

RADIO ENGINEERING

*The Technical Magazine of the
Radio Trade - Edited by M.B. Sleeper*

Complete Set Developments

AUGUST, 1926

Gas Heating for Bakelite Molding Presses

Describing Methods for using gas heating to speed up production and to obtain greater uniformity in the finished products

Developments in Short Wave Equipment

Details of the first factory-assembled receiver for short wave, telephone and telegraph reception

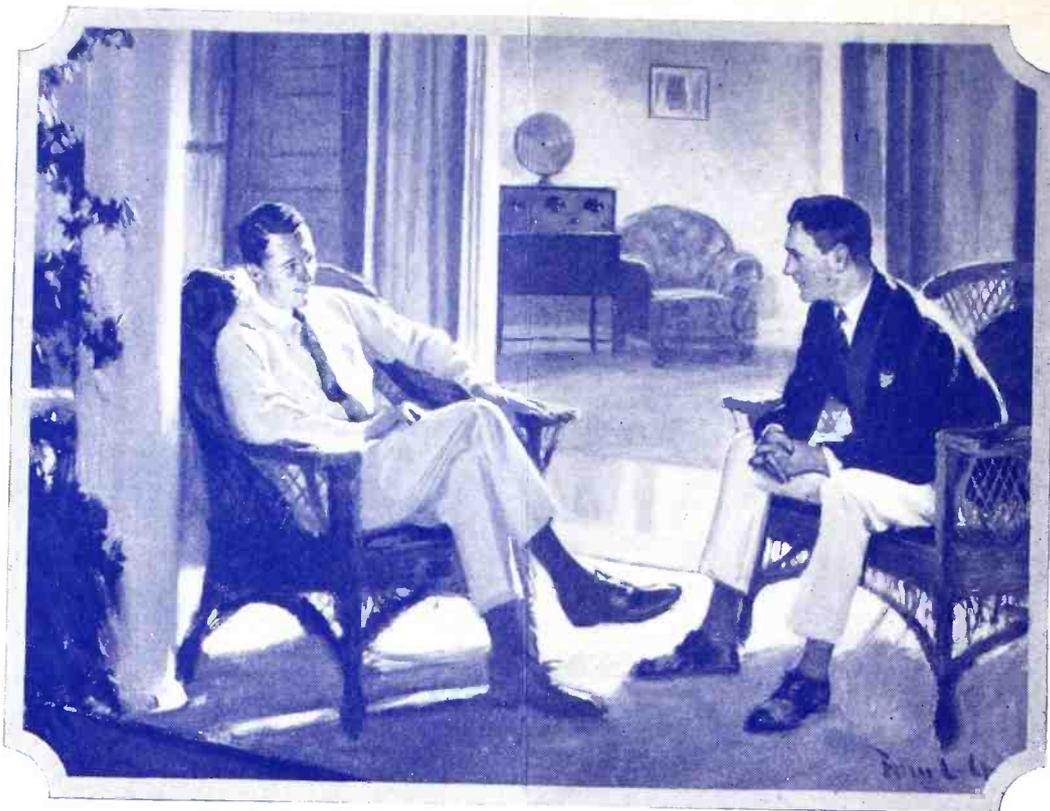
More Data on Shielded Receivers

The big feature of the new sets is the use of shielding. Here is more data on the way sets are being designed for it



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VOLUME VI NUMBER 8
Sixth Year of Publication



*“My wife insists on
getting a radio set exactly like yours.
Where did you get it?”*

“THE Radio Shop put it in for me, Jim. I’ve never had anything that was less trouble or expense, or that gave us all so much pleasure. We don’t see how we ever got along without it.”

“How about batteries? I’ve heard you have to give them a lot of attention.”

“Not if you get good ones, Jim. The service man from The Radio Shop who installed my set said that the Evereadys he was supplying were exactly the right size for the receiver and should last eight months or longer. I’ve had the set six months now, and as far as I can tell, the ‘B’ batteries are as good as new.”

That’s the experience of those who follow these simple rules in choosing the right “B” batteries for their receivers:

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On 1 to 3 tubes—Use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

On 4 or more tubes—Use the Heavy-Duty “B” Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or longer.

Follow these rules and you, too, will find that Eveready



LEFT—No. 486,
for 4, 5 or more
tubes, \$5.50.

RIGHT—Eveready Dry Cell
Radio “A” Battery,
1½ volts.



EVEREADY

Radio Batteries

—they last longer

Radio Batteries offer a most economical, reliable and satisfactory source of radio power. How long they last, of course, depends on usage; so if you listen less you can count on their lasting longer, and if you listen more, they will not last quite so long.

Send for booklet, “Choosing and Using the Right Radio Batteries,” sent free on request. There is an Eveready dealer nearby.

*NOTE: A “C” battery greatly increases the life of your “B” batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a “C” battery.

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 Radiotrons
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RADIO CORPORATION OF AMERICA
 NEW YORK CHICAGO SAN FRANCISCO



RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA

EDITORIAL

DELIVERIES start June 15th." In spite of the warm weather, arrangements for a foursome, or a double-header at the baseball park, this news from the factory always brings enthusiasm to the radio manufacturer's local representative, and reminds him of the new handle that must be put on his sample case.

A definite date for shipments means to him a renewal of activity, and an up-grade in his chart of monthly commissions. He is ready to call off old grudges against the factory, forgive all broken promises and, this season, do the job as he would have done it last year if they had only given him the goods to sell.

But what will that delivery date mean to him on August 15th? And what will it mean to the factory next April?

The factory is such a long way from the jobbers and dealers and consumers. Great distances separate the engineering department, the shop, advertising and sales departments, and the sources of supply for materials—distances which measure the accuracy of the delivery date promise.

How will those representatives, pepped up with enthusiasm over the first samples, all set to put across the new line, to show results that will win an occasional letter of commendation from the sales manager, hoping this year that they can meet the jobbers with a smile and a hearty hand shake, feel after the 15th of August?

Which is another way of asking about the financial situation at the factory next April.

What radio manufacturer would advertise this way—"This is the factory that means well, but what we mean doesn't amount to much. We mean to meet our delivery promises, but our engineers have trouble about making up their minds, our shop doesn't know enough to do things right the first time, and our purchasing department hasn't had enough experience to find out what sources of supply are dependable. However, if we get the finished job in production before the season is over, you will be able to make real money by selling it."

You may say that's absurd, yet hundreds of factory representatives advertised dozens of companies that way last year. Not in those words, but jobbers and dealers aren't stupid. The representatives might just as well have told the bald truth instead of lying awake nights to think up excuses for irate customers who saw the season and the season's profits slip away with no goods to sell when, in many instances, they had dropped old lines to take up new ones which promised greater profits.

If an example is necessary, it is best demonstrated by the failure of the Music Master combination. Walter Eckhardt's own organization could have sold twice the anticipated output of the associated companies. He even financed some of them, for they were all wobbling financially, but he couldn't think and act for them. They had all the weaknesses disclosed by broken promises of delivery dates.

How will your organization be advertised—by representatives out hustling to put the line across, working closely with jobbers who are getting goods to sell, or by representatives who stay in their offices, fearing to meet their customers?

M. B. SLEEPER,
Editor.

RADIO ENGINEERING

The Technical Magazine of the Radio Trade

Edited by M. B. SLEEPER

Vol. VI.

AUGUST, 1926

No. 8

Sixth Year of Publication

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In the September Issue

A bit of hard luck at the last moment made it necessary to hold over the story of the US-76-power supply unit, but it will be ready for September. There is the Silver-Marshall power amplifier, supplying B voltage to the set, also ready for next month. The technical men in the manufacturing companies, as well as those with the dealers and jobbers will find some new stuff they will be glad to have. Look for the M. B. Sleeper booth at the New York Radio Show.

In the October Issue

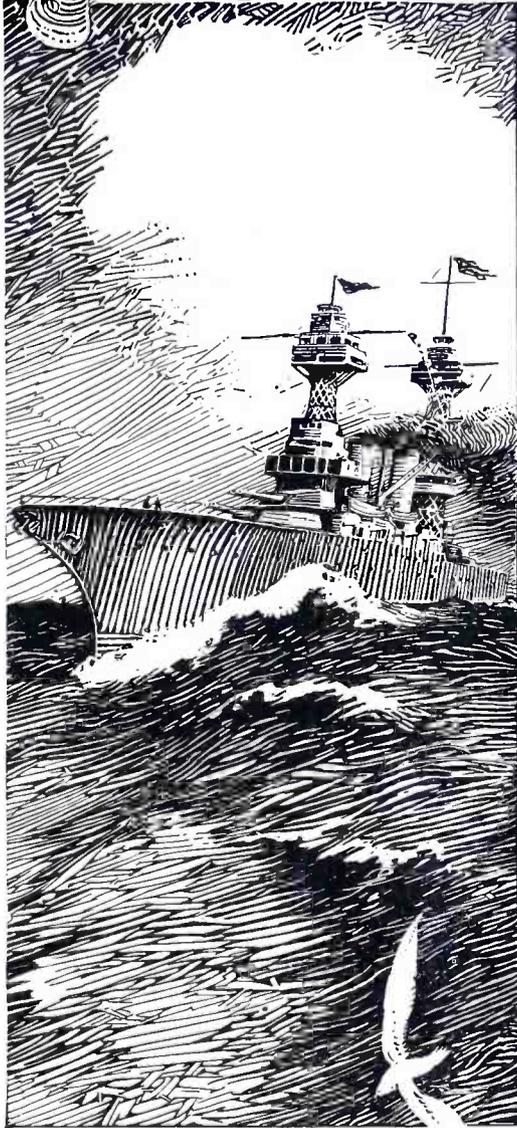
Radio Engineering originated the method of base panel assembly, and also the rear-connection method so long ago that most people assume that it was always done that way. Another design feature of greater importance and equally fundamental will be introduced in October. Watch for it, because it will unquestionably turn set design inside out.

RADIO ENGINEERING

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Radio Engineering, August, 1926

Cardwell Condensers

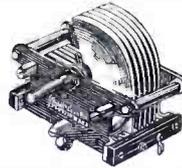


PERFECTION

IN the modern dreadnaught, every part is tested, retested, and tested again. It must be perfect.

No other condenser available has nearly the inspection which is part of the manufacture of every Cardwell Condenser. Like the Battleship, it must be right. There can never be a failure.

The Taper Plate Type "E"



Modified Straight Wave Length Type "C" for more long wave separation



PRICES:

173-C	192E	.0005	\$5.00
171-C	169E	.00035	\$4.75
170-C	168E	.00025	\$4.25
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"THE STANDARD OF COMPARISON"

GORHAM

JULIUS CAESAR, his toga blown gently by the breeze which sang softly thru his olive crown, stood on the shore of the Mediterranean Sea, anxiously squinting thru a telescope poised on the shoulder of his third assistant secretary, when a sand crab bit the toe of the third assistant, causing him to jump and poke Julius Caesar in the eye with the butt end of the telescope.

Without the least display of emotion, Caesar grasped the telescope like a baseball bat, socked the third assistant just below the right ear, and strode slowly across the beach to his tent.

Mark Anthony, busily typing at a portable field table, sensed the emotions of his superior. All day he had waited, feverishly anxious to discuss with Caesar certain actions of the Roman Senate during their absence in the campaign, but Caesar would not hear him.

Already that day the crews of three ships, manned by the fastest oarsmen of the Mediterranean, had been slain, and Anthony dreaded the return of the fourth, for he felt that they, too, had failed in their mission.

Caesar nervously picked up a copy of *Gentlemen Prefer Blondes*, threw it at the Nubian slave standing on guard just outside the entrance to his tent.

"Anthony," he cried, dropping to his couch and burying his head in his hands, "This is too much! I, who conquered the Alps—oh, to be in despair over such a thing as a B battery! Can there be no B battery within the length and breadth of the Roman Empire which will deliver two amperes without going dead in a single evening?"

"If to-night my experiments are again interrupted, I shall throw every radio engineer within the Empire to the lions!"

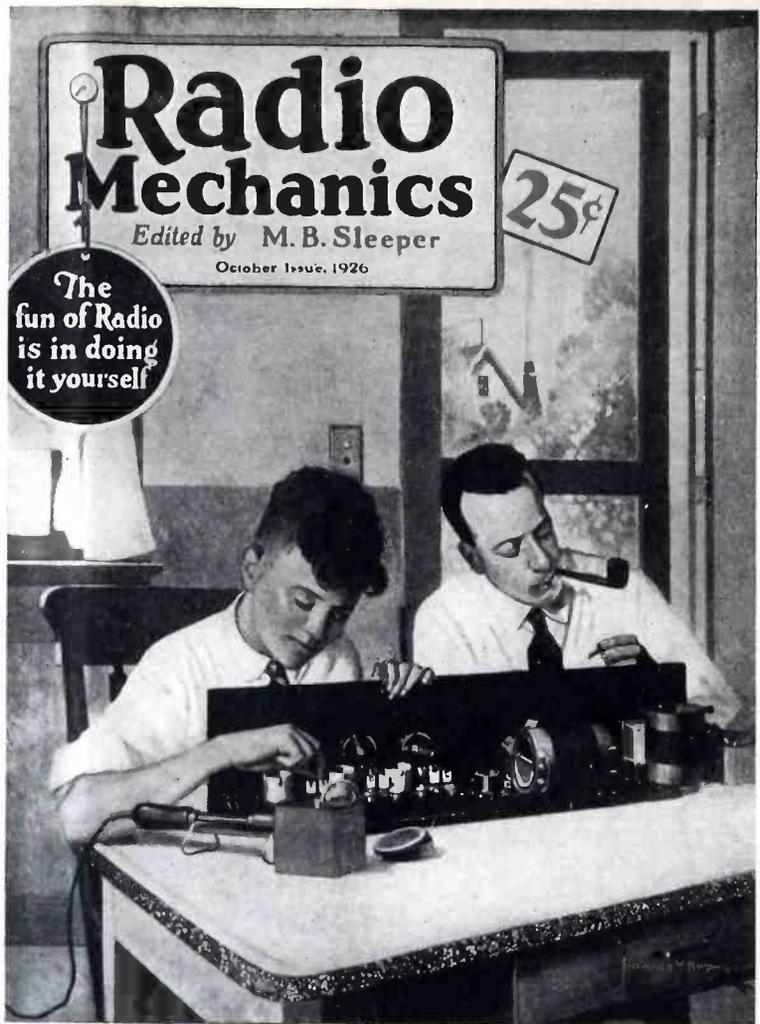
History tells us that B batteries were not the only thing that contributed to the downfall of Julius Caesar. He couldn't draw two amperes from a B battery eliminator either. Mark Anthony, who so faithfully cooled Caesar's fevered brow when he was shooting trouble, never explained why he wanted to put such a load on the plate supply, but we do know that the crew of the fourth ship, as well as all the radio engineers of the Empire, which included most of the civilized world at that time, were put to death because they couldn't find a battery that met Caesar's specifications.

Thus it was that the radio became a lost art until it was revived by Marconi. But in those days, the printing press was unknown, and there were no radio magazines. Consequently, Caesar's experimental work was mostly a matter of sweating and swearing. If he had had a good radio magazine to help him enjoy his radio work, and have some real fun out of it, the radio art would now have the benefit of centuries of development, instead of being wiped out, for all these years, because Caesar lost his temper over trying to do something that he shouldn't have wanted to do in the first place.

Now, that's why we have brought out *Radio Mechanics*—to show all the young boys how to get fun and useful knowledge from radio, and to show the grown-up boys how to get recreation and enjoyment from radio.

Whether it's doing things with complete sets, or making things from parts, *Radio Mechanics'* job is to show folks how much fun radio can be. Then, in case we should have another world-wide dictator, there'll be no chance that he will lose his temper, kick in the front panel of his radio set, and order all radio engineers shot at sun-rise.

M. B. SLEEPER, *Editor.*



A New Magazine A New Editorial Policy A New Influence in Radio

DEVOTED exclusively to interesting things which can be done by the average man or boy, with the everyday facilities found in the ordinary home. Whether they are about sets or parts, articles in **RADIO MECHANICS** will be only those which present the enjoyment, instruction, relaxation, and recreation of radio—in short the fun of radio in the home.

Starting with 100,000 copies on sale September 10th, **RADIO MECHANICS** will present the fun of radio as it can be enjoyed by the 10,000,000 prospective customers for complete sets and parts.

ADVERTISING FORMS FOR OCTOBER CLOSE AUGUST 1ST

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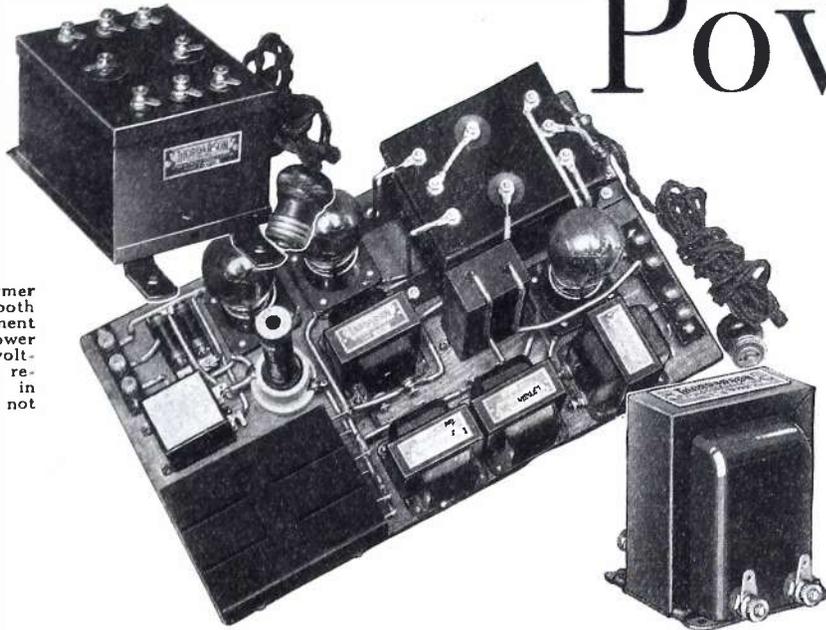
RADIO MECHANICS, Inc.

