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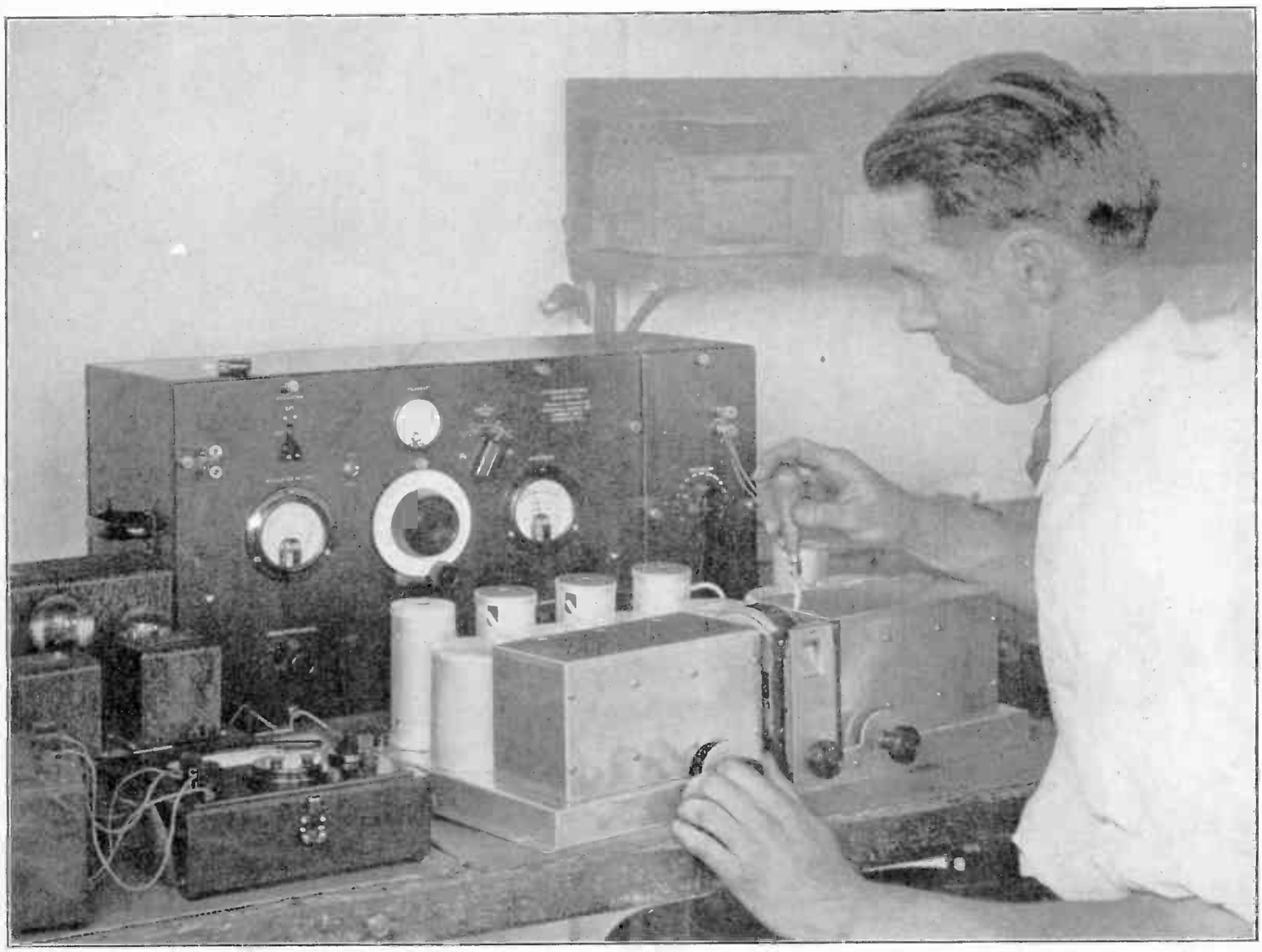

An engineer testing the MB-30 finds the sensitivity ¼ microvolt per meter at 1,000 kc. See circuit diagram and article, pages 3 and 4.

