler. It was set with its axis at right angles to that of the pickle-bottle coil to prevent coupling. This 10-turn coil acted as a loading coil in the antenna circuit of a receiving set.

Readings of the meter at the four different capacities were 27, 35, 43, and 61, as you will set in the curve for 550 meters at coil 1. Coil 2, similar to the first, but with 20 turns, gave further increases. Coil 3, of 40 turns, increased the reading only at 0.0001 mfd. The bottom curve shows the average increase over the readings obtained without any loading coil.

Following are curves made in a similar manner at wavelengths down to 300 meters. At 500 meters the average increase is very small, indicating only a slight gain by the use of the loading coil. At 450 meters the gain is negligible, while at 400 meters and below there is a definite loss.

Thinking that there might be resonance peaks which we skipped by using a step inductance, we connected another variable condenser in series in the dummy antenna circuit. This made the equivalent of a tapped coil and series tuning condenser in a receiving set. However, when
we repeated the measurements we found that, at most settings, the readings were cut down, and increased only slightly at a few settings.

This series of measurements appears to indicate, then, that for all practical purposes, a 6-turn primary coupling coil gives as good results, or better, than can be obtained with a tuned antenna circuit. We had an idea that a double condenser might be used advantageously, one section to tune the secondary, and the other to tune the antenna roughly, but these results show that there is no use for such an arrangement as it is no improvement over the simpler method.

A New Method for Making Connections

A n analysis of defects which develop in receiving sets after they have left the factory shows that one of the weakest points in radio receivers is the methods of making the connections between various instruments. There are several things that contribute to this difficulty. It is hard to explain it, but somehow or other, unless the nuts which hold the soldering lugs on the terminals are actually soldered to the screws, they do come loose. Again, soldered joints which appear to be secure are frequently just about strong enough to hold the wires until they are subjected to strain when the set is being shipped out. Soldering lugs frequently break off right at the nuts which hold them in place. Altogether, for production work, lugs are not satisfactory. Some concerns have tried to solder wires directly to the screws but here again there is trouble because a film of oil is generally found on screws which have not been nickel plated, and soldering does not stick well to screws which have been nicked.

The first practical method for making permanent and solid connections has been brought out by the William Stevens Company. These connectors are shown in Fig. 1, applied to some of the conventional instruments. The Lastite is a sort of hexagonal cap nut, threaded for 6-32 or 8-32 screws. The head of the nut, instead of being rounded off, is turned down to a small tube. The hole is large enough to take two No. 18 wires, and the wall thin enough so that it can be soldered to very quickly. In trying out these Lastites at the Darien laboratory, we have found it most satisfactory to put the ends of the wire in soldering paste, then insert them in the hole, and finally solder them. This is the best way to make sure that the paste gets into the hole. The solder then flows in readily.

Another important factor is that the Lastites can be put in place more quickly than lugs, for they do not need to be pointed in any particular direction and clamped in place.
Type B—AC Tube Transformer

Specified by Cockaday for use with AC Radio Tubes

Sensational—nothing less—describes the reaction of fans and set manufacturers since Popular Radio announced the wonderful new circuit by Cockaday using AC Tubes.

Dongan Type B—AC Tube Transformer was designed especially for Popular Radio AC Receiver. Dongan's leadership in transformer design and production is thus acknowledged.

In this AC Receiver, using McCullough AC Tubes and Dongan Type B—AC Tube Transformer, radio performance assumes new refinements—to say nothing of the simplicity and economics of operation. Fans and set builders who plan new AC sets send us your specifications. Our engineering department will gladly work with you in the correct use of Type B—AC Tube Transformers. Prices on request.

For Set Manufacturers

Voltmeters

Attractive Prices

Audio Transformers

Jobbers and Dealers:
Write or wire for sample and discounts.