M. B. SLEEPER, President

Radio Hill, Poughkeepsie, New York

Radio Engineering, August, 1926

Reserve Power



Supply Transformer R-198 furnishes both plate and filament voltages for power tube and plate voltages for entire receiver. Silent in operation. Will not heat up.
Price \$12.00

Choke Coil R-196 for filter circuits of power amplifiers and B-eliminators. 30 henries inductance. 70 milliamperes capacity. Generous shell type core.
Price \$5.00

THORDARSON POWER AMPLIFICATION *and* B-SUPPLY *from the light circuit*

Force a car up a steep hill and the engine knocks. Force a radio set and the quality becomes ragged and the reproduction distorted.

Faithful reproduction of the deeper bass tones requires a considerable expenditure of electrical energy,—more, in fact than the vacuum tube of the average receiver can handle.

A power amplifier built with Thordarson transformers and chokes uses larger capacity tubes and reproduces the heavier, more vibrant tones with undistorted quality and volume.

Other Thordarson Radio Transformers



R-200 Amplifying Transformer. A quality transformer with unusually faithful reproductive powers and a very wide amplification range. Large core. High inductance primary winding.
Price \$8.00

R-195 Raytheon B-Eliminator Transformer. Converts the house lighting current into proper values to supply the plate requirements of any receiver.
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R-190 Autoformer. An all frequency amplifier. An impedance with a step up ratio. Combines the faithful reproduction of the impedance with the amplification of the transformer.
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Standard Amplifying Transformers. Will meet the tonal requirements of the average ear. Generous shell type core. Good amplification range. In three ratios.
2 to 1 ratio R-152 \$5.00
3 1/2 to 1 ratio R-150 \$4.00
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Write For Descriptive Circulars



(3440-A)

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Transformer specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.



Dubilier Condenser
Type 901

Buy condensers *this way*

IT is the *working voltage* that determines the life and efficiency of the condensers you use. Buy "working voltage" as well as capacity.

All DUBILIER CONDENSERS are clearly marked with their recommended maximum D.C. *working voltage*. This tells you exactly what voltage your condensers will stand in continuous service.

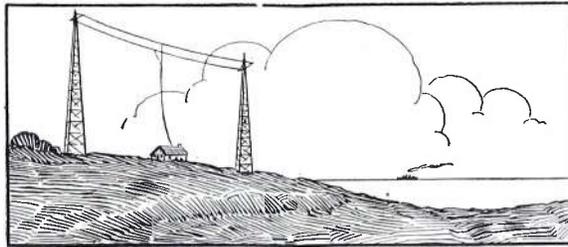
The new DUBILIER CONDENSERS—Types 901, 902, and 903 may be used for any purpose where the potential at *continuous operation* does not exceed their rated working voltages of 160, 400 and 600 volts D.C. respectively. Each type may be obtained in 1, 2, 4 and 6 mfd. sizes at prices ranging from \$1.50 to \$13.50.

Look for the DUBILIER name and the rated working voltage on the condensers you buy for battery eliminators, power amplifiers and receivers.

Dubilier

CONDENSER AND RADIO CORPORATION

4377 Bronx Blvd., New York, N. Y.



HIGH PRESSURE GAS FOR BAKELITE MOLDING

*Results of tests made to determine the possibilities of gas heating to increase production with lower costs — By N. E. Berti**

MOLDING plastics such as rubber, resin and shellac compositions is almost an age old industry. Methods, equipment and formulae were well developed to meet the needs of the trade as it had existed for years. Bakelite was then developed as a marvel of modern chemistry. A synthetic product, made by the action of phenol (carbolic acid) and formaldehyde in the presence of small amounts of an alkali, this material had possibilities far beyond those exhibited by any known plastic.

Although this new product had so many possibilities, the same methods of molding and equipment were used for molding as had been handed down from rubber and shellac composition practise. This equipment consisted generally of steam heated hydraulic presses. Heat is used to bring about the chemical reaction and pressure to control the reaction against loss of gases formed during the condensation. The ingredients are bought in an intermediate state so that the molder can complete the forming in a single operation. The usual molded product temperatures of 280° to 350°F commonly used are produced by high pressure steam. For this work, steam pressures higher than 50 lbs. gauge are necessary and consequently transmission losses are high.

The radio industry, consuming thousands of bakelite products, has called for greater production without proportionate increases in plant investment. With the isolated power plant a thing of the past, high pressure steam instead of being a by product of the power house found use solely for processing.

It had always been thought that direct firing by gas was difficult because of the possibility of the formation of hot spots and rapid destruction of platens of the presses. There are two platens in a press, the top one being stationary and the bottom one capable of being raised. The material to be molded is formed in tablets just large enough to produce the finished piece

with the minimum waste. The molds used are of steel and split after the fashion of flasks used for iron castings. The tablets are put in the bottom half of the mold and the top half pushed down as far as possible. Dowel pins are used for centering the molds to insure the correct dimensions in the finished products.

The mold is set on the bottom platen, and the pressure applied, which raises this platen until the mold is completely closed. The heat is transmitted from the platens through the mold

molding is not high enough or the curing time too short, the reaction may start again when the right temperature conditions are found and go to completion with the formation of gases which form blisters and large gas pockets completely destroying the best properties of bakelite. In common with all chemical reactions, the speed of the curing process doubles for every increase of 20°F. This makes it possible to cut down the time of molding by very nominal temperature increases. To increase the working temperature 20°F by steam heating requires a vastly greater increase in steam pressure.

This in brief, was the problem confronting The Molded Products Corporation of New York City, a large molder of radio parts. The bases for vacuum tubes were reheated during the tube basing process of assembly, disclosing surprisingly high percentage of uncured tubes. The time cycle of molding was so great that the bonus workmen were not making their minimum production. A night crew was used to keep up output with the usual failings of night shift production. After operating under these conditions for some time, a temporary lull brought about the other extreme. Steam boiler equipment designed for 24 presses had to be adapted for but three presses. Even though there were two high pressure gas-fired boilers, this variation was very wide, and the standby and transmission losses mounted materially when but three presses were used.

The adaptability of gas was then brought out. The cored passages in the platens which had been used for the circulation of steam were made available for direct firing by removing the plugs from the ends or drilling into this opening. A small pipe burner fitted with nickel screen tips was placed in each of the four cored steam passages. These four branches were connected to a common manifold which distributed to the separate branches the correct air-gas mixture, supplied by an Ensign Reynolds injector. Because of the confined space in these cored passages,

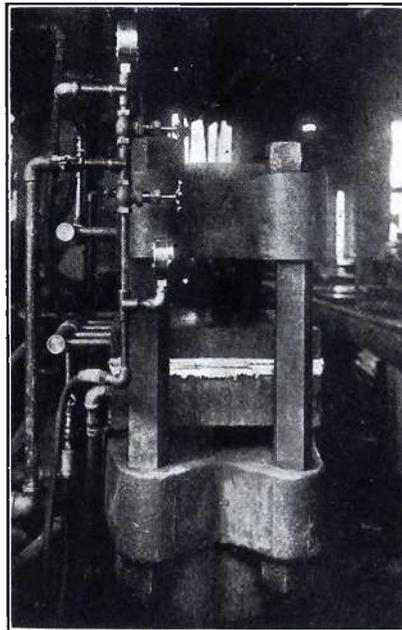


Fig. 1. Front view of a gas-heated press. Note the asbestos packing

to the tablets which have been forced into all parts of the mold by the pressure exerted. The heat brings about the reaction which results, when the conditions are correct, in a hard glossy article with very sharp outlines. If the temperature and pressure have been right, the bakelite is hard and firm, free from blow holes or pores and will withstand direct flame contact in excess of 500°F with no harmful results. If the temperature during

*Department of Utilization, Consolidated Gas Company of New York.

a complete air gas mixture had to be made before being delivered to the burners. Secondary air for burning an air-gas mixture produced by a Bunsen or similar mixer, was obviously impossible. The inert products of combustion, consisting entirely of carbon dioxide, water vapor, and nitrogen could not support combustion unless the complete mixture was ready in advance. The injectors used induce all the air for combustion because of the velocity head of the gas supplied through a small orifice at from 2 to 4 lbs. Mixing is complete in a very short space and this complete mixture is supplied to the burners.

The nickel screen burner tip is of such construction that it reduces the volume of the inner cold and unburning cone of the flame to a number of very small flames which act as mutual pilot flames. This prevents blowing off of the flames. That is, the flame does not leave the burner, which is the tendency for the complete flame, unless some such precaution is taken. It also prevents the back fire or flash back until a very low pressure is reached. By reducing the cold portion of the flame a hotter flame results which has also a considerable velocity.

This hot concentrated flame is of great benefit for there is no flame impingement which would result with a longer cooler flame. By using a number of such small flames a uniform ribbon of heat can be produced. The heat from each individual tip can be proportioned to the space to be heated, to give any desired temperature in this space. By directing these burners towards the work, the back of the platens were heated only by conduction of heat through the metal, reducing losses by heating a minimum amount of excess metal. The burners in the upper platen were directed down and those in the lower platen, up. The capacity of the burners is slightly different. The burners in the top platen have maximum consumption of 30 cu. ft. per hour and the lower platen burners use but 17 cu. ft. per hour. This is partly the result of the heavier heat insulation which was used below and partly by the difference in platen dimensions. Although both platens are 15 ins. square, the combustion chamber in the bottom platen is but $\frac{1}{2}$ in. from the surface, but this distance is 1 in. in the top platen. This gives a greater heat storage capacity in the top platen but also requires a higher temperature at the burners to produce the same mold surface temperature.

The application of this equipment is adequately shown in the photographs. Fig. 1 shows the front view of a molding press equipped with the high pressure equipment. The layer of asbestos insulation below the bottom platen is visible but the top is recessed which hides from view the insulating powder used at that point. The ends of the pipe burners are visible in the cored steam passages. The control

valve and gauge for each burner is at the upper left where these are accessible to the molder. The handle at the right is for raising and lowering the bottom platen by means of hydraulic pressure. Fig. 2 gives a side and back view of the burner connections and shows, extending vertically above the upper burner, the injector. Provision was made for supplying gas to the lower platen regardless of its position by using a standard A. G. A. flexible hose. Fig. 3 is perhaps the most interesting comparison in the installation. It pictures one of the two high pressure steam boilers with its feed water pump next to it and in the corner the

tween the highest and lowest points was less than 10°F . This was borne out by the finished work which gave absolutely uniform pieces throughout. The temperature used, of 325°F . on the surface is so low that the steel has maintained its hardness. The temperature in the burner ducts is so low that sealing or oxidation does not occur.

With the installation of this method of heating on three presses, a comparative test was made against three similar presses heated by steam from the high pressure boilers. The first result was an increase in production. The steam heated presses could turn

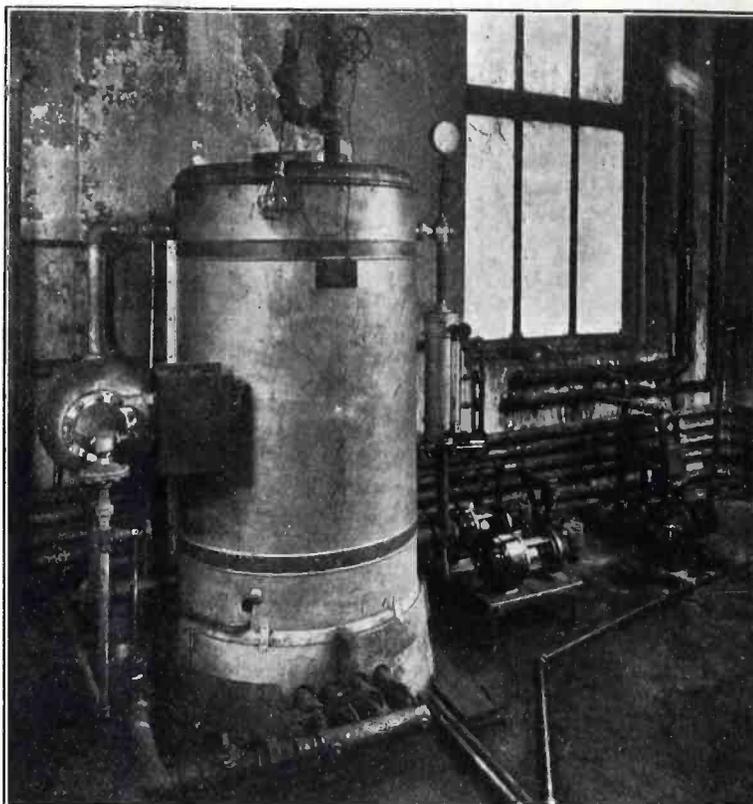


Fig. 3. High-pressure boiler, feed water-pump and belt-driven compressor for the installation

small belt-driven compressor which supplies gas to the same presses as the steam boiler previously operated. The compressor is air cooled and has an automatic relief valve which always maintains a constant gas pressure. This relief valve by-passes all gas not used by the burners back to the inlet side of the compressor at service pressure. By this means it is impossible to build up pressure above that for which the constantly functioning relief valve is set. The floor space taken by the compressor is decidedly less than that occupied by the feed water pump.

The vital part of any installation is not the engineering features but the overall operating results. To investigate these, the first check was made by using a spot-temperature thermocouple. A complete series of readings was made of the temperatures at different points on the surface of the platens. The maximum variation be-

out a heat in 6 minutes but the direct fired presses were giving two heats in this time. In fact, by slightly raising the temperature, a two minute heat was carried through but this cycle soon got the better of the molder. The next result was a decrease in fuel consumption. On the basis of several days run of these six presses, the direct fired presses used 27.3 cu. ft. of gas per hour per press against 173.8 cu. ft. per hour per press for the steam heated presses.

This comparison, however, is decidedly unfair to the steam boiler as the boiler has capacity for 12 presses and the standby and transmission losses would normally be divided by 12 instead of 3. However, it was possible to obtain the consumption for several months when both steam boilers were operated at capacity load and compare it with the direct fired application. This showed a consump-

tion of 517,000 cu. ft. for the steam heated presses against a consumption of 238,000 cu. ft. for similar operation when direct fired. When comparing this data on the basis of equal output, the consumption for the direct fired installation must be halved. This represents a saving, for equal production, of 77%. The third advantage came in quality of finished work. The new installation produced parts very glossy, free from rejects, and of high dielectric strength. They were thoroughly cured as none of the bases were blis-

is as simple as raising and lowering the press.

That the initial installation was successful is evidenced by the order to complete the change over to all the twenty-four presses. This is merely in line with the common trend to better and more rapid production. The installation has been very satisfactory to the Gas Company, for it has opened up a new field of endeavor which, because of its size, will inevitably add to the load, safe against competition from all other heating sources. The

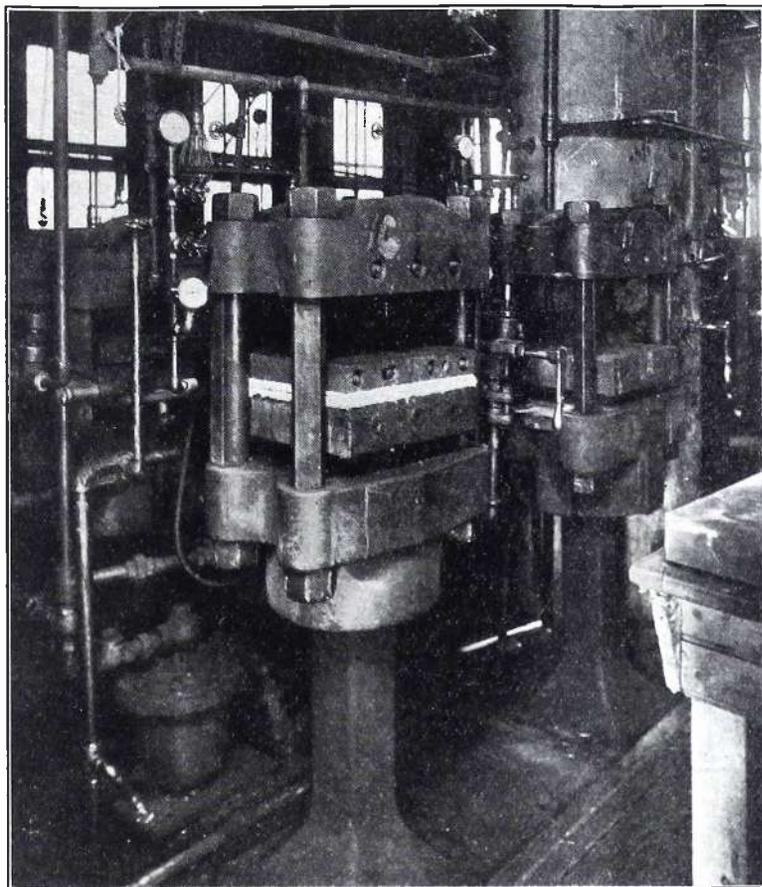


Fig. 2. Bakelite molding press equipped with connections to provide heating by gas

tered by heat during subsequent assembly.

Automatic temperature control was suggested for these presses but it was deemed inadvisable. The platens act as a good reservoir of heat from which the molds are heated. An intermittent heating cycle of such short length is far from ideal for automatic control. The method of continuous firing results in storing up of heat in the platens during the minute or so when the press is empty. It also continues to deliver heat when the mold is inserted which is the period during which the severest demand is made. With automatic control the burners would be cut down just before the mold was put in or just after, because of the lag in temperature. Automatic control also does away with much of the simplicity of the installation which is one of the features, as the adjustment of burners

consumer has become convinced that his production methods rank ahead of all competitors and that gas properly applied has given him this advantage.

Service Testing Kit

Many of the concerns who are furnishing really high grade radio service to set owners are equipping their men with the new Jewell kit. This is manufactured by the Jewell Electrical Instrument Company, of Chicago.

The kit is divided into sections. The lower compartment contains A, B, and C batteries sufficient to run practically any radio set. Four dry cells in series supply the A power, six small B batteries furnish 135 volts, and three 7½-volt C batteries give up to 22½ volts. All three sets of batteries are connected to taps so that any voltage can be obtained for any purpose.

The lower compartment can be completely removed, greatly facilitating the connection of the batteries.

The upper part of the case, arranged so that it can be used without the battery box if desired, is big enough to hold one or two tubes, the connecting leads which are furnished, and various tools required in service work.