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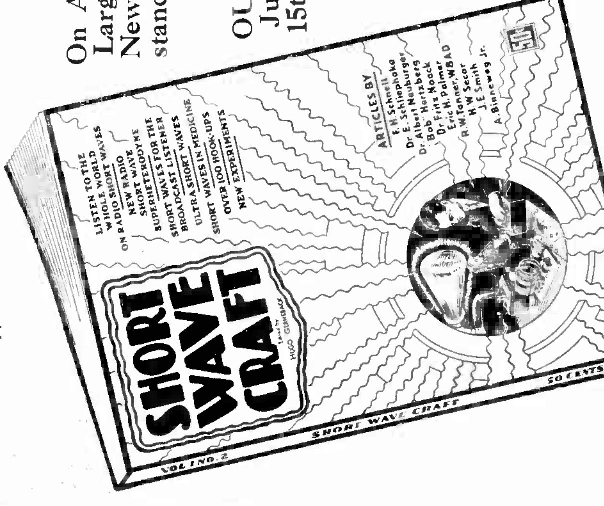

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The MB-30 AC Tuner

By Neal Fitzalon

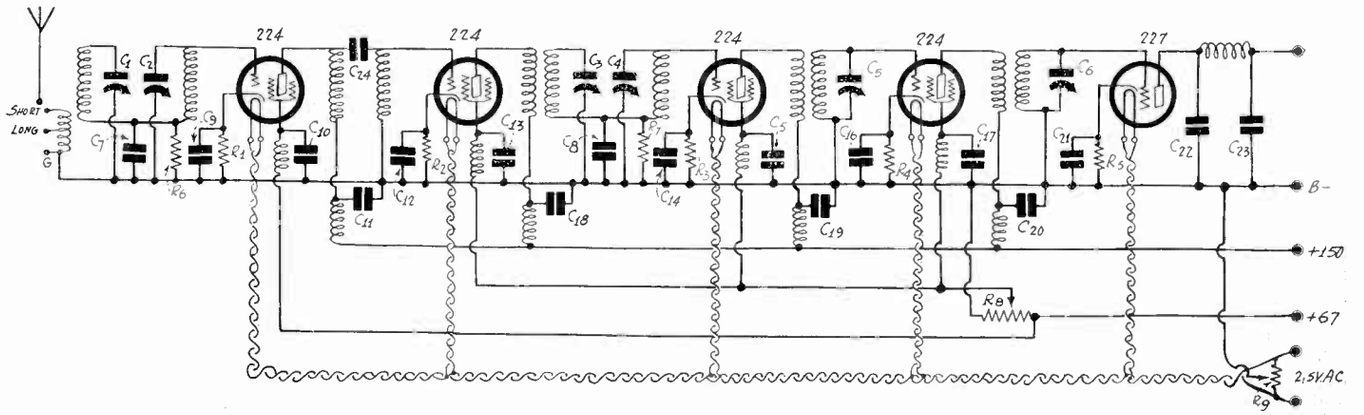

FIG. 1
CIRCUIT DIAGRAM OF THE MB30 TUNER AND RADIO FREQUENCY AMPLIFIER IN WHICH SIX TUNED CIRCUITS ARE USED

THE design of a modern radio frequency tuner and amplifier is an engineering feat requiring thorough knowledge, and technical experience, and the necessary laboratory facilities can undertake it and carry it to a successful conclusion.

The name of Glenn H. Browning has long been associated with superior receivers, notably the Browning-Drake series of circuits and the MB29 receiver. Likewise the name of James Millen has been associated with some of the most successful sets. Those who recall the MB29, which appeared in RADIO WORLD a little over a year ago for the first time, will remember that this highly successful circuit was designed by Prof. Browning and Mr. Millen.

Ever since that circuit was launched successfully these famous engineers have been at work designing the MB30 receiver, which is a still more pretentious example of radio engineering skill. Every feature which in any way contributes to the success of a radio receiver has been carefully considered during the process of design and construction of this new receiver. Every step has been taken with the guidance of laboratory results. Nothing has been left to chance. Nothing has been compromised, unless the compromise was of a nature that resulted in overall improvement.

Principal Characteristics

The principal characteristics of a radio frequency tuner and amplifier are selectivity, sensitivity, uniformity of response, stability, and a band pass effect which permits high selectivity without cutting of sidebands.