Type N

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>0—7 volts</td>
<td>$1.25 List</td>
</tr>
<tr>
<td>0—50 volts</td>
<td>$1.25</td>
</tr>
<tr>
<td>0—250 volts</td>
<td>$2.00</td>
</tr>
</tbody>
</table>

Type S

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–1</td>
<td>$1.00 List</td>
</tr>
<tr>
<td>4–1</td>
<td>$2.00</td>
</tr>
<tr>
<td>6–1</td>
<td>$2.75</td>
</tr>
</tbody>
</table>

Dongan Electric Manufacturing Co.
2095 Franklin Street, Detroit, Mich.

Transformers of Merit for 15 Years
Amsco Quality Parts

The standard of excellence by which all others are judged. Used by many of the leading set manufacturers as well as by foremost radio engineers. They are laboratory instruments.

At dealers everywhere. Free literature on request.

AMISCO PRODUCTS, Inc.
416 Broad Street New York
Finer Adjustment!

THROUGH closer graduation of capacity, the Chelten Low Loss Midget Vernier permits much sharper tuning than is possible with the general run of verniers. Shunt it across terminals of main condenser. Introduces no additional losses. Mount it anywhere on panel.

CHELTEN
Low Loss
Midget Vernier

Used also as a STABILIZER in most circuits

Remember, the CHELTEN is the ORIGINAL Midget variable condenser. All others are Imitations.

Write for full information.

CHELTEN ELECTRIC CO.
Philadelphia

---

Measure Your Magnetic Flux

The RAWSON FLUXMETER is a rugged portable WORKSHOP meter which can be used without levelling. An internally mounted dry battery supplies the power to return the pointer to zero after a reading has been taken. With the aid of a simple search coil the total flux in Maxwells or lines in a permanent magnet can be read directly on scale of meter, as can also the flux density in a gap. Hysteresis curves in transformer core can be very easily determined.

RAWSON
ELECTRICAL INSTRUMENT COMPANY
Norfolk St., Cambridge, Mass.
Through the Locals 
ALL-AMAX Reaches Out

Every ALL-AMAX Set, wherever it may be, brings to its owner his choice of all the beauties in the air. Every day come more and more letters to our office telling of the almost unbelievable long distance reception which has rewarded the owners of ALL-AMAX.

Remember, too, that ALL-AMAX is completely mounted on panel and baseboard. Simple photographic instructions make wiring easy.

ALL-AMAX SENIOR, three tubes and detector ........ Price, $42.00
ALL-AMAX JUNIOR, one tube and detector ........ Price, $22.00

ALL-AMERICAN RADIO CORP., E. N. Rauland,President, 2682 Coyne St., Chicago

A Feature the Engineer will Appreciate

Low-Loss Coils, Low-Loss Condensers and then a method of oscillation that does not involve introducing resistance and losses into the circuit—and you have the "NAMELESS."

Bremer-Tully engineers long ago saw the folly of reducing losses and resistances in coils and condensers and the adding resistance or loss in the circuit to control oscillation. They devised the now well-known B-T "NAMELESS" circuit, wherein oscillation is controlled by a combination of reversed magnetic and electro-static coupling.

This method used exclusively on the "NAMELESS" means the set may be operated on any wave length at its point of greatest sensitivity, just below oscillation. In practice this feature means distance, tone, selectivity to an extent hitherto unknown in radio.

Bremer-Tully MFG. Co. 532 S. Canal St. Chicago, Illinois

NEW! Resistance-Coupled Amplifier Kit $5.00 for only........

Electrad 3 stage Resistance Coupled Amplifier Kit No. 1
Price $5.00
Write for free diagrams and instructions

ELECTRAD
428 Broadway
New York City
BMS Fantail Jacks

The easiest soldering jacks made!

B. M. S. JACKS have the exclusive cupped fantail lugs, which make soldering easy. The jacks are made of solid brass, while the springs are of phosphor bronze.

Manufactured by
Brooklyn Metal Stamping Corp.,
718 Atlantic Ave., Brooklyn, N. Y.

who also make B. M. S. TRI-COIL, ($2) TRI-JACK, (90c), and TRI-PLUG (75c).

Made in 9 styles. At all good dealers.