The top panel contains a high resistance voltmeter with scales for 7, 70,



140, and 280 volts, and a meter for 14 mls, 70 mls, and 7 amperes.

A very important point is that the voltmeter has a resistance of 800 ohms per volt, drawing only 1.25 milli-amperes at full scale. Therefore, it gives reliable readings on eliminators.

With this equipment, wiring can be checked for open or short circuits, B battery consumption measured, and all voltages accurately tested.





Fig. 1. One of the cabinet designs for the 10-tube de Luxe

Six Matched Circuits

So accurately are the circuits matched in the Zenith de Luxe that they can be controlled by one knob—By H. C. Forbes

If you will look back in some of the old radio text books, you will find circuit diagrams of an old Marconi receiver in which an intermediate tuning circuit was employed

* Chief Engineer, Zenith Radio Corporation.

as a sort of strainer to put the incoming signals through an extra tuned circuit before it reached the tuned circuit connected to the detector, in order to reduce the signal strength of unwanted, interfering signals.

That arrangement was not widely used because it consumed a large amount of energy. In fact, an incoming signal can only be put through a series of strainer circuits when each one of these circuits amplifies the signal to an extent greater than the energy is absorbed.

The 10-tube Zenith de Luxe set is usually considered merely as an outfit equipped with multi-stage R. F. amplification. That is true, but that only tells a part of what goes on in the Zenith set to account for its amazing sensitiveness and sharpness.

Radio sets can be sharp in two ways. A single circuit regenerative set can be very sharp, but it is only so due to the instability of the tuning. This is readily noticeable in its tendency to spill over into oscillation from a sharp signal or a sudden burst of static. Such selectivity is most undesirable.

Selectivity can be obtained also in such a way that there is no tendency to oscillate at all, and the sharpness is merely a matter of confining the response to a narrow band of frequencies.

To make the action which takes place in the Zenith set a little more understandable, let us take an example. Suppose you have half a dozen bowl-shaped sieves, so constructed that the mesh at the bottom is fine and around the sides it is rather coarse. If you put some sand and stones in the top sieve and shake all six sieves at once, the fine sand will go through at the center of the sieve readily while some of the stones will be shaken up around the sides so that they will pass through the larger holes. Some of the stones, however, will go to the bottom of each sieve and will be held back by the fine mesh, so that what comes out of the bottom sieve will probably be only fine sand.

If, on the other hand, you throw the mixture of stones and sand into each sieve, the effective sifting will be hardly more than if only one sieve was used.

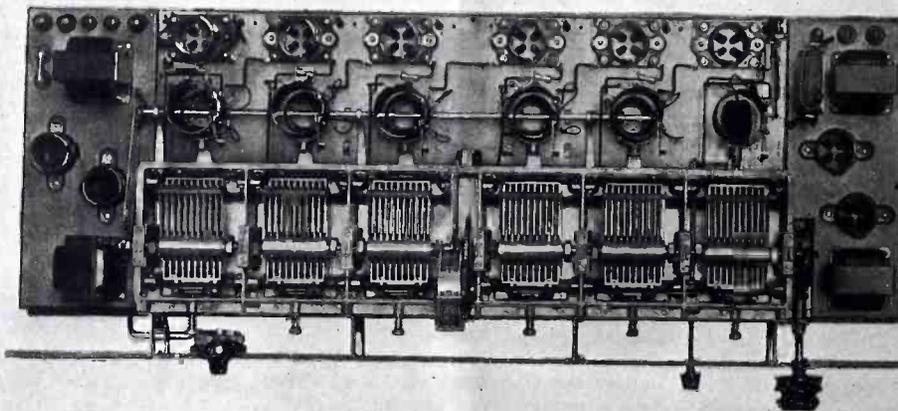


Fig. 2. Top view of the chassis, on which all the parts, including the gang condenser, are mounted. This picture was taken with the shield removed

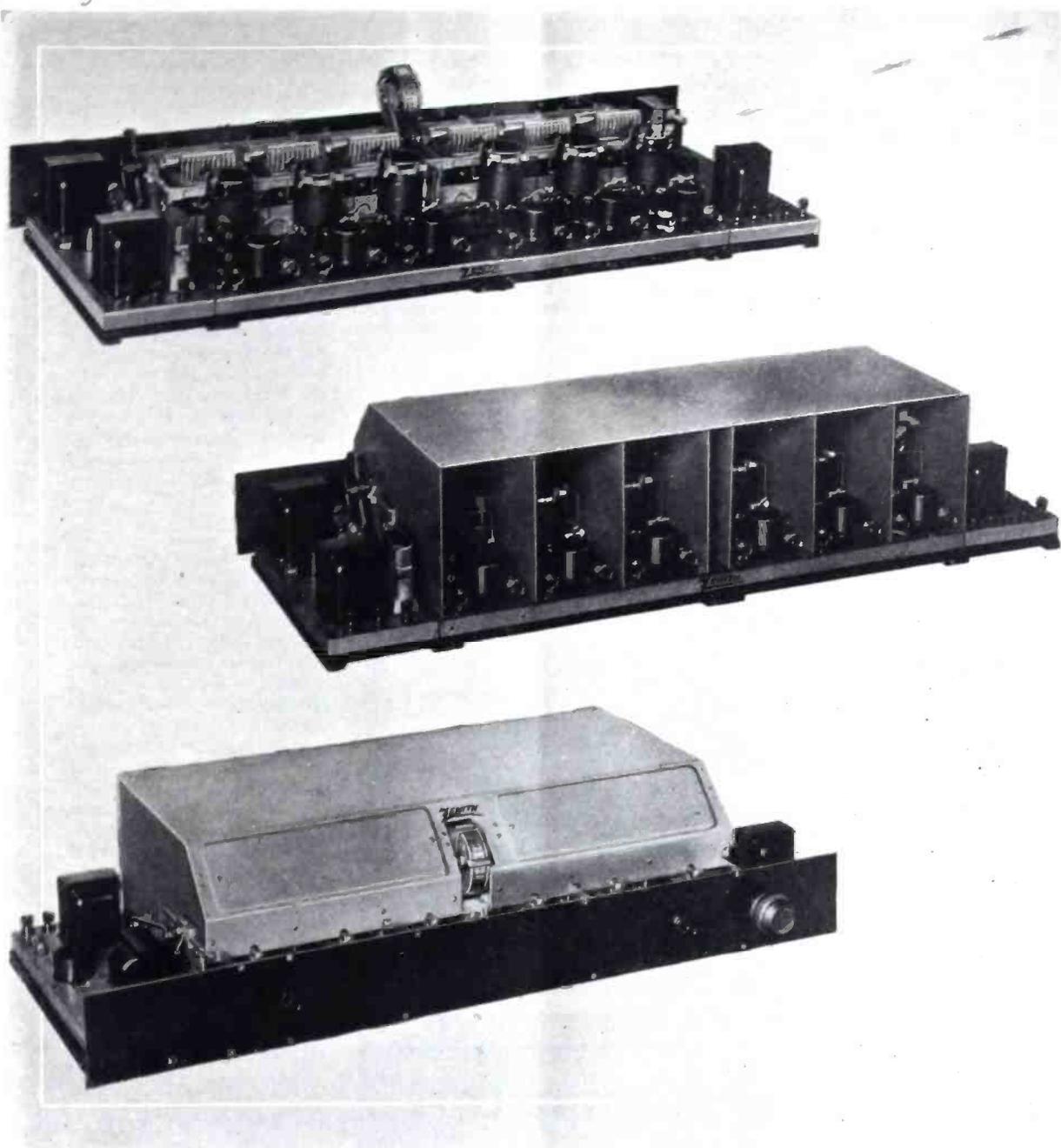


Fig. 3. Three views of the mechanism, showing the arrangement of the coils and the design of the shielding

That is just what happens in radio sets.

Using a series of tuned circuits, if the incoming signal is not only picked up by the antenna but also by each tuning coil, the tremendous sensitiveness of the multi-stage R. F. amplifier will pick up the incoming frequency on the coils and the circuit. The signals will not be made to start at the first circuit and go through each one in turn, as would be the case in the series of sifters if the mixture is only put in at the top.

In order to make the signals go through the tuned stages successively, the Zenith set is built with the very elaborate system of shielding. Consequently, signals can reach the radio circuits only through the antenna. The individual circuits cannot pick

them up directly on the coils and wiring. Actually, the frequency response is limited to a band approximately 10,000 cycles wide. For the reason that, in the successive stages, frequencies outside of this band are gradually lost until, in the last stage, they do not come through at all.

Very often two stations come in on wavelengths so close together that only a beat note or whistle can be heard on ordinary sets. By careful tuning, however, it is nearly always possible to separate such stations with this receiver because it can be tuned to the lower side-band of one station or the upper side-band of the other. In fact, it is even possible to tune the set in such a way that high or low notes can be excluded.

Sharper tuning than this could be

obtained but the 10,000 cycle band is the limit of selectivity because that much is necessary to include all the audible frequencies transmitted from the broadcasting stations.

Not only does the de Luxe receiver cover the normal range of 200 to 550 meters, but it can be changed over, by closing a group of small switches, to work at 80 to 225 meters. This is very important due to the rapidly increasing popularity of short wave reception. This is an important sales feature for those who want radio reception of the highest quality for entertainment in the home, but at the same time like to play around with the super-range reception which is possible at short waves.

The design of the condenser unit is such as to win the respect of those

who appreciate the niceties of mechanical design in radio equipment. The condenser has 6 sections. The frame, one of the largest and most intricate aluminum die-castings ever made carries the individual die-cast stators and at the same time serves as the chassis of the set itself. The rotors are also individual die-castings, clamped to a large ground-steel shaft. Thrust bearings are provided at the center so that expansion and contraction is taken care of correctly. There are 7 babbit-metal bearings to eliminate any misalignment of the shaft and to provide adequate support during shipment.

The inductances are attached to the condenser framework. An auxiliary shaft runs lengthwise of the frame through the lower parts of the coils, with the exception of the antenna coil, to carry the plate circuit rotors. This shaft is connected to the condenser shaft by a mechanism similar to that

used for connecting the driving wheels of a steam locomotive.

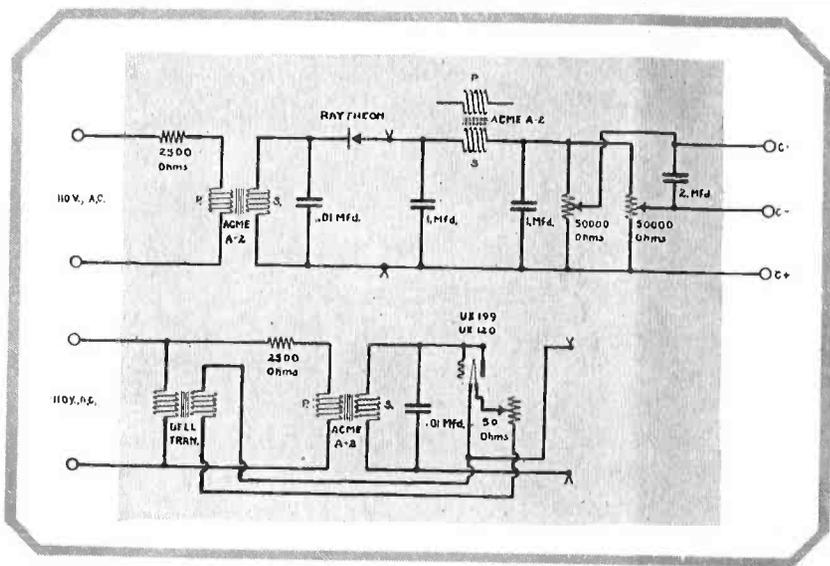
The antenna compensating vernier consists of a rotor coil serving as a variometer. The rotor is operated by a separate link mechanism to the condenser shaft.

Compensation for the condenser capacities is provided so that, after the units have been assembled, the capacities are matched to $1\frac{1}{2}$ mmfd. over the entire scale. This is an accuracy of $\frac{1}{4}$ th of 1 per cent at the maximum capacity. The coils are also balanced during assembly, the measurements being made with bridges capable of indicating an error of 1 part in 20,000.

The accompanying views show other mechanical details, including the construction of the shielding. Eyelets are used for assembling the shield, not only to insure perfect contact be-

tween the separate parts which make up the complete shield but to assure greater permanence than is possible with machine screw assembly or soldering, both of which are liable to loosen up from the vibration during transit.

All controls and adjustments are on the front panel. This makes it unnecessary to open the set for any final settings when the instrument is installed. There is simply the main tuning adjustment which rotates the variable condensers and the other controls which work from the condenser shaft, a volume control which also serves as the ON and OFF switch for the filament, and a vernier adjustment on the first R. F. amplifier which is used to compensate for various sizes of antennas. Once this vernier setting has been made, it should not be turned again.



the audio end, particularly when a power tube used for the last stage.

However, if the negative C battery voltage is increased when the B voltage goes up, the plate current will remain constant. Or if the C voltage is reduced when the B voltage falls, the plate current will not change.

That is why we use a C battery eliminator in addition to the B eliminator, in sections where the line voltage is not reasonably constant.

Fig. 1 shows a C battery eliminator circuit so designed that the output voltage varies with the line voltage to take care of changes in the B eliminator output.

Above is the wiring of the unit for a Raytheon tube. A UX 199 or UX 120 can be used if the circuit is changed up to the point where the V-marks are indicated. In the latter case, a 6 volt bell-ringing transformer supplies the filament current.

There is a 2,500 ohm Lynch or Tobe Deuschman resistor in series with the primary of an Acme A-2 audio transformer. That supplies the voltage to the rectifier tube. Another A-2 transformer is used as a choke. You will see that the primary is left open. Potentiometers of 50,000 ohms resistance, such as the Centralab types, give two values of C voltage. They will go up to about 90 volts, or more than enough to take care of any power tube.

The fixed condensers must be able to withstand about 150 volts. Good by-pass condensers ought to be satisfactory.

When the C eliminator is put into operation, the potentiometers are adjusted while signals are coming in. After that, no further regulation is required, for the device functions automatically, increasing the negative voltage on the tubes when the line voltage goes up, decreasing when it goes down, and at all times maintaining an approximately constant current through the tubes.

Why the C Eliminator?

If fluctuating line voltage affects the B eliminator, use a C eliminator to keep the plate current constant

“WHY is my set so erratic in operation since I bought a B battery eliminator?” comes the query from the B. C. L. in the small towns. Nothing wrong with the set, eliminator O.K., but volume and quality changing during the day and at night.

Service men who have had experience with this kind of trouble get the electric light company on the job to measure the voltage of the 110 volt supply line. In some localities 110 volts means anything from 85 to 115 volts. Obviously, no battery eliminator is going to work right under such conditions.

A very neat answer to this situation has been given by Mr. Dallin,

engineer for the Acme Apparatus Company. It is in the form of a simple device, cheap enough to build, and most satisfactory in operation. It is a C battery eliminator.

It may seem odd to add a second eliminator to overcome the deficiencies of the first one, but that is the case. Mr. Dallin explains it in this way:

The essential thing is to keep the plate current constant. When the line voltage goes up or down, the output voltage from the B battery eliminator changes accordingly. This automatically changes the plate current in the audio amplifier tubes. Ordinary changes in the R. F. and detector tubes have little effect, but they do make a great difference in

A.M.E.S. Radio Standards

Standards of practice adopted by the Associated Manufacturers of Electrical Supplies—Part II

Receiving Set Terminal Markings

26101: The standard markings for binding posts or terminals on radio receivers shall be as follows:

(a) The binding post for connecting the antenna wire shall be marked with the word ANTENNA or the abbreviation ANT, and the binding post for connecting the ground wire shall be marked with the word GROUND or the abbreviation GND.

(b) Binding post for connecting the conductors extending to a loop shall be marked LOOP 1, LOOP 2, etc., to correspond to similar markings on the loop.

(c) The binding posts for making connections to "output" apparatus or circuits shall be marked OUTPUT.

(d) Binding posts for connecting the conductors which extend to the batteries shall be marked A for filament battery, B for plate battery and C for grid battery, with polarity indicated by a + sign for the binding post that connects to the positive (+) terminal of the battery, and a (—) sign for the binding post that connects to the negative (—) terminal of the battery. These polarity signs shall be placed before the battery designation letter as follows:

The binding post for connecting to the negative terminal of filament battery shall be marked —A.

The binding post for connecting to the positive terminal of a filament battery shall be marked +A, with the battery voltage added at discretion of the manufacturers. For example, +A1½, +A4½, +A6.

The binding post for connecting to the negative terminal of a plate battery shall be marked —B.

The binding post for connecting to the positive terminal of a plate battery shall be marked +B, with the battery voltage added at discretion of the manufacturer, using multiples of 22½, with ½ as a common fraction. For example, +B22½, +B45, +B67½, or +B90.

The binding post for connecting to the negative terminal of a grid battery shall be marked —C.

The binding post for connecting to the positive terminal of a grid battery shall be marked +C, with the battery voltage added at discretion of the manufacturer. For example, +C3, or C4½.

All terminal designations shall be marked on the radio receiver without quotation marks. Quotation marks are permissible when specifying these terminal designations in printed instruction, as for example "ANT" or "— A."

Separate pair of terminals are recommended for each battery and these terminals shall be so arranged that the polarity marking for any particular battery shall be kept in proximity and with the polarity arranged — to left and + to right when facing the terminals.

Size of Compartments in Receiving Set Cabinets for Dry Cell "B" Batteries

26111: The shape and size of standard battery compartments for housing "B" batteries in self-contained radio receivers shall be based on the vertical form "B" battery of the following sizes:

For Portable Type Radio Receivers — Standard battery compartments shall be so designed as to house 22½ volt vertical form "B" batteries made up of either the "B" or "C" size cells.

For Semi-Portable and Non-Portable Types of Home Radio Receivers — Standard battery compartments shall be so designed as to house 45 volt vertical form "B" batteries made up of either the "D" or "F" size cells, figured according to the vacuum tube plate current requirements as follows:

(a) When the plate current drain does not exceed 15 milliamperes, the vertical form battery shall be made up of size "D" cells.

(b) When the plate current drain does not exceed 15 milliamperes, the vertical form battery shall be made up of size "F" cells.