Let us examine the circuit diagram of the MB30 with the object of discovering how the principal desirable characteristics have been attained. Last week we published curves showing the selectivity and sensitivity of this tuner and amplifier. Now we show the diagram of the circuit with which these curves were obtained.

We note from Fig. 1, which is the diagram in question, that the tuned input circuit is in the form of a band pass filter comprising two tuned circuits, tuned with identical condensers C1 and C2, and also that these two circuits are coupled by means of a condenser C7 and a resistance R6. The value of the coupling condenser is such that the pass-band has the proper width, and the value of R6 is such that it does not appreciably affect the value of the coupling capacity, yet low enough to establish an effective grid return. The value of the coupling condenser is .05 mfd. and that of the resistance is 20,000 ohms.

We observe also that there is a similar band pass filter between the second and the third tubes. The design of the second band pass filter is exactly the same as that of the first, except that the first has a primary winding suitable for the antenna and the second has a primary winding that couples the screen grid tube effectively to the tuned circuit. Except for the primaries, the corresponding parts in the filters have the same values.

Standard Tuners Used

We further note that between the third and the fourth tubes and again between the fourth and the fifth tubes are standard

List of Parts

C1, C2, C3, C4, C5, C6—Two three-gang tuning condensers.
C7, C8—Two .05 mfd. fixed condensers.
C9, C10, C11, C12, C13, C14, C15, C16, C17—Nine .01 mfd. by-pass condensers.
C18, C19, C20—Three .1 mfd. by-pass condensers.
C21—One 1 mfd. by-pass condenser.
C22, C23—Two .00025 mfd. condensers.
C24—One .006 mfd. condenser.
R1, R2, R3, R4—Four 350 ohm bias resistors.
R5—One 20,000 ohm grid bias resistor for detector.
R6, R7—Two 20,000 ohm grid return resistors (grid leak type)
R8—One 50,000 ohm volume control potentiometer.
R9—One 10 ohm center tapped resistor.
Seven special coil assemblies including RF choke coils with shields.
One output filter RF choke coil.
Five UY sockets.
One National drum dial with dial light.
Four binding posts.
Five lead cable.
One National MB30 chassis.
Five tube shields.