204 DOUBLE CIRCUIT CLOSED

An unfailing power supply
for both circuits

Here at last is an unfailing power supply for your radio set. Balkite Radio Power Units furnish constant uniform voltage to both "A" and "B" circuits and give your set greater clarity, power and distance. The Balkite Battery Charger keeps your "A" storage battery charged. Balkite "B" replaces "B" batteries entirely and furnishes plate current from the light socket. Both are based on the same principle, are entirely noiseless, and are guaranteed to give satisfaction. Sold by leading radio dealers everywhere.

Balkite Radio Power Units
BALKITE BATTERY CHARGER—BALKITE "B" PLATE CURRENT SUPPLY

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

Good materials and honest workmanship go far in transformer efficiency. Add to these the experience gained in 24 years of transformer building and you have the facts behind the quality of the AmerTran—a transformer hard to beat from any angle.

Among the better audio transformers AmerTran ranks high—higher than most by actual test.

AmerTran is made in two types, one quality—A F 6, ratio 5:1 and A F 7, ratio 3:1. Price either model, $7.00 at your dealer's.

AMERICAN TRANSFORMER COMPANY
173 Emest St., Newark, N. J.
"Transformer builders for over 24 years"

Data on Batteries, Eliminators, and Chargers

MANUFACTURERS of batteries, eliminators, and chargers are requested to send immediately, for publication in the July issue of Radio Engineering, the following data on each type which will be on sale this fall: Dry Cell A Batteries: 1. Width, thickness, height over binding posts. 2. Open Circuit voltage. 3. Load voltage when battery should be destroyed. 4. Maximum steady current drain recommended.

Storage A Batteries: 1. Open Circuit voltage. 2. Width, thickness, height over binding posts. 3. Ampere-hour rating. 4. Load voltage at which battery should be recharged. 5. Charging rate. 6. Does battery have 2-volt binding post? 7. Can battery be supplied with built-in charger?

Dry Cell B Batteries: 1. Width, thickness, and height over binding posts. 2. Open Circuit voltage. 3. Load voltage when battery should be destroyed. 4. Maximum steady current drain recommended.

Storage B Batteries: 1. Open-circuit voltage. Width, thickness, and overall height. 3. Approximate ampere-hour rating. 4. Load voltage at which battery should be recharged. 5. Charging rate. 6. Is voltage variable? 7. Can battery be supplied with built-in charger? 8. What type of cells are used?


This data should be addressed to Manufacturers' and Designers' Data Department, Radio Engineering Magazine, 52 Vanderbilt Avenue, New York City. It must be received before June 5.
The Jewell No 110 TUBE-CHECKER was designed to meet the demand for an inexpensive outfit for use in quickly checking quantities of tubes. While it does not give the complete characteristic curves possible with the Jewell No. 95 radio test set, it is invaluable in weeding out tubes which do not function or which are too low to be of value.

Send for Jewell 15-B Radio Catalog

Jewell Electrical Instrument Co.
1650 Walnut St. - - Chicago
If You Build Sets—

Remember that a set is no better than the merchandise that goes into it. If you want quality performance, build into your set—the standard equipment used by the forty leading manufacturers—Pacent Radio Essentials.

You get the full benefit of the eighteen years radio experience of this pioneer manufacturer of parts. Write for our interesting catalog.

Pacent Electric Company, Inc.
91 Seventh Ave.
New York City

Washington  St. Louis
San Francisco  Detroit
Philadelphia  Boston
Jacksonville  Birmingham
Minneapolis  Buffalo
Chicago  Pittsburgh

Canadian Licensee: H. H. White Radio Co.
Hamilton, Ont.

"Don't Imprecise—Pacent"
AS ANNOUNCED in the April issue of Radio Engineering, a new $25,000 laboratory, the finest non-commercial radio laboratory in the country, is being designed for use in developing new ideas and equipment to be shown in Radio Engineering Magazine.

Every new subscription, renewal, or extension to RADIO ENGINEERING, addressed to Our Laboratory Fund will be entered in the usual way, and the magazine sent out each month, but the two dollars will be set aside for the Laboratory Fund. Therefore, 12,500 new subscriptions or extensions are required to build the laboratory.