Particular attention is called to the fact that compartments designed to house only the 22½ volt vertical form "B" batteries for semi-portable and non-portable types of home radio receivers are not included in the standard.

Size of Compartments in Receiving Set Cabinets for "B" Batteries

26112: The size of standard compartments in radio receivers for "B" batteries shall be based on the vertical type of "B" battery of 22½ volt or 45 volt blocks, concentrating on the latter size as far as practicable. The size of these "B" battery blocks shall be based on the following individual cell sizes:

(a) For portable receiving sets the battery blocks shall be made up from "B" and "C" cell sizes.

(b) For current drains of 15 milliamperes or less, the battery blocks shall be made up from the "D" cell size.

(c) For current drains in excess of 15 milliamperes, the battery blocks

shall be made up from the "F" cell size.

Receiving Set Wiring Diagrams

26121: It shall be standard to supply with each receiving set a picture type wiring diagram showing in perspective the terminals, batteries, etc., etc., with the external electrical connections.

Antenna Installation Regulations

26131: If information is supplied to purchasers of radio apparatus in reference to the installation of antenna it shall follow the regulations of the "National Electrical Safety Code" and the "National Electrical Code."

Package Markings for Variable Condensers

26142: It shall be standard to mark on individual boxes or cartons the minimum and maximum capacitance of variable condensers, designed for use in radio circuits, in micro-microfarads. It is not standard to indicate the size of condensers by marking on the carton the number of plates.

Shaft Extension Dimensions for Panel Mounted Apparatus

26151: Standard shafts for apparatus using knobs, pointers or dials and designed for mounting on radio receiver panels shall have the following dimensions:

(a) The controlling shaft extending through the panel to be .250 inch in diameter with a plus or minus tolerance of .001 inch.

(b) For large panel apparatus, such as variable condensers, variometers and variocouplers, the length shall be one (1) inch, measured from the apparatus face or mounting lugs (if used) to the end of the shaft.

(c) For small panel apparatus, such as rheostats, potentiometers and variable grid leaks, the length shall be three-fourths (¾) inch, measured from the apparatus face or mounting lugs (if used) to the end of the shaft.

Voltage and Temperature Readings

(1) Voltage—The voltage of individual cells for the "A" battery shall be measured with a voltmeter having a resistance of not less than 100 ohms per volt, and having not less than 50 divisions per volt on its scale.

(2) Temperature — The standard temperature for making tests shall be 20° C. Deviations from this temperature shall be stated.

Dongan

Dongan Electric Mfg. Company, Detroit, Mich., has already designed a new transformer, No. 1572, for the new 80-milliamperere Raytheon tube.

The new transformer is similar in appearance to the other transformers and chokes in the Dongan line. It works with the regular type 1591 chokes.

Tuned R. F. Going Strong

A first-class set of up-to-date parts, built around the Aero Coil tuned R.F. kit—By S. W. Nichols

Now that coils, rather than condensers, have been recognized as the chief sources of resistance in radio tuning circuits, it is only natural to ask: "Admitting that there are high losses in coils incorrectly designed, do these losses have any actual effect on the operation of the set or the results as they are evidenced by the loud speaker?"

This question is quite in order for we do not want to fool ourselves about the importance of coil losses as we did about condenser losses. Since all losses are apparently wiped out by regeneration, it does not appear that they should affect the tuning circuits.

Actually, coil losses show up on both operation and quality. To wipe out the resistance of high loss coils it is necessary to use much regeneration, one form or another. The more regeneration, the more unstable and critical the tuning, and the more regenerative distortion brought into the R.F. and A.F. circuits.

Cutting down coil losses, or resistance, reduces the amount of regeneration used or permitted in the tuning circuits to give maximum undistorted signal strength.

This can be demonstrated mathematically and in practice. Some set owners, troubled by distortion and over-critical tuning, have found high-loss coils the source of their difficulty, as indicated by the elimination of those effects when coils of correct design were substituted.

In the set shown on the opposite page, with the wiring diagram below,

* See curves on page 274. RADIO ENGINEERING, July, 1926.

tuned R.F. has been employed in a design which meets the latest standards of practice, not only as to the inductances — spaced-wound without supporting tubes—but in the circuit and arrangement of the parts, every effort has been made to provide tuning which is sharp because the circuits are themselves of low resistance, so that they are not made critical by the introduction of regeneration.

This makes the set easy to tune, and gives the audio end a chance to show up at its best.

There are several design features worthy of note. Unlike most tuned R.F. sets, this outfit uses variable coupling to the antenna. This is semi-adjustable, as no control is put thru to the front of the panel. In cities where extra sharp tuning is necessary, the coupling should be loose, but in the country, away from interference, it can be made as tight as possible.

All wiring is put beneath the base. That is the proper method, preferably both as to appearance and utility. Anyone who has shorted the wrong wires by dropping a screw driver knows that the vacuum tubes are safer when this method is employed.

The diagram shows the connections as they should be made for a UX 210-A or CX 301-A, as well as the Donle detector tube. A single change, however, permits the use of the new UX 200-A or CX 300-A detector. Instead of running the lead from the lower ends of the coil and variable condenser, in the detector grid circuit, to the A+B— leads, it should be

run to the lead from the 30-ohm detector rheostat to the A— binding post. Then the full efficiency will be obtained from the UX 200-A or CX 300-A.

Some very interesting experiments can be made with this receiver. To determine the effect of losses on the feed-back required, adjust the high resistance in the plate circuit of the R. F. tubes until they are almost oscillating.

Then put a small piece of insulating material inside each coil. There will be very little effect in the first coil, because of the resistance introduced through the antenna system, but there will be considerable change in the other coils.

Not only will the oscillation point change, but the signals will be reduced. That is not entirely due to losses, however. It is partly due to detuning, for the introduction of insulating material or metal in the field changes the inductance.

Next, retune the condensers. That will bring the signals up in volume again, but you will have to reduce the plate resistance to bring the circuits back into oscillation.

This demonstrates most clearly that coil losses are wiped out by regeneration, but at the sacrifice of tone and stability, particularly on faint stations. A further demonstration is given by the effect of metal plates at the open ends of the coils, such as is the case where coils are mounted close to condensers with their axis parallel to the condenser shafts.

Then a greater amount of loss is introduced, and still greater is the amount of regeneration required to bring up the signals to normal volume.

Be sure, in making any experiments of this sort, that you do not mistake the detuning effect of materials introduced in the field for losses in the signal strength, as that can be made up, under all ordinary conditions, by more feed-back from one source or another. Also, remember to make the tests on average stations.

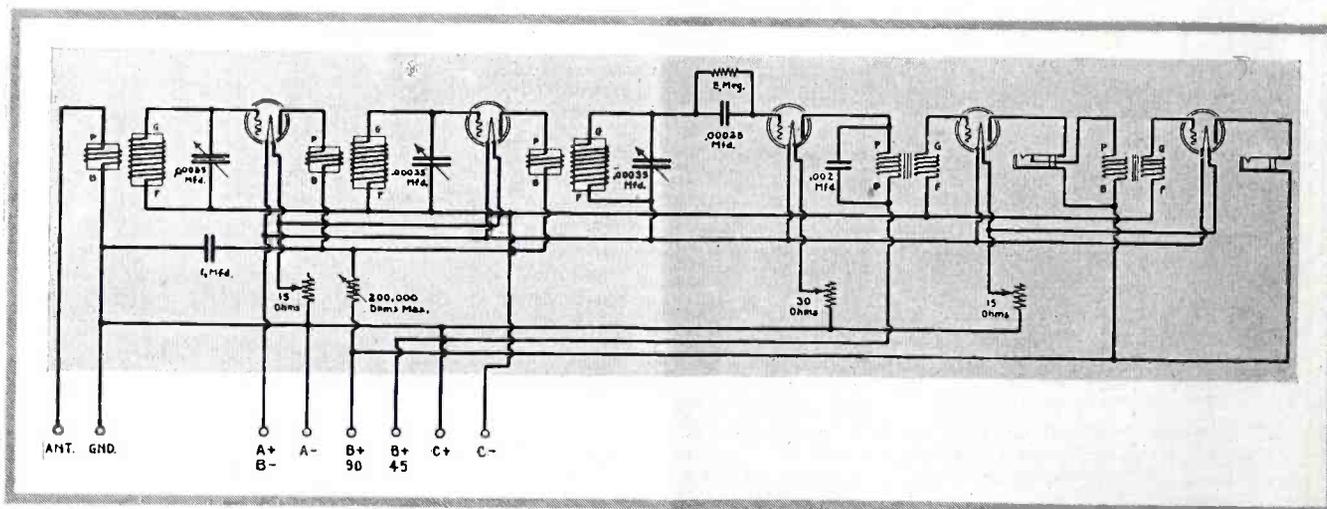
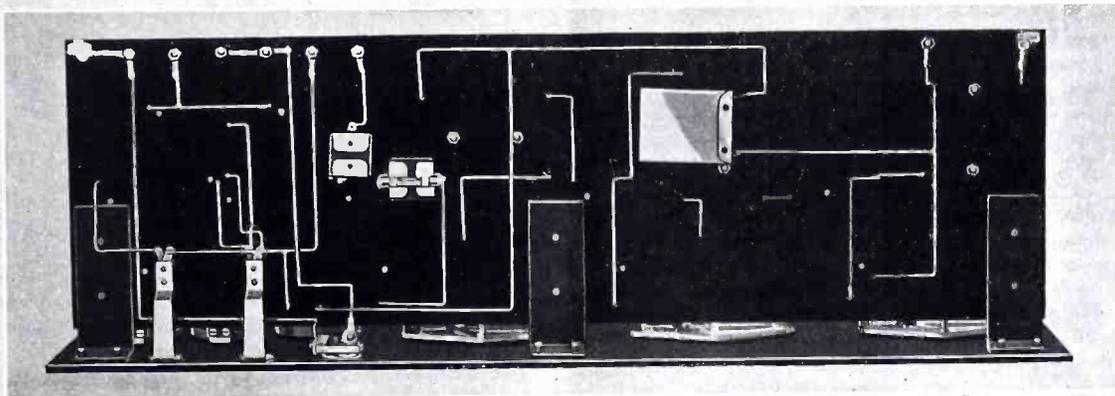
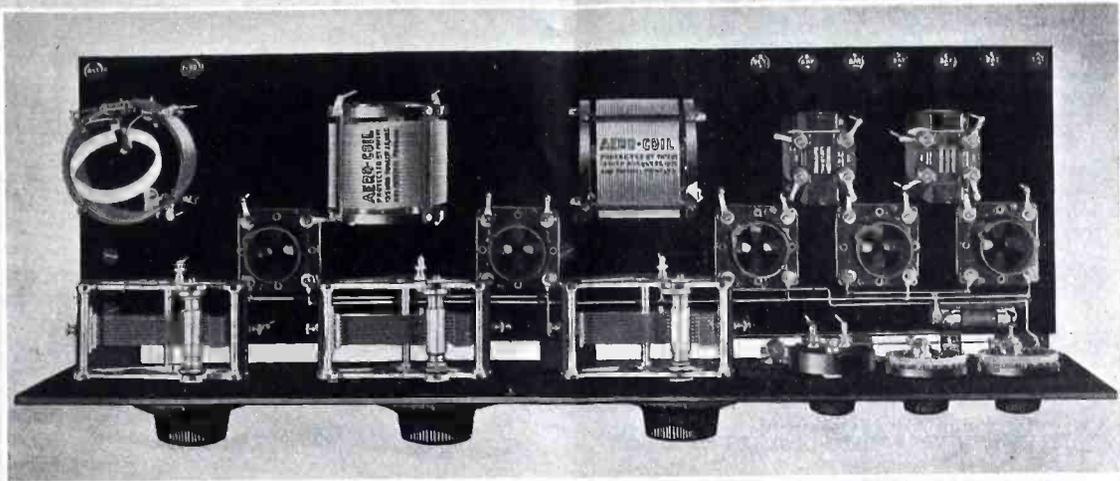


Fig. 1. Circuit and constants for the Aero set. Follow the terminal markings on the coils, for the polarities must not be reversed. This diagram is correct for the Donle detector, but for the UX-200-A or CX-300-A the grid return of the detector should go to the minus filament lead



For all-round satisfaction there isn't anything much better than a set with two good stages of tuned R.F., unless it's a set with more than two stages. Correct design, plus good parts and careful workmanship means satisfactory results. In congested centers, near strong local stations, it will cut down interference to put this set in a cabinet having a metal lining, to prevent pick-up directly on the coils.

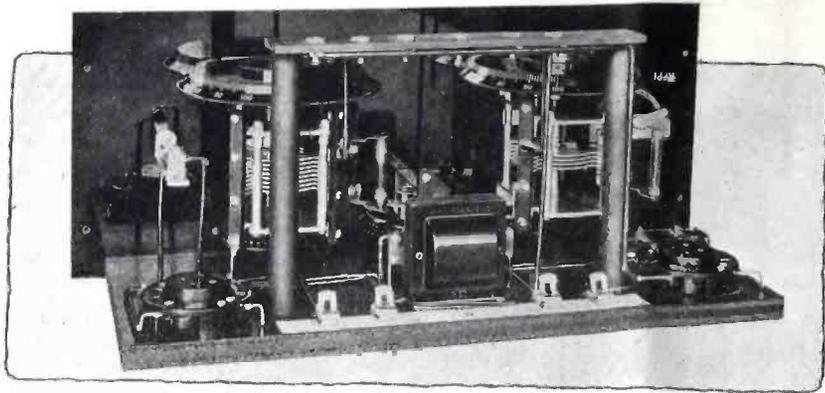


Fig. 1. The coils are mounted on the elevated strip which protrudes thru a slot in the top of the cabinet

For Short Wave Reception

*Describing the CR-18 short wave receiver, with construction notes for the set builders—By F. B. Ostman**

CONTRARY to the generally accepted opinion, the short wavelengths which are attracting such interest in the radio field are not a new discovery. It is interesting to note that the earliest experiments in radio, during the last quarter of the nineteenth century, were carried out in the band that we now know as "short waves." The simple apparatus devised by the pioneer investigators of radio was of such proportions and design that only very short waves were radiated. These were measured and their behavior determined in the confined space of the laboratory. As attempts were made to radiate higher power to cover greater distances, the radiating surfaces, i. e., aerial and ground systems, were increased in size and consequently the wavelength increased. It was then felt that to cover greater distances that it was necessary to have large radiating systems, and from then on, until recently, the development of short wavelengths was neglected.

When Marconi first brought this new force before the public in the form of telegraphy without wires, the waves in the vicinity of 600 meters were accepted as the most practical. The first attempt at Trans-Atlantic signaling was made on wavelengths around 1,800 meters. The trend toward longer waves and longer distances continued with the ever increasing use of higher power to insure reliable communication. During the World War, Trans-Atlantic stations were built to operate on waves as high as 25,000 meters.

In 1912, the Department of Commerce classified and licensed all radio stations, assigning certain wavelengths to each class of stations. In order to prevent amateur interference with Naval and Commercial stations, wavelengths around 200 meters, then con-

sidered useless, were assigned them.

Although limited to low power and 200 meters, it took but a few years for the amateur to perfect apparatus to enable him to communicate up to the considerable distance of 2,000 miles. While not consistent, these results were very encouraging. Except during the period of the World War, when amateur activities were suspended, continuous progress was made. With the development of the vacuum tube for transmitting and its practicability for radio telephony, new interest was aroused and the first practical broadcasting was accomplished. Following these developments, commercial companies became interested in broadcasting, and it was not long before the number of broadcasting stations had become so numerous, that new wavebands were necessary to make room for these additional stations, and to remove the possibility of interference from amateur transmitters, a recent Radio Conference at Washington, D. C., extended the amateur waveband from 200 down to 150 meters. After operating on the lower portion of this band for a short period, it was found that greater distances could be covered than was heretofore possible. These indications led many to believe that the wavelengths below 150 meters held further possibilities. A few amateurs then obtained special licenses which permitted them to operate on wavelengths down to 100 meters and, on this wavelength, using a very small amount of power, they succeeded in carrying on communication with France and other foreign countries. This remarkable work encouraged many of the experimenters to drop to still lower wavelengths. Tests made as low as 10 meters indicated that extremely short waves offered a fertile field for research and were useful for long-distance communication with low power.

Realizing the importance of the low wavelengths, the United States Army, Navy and Commercial Companies have erected many stations in order to study further the characteristics of these high frequencies. Many of the foreign countries are now utilizing the shorter wavelengths and the number of short wavelength stations throughout the world has increased rapidly. So important are these low waves considered at the present time that the U. S. Department of Commerce has allocated wavelengths from 200 down to .74 meters. Exclusively assigned wavebands for Army, Navy, trans-oceanic, relay broadcasting, and amateur experimentation have been made.

Use of Short Waves

The fascination of the short waves has taken hold of every type of radio enthusiast. Still in its infancy, there is no telling to what extent the development of short waves will finally lead. It behooves every earnestly interested radio man to follow closely this interesting phase of radio development. Short-wave activities are so diversified as to appeal to everyone.

Of prime importance at this time is the low wave broadcasting being carried on by a number of American and foreign broadcasting stations. WGY and KDKA lead in popularity. Operating on various low wavelengths, simultaneously with their high wave broadcasting stations, they have been heard almost all over the world, far beyond the distance obtainable on their regular broadcast waves.

Extensive experiments are now being carried on by the large radio communication interests to determine thoroughly the reliability of short waves for trans-oceanic and commercial purposes.

Low wave amateur experimentation has resulted in phenomenally increased range of amateur stations. Owners of very moderately equipped stations in all parts of the world have become neighbors and exchange almost daily conversations for their friends. The extremely low power used in most cases makes these achievements seem almost incredible to those not familiar with the work.

The MacMillan Arctic Expedition and the Hamilton-Rice party on the Amazon were probably the first to realize the advantages of the short waves in establishing contact with the outside world. Short wave radio has become an invaluable adjunct to exploration. This is further emphasized to the use of radio equipment now with the Wilkins and the Byrd Arctic Expeditions. In the latter instance the short wave receiving equipment to be described in this article is being used, and the Byrd expedition is maintaining contact with the Grebe Company through their experimental station at Richmond Hill, N. Y.

The CR-18 Short-Wave Set

The short-wave CR-18 receiver shown in Figs. 1 and 2 has been de-

* Service Engineer, A. H. Grebe & Co., Inc.

veloped for reception on low wavelengths.