Utmost Gain from Tuner

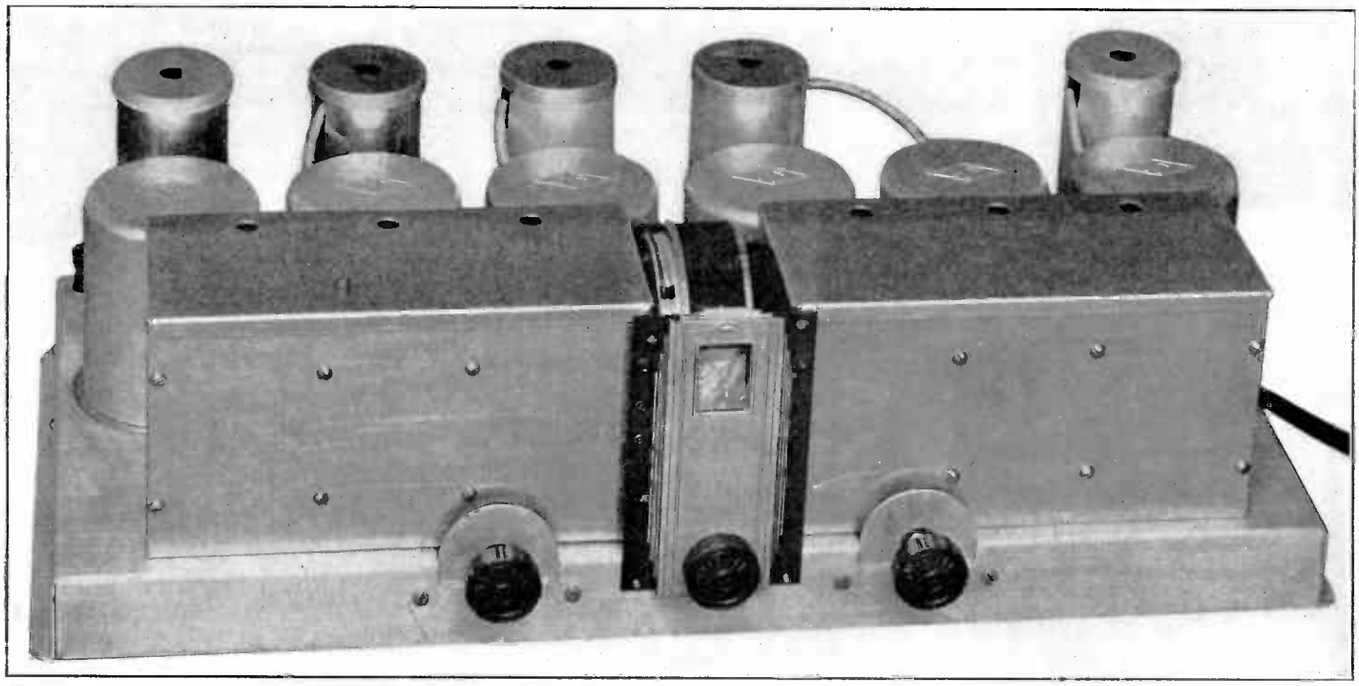

FIG. 2
THIS DEPICTS THE FRONT VIEW OF THE MB30 RADIO FREQUENCY TUNER AND AMPLIFIER, AND SHOWS THE TWO CONDENSER UNITS AND THE DRUM DIAL

radio frequency tuners, tuned respectively by C5 and C6. The two radio frequency transformers have been designed, by experiment as well as by theory, to match the screen grid tubes most effectively near the high end of the frequency band covered by the tuner.

Thus the tuner consists of six tuned circuits, tuned by six identical condensers sections, mounted in two three-section units and controlled by the same dial.

The sensitivity curve of the standard radio frequency transformers rises with frequency. That is, it is lowest at the 550 kc end and highest at the 1,500 kc end. The sensitivity curve of the band pass filters, on the other hand, has a sensitivity curve that falls at both ends and has a maximum in the middle, or somewhere between 900 and 1,000 kc. It is clear that when the two band pass filters and the two standard radio frequency transformers are combined the sensitivity curve will fall at the low frequency end and will remain practically level from the middle of the band up to 1,500 kc.

Such a characteristic is not desirable since the low frequency stations would not come in so well as the higher frequencies. For this reason a compensation has been introduced in the form of an untuned radio frequency coupler between the first and the second tubes. This untuned radio frequency transformer has a sensitivity curve that rises as the frequency goes down. That is to say, the curve is low at 1,500 kc and rises with an ever increasing slope toward the 550 kc end. In fact the curves is just the opposite to the curves for the two standard radio frequency transformers. Thus we have the desirable compensation in the amplification.

The result is that the overall sensitivity curve of all the couplers is very nearly constant from one end to the other. It rises slightly at the middle of the band but the total rise as compared with the level at either 550 kc or 1,500 kc is so small that it could not be appreciated except with sensitive instruments. The overall curves were printed last week in RADIO WORLD.

Sensitivity Assured

The four screen grid tubes suitably coupled by means of specially designed transformers and band pass filters assure the high uniform sensitivity shown in the curve printed last week. The combination of two band pass filters and two standard radio frequency tuners assures a high order of selectivity without excessive sideband cutting. The improvement that has been effected in both the selectivity and the admission of the side bands can well be appreciated by studying the selectivity curves printed last week.

The designers thus have met successfully four of the principal characteristics that a good radio frequency tuner and amplifier must possess, namely, selectivity, sensitivity, uniformity of response, and minimum side band cutting consistent with high selectivity. It remains to see what they have done with stability, a characteristic the circuit must have to a high degree if it is to be at all successful.

The secret of stabilizing an amplifier is in making it a unidirectional device, that is to say, designing it so that the signal passes in one direction only, and increasing in intensity as it progresses to the audio amplifier.

Making a circuit unidirectional means preventing all feedback wherever there is any chance for the signal to go backward. An oscillator is made by intentional back coupling, and an oscillator is just what we do not want. We want a straightforward amplifier.

There are few jobs, indeed, in which feedback has been prevented so thoroughly as in this one. Let us go into detail pointing out the thoroughness with which this circuit has been made unidirectional.