Perhaps the first question to come to your mind is—"Suppose I pitch in and help get subscriptions to help build Our Laboratory. What will Our Laboratory do for me?"

Here is the answer—Commercial radio laboratories make the results of their work available to you only in the form of expensive, complete receiving sets, telling you as little as they can about what is inside of them. Our Laboratory will make its results available to you thru RADIO ENGINEERING in the most complete and interesting form, telling you all the details, giving you all the data.

Take the RE 1 receiving set, for example, a totally new type of outfit hitherto to the design of the tuning and amplifying circuits. This will show you what we have been able to do in new development work even under the handicap of the old laboratory.

SPECIAL ADVANCE INFORMATION

Although the complete construction data on the RE 1 receiver will not be ready until the September issue of RADIO ENGINEERING, a special blueprint has been made up, giving the circuit and the constants, which we will send to each subscriber, new extension, or renewal, whose subscription is addressed to Our Laboratory Fund. To get your print for the RE 1, the envelope must be addressed to Our Laboratory Fund or no print will be sent.

LABORATORY SERVICE WITHOUT COST

It is important to mark your subscription "Our Laboratory Fund," because such one as marked will be checked on our records. Then you can have tests and measurements made at the Laboratory without charge up to the value of ten dollars, as shown in the schedule in the December, 1924, issue. In addition, you will be entitled to whatever special assistance the Laboratory can give you.

We are asking you to help us with the construction of the new Laboratory, dedicated exclusively to your own interests, in a way which gives you, without expense, the services of a commercial laboratory.

Checks or money orders should be made payable to M. B. Sleeper, Inc., and sent to OUR LABORATORY FUND.

M. B. SLEEPER, INC.
A-52 Vanderbilt Ave., New York City.
Compact and Efficient

The outstanding features of the type 269 variometer are its size and its efficiency of operation.

It is much smaller than the average variometer which gives it a decided advantage where compactness and portability of the set are considerations.

Terminals are very accessible and a soldering lug is provided for using split variometer connections.

Stator and rotor forms are of genuine moulded bakelite, wound with green silk covered copper wire. Bearings are accurate and smooth running.

The ratio of maximum to minimum inductance is 10 to 1.

General Radio Type 269 Variometer

Price $5.00

General Radio Co
Cambridge, Mass.
FORMICA is the mark of quality in radio

FORMICA panels, tubing and Base panels are the marks of quality in a radio set. You can be sure that the set which has them has been built for lifetime service—and that enduring good performance has not been sacrificed to the saving of a few cents here and there.

It is more necessary than ever this year to judge a radio set by the material it contains. Price competition last year brought in the type of apparatus that would perform beautifully for a week or two and then quit. And price competition is still with us. Formica is used by nearly all the great makers of high quality apparatus. They swear by it as they always have. Be sure you have it in the set you buy.

Dealers: Formica is the standard panel in the eyes of the amateur. He wants it, and dealers who give it to him make the most from their panel business.

THE FORMICA INSULATION COMPANY
4653 Spring Grove Ave., Cincinnati, Ohio.

Formica is made from Bakelite Resins

SHEETS  TUBES  RODS

Write for Booklet "What Formica Is"

1. Formica is used by 125 leading makers—and has for years been used by more makers than all other materials.
2. Formica will last forever.
3. Formica, in appearance, is the finish of all panel materials and always remains so.
4. Formica's electrical qualities of every kind far exceed any possible requirement.
5. Formica has high mechanical strength and will not break or wear.
6. Formica will not sag from heat or cold or under pressure. It retains its dimension. Everything put upon it stays right and precisely where you put it.
7. Premium panels are sold in best craft paper envelopes which assure you that you are getting the absolute.
8. Formica is one of the most widely approved materials in radio.

Hear the
Pumpkin
Orchestra over
WLW every
Tuesday
evening
from
3 to 10
central
Standard
Time.
CABINETS

We build them—any design—any quantity

BALDWIN CABINETS

are the product of superior craftsmanship.