The operation of A. H. Grebe's amateur and experimental station, for the past fifteen years, under call letters 2ZV and 2XE, has made it possible for this organization to keep in

from operator's body, and metal objects, thus eliminating capacity effects and attendant losses.

Plug-in coils are featured, which enable rapid change to be made from one frequency band to another, and are so designed that maximum signal

a choke coil, prevents unstable action and dead spots formerly encountered to an objectionable degree in tuning.

Absolute rigidity in construction, simplicity, and excellent mechanical design insures long operating life and freedom from trouble. Compact construction and adaptability for storage or dry battery tubes makes it available for station or portable use.

Circuit Data

The circuit, shown in Fig. 3, is regenerative, with inductive antenna coupling and capacity control of feedback. Two tubes are employed, a detector and one audio amplifier, since this set is designed for head-set operation. A loud speaker can be used by the addition of an external stage of audio amplification or a super-power amplifier, if desired.

One rheostat controls both tubes, since delicate filament control is not necessary on the hard tubes employed.

A so-called shunt-feed circuit is employed for regeneration with a series condenser as the only control of regeneration. In place of the usual radio frequency choke coil a compact 25,000 ohm resistance is used. This value is sufficient to prevent passage of radio frequency current, and yet no noticeable drop results in the signal delivered to the audio amplifier.

The beat frequency control is especially useful on the low waves after

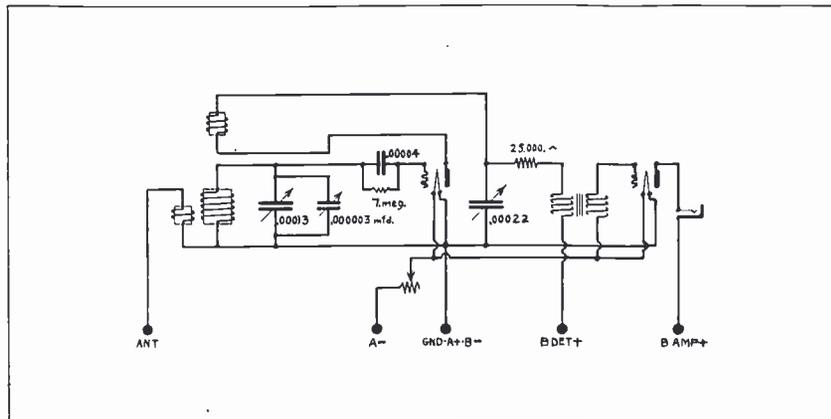


Fig. 3. Schematic diagram and constants of the Grebe CR-18 short wave set

touch with amateur requirements along with development work on these short waves and has enabled this company in a practical way to test theories and experimental work done in its laboratory. The CR-18 is therefore the result of many laboratory and practical experiments and new ideas, checked in a practical way, finally designed to operate efficiently under present-day conditions.

Previously the only available short-wave receivers were the home-constructed instruments of the amateur builders. Obviously, each instrument was of individual design incorporating the ideas and theories of its constructor. The CR-18 is the first standard instrument available to those who have manifested interest in short wave receivers who have not desired or been able to construct their own.

In designing a receiver for short-wave reception, many problems are encountered which are not met with in dealing with the higher wavelengths. Radio frequency amplification does not seem to offer any particular advantages, and more complex circuits, using multi-stage amplifiers, are either unstable or have too many operating controls to be of any value.

The CR-18 employs a coupled regenerative circuit which is best adapted for reception of frequencies between 1,500 and 30,000 Kilo-cycles, 10 to 200 meters.

An antenna coupling coil provides variable magnetic coupling between antenna and grid circuit, producing a high transfer of energy without affecting the wavelength calibration. This also makes possible the use of harmonic tuning to increase the signal strength, gives greater selectivity from high wave local stations, and reduces interference and induction noises.

The losses in the entire circuit are reduced to a minimum by proper placing of the elements. Inductance coils are mounted on supports, far removed

strength is obtained. An isolated grid terminal lowers the minimum capacity, and insures correct insertion of the coil.

Accurate tuning is provided by means of the beat frequency control to within a fraction of a Kilo-cycle. This control consists of a separate variable air condenser of very small capacity variation.

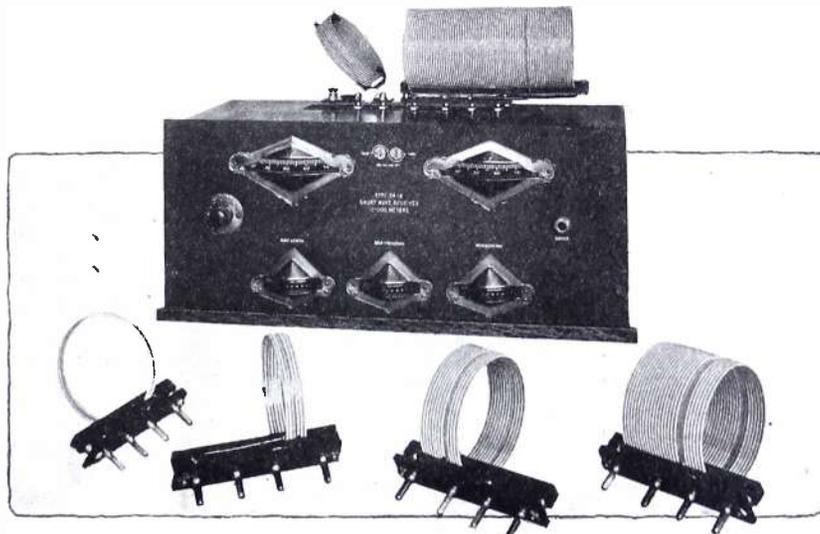


Fig. 2. Showing the front of the set with an Inductance unit in position—also the other coils provided

Accurate calibration of the set using each coil is provided, enabling the operator to pick up his stations by dial settings, with the assurance that the adjustment is absolutely accurate and permanent. This original calibration is obtained from a quartz crystal oscillator, the present accepted standard of frequency measurements.

The plate circuit is designed to give smooth control of regeneration without affecting wavelength calibration. The oscillating point is, practically constant over the entire tuning range. A non-inductive resistance, rather than

the finest possible adjustment with the main tuning control has been made. Harmonic tuning can be accomplished by the use of loose inductive coupling, with a variable series condenser in the aerial lead. Best results are obtained when the fundamental period of the antenna is some multiple of the received wavelength.

Theory of Short Waves

It is impossible to discuss in detail the theory of short wave operation in the scope of this article. As yet, much of the phenomena encountered in the

short wave field remains unexplained, and therefore offers a fertile field for the enthusiastic experimenter and engineer who will apply himself to the collection of data on this important subject.

A great deal of valuable experimental work can be accomplished by anyone who will listen in on the short wavelengths and keep an accurate record of the results obtained. One of the problems involved is the nature of propagation of the signal between transmitter and receiver. It appears that the very short waves do not follow the curvature of the earth as do the longer waves but are reflected by some medium in the upper atmosphere. This reflection results in what is now termed, a "skip-distance" effect. A signal which is very strong a thousand miles or more away is often inaudible a few hundred miles from the transmitter. This phenomenon seems to be dependent upon the season of the year, time of the day, wavelength used, power of the transmitter and possibly certain local conditions of the installation.

Sufficient information should be gleaned from this article by those experimentally inclined who favor building their own receivers, to enable them to incorporate the various features which have been used in the CR-18. The manufacturers are genuinely interested in the development of the short wave field, and have compiled information of a valuable nature which is available to all experimenters who desire to expend serious thought on such development work.

Socket Contacts for Manufacturers

Set manufacturers as well as those who are putting out construction kits will be much interested in the new socket contacts designed by A. G. Heller, President of the Insulating Company of America, New York City.

The socket contacts are designed to be mounted underneath a horizontal Bakelite panel, in which holes are drilled to pass the tube pins.

Each contact, contrary to ordinary practice, is eyeleted in place at the point where the base pin passes through the panel. Consequently, the contact arm itself can be swung to the side in order to give it the correct position to take the wiring. Only the four holes for the pins are drilled in the panel. Ordinary types require two or three holes per contact, so that the new type saves four or eight holes per tube.

If the contacts are arranged along two parallel lines, they occupy a rectangle 9/16-in. by 1-9/16 ins., or if they are arranged diametrically opposite each other, they occupy a space 1-1/8 ins. square.

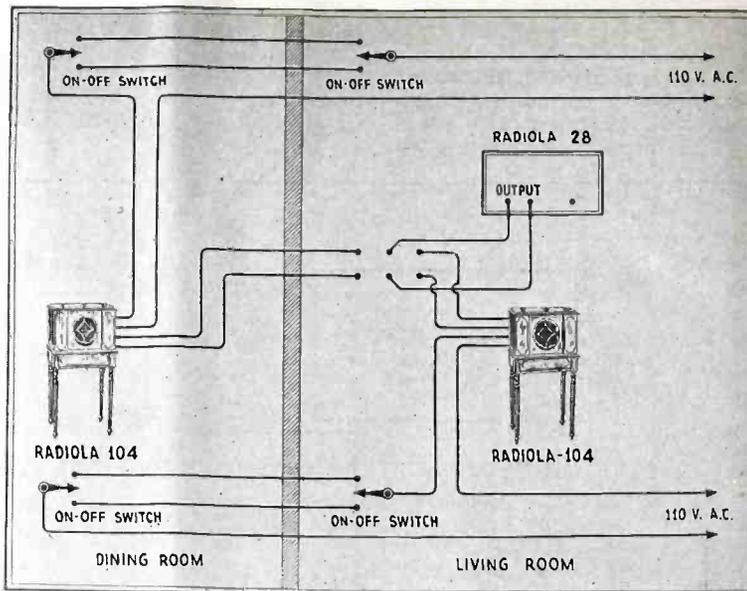


Fig. 1 The D. P. D. T. switch puts either loudspeaker on the receiving set, and whichever loudspeaker is connected can be turned on or off from either room

Radio House Wiring

The use of a radio set is no longer confined to one room, as is explained in this article—By Austin C. Lescaboura

RADIO house wiring—that's the next move in radio engineering and radio merchandising! With the vast strides made in radio receivers and with the advent of high-power broadcasting, ensuring enjoyable and reliable radio service day in and day out irrespective of season or atmospheric conditions, radio ceases to be a mere means of entertainment for the few leisure hours spent in the living room of an evening, and, in marked contrast, becomes a household necessity for every hour of the day. Therefore radio, at this time, assumes the importance of a domestic utility that must be made available in every part of the house. And thus we arrive at radio house wiring.

There are no hard and fast rules for radio house wiring, to be sure. It is such a new thing and one so full of variables, as the mathematician would say, that every house must be considered entirely on its own merits. Thus the simplest radio house wiring, if it may be termed such, is simply an extension cord between radio receiver and perambulating loud-speaker. Surely this arrangement is better than a loud-speaker immediately next to the radio receiver, for it provides considerably more radio service. A step further is to run light wiring, exposed or concealed, from the master receiver to several remote loud-speaker outlets, so as to provide radio service in several parts of the house. If sufficient power is available, such as through the use of a power amplifier, two or more loud-speakers may be operated at one time from the same re-

ceiver. If we carry the radio house wiring still further, we soon come to a point where a second and even a third radio receiver, operating individual groups of loud-speakers, are justified, not only providing a convenient means of controlling volume and selection of program right at hand but also providing a choice of two or more simultaneous programs.

In the absence of any definite rules or regulations or principles, Dr. A. N. Goldsmith, Chief Broadcast Engineer of the Radio Corporation of America, suggests these simple guides: first, for adjoining rooms not separated by sound-proof partitions and in families wherein all members are willing to listen to the same radio features, a master receiver with feeders to two or more loud-speakers should be employed; secondly, for widely separated parts of a house, with sound-proof partitions between, or in families where there is a marked divergence of opinion as to what radio programs are to be heard, a separate master receiver, wired to its own loud-speakers, should be employed. Dr. Goldsmith is absolutely in favor of BX or flexible armored cable for the wiring, identical to that employed in concealed electric light wiring. Such wiring is permanent, free from trouble, and complies with the fire underwriters' rules which are bound to prove more and more of a factor in these days of high potential currents between receiver and loud-speaker, and alternating-current drive.

But better than mere generalities, no doubt, is the specific case of the Model Radio House, sponsored by the Radio Corporation of America and

Notice to Readers

HERE appears to be so much misunderstanding concerning M. B. Sleeper's connection with the Sleeper Radio Corporation that an explanation is due our readers.

In 1919 M. B. Sleeper organized the General Apparatus Company, the name of which was later changed to Sleeper Radio Corporation. During Mr. Sleeper's absence abroad, the company got into financial difficulties and, upon his return in December, 1922, the concern was reorganized.

Feeling that the condition of the industry at that time did not warrant his continuation in manufacturing, Mr. Sleeper organized M. B. Sleeper, Inc., to take over RADIO ENGINEERING magazine as an independent paper, though it was originally published as a house organ for Sleeper Radio Corporation.

Disapproving of the manner in which the business was conducted, Mr. Sleeper not only refused to carry the advertising of Sleeper Radio in RADIO ENGINEERING magazine, but insisted upon disposing of his stock in the manufacturing company. On December 21, 1923, the sale of the stock was concluded and, since that date, M. B. Sleeper has no share in the ownership or management of Sleeper Radio Corporation, although the company has, unfortunately, continued under his name.

By a contract made at that time, M. B. Sleeper agreed not to engage in the manufacture or sale of radio equipment under the corporate or trademark name of "Sleeper," except in the case that Sleeper Radio Corporation discontinued or went into bankruptcy.

This came about in the early part of 1926, when Sleeper Radio went into bankruptcy with a loss to creditors and stockholders estimated at a million dollars. Shortly after, the assets of the defunct company were bought for \$7,500, and an attempt is being made to put the company in business again.

Now, although M. B. Sleeper is in a position to engage again in the manufacture of radio equipment, sold under the Sleeper name, it should be understood definitely that he is in no way connected with, or responsible for, the activities of any concern whose equipment do not bear the mark "Licensed for manufacture by M. B. Sleeper."

It is unfortunate that this situation should arise, but the directors of M. B. Sleeper, Inc., take this opportunity to warn the readers of RADIO ENGINEERING against any misunderstanding over the similarity of names. Look for the initials "M. B." and you will know which is which.

(Signed) M. G. MURRAY,
Secretary, M. B. Sleeper, Inc.

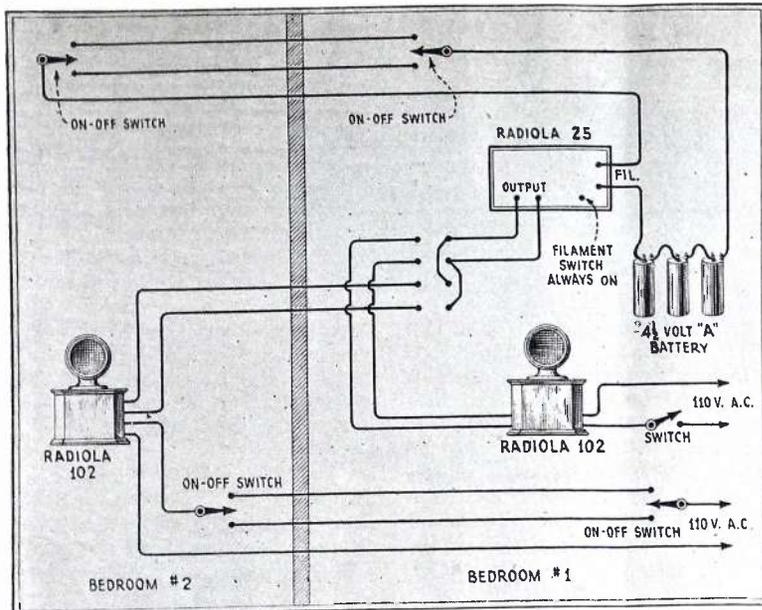


Fig. 2. Closing the 4-pole switch puts both speakers on the set. The tubes can be turned on and off from either room, the A. C. for the speaker in room 2 can be turned off in that room, or either speaker controlled from switches in room 1

just completed at St. George, Staten Island, overlooking busy New York Harbor. This house, of modest size but exquisite design, represents what can be done when an electrical contractor and a radio man collaborate in furthering each other's interests. The same ideas may be applied on a larger scale for the mansion, or on a smaller scale for the most inexpensive bungalow. Standard radio equipment is employed throughout, greatly enhancing the practical value of this worthy example.

Three radio receivers, with their individual "feeders" and loud-speakers, are employed in the Model Radio House, together with a system of concealed wiring, convenient alternating current outlets for power supply, and remote-control switches for turning the distant receiver on or off. In the living room there is an 8-tube super-heterodyne receiver, operating a cabinet type power speaker in that room and a similar loud-speaker in the dining room. Switches in each room control the operation of either loud-speaker and the receiver. In the kitchen there is a battery-operated 5-tube radio frequency receiver, with antenna and ground connections from baseboard outlets. The cone speaker is placed alongside the receiver, and both are protected in a neat wall cabinet. Upstairs, in the master bedroom, is a 6-tube super-heterodyne, operating a power cone-speaker in that room and a similar power cone speaker in the guest room. The loud-speaker in either room may be turned on or off, although the choice of program rests with the occupants of the master bedroom. A time switch turns on the radio service in the morning, thus serving as an effective alarm clock for the household, and bidding them do their setting-up exercises even if it

does mean climbing out of a warm bed!

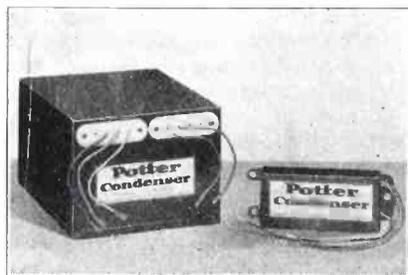
The wiring of the Model Radio House was handled by the same electrical contractor who did the electric wiring, while the standard radio equipment was installed by the usual radio service man. All of which means that radio house wiring is a thoroughly practical idea at this time.