Back Coupling Eliminated

One chance for back coupling is in the grid bias resistors. If two or more tubes are put on one bias resistor there will be considerable feedback through this common impedance. While this coupling may be reduced by connecting a large condenser across the resistance, there will always be some feedback remaining, and in a sensitive circuit it takes extremely little to unstabilize the circuit. For this reason there is a separate bias resistor for each tube in this circuit. Not only that, but each resistor is by-passed with a fairly large condenser. While this condenser does not stabilize the circuit, it does prevent reverse feedback through the resistance and hence tends to retain the sensitivity, and this it does without introducing any back coupling which would upset the stability.

The next chance for feedback and instability is in the screen circuits. Since all the screens are connected, directly or indirectly, to the same point on the voltage divider, or the same voltage source, there would be a common impedance for all the screens if means were not introduced to prevent it. As in the case of the bias resistors no two screens can be connected to the same point unless isolating devices are placed between. In series with each screen of this circuit there is a radio frequency choke coil which not only prevents voltage variations existing in the supply from reaching the screen but also prevents signal voltage variations on the screen from reaching the common supply. However, in order to keep the screen at a constant voltage relatively to signal variations it is necessary to by-pass each choke coil from the screen to ground with a large condenser. The choke and the condenser prevent the signal screen current from getting into the voltage supply and hence from getting into any other screen circuits.

Plate Circuits Likewise Treated

The individual plate circuits are treated in exactly the same fashion as the screen circuits, and for the same reason. However, since the plate currents are larger than the screen currents, and are therefore more likely to cause instability, three of the by-pass condensers, C18, C19, and C20 are of .1 mfd. capacity, whereas most of the others are only of .01 mfd capacity.

Battery Type Converter

By Ralph Heming

IN the June 7th issue we published a simple short-wave converter utilizing one screen grid modulator and one general purpose tube oscillator. Both tubes were of the AC type, so that the converter was applicable only where alternating current is available. Since the appearance of that circuit we have had numerous requests not to forget those fans who prefer to use batteries or who are forced to use them for lack of alternating current.

To adapt this circuit to battery operation does not require many changes as becomes apparent by comparing the AC circuit with the DC circuit shown in Fig. 1 herewith. The radio frequency transformer T1 and the oscillator coil T2 are exactly the same as they are in the AC circuit, and therefore the tuning condensers are also the same.

Since the first tube is to work primarily as a detector with a low voltage on the plate, the grid bias and the screen voltage must also be low. The bias is provided by putting a 10 ohm resistance R1 in the negative leg of the filament and the screen voltage is provided by returning the screen to a potentiometer P across which is impressed 45 volts. This potentiometer, which may have a resistance of 30,000 ohms, is connected between ground and plus 45 so that the screen voltage can be varied from about 1.32 negative to nearly 45 volts positive. The greatest detecting efficiency will be found when the slider is set at about 3 volts positive.

Controlling Volume

Another 10 ohm resistor R2 is put in the positive leg of the screen grid tube to limit the current to a safe value no matter where the rheostat Rh is set. This rheostat is used as a volume control. However, it is not absolutely necessary to use it since there will be a volume control in the receiver with which the converter is to work.

The oscillator tube is a 201A, which oscillates readily with a voltage as low as 45 volts on the plate. The grid of this tube is biased to the extent of one volt, the drop in the ballast resistor R3, which should have a value of 4 ohms.

Each of the by-pass condensers C3 and C4 should have a capacity of .01 mfd. or more. The tuning condensers C1 and C2 specified in the AC circuit were of .0005 mfd. capacity and the coils specified were for this capacity.

While the coils specified for the AC circuit were of the small plug-in type, larger coils may be used both in that circuit and in this one. Coils having a diameter of 3 inches with space wound turns on a special form are available. These coils are slightly more effective than the small coils but they do not permit as compact assembly. The small coils may be placed parallel without any undesired coupling between them, but the large coils should be mounted at right angles. This may be done in two ways; first, by placing the mounting at right angles, and second, by placing them in the manner of neutrodyne coils.

If the coils are not placed at right angles a metal sheet larger than the largest dimension of the coils should be placed midway between the tubes.