Send us your inquiries and specifications. They will receive prompt attention.

BALDWIN

Radio Electrical Mfg. Co., Inc.

684-891 Bergen St.,

Brooklyn, N. Y.

Telephone: Sterling 7688

Large assortment of stock models. Write for list.

MUTER

DEPENDABLE FIXED CONDENSERS

MICA INSULATION
BRASS ELECTRODES
ACCURATE CAPACITIES

Used by Leading Set Builders
SAMPLES AND QUOTATIONS
PROMPTLY FORWARDED

LESLIE F. MUTER COMPANY
76th AND GREENWOOD AVE.

CHICAGO ILLINOIS

Silver-Marshall, Inc.

RADIO

108 S. Wabash Ave.

EQUIPMENT

Chicago, Ill.

The Ultimate in Four-Tube Performance

Super-het results on four tubes are common occurrences reported by builders of the famous Four-Tube "Knockout," designed by McMurdo Silver, Assoc., I. R. E. This remarkable receiver, which was described and recommended by M. B. Sleep in last month's "Radio Engineering," will positively do on a seventy-foot aerial what any super will do on a loop. A novice can build and operate it. Mr. Silver's booklet on the "Knockout" describes the receiver in detail. It may be had for 25 cents.

Complete Parts—$44.40

Ask Your Dealer to Show You S-M Products
Why it Pays to Buy DURRANT Kits at DURRANT Prices

The surest guarantee of success in your radio work is the use of good parts—not things that may be good enough, but the best parts, made by manufacturers of national reputation. Gyp parts give gyp results.

Realizing this, DURRANT, in building a reputation as the foremost supply house for set builders, supplies to its customers only such products that, by their high performance, will maintain the reputation of DURRANT for selling construction kits that are always successful.

DURRANT does not offer cut-price inducements—Obviously there is something wrong when goods are advertised at prices less than cost. If you stop to consider it, you will see that you pay DURRANT the lowest price at which you can get dependable supplies promptly with the postage prepaid.

The companies listed below furnish the parts for the Browning-Drake Five construction kit:

- Benjamin Electric Company
- Brooklyn Metal Stamping Co.
- Daven Radio Company
- Dubilier Condenser & Radio Co.
- Formica Insulation Company
- General Instrument Company
- H. H. Ely Mfg. Company
- James Goldmark Company
- Mitchell-Rand Mfg. Company
- Metro Electric Mfg. Company
- National Company Incorporated
- New York Coil Company

DURRANT SELLS ONLY NATIONALLY ADVERTISED PRODUCTS

The Browning-Drake Five is a year ahead of all other receiving sets in four important features:

1. In a single stage of tuned radio frequency amplification it produces the amplification of two ordinary neutralized tuned R. F. stages.
2. The efficiency of regeneration—which tuned R. F. sets do not have—is obtained by a simple control which prevents oscillations and interference with other receiving sets.
3. Resistance coupled amplification is provided to give the perfect, high-ratio volume which only resistance coupling can produce—and with one-third the B battery consumption.
4. In miles per tube and volume per milliamperc, the Browning-Drake Five outperforms any other circuit at far lower operating cost. Build this set for real satisfaction. No worry that it will be out of date next year.

BROWNING-DRAKE FIVE, the set that's a year ahead—complete construction kit, all parts, even to the screws and nuts. Formica panels drilled and engraved, packed in heavy shipping case, post paid........................ $59.90

DURRANT RADIO, Ltd.
SUPPLIERS TO RADIO SET BUILDERS AND EXPERIMENTERS
C-52 Vanderbilt Avenue  New York City
Manufacturers of Sets

DXL Condensers are Unequalled
Your Engineers Know It
Your Sales Will Prove It

Fans demand Better Sets.
A good Set demands Better Condensers.
DXL offers a complete line of Straight Line Low Loss Condensers representing the high point in condenser design.
Each condenser is a precision instrument.
Prices are Attractive.
Our engineering department is at your service. Complete information on request.