The possibilities of radio house wiring, so far as the radio trade is concerned, are practically without limit. Like the proverbial growing of two blades of grass where but one grew before, it means an increased demand for receivers and loud-speakers, power amplifiers and wiring supplies. For the present, of course, the radio house idea must be sold to the public. The Model Radio House is the opening gun in this campaign which, to become effective on a nation-wide scale, must be copied in many localities by similar model radio houses. The details are left to the enterprising radio dealer and radio service man, perhaps with the collaboration of an equally enterprising electrical contractor. Perhaps a special house can be built for the purpose by a group of radio men in a given locality. Again, it may be possible to secure the radio rights to some model house being erected. Still again, several houses may be wired and equipped for customers, even at more than reasonable prices, in order to have something to show to others. Of course, any installations intended to get the radio-house-wiring ball a-rolling, will have to be open to the public in order to sell the idea.

Just as electricity has grown from the simplest sort of installation for only the most essential lighting fixtures in the home, so must radio house wiring now come into existence.

With the Manufacturers

Current news about the activities and plans of the radio manufacturers and concerns which make things used by the industry



Potter condenser equipment for Raytheon eliminators

Potter

The Potter Mfg. Company, Chicago, Ill., has been most successful with their condenser kit for the Raytheon eliminator. The two units are shown in the accompanying illustration.

Potter is also making condensers for a number of manufacturers who are building eliminators and other equipment requiring condensers of large capacity suitable for either dry or low voltages.

Jones

Howard B. Jones Radio Company, Chicago, Ill., manufacturers of the Multi-Plug, are now making waxed-wire harnesses for receiving sets. The harnesses are, of course, designed for special sets built by manufacturers. They use a very attractive and entirely satisfactory method of tying the wires together—a method which makes the cost very low indeed. Since the harnesses are made on standard jigs, there is not the slightest variation in the length of the conductors. Consequently, they fit perfectly to the terminals of the sets.

Saal

A novelty in loudspeaker design has been introduced by H. G. Saal Company, 1800 Montrose Avenue, Chicago, Ill. This loudspeaker stands on the floor, so that it can be located at any convenient point in a room. The cord is long enough to reach the receiving set if the speaker is put up near by, or it can be connected by an extension cord if necessary.

Grimes

David Grimes, former Chief Engineer of David Grimes, Inc., is now carrying on development work, independently, on the Inverse Duplex circuit.

Of all the men involved in the various failures, during the past winter, we believe that Grimes is most liable to surmount financial difficulties, with

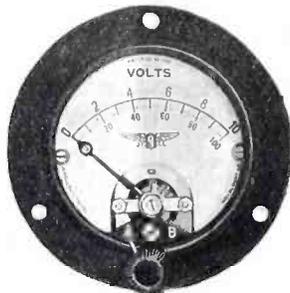
which he was in no way concerned, and come out on top.

It appears quite likely that the Inverse Duplex would have been successful at the start if as much had been known then as now concerning shielding and the isolation of circuits.

Practical experience showed that the original double-duty circuits did not actually perform the work of separate tubes. On the other hand circuits designed in accordance with our present knowledge may perform in practice as they promise to in theory.

Jewell

Jewell is making rapid progress in putting across, both to the manufacturers and to the public, the idea of



One of the most popular Jewell instruments, a double-reading voltmeter

equipping receiving sets with meters. This is in keeping with the general trend which indicates that a good receiving set, properly equipped, cannot be built at a low price without the sacrifice of advantages or conveniences.

Daven

Daven Radio Corp., Newark, N. J., has a kit of coils for tuned R.F. receivers. A special advantage in their design is the small size, by which the external field is reduced. Moreover, because of the small space taken up by them, they can be very conveniently mounted behind the front panel.

DeJur

DeJur Products, Inc., New York City, is bringing out an exceedingly neat 3-stage resistance coupled ampli-



Another new DeJur instrument

fier. Although it is very reasonable in price, it has thoroughly first class construction throughout, one feature of which is the use of die-formed strips for all connections.

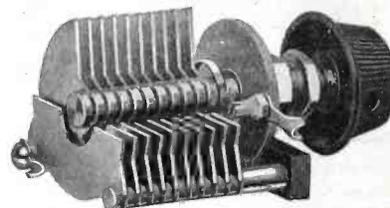
Insulating Company of America

Instead of sitting back to take orders from manufacturers, the Insulating Company of America, New York City, is working to assist the manufacturers in the solution of their problems.

Among other things, this concern has brought out a new socket adapted particularly for economical use by manufacturers of complete sets and for construction kits.

Precise

Precise Mfg. Company, Rochester, New York, well-known to set builders by their introduction of the single control design for super-heterodynes, has



Precise vernier or balancing condenser

a splendid little vernier condenser which is also useful in special circuits where small variable capacities are required. It is shown in the accompanying illustration.

Van Horne

The Van Horne Company, Franklin, Ohio, has recently introduced a novelty in the form of a socket absorbing arrangement built into the bases of their tubes. There is a flexible connection between the elements and the leads and the contact pins, allowing the use of sponge rubber between the upper and lower halves of the tube base.

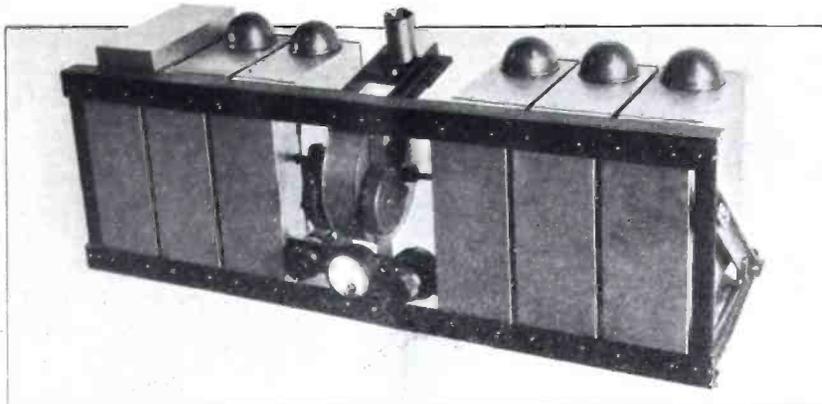
Cornish Wire

The Cornish Wire Company, 30 Church Street, New York City, is offering a highly useful service to manufacturers in connection with their wire problems.

So many special questions come up concerning the use of insulation for inductances, transformer and choke coils, and special items such as rigid and flexible conductors for wiring sets. They have made a special study of the various factors to be considered by radio manufacturers, and have gathered much useful information along this line which is available to those who ask for it.

U. S. L.

1927 condenser models are now in production by the United Scientific Laboratories, New York City. The new designs incorporate a number of mechanical and electrical improvements. Starting early, they will be able to make prompt shipments for fall business.



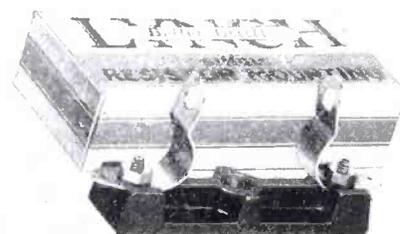
1. Freed-Eismann has surprised the trade by making their new 1927 neutrodyne in a single-control shielded job, operating from a loop antenna. A Weston meter and switch shows the voltage of each circuit



2. Bremer-Tully seem to have set a precedent by making a B battery eliminator of sufficiently straight-line voltage regulation characteristics that no adjustments are necessary



4. Used as a pin-jack voltmeter this Weston instrument reads up to 4 volts, on 160 volts when put into the mounting base which contains an extra resistance



3. Arthur Lynch is backing up a line of high merit with a most aggressive sales campaign. Here is the new resistor mounting just added to the Lynch resistor family



5. United Scientific Laboratories are already delivering the Pierce Airo construction kit. It is a six-tube, single-control outfit, very nicely designed for the set builder. Incidentally, it is designed to be put out at a very reasonable price

6. Rear view of the assembled Pierce Airo kit. The three-section condenser is provided with two compensators, by means of which two of the sections can be made to match exactly with the third, thus assuring absolute resonance thru-out

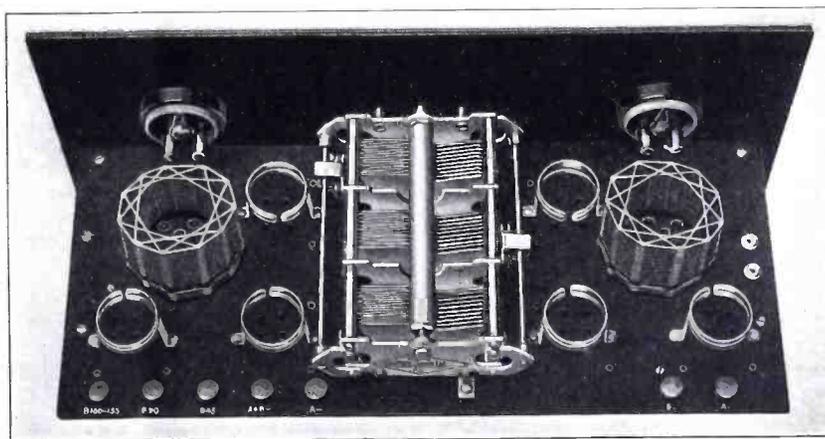




Fig. 1. A single-control, D.C.-operated receiver

How to Use 110 Volts D. C.

An unusual one-control set built for P. Dyson-Skinner, to meet the D.C. situation in New York City—By J. Grabar

So much of New York City, as well as other parts of the country, is equipped for D.C. that some data on a set using direct current for the A and B supply may be useful to service men and set builders.

The set illustrated in Fig. 1 was made for single control, using a horizontal scale for calibration. The tuning circuits are interesting as a special problem, but the A and B supply arrangement is applicable to any receiver.

As shown in Fig. 2, the inductances of the R.F. end are tuned by a double Amsco condenser. The shaft does not come thru the front panel, however, but carries a gear wheel, taken from the vernier control of a General Radio condenser. Below the gear is a small pinion which, by a knob at the front, rotates the double condenser. The gear also

runs against a strip of metal-backed Bakelite rack, made by Kurz-Kasch. This rack carries the pointer which, moving in a slit, works against the calibration scale.

Slight variations in the tuned circuits are taken care of by a vernier

condenser in the detector circuit. The coils are of pickle bottle design.

Using one stage of resistance coupled A.F., plus a stage with transformer, gives plenty of volume and first class quality. This combination was selected because of the Donle tube used for the detector.

A series circuit was arranged for the filaments because it put less current thru the resistances and choke, making the circuit much simpler than with parallel connections.

One Dongan choke and an 8.0 mfd. Potter condenser took out all the ripples. In addition, there are bypass condensers in the R.F. and A.F. returns to the filament.

Two Centralab variable resistances of 500,000 ohms maximum, give adjustments for the R.F. and detector tube plates, but the full voltage was applied to the A.F. amplifier tube.

A Pacent potentiometer plus a 50 ohm Pacent rheostat give sufficient resistance to cut down the 110 volts for the filaments. The potentiometer gets warm, but it has been handling 0.25 ampere for several months without appearing to be worse for wear. A 0.8 voltmeter is put across the filament of the detector tube. The resistances are set to make this meter read 5 volts. Since the tubes are in series, if the voltage across one tube is right, all the rest must be right also.

Near the place where the set was to be set up, there was a floor plug already. However, it was of the conventional design. Shortly after the installation was made, a distress call came in. The set seemed to be o.k., but it didn't work. A minute's investigation showed that someone had accidentally pulled at the plug, and has severed the polarity when it was put back. There was no more trouble from that, tho, because we took out the old fixture and put in a polarity plate which, with its special plug, made it impossible to reverse the connection.

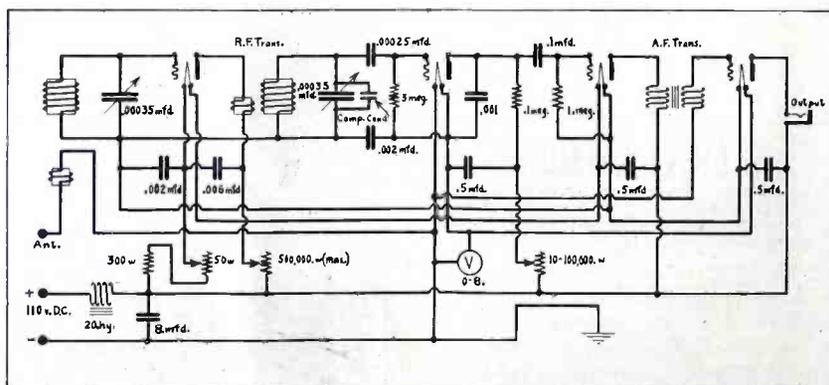
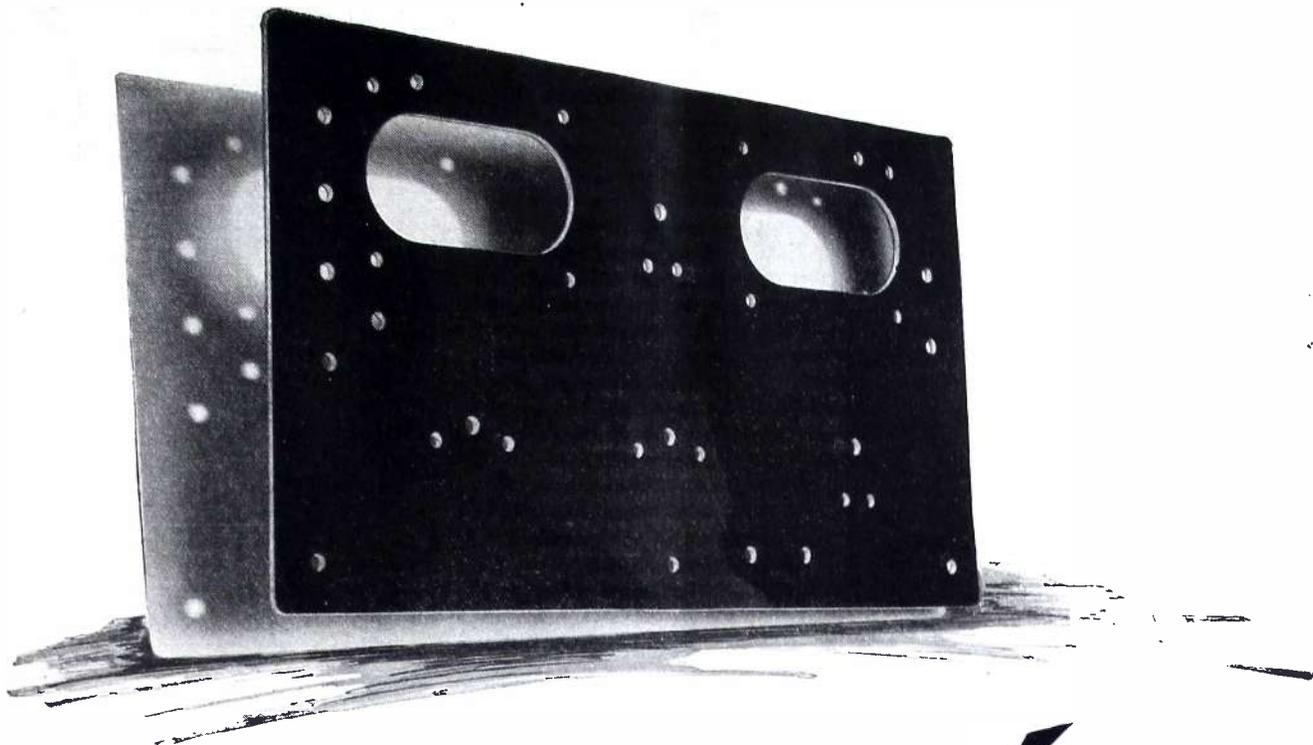


Fig. 2. Circuit diagram for the set and the D.C. supply for A and B



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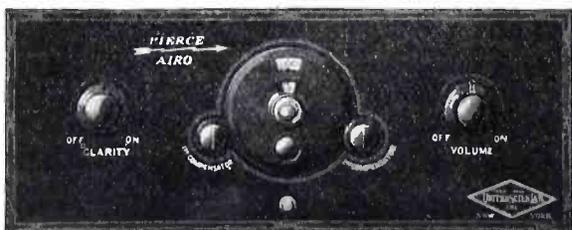
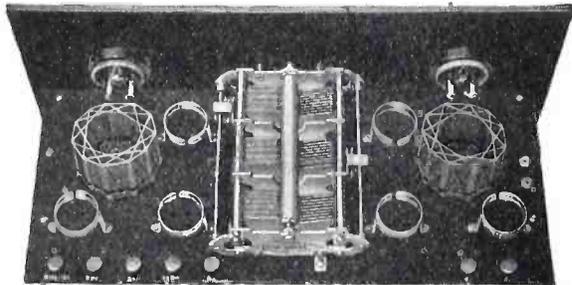
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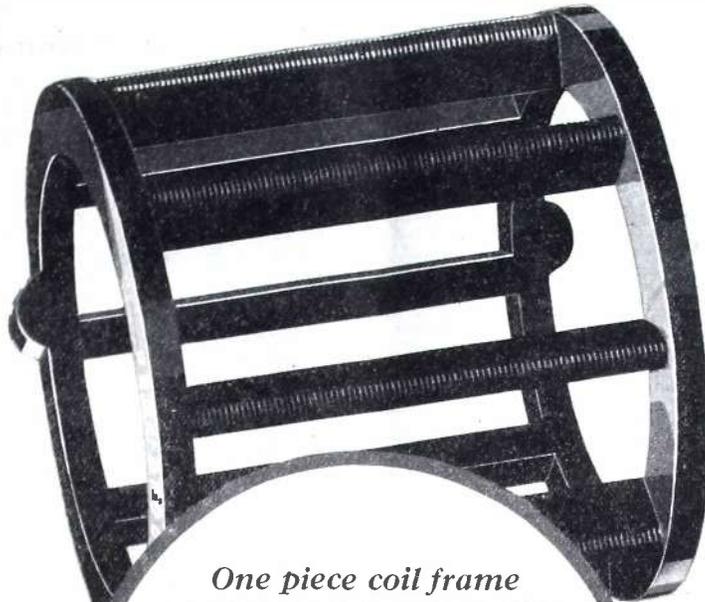
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- 1—Dubilier By-pass condenser, 1 mfd.
- 1—Amertran DeLuxe Second Stage.
- 1—Jewell Milliammeter, 0-50, No. 135.
- 1—Federal Potentiometer, No. 25, 1,800 ohms.
- 1—Electrad open circuit Jack.
- 2—General Radio UX Sockets.
- 2—Daven Single Resistor Mountings.
- 1—Aerovox Lavite Resistor, 200,000 ohms.
- 1—Aerovox Gridleak Resistor, 1 Meg.
- 4—Durrant Coil Mounting Pillars.
- 7—Lastite Terminals, 6-32.
- 10—1" F.H. 6-32 Black Lacquered Screws.
- 8—1/2" F.H. 6-32 Nickel-plated screws.
- 6—3/8" R.H. 6-32 Nickel-plated screws.
- 24—3/8" R.H. 6-32 Nickel-plated screws.
- 8—3/4" R.H. 6-32 Nickel-plated screws.
- 50—6/32, .041 Nickel-plated nuts.
- 1—5 ft. Single phone cord.
- 1—Coil writ.
- 3—Lengths No. 7 Varnished Tubing.