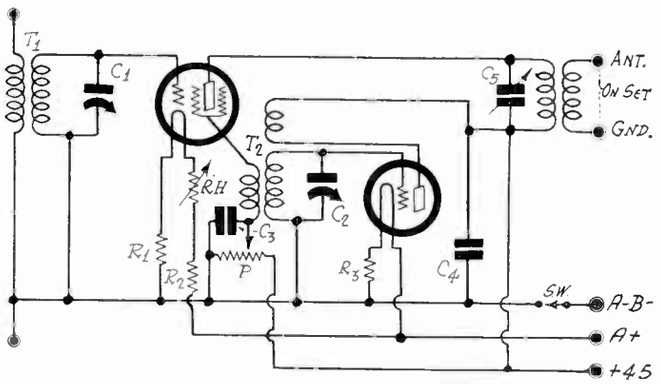

FIG. 1.
CIRCUIT DIAGRAM OF A BATTERY OPERATED SHORT-WAVE CONVERTER.

Provision for Pick-up Winding

In the small coil the pick-up winding was put on the same form as the oscillator windings. A five-prong tube base was used for the coil form, and the sixth terminal was made flexible and long enough to reach a special binding post. When the large coils are used the pick-up winding is the same for all the coils in the set and is the winding mounted permanently on the coil mounting. This winding is mounted on a hinge so that the coupling can be varied as required by the frequency of the signal. The position of the pick-up coil is not at all critical and the only time it is necessary to change it is when the coupling is so close that the oscillator will not function.

The first tuner T1C1 is not absolutely essential but it is advantageous in that it increases the selectivity considerably. The tuner does not make the circuit critical so that it does not make it difficult to find the short wave stations. They are found by tuning the oscillator and then they are brought up to maximum strength by tuning the first condenser accurately.

The intermediate frequency tuner is an important feature in bringing in strong signals. This is tuned to the same frequency as that for which the radio receiver is set. That is, if the radio receiver is tuned to 1,500 kc, the condenser C5 is also adjusted so that the output circuit is tuned to this frequency. This does not add any complication to the tuning because the intermediate frequency is selected once and left alone. For example, C5 might be adjusted before the converter is connected to any receiver and then the receiver may be tuned to the frequency to which the coupler happens to be tuned. Of course, it must fall within the tuning range of the broadcast receiver, preferably near the 1500 kc end of the scale.

Added Efficiency

The output intermediate frequency coupler adds considerably to the sensitivity of the circuit and the extra trouble in installing and adjusting it is well repaid. Not only does it provide another intermediate tuner but it provides a by-pass condenser for the high frequency signals, and this always increases the detecting efficiency of the tube.

Since the oscillator tube is a 201A tube the filament battery should have a voltage of 6 volts.

If a very compact short-wave converter is desired it is possible to use a 99 tube for oscillator. A slight change in the filament circuit is then desirable so that a dry cell battery can be used. In that case R1 remains at 10 ohms but R2 is omitted. It is well to retain the 30 ohm rheostat Rh. When the oscillator is a 99 tube and the filament battery voltage is 4.5 volts the value of R3 should be 25 ohms. When the circuit is built with small battery tubes the filament battery should consist of three No. 6 dry cells in series and the plate battery may be a single block of 45 volt B battery.

The list of parts appended is for the case when the first tube is a 222, the second a 201A and when the filament battery voltage is six volts.

As far as sensitivity is concerned there is practically no difference whether the oscillator is a 99 or a 201A. The sensitivity depends on the screen grid modulator and on the coupling between the oscillator and the modulator.

LIST OF PARTS

T1—One set of short-wave coils for antenna coupler with suitable socket (Air-King).

T2—One set of short-wave coils for scillator as described June 7, page 7.

T3—One TRF transformer or a set of large coils (Air-King).

C1, C2—Two .0005 mfd. straight frequency line Hammarlund condensers.

C3, C4—Two .01 mfd. by-pass condensers.

C5—One adjustable condenser, which may consist of one .00025 mfd. fixed condenser and one Hammarlund 100 mmfd. trimmer condenser.

R2, R3—Two 10 filament resistors.

R3—One 4 ohm filament resistor.

Rh—One 30 ohm rheostat.

Sw—One filament switch (may be part of P).

P—One 30,000 ohm potentiometer.

Two vernier dials.

Two UX sockets.

Seven binding posts.