RADIO CORPORATION
5777 Stanton Ave. Detroit, Mich.

RADIALL COMPANY
Dept. IL-11, 50 Franklin St., New York City
Write for FREE Hook-ups

GLASS GRID LEAKS
With the famous Impregnated Resistance Element

YOUR OWN NAME OR TRADE-MARK IF DESIRED
WRITE FOR PRICE LIST

TRIPDOT
ELECTRIC CO., INC.
16 HUDSON ST., NEW YORK CITY
WHOLESALE ONLY
The men whose names are listed below are prepared to handle all emergency work, take care of batteries, and replace tubes. Their charge is $1.50 per hour, not including travelling time except to unusual distances.

The charge for listing in this section is 50c. for one month, $2.00 for six months, $3.00 for twelve months, payable in advance. The * indicates that we have received letters from six set owners stating that the man after whose name the * appears has handled their I and M work satisfactorily.

A REGISTRY OF RADIO INSTALLATION and MAINTENANCE SERVICE MEN WHO INSTALL, MAINTAIN, and REPAIR RADIO EQUIPMENT

Conn., South Norwalk—A. GHIRARDI* Rowayton. Tel. Nor. 2724

D. C., Washington—A. C. BURG U. S. Soldiers' Home. Tel. Col. 758 Br. 41

Ill., Chicago—WELLAND & CO. 6711 Stewart Ave. Tel. 1124 Normal

Mass., Boston—H. A. NICKERSON 201 Devonshire St. Tel. Cong. 5156

Mich., Detroit—J. E. JOHNSON 91 Gladstone Ave., Tel. Empire 8381J

Mich., Detroit—WM. MILLIGAN 6545 Woodward Ave. Tel. Northway 5691W

Minnesota—GEO A BECKER 4709 Wentworth Ave. Tel. Locust 6291

N. Y., New York—APEX RADIO CO. 123 Liberty St. Tel. Rector 3176

N. Y., New York—HERBERT MULLER 954 Lexington Ave. Tel. Rhody 3903 154 Nassau St. Beck. 8040

N. Y., New York—RONALD MAAR 470 W. 157 St. Tel. Wada. 9799

N. Y., New York—RADIO CONST. LABS.* 71 W. Bway. Tel. Walker 2143

O., Kent—KLADAG RADIO LABS.* Kline Bldg. Tel. 127
Now That You Get "Distance"—How About Quality?

Performance Is The Real Test!

Results from the DAVEN SUPER AMPLIFIER are so perfect that all the instruments of band or orchestra selections can be distinguished one from the other. The Musical Critic will select a Super Amplifier for his receiver because of its absolute fidelity in reproduction. It is a completely assembled unit and besides its ease of attachment it has the following advantages.

NATURAL TONE QUALITY
GENEROUS VOLUME
LOW "B" BATTERY CONSUMPTION

Resistance Coupled Amplifier Kits in 3 and 4 stages for those who prefer self assembly.

DAVEN RADIO CORPORATION
"Amateur Specialists"
NEWARK, N. J.

THE ARISTOCRAT OF AMPLIFIERS
Acme Transmitting Condenser stands up under high voltage

ACME APPARATUS CO. makes a condenser especially adapted for short wave transmission. Dielectric losses are so small that the condenser will stand up under high voltage and not get warm.

The dielectric is of the finest grade hard rubber so that there is no chance of a breakdown. The capacity is .0001, a low capacity very useful on short waves as more inductance can be used. It is of the same low loss construction as the standard .0005 Acme low loss condenser.

The Acme Transmitting Condenser has been tested in transmitting apparatus and users are enthusiastic about the satisfactory results.

If you have any difficulty in getting Acme transmitting Apparatus write either to the Acme Apparatus Company, New York Office, 1270 Broadway, or to the factory, Cambridge, Mass., and you will be taken care of promptly. Send for Booklet T, on Transmitting Apparatus.

ACME APPARATUS COMPANY
Dept. H-5
Cambridge, Mass.

ACME ~for amplification