ALL AT THE MONEY SAVING PRICE OF \$67.50

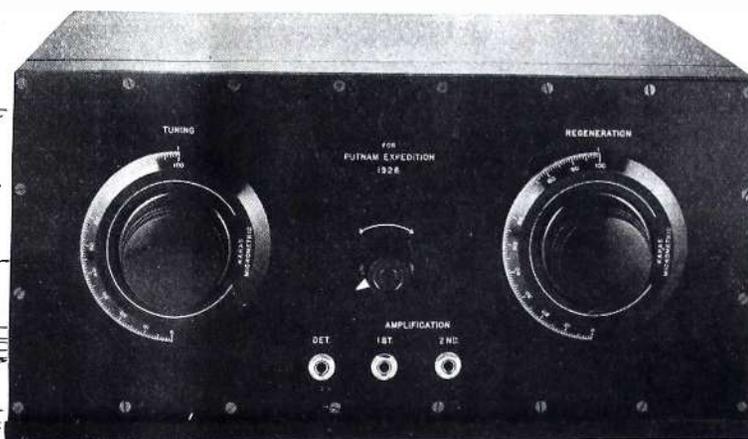
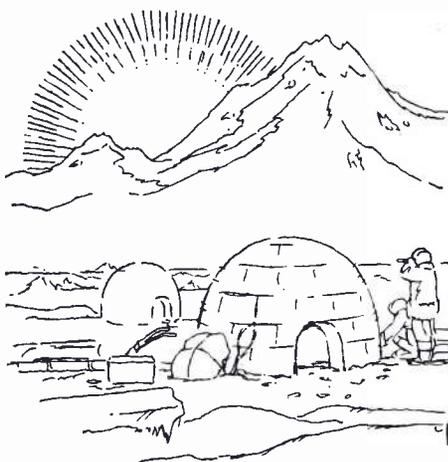
Complete set of blue prints, postpaid, \$1.00

NOTE: Durrant can supply all Pacent accessories. As a recognized agent for Pacent Essentials, Durrant maintains a complete stock.

DURRANT RADIO, Ltd.

52 Vanderbilt Ave., New York City

Even In "Greenland's Icy Mountains" This Set *Must Not Fail*



—And Karas Apparatus Was Chosen

To insure communication at all times, a short wave receiver was **built to order** for the American Museum Greenland Expedition. To withstand the extremes of cold and dampness to which such a set would be subjected, only the finest parts could be used. Karas Orthometric Condensers and Karas Micrometric Vernier Dials were the choice of the expert who guaranteed that set's performance.

Karas Micrometric Vernier Dial is a recent achievement of Karas engineers. It tunes to 1/1000th of an inch with a ratio of 63 to 1. It turns easily with a liquid-like smoothness and there is no possibility of back-lash. Rough tuning is done with the larger knob. The vernier is continuous from end to end of scale. Dial markings in gold inlay—200 divisions instead of the usual 100—available clockwise or counter-clockwise—either 180 or 360 degree rotation. Diameter 4 1/2". Price \$3.50 each.

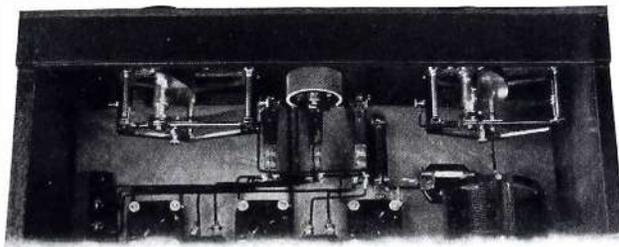
The Karas Orthometric Condenser, with its straight frequency line tuning characteristics and brass plates, is preferred by leaders in short wave work. 5 plate .0001, \$6.50; 7 plate .00014, \$6.50; 11 plate .00025, \$6.50; 17 plate .00037, \$6.75; 23 plate .0005, \$7.00; special 17 plate with extended shaft for Equamatic System, \$7.00.

Karas Harmonik audio transformers, placed in either a short wave CW outfit or a broadcast receiver, give very high voltage amplification—without distortion. Price, \$7.00 each.



New Karas Micrometric Vernier Dial in which there can be no back-lash.

Inside view of special made-to-order receiver.



KARAS ELECTRIC CO.

Factory: N. Rockwell St.
Offices: 1060 Association Bldg., Chicago

Karas Electric Company,
1060 Association Bldg., Chicago.

Please send me Karas Harmonik Transformers, Karas Micrometric Dials and Karas Orthometric Condensers, sizes as checked below. I will pay the postman the price plus postage upon delivery. It is understood that I have the privilege of returning these condensers, dials and transformers for full refund any time within 30 days if they do not prove entirely satisfactory.

. . . 5 plate; . . . 7 plate; . . . 11 plate; . . . 17 plate; . . . 23 plate
Dials, . . . O-Right, . . . O-Left, . . . 180°, . . . 360°

Name

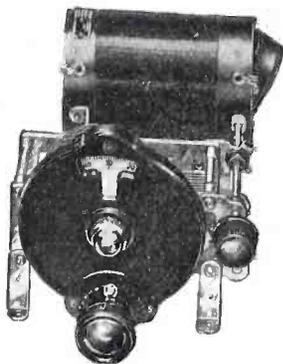
Address

If you send cash with order, we'll ship condensers, dials and transformers postpaid.

The Thrill of Building Your Own!

The only reason automobiles aren't homebuilt by the thousands is that they can't be put together on a kitchen table. Dependable radios are being built at home by many thousands and you, too, can build your own set.

You can experience the thrill of building your own radio. You, yourself, can keep abreast of this ever unfolding art.



ED-ZB

The genuine NATIONAL Brown-Drake Radio-Frequency Transformers

with NATIONAL "EQUICYCLE" Condensers and NATIONAL Velvet-Vernier Dials;—space-wound coils for real low-loss,—unique three-quarter turn condensers still further to space out stations;—vernier dial control of velvety smoothness and fineness as you wish from 6-1 to 20-1.

These NATIONAL Units with the NATIONAL Impedaformers, Type B, for audio-amplification;—and the required sockets, rheostat, panels, wiring accessories, may be put together EASILY by you into a modern receiving-set;—*sensitive* to distant receiving signals; *selective* in its separation of closely-spaced stations, capable of lifelike, *faithful* reproduction,—simple to operate.

Write for Pamphlet 110-RN—Be sure you get Genuine National Products.

NATIONAL CO., Inc.

W. A. READY, President
Engineers and Manufacturers
110 Brookline Street Cambridge, Mass.

SUCCESS--1

FOR eleven years, the M. B. Sleeper name has stood for dependable construction data for radio set builders.

Practical, conservative designs, always kept within the limitations of home-workers, they have helped thousands of set builders to construct successfully various kinds of equipment always just a little farther advanced in mechanical design, always a little more satisfactory in results.

The three units described below are typical examples of designs which have established such a high reputation for M. B. SLEEPER Dataprints.

5-N-1 SHORT WAVE RECEIVER

5-N-1 Dataprints show the construction details of a short wave receiver having an established range of 5,000 to 10,000 miles, working on 15 to 133 meters. This is the only design officially O.K'd by F. J. Marco, nationally known short wave expert of Chicago, and by the Karas and Aero Coil Companies

..... Postpaid, \$1.00
(described in Radio Engineering, April, 1926)

US-76 SHORT WAVE PHONE TRANSMITTER

Operated from B batteries or the US-76 power supply unit, you can talk to your friends 50 to 200 miles away—hold regular conversations with them. It's easy to build when you have the US-76 Dataprints. They give you all details.

..... Postpaid, \$1.00
(described in Radio Engineering, May, 1926)

US-76 POWER SUPPLY UNIT

This A.C. power unit, with a Raytheon tube, supplies A, B, and C for the US-76 short wave telephone transmitter. Just plug it into the 60-cycle 110-volt socket. It will be described in the September issue of RADIO ENGINEERING, but you can get the Dataprints now. Postpaid, \$1.00

M. B. SLEEPER, Inc.

Technical Publisher
A-52 Vanderbilt Ave. New York City

SM

The Why of S-M Audios

The Power Units



330 Power Transformer

This power transformer is designed for Raytheon or Rectron tubes. It has two 300 volt secondaries, a 110 volt, 60 cycle primary and a 7.5 volt filament lighting winding. Rated at 85 milliamperes continuous duty without heating, it will furnish double this current for reasonable periods. Price, \$6.00.

331 Unichoke

The S-M Unichoke is a two-winding high inductance filter choke licensed under the Clough Patent Application. Its current capacity is 85 milliamperes; or double this for reasonable periods. Its filtration when properly used, is guaranteed to be superior to that of other standard power supply filters. Price, \$6.00.

332 Condenser Bank

S-M No. 332 contains two 1/10th mf., two 2 mf., two 1 mf., and one 4 mf. condensers, tested at 700 volts D.C. It is intended for use in "A", "B" or "C" power supply filters. Price, \$10.00.

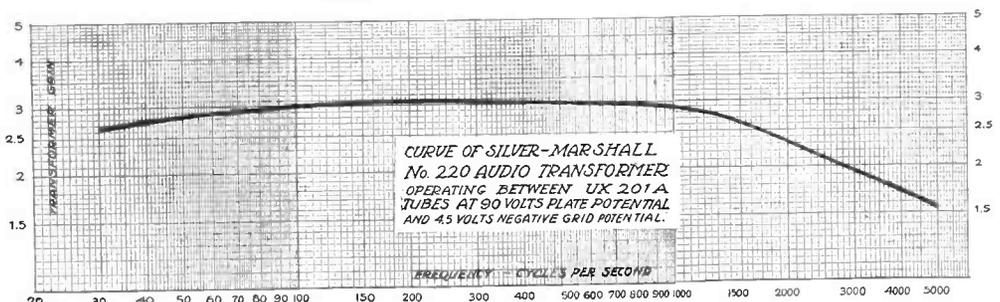
Above instruments are housed in uniform one-piece drawn steel cases, black enameled. They are completely shielded, and provided with screw terminals. Size, 4 inches high 3/4 inches wide and 2 1/2 inches deep (3 1/2 inches over mounting lugs). Weight, three to four pounds.

S-M audio transformers were introduced with the guarantee that they would give the finest quality of reproduction obtainable. So far they have met with overwhelming success. Production has been steadily increased since the first samples brought back enthusiastic reports from editors, jobbers, dealers, and experimenters.

WHY?

There must be reasons—facts behind this landslide of approval of transformers introducing an entirely new thought in audio reproducing systems.

These facts, briefly, are presented here. "The Secret of Quality" available at your dealer gives the substantiating details.



FACTS

Frequency Response Characteristic

The curve of the S-M 220 is flatter than that of any other commercial transformer from 32 to 1,000 cycles. In the case of several \$10 transformers, the percentage of distortion is several hundred percent greater than that of the S-M 220 over this range. Above 1,000 cycles the response falls off at a carefully pre-determined rate to compensate for the reverse effect in broadcast transmission and commercial loud speakers.

Frequency Range Covered

S-M 220's cover a range of from below 30 cycles to 8,000 cycles approximately. This allows reproduction of all common musical notes and their second harmonics—necessary for natural quality. Frequencies above 8,000 cycles are intentionally cut out thus eliminating hiss, background noise and high frequency oscillation. Practically no other available amplifying devices possess this new characteristic.

New Principle

S-M 220's are the first audio amplifying devices available to listeners in which the far-from-perfect quality of broadcast transmission and available loud speakers has been taken into account and compensated for. These two factors produce a signal weak on low frequencies and strong on high frequencies. S-M 220's do just the opposite. They possess a falling frequency characteristic—weak on high notes and strong on low notes. This compensates for everyday transmission and loud speaker characteristics of a reverse nature. The result is quality of unbelievable perfection—bass organ notes that shake a room, just as does the original organ itself. All notes, both high and low, are reproduced more faithfully to the ear than with any other available amplifying system.

Physical Characteristics

The weight of the 220 core, of highest grade silicon steel, is over 2 1/2 lbs. The total weight of the transformer is less than 2 lbs. Compare this against an average weight of less than 2 lbs.

"The Secret of Quality"

This booklet contains laboratory data never before available even to many manufacturers. It is the only authoritative treatise on all types of audio amplification, written in non-technical language, ever published. 10c is the price of this 96 page book. Ask your dealer for a copy.

SILVER-MARSHALL, Inc., 854 W. Jackson Blvd., Chicago, U. S. A.

for five transformers supposedly in the class of the S-M 220 yet selling at from \$2.00 to \$4.00 each higher. The mean-turn length on the 220 winding is twice as great as several of the transformers referred to. This takes wire—plenty of it. The core cross-section is 1 1/4 inches.

All this means but one thing—quality—for assuming good average engineering, the quality of an audio transformer is almost always approximately proportional to its size.

Handling Capacity

The 220's will handle sufficient input energy to obtain maximum power output from a UX171 tube—over six-tenths of a watt. Properly operated, with somewhat less amplification than shown in the accompanying curve, they will develop an output voltage of from twenty to thirty volts—with an even flatter characteristic than shown in the curve. The primary windings will handle 15 milliamperes continuously.

Output Transformer

S-M 221 output transformer is designed to deliver maximum power to standard cone speakers at 30 cycles, and decreasing power as the frequency increases. This effect aids in compensating for average speaker characteristics of a reverse nature. S-M 221's will handle the full power output of a UX171 or UX210 tube. They are guaranteed to improve low note reproduction and handling power on any standard receiver when merely connected between the set and loud speaker.

General Data

S-M 220's have a turn ratio of 3:1. Their primary inductance is approximately 100 henries. Their impedance ratio will fit any standard tube on the American market. The 220's and 221's are supplied in drawn steel cases—completely shielded. Guaranteed unconditionally against mechanical and electrical defects—and for absolute satisfaction.

DeJUR

All Metal-Air-Cooled RHEOSTAT

One
Hole
Mount



Bakelite
Arrow Pointer
Knobs

In order to meet the demand of set manufacturers for a highly efficient low-cost resistance unit, our engineers have developed the DeJur Air-Cooled Rheostat. It is a one hole mount product and does not have to be taken apart in order to mount, thus saving time and expense. Operates without any noticeable temperature rise at a constant co-efficient of conductivity. Filament voltage can be built up slowly and uniformly and can be held at the right point for the most efficient operation. The sliding contact arm is adjustable and the resistance is exposed on all sides. Any ohmage from 1 ohm to and including 600 ohms capacity can be incorporated in this rheostat. An all metal rheostat, with the one hole practical mounting feature, lugs built in and not merely added make this rheostat a very desirable one for the manufacturer. Screws, nuts and other loose parts which usually cause trouble in the ordinary rheostat are entirely eliminated in this construction. Recommended for the lowest to the highest price receiving sets.

Standard Stock Sizes 6-10-15-20-30 Ohms
Below 6 Ohms and Above 30 Ohms Built to Specifications

POWER RHEOSTAT



This rheostat was designed for a large current carrying capacity. It has a large Bakelite base, 2 3/4" diameter and is a single-hole mounting. The resistance element ranges from 1 to 2,000 ohms, and is tightly fastened to the frame. The contact arm is designed to ride over the surface of the resistance smoothly. Soldering lugs are supplied for convenient connections. Furnished with a Bakelite knob. Special ohmage and carrying capacity made to specifications.

Write for Catalog of Complete Line of

DeJUR PRODUCTS Co

"The world's largest manufacturer and exporter of radio products"

Lafayette and Broome Sts., New York City

SUCCESS--2

RADIO dealers generally carry M. B. Sleeper Dataprints because they can trust them. They know their customers will be successful, because M. B. Sleeper Dataprints are accurate and reliable right down to the least detail.

In fact, you would expect that of the man who introduced the picture wiring diagram method of showing set construction.

Others have copied the method—it is now in universal use—but only in the Dataprints do you find the clearness of design which originated the method.

This is exemplified in the 210 Power Amplifier and C Battery Eliminator described below.

210 POWER AMPLIFIER

This is the only design available for a power amplifier run from 60 cycles, 110 volts, which can be connected to any set without disturbing a single wire. No matter what type of set you have, no matter how good the present quality, you haven't heard real radio music until you hear your set with the 210 Amplifier. It will give as much or as little volume as you want—the important thing is the quality. The 210 Power Amplifier Dataprints show how to build it. **Postpaid \$1.00**

(described in Radio Engineering, June, 1926)

C BATTERY ELIMINATOR

95% of the trouble with Battery eliminators comes from varying line voltage, something beyond the power of the B eliminator to control. Mr. Dallin, of the Acme Apparatus Company, has devised a C battery eliminator which automatically corrects that trouble. It's a simple device, using a Raytheon tube, which you can build in an hour. The CBE Dataprints show you how. . . . **Postpaid \$1.00**

(to be described in Radio Engineering, Sept. 1926)

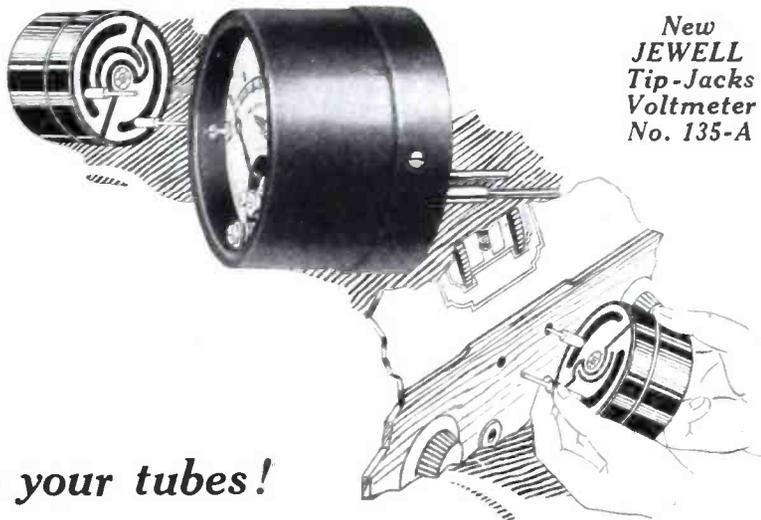
M. B. SLEEPER, Inc.