One 7x10 panel.

One 7x9 sub-panel.

Two brackets for supporting sub-panel and holding it to panel.

One six volt battery and one 45 volt battery.

Sidelights on Coils

By Manning Manwaring

THE successful operation of all devices, whether electrically, mechanically or chemically operated, usually depends upon at least one vital part, and in some cases more than one.

An automobile will not run without a regularly recurring spark. A steam engine must have a properly arranged admission valve.

Whether the same comparison can be made and analagous conclusions drawn in the case of radio circuits, or a complete radio set, is problematical.

Nevertheless, there are parts of a given radio receiver upon the electrical characteristics of which a very great deal depends.

If I ask the reader to think of some I wonder what the answer will be? Probably the majority of answers will be tubes, which is correct in a measure, but you can replace a tube easily if one should prove to be faulty or unfitted for its particular job.

Well, what next? Audio transformers and speaker?

That's better, because good ones, or rather suitable ones, are difficult to replace at times. But still you have not found it yet.

"Coils." someone suggests hopefully.

Says It's Coils for Sure

Coils it is, say I, by all means, because even though tuning condensers be whatever they may, a poor tuning coil does render a set virtually useless. And particularly if the coil should happen to be a poor match for the condenser with which it is used. There are many useful pointers about coils for radio set use that experimenters should know. There is a prevalent idea in some quarters that if the necessary number of turns of insulated copper wire are wound around a piece of tubing (made of insulating material), whether in accordance with a formula or otherwise, and a variable condenser is connected in series or in parallel (according to what the constructor is aiming at), that it is only necessary to adjust the number of turns by trial until the desired stations, or the lowest available broadcast frequency, is tuned in.

If radio frequency tuning coils needed only the electrical property called inductance, and "possessed" no other virtues or vices, the major problems would vanish very quickly.

But things don't work out this way, unfortunately, and so we have to make some further analysis.

If a radio frequency coil for regular broadcast reception use in a present-day set would function with but one turn of wire one of the major problems would be conquered, but we all know that this cannot be. We have to use more than one turn and because of this plurality of turns we automatically introduce some capacity effect.

Inductance and Capacity Oppose

Fig. 1 shows in substance what I am driving at.

It will be seen by inspection that the inductance and capacity due to curve EMF always tend to neutralize each other.

This ideal case diagrammed is very closely approached under conditions of low circuit or coil resistance. For the present, though, it will serve illustrative purposes nicely.

Capacitance, no matter where encountered, always tends to behave the same way—and so, also, does inductance—and whether these two properties are present in isolated or common circuits they always tend to oppose each other—and, as is to be expected, also, the more prominent effect of the two is always manifested to a greater measurable extent. In radio frequency coils the range of inductance values is usually small.

Also the range of coil capacitance is small. Nevertheless, only a minute "quantity" of coil capacity is needed to offset its inductive property, hence when a radio frequency coil is made the maker must take cognizance of coil capacitance, known also as self-capacitance. The term distributed capacity refers to another though associated effect.

Use of a Theoretical Tubing

Fig. 2 illustrates a coil that has been wound on a perfect insulating tubing and has inductance and self-capacity only. The wire is bare and is space-wound and has no coating of adhesive insulating varnish, in other words, it has no appreciable distributed capacity.

All kinds of matter and even the molecules of which they are composed possess some electrical capacity and the value of this property depends naturally upon the linear distance between said pieces of matter, and the mutual attractive force relationship between the various particles that constitute the particular substance we have at hand.

Fig. 3 shows a diagram of an atom. To make the picture clearer let us suppose that the group of positive and negative charges represents the positive and negative particles in a sample of bakelite tubing and that their particular distribution around the dotted circle enclosing positive charges is due to natural chemical properties of bakelite—or at any rate of a particular sample. These negative bodies arranged around the outer circle are seen to be equidistant from one another on the circle and are also radially equidistant from the common axis of radius R.

There exists capacitance between a negative body and the positive body on the same radius line and since the bakelite sample being examined is in chemical and therefore electrical equilibrium it will be realized that work must be done to pull one of the negative bodies from its diagrammed position either way.

What Capacitance Is

Capacitance is the name given to the force that must be applied (whether to the respective left or right) to displace the location of any one or more of the negative or positive bodies from their given position of equilibrium.