Technical Publisher

A-52 Vanderbilt Ave. New York City



**CONTROL
Your
Filament
Voltage —**



*New
JEWELL
Tip-Jacks
Voltmeter
No. 135-A*

Stop burning up your tubes!

If you have a set, in the panel of which two Tip-jacks have been installed by the manufacturer, you will need a Jewell Tip-Jack Voltmeter.

Send for Special Circular Just Off the Press

JEWELL ELECTRICAL INSTRUMENT CO.
1650 Walnut St. - - - - - Chicago

"26 Years Making Good Instruments"



CLAROSTAT

THE UNIVERSAL RANGE VARIABLE RESISTOR

ENDORSED and USED by

DEALERS and JOBBERS—

Power supply is the biggest development this year. Raytheon publicity in scores of magazines and newspapers has specified Clarostat as the only variable resistor for battery elimination. Your customers will demand it this fall. Write us now.

\$2.25

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Kokomo
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Modern Electric
Raytheon
Reichmann
Silver Marshall
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Webster
Zenith

MANUFACTURERS—

Clarostat has a universal resistance range of from practically 0 to 5,000,000 ohms—a current-carrying capacity of 20 watts—is absolutely noiseless in operation—and requires but one hole for mounting.

Special types of Fixed and Variable Resistors to meet any and all requirements of Receiver and Power Supply Manufacturers.

AMERICAN MECHANICAL LABS., Inc.

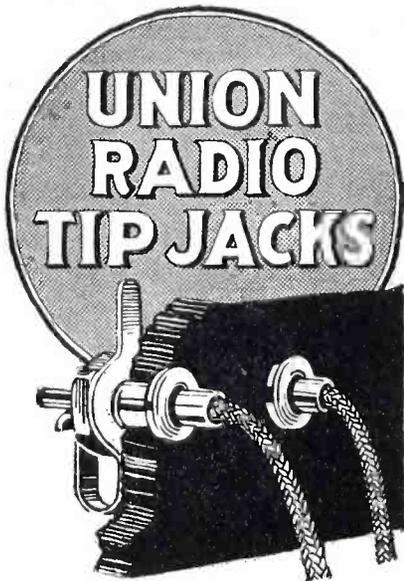
285 N. 6th ST., BROOKLYN, N. Y.

RADIO DEALERS

Would you like to have advance information on construction articles to appear in RADIO ENGINEERING and RADIO MECHANICS? That will keep your technical man advised and prepared for things which your customers will be asking about. If so, fill out this slip and mail it at once.

M. B. Sleeper, Inc., Radio Hill, Poughkeepsie, N. Y.

Please send advance dope each month to Mr.
Company City State



(Patented)

Always in Demand

THESE sure-fire sellers and repeaters bring in steady profits the year 'round. They make positive contacts quickly and easily—no parts to loosen or lose. Ideal for permanent or temporary connections. All parts heavily nickel-plated. They are used as standard equipment in many of the best sets.

Retail at **25c** a Pair

Firmly grip all wires from No. 11 to No. 24 B & S gauge. Three sizes for all panels. TYPE A (Standard) for 3/16" to 1/4" panels. TYPE B (Special) for panels, cabinet walls and partitions from 5/16" to 1/2" thick. TYPE C (Special) for panels up to 1/8" thick. Packed in self-selling counter cartons of 1/12, 1/2 and one gross pairs.



Identification Tags

Hard red fiber ovals, marked with proper identifications of battery connections, such as A—, B—, B67, B90, etc. Prevent shorting battery or blowing tubes. Two holes, will take any wire up to 1/8". Packed 100 in box of one designation only. Retail price \$1.00. Also in set of 9, retail price 10c.

To All Branches of the Trade

Send for illustrated circular and sample of these fast-selling radio products, and details of our attractive proposition.

UNION RADIO CORPORATION
124 ~ SUSSEX ~ AVENUE ~ NEWARK ~ N.J.
NEW YORK OFFICE ~ 40 ~ EAST ~ 34TH ~ STREET.

ELECTRAD

A Little Thing To Look At, But a Big Thing In Your Customers' Sets

You know how important a factor in insuring good reception is the right grid leak. Here's one that will make a satisfied customer of everyone to whom you sell it.

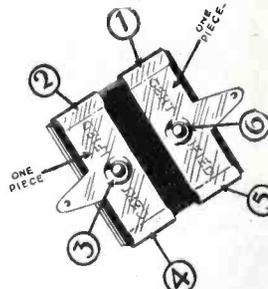
ELECTRAD Metallic Leaks and Resistors

Give clearer reception with greater signal strength. No carbon, paper, varnish or fiber. The metallic resistance element is fused to the inside of a glass tube. Noiseless, accurate, non-inductive, non-hygroscopic. Uniform in all weathers and working conditions. Capped with the exclusive Electrad ferrule. Impregnated under high vacuum. Great current-carrying capacity without overheating or change of resistance. List, 60c—in Canada, 85c.



ELECTRAD Certified Mica Fixed Condensers

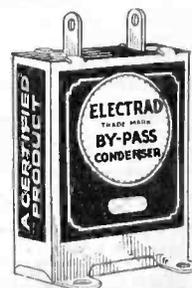
This is the famous "Six Point Pressure" Condenser, without an equal for performance. Uniform pressure insured by rigid binding at six points. Sheet copper—not tinfoil—soldering iron can't hurt it. Certified, electrically and mechanically. Guaranteed to remain within 10% of calibration. Standard capacities—all types. In sealed packages, list 30c to 75c—in Canada, 45c to \$1.50.



ELECTRAD Certified By-Pass Condensers

Supply the demand for a superior and dependable by-pass condenser. Has low power factor, low radio-frequency resistance and negligible D. C. leakage. Guaranteed working voltage 250 A. C. Every condenser given one-minute test of 1000 volts—not flash test, which is not accurate. Impregnated with paraffin under high vacuum. Paper used has higher dielectric strength than any other known—developed and used exclusively by Electrad. List, 60c to \$3.75, in Canada, 85c to \$5.25.

Write for details of our square dealer proposition that helps you sell and protects your profits.



Write for information on the Electrad 500,000-ohm compensator for perfect control of tone and volume. 428 Broadway, New York City.



ELECTRAD

Inc

MATCHED CONDENSERS AND COILS



Type 277D Coil
Price \$1.50

For maximum efficiency in tuning a radio receiver over any range of wavelengths it is essential that the coils and condensers have the proper inductance and capacity values.

General Radio coils are designed specifically for use with General Radio condensers to cover definite wavelengths.

This means that by using the proper General Radio coil and condenser combination for the desired range, sharp and accurate tuning is assured without loss of signal strength. Likewise the troublesome tendencies which are apt to follow the use of unmatched condensers and coils are completely removed.

There are standard General Radio coils and condensers for various wavelength ranges from 50 to 600 meters.

Ask your dealer or write for catalog 924-C describing all General Radio parts.

GENERAL RADIO CO.—Cambridge, Mass.



Type 247-F Condenser
Price \$4.00

GENERAL RADIO INSTRUMENTS

Behind the Panels of Better Built Sets

LARGE WOOD WORKING PLANT

Available for the Manufacture of
Radio Cabinets

Large manufacturing company with modern wood working plant, whose business is done principally in the first six months of the year, is desirous of contracting with reliable radio manufacturer for the building of radio cabinets in large quantities. Deliveries to be made in summer and fall months. Will make attractive proposition. Address

Dept. L.C.—3100 So. Kedzie Ave.,
Chicago, Ill.

—For POWER SUPPLY!

MANUFACTURERS AND JOBBERS

who want complete eliminators made up under their own name—who need special eliminator parts made to specification

Communicate, now, with

SHORE ELECTRIC CO.

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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

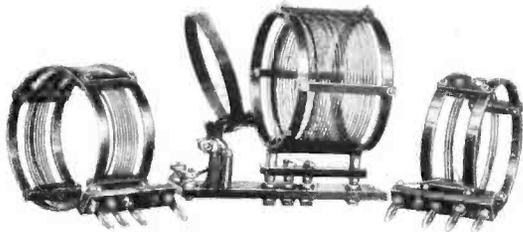
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NEW 1927 CATALOG

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—the Aero Coils that are performing so remarkably!



Range 15-130 meters

Low Wave Tuner Kit—\$12.50

This is the supersensitive kit that has performed so wonderfully in bringing in low wave stations from all parts of the world. Completely interchangeable. Has gapless range 15 to 130 meters. Complete with base—\$12.50. Interchangeable Coil No. 4, range 125 to 250 meters, \$4.00. Coil No. 5, range 235 to 550 meters, \$4.00.



Tuned Radio Frequency Kit—\$12.00

The supersensitive coils composing this kit will improve the performance of any set. Big 8-page, 4-colored layout system (actual size blue prints) and complete instructions for building the Aerodyne Receiver free with each kit.

Order from your dealer or direct from us.

AERO PRODUCTS, INC.

1772 Wilson Ave.

Chicago, Ill.

the final condenser!

YOU can now cease your search for a perfect tuning unit. You can now quit your testing of innumerable condensers. The country's foremost radio engineers have pronounced

METRALIGN SLT Straight Line Tuning

as the only condenser embodying new and vitally important improvements over the old types—solving forever the tuning evils of the past.

Sets equipped with METRALIGN SLT condensers break down all sales resistance, by the ease with which *all* stations on *all* wave lengths can be tuned in or out and accurately logged.

Get the complete METRALIGN SLT story. Write for booklet today.



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477 Broadway, New York City

*Makes any set a new set
—in 15 minutes*

I.C.A.

PANELS AND SUB-PANELS

Reduce Manufacturing Costs



BUILD your set around I.C.A. Panels and Sub-Panels —they will save you money.

As the world's largest panel house, engaged in volume production, we reduce manufacturing costs to a minimum, which means *lower prices to you.*

All I.C.A. products measure up to the highest standards of material and workmanship. And, of importance to the manufacturer, our facilities insure quick delivery.



I.C.A. Panels are furnished in Bakelite, Insuline, etc., in black or wood finishes, machined and decorated to any specifications.

Submit your plans for our quotations.

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RADIO PANEL & PARTS DIVISION
INSULINE BLDG., 59 WARREN STREET
NEW YORK



Only the eyelets appear on the top.

The New I.C.A. Socket

Shock-proof; non-microphonic. Occupies minimum area, permitting use of smaller panels and shorter leads at big savings. Swivel construction of contacts allows position of wiring to be determined *after* contacts are installed. Designed for soldered, eyeletted or screwed wiring.

ALL DONLE

Tubes have been developed with the consistent idea that proper use of rare atmospheres results in a high efficiency obtainable by no other means.

B-6 Detector \$5

THE DONLE-BRISTOL CORP.
MERIDEN, CONN.



RAYTHEON
CONDENSER
BLOCKS

Try our Raytheon Condenser Block and Lavite Resistors for your "B" Eliminator. Write in for circuit sheet.



LAVITE
RESISTANCES

AEROVOX

"Built Better"

AEROVOX products are used by over 200 of America's Radio Manufacturers.

AEROVOX Fixed Condensers are approved by M. I. T. and Yale Universities

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Boston, Mass., 94 Portland Street
Los Angeles, Cal., 324 N. San Pedro St.



The Benjamin Radio Policy is based upon a definite acceptance of maker responsibility clear through the selling channels to the set manufacturers and amateur set builders.

The dealer can stock Benjamin Radio Products upon three fundamental considerations that are the basis of successful merchandising. **FIRST:** They are the best that he can buy for their respective places in the hookup, and therefore he can serve his customers well by recommending them. **SECOND:** He is handling a product that has national acceptance. **THIRD:** His own selling effort is supplemented by intelligent, effective and liberal sales promotion by the manufacturer.

Benjamin Radio Products are nationally advertised in QST, Radio News, Radio Broadcast, Popular Radio, Radio Digest, Radio and Radiocast Weekly on a broad and comprehensive schedule. In addition to this, there are many exclusive and highly effective dealer helps. Not only sales promotion literature, but individual, personalized assistance on technical questions as they relate to the business of enabling the dealer to better serve his customers.

NOW READY—New literature on how to build the Improved Controllodyne—a 5-tube, tuned radio frequency set that has created a tremendous interest among fans and another new utility 5-tube portable and home receiver, with full size layout and complete instructions put up in envelopes ready for the dealer to send his customers

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San Francisco:
448 Bryant St.

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TRADE MARK

Push Type
Cle-Ra-Tone
Sockets



Improved
Tuned Radio
Frequency
Transformers



"Lekeless"
Tuned Radio
Frequency
Transformers



Straight Line
Frequency
Condensers



Battery Switch



Brackets



**8 out of 10
Manufacturers**

Depend on EBY for Binding Posts

Eight out of ten of the leading radio receivers are factory equipped with EBY Binding Posts.

Profit by the experiments and experience of those who know and use EBY wherever a good electrical connection is necessary.

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Made in
30 different
markings



Standard
Equipment on
many receivers

The Lastite

combines in one piece a binding nut and soldering terminal. Either way it is a better contact.

the bus wire
the solder
thin, circular
flange



tube that
holds bus wire
threaded base
instrument
or panel

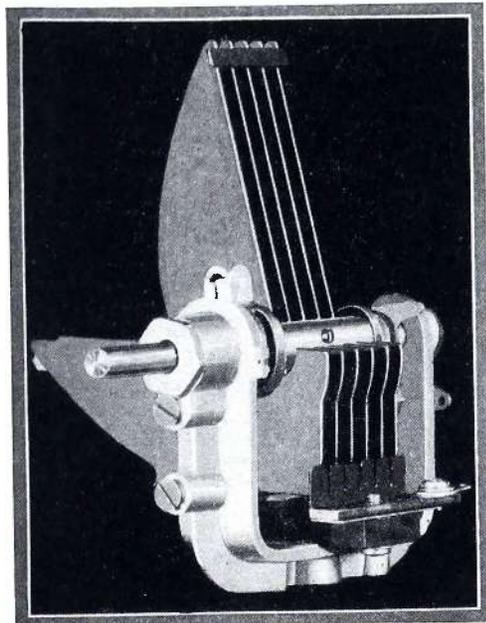
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Patent Applied For

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The small capacity and inductance values used for shortwave reception, require exceptional strength of structure and accuracy in the manufacture of the condensers and coils.

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For Better Radio
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Mr. Radio Engineer

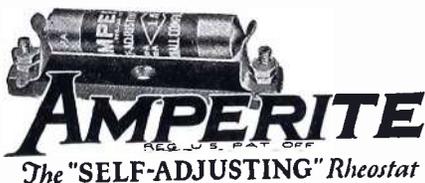
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- To—Solve all tube control problems.
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~ with the adapted
**Mogul 5VCX Power
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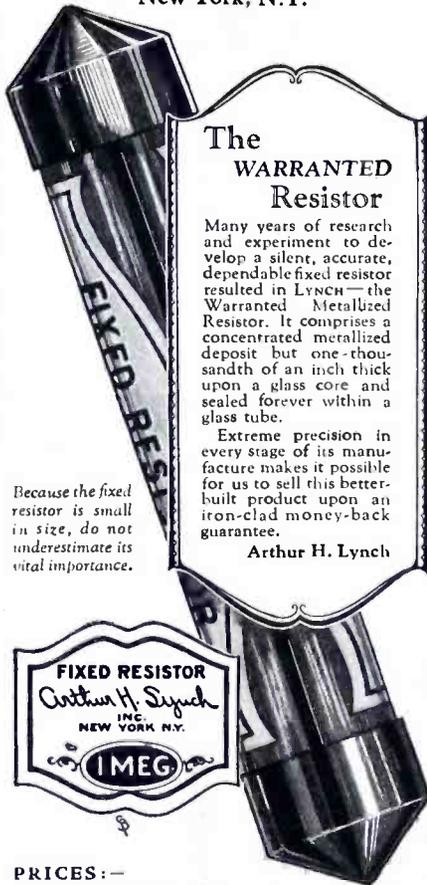
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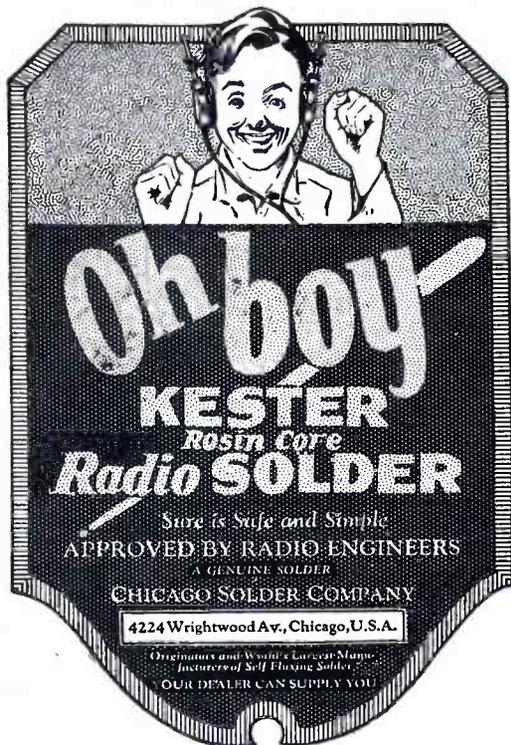
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FIXED RESISTORS

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Now refinements in construction make possible a flexible and even more fool-proof

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Off when it's on ~ On when it's off



*Newest
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*Audio Transformers
for Set
Manufacturers*

No. 117 Semi-cased.

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