The coil of Fig. 2 was and still is an almost ideal coil, because it has none other than self-capacity in addition to inductance, but let us now remove the insulating tube (without disturbing the turns and dotted-line condensers) and replace it with an actual sample of tubing.

Since the tubing we now have is made up of countless numbers of positive and negative bodies similarly arranged and identical in molecular structure to Fig. 3, it will be realized that when currents flow through the coil of Fig. 2 the arrangement of the positive and negative bodies will be affected.

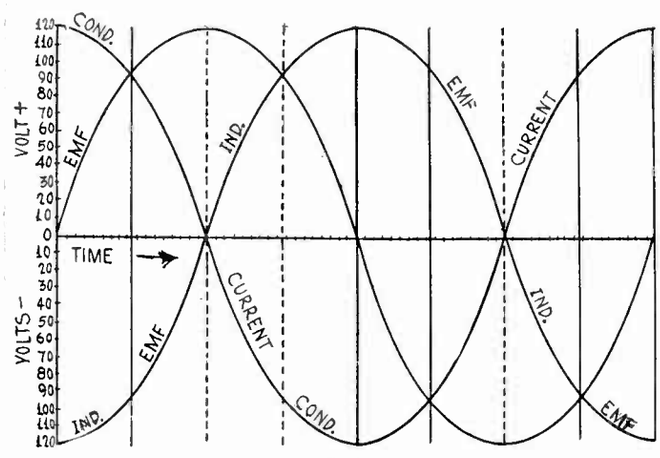

FIG. 1.
CAPACITY AND INDUCTANCE EFFECTS IN AN IDEAL CIRCUIT.

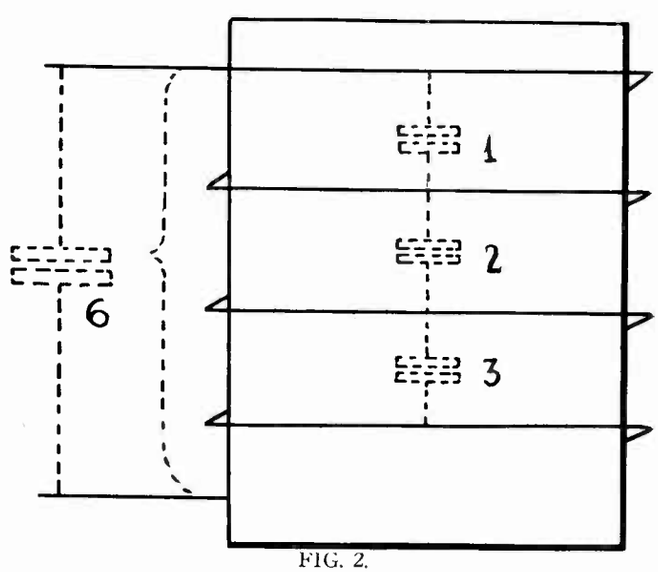

FIG. 2.
AN IDEAL COIL THAT HAS SELF-CAPACITY ONLY. THE CIRCULAR FORM IS A PERFECT INSULATOR.

Wanted: Television Valve

By Meyer E. Eisenberg

IN the June 7th issue of RADIO WORLD, you state that the recent Alexanderson experiment, resulting in a six-foot television image, made use of the Karolus cell. Strictly speaking, the cell referred to is a Kerr cell and the credit for it goes to Dr. William Kerr, the English physicist, who discovered it about 1875. Therefore, properly it should be called a Kerr cell. Karolus employs a modification of the Kerr cell in the Karolus-Telefunken Television apparatus, which is getting some attention in Germany today. The Kerr cell is also used by Karolus, in a system of photo-telegraphy, and by Klangfilm-Tobis, as a means for making the sound track on movie film.

It is interesting to note that the beginning of the work that has culminated in the Alexanderson demonstration reaches back to 1808, when Malus discovered the polarization of light from a sheet of glass. The simplest device for polarizing light is a pair of Nicols' prisms—which, by the way, are the prisms mentioned in your article, but not by name. William Nicols led James Clerk Maxwell to the study of light and its polarization.

Ray of Light Rotated

Faraday had shown, about 1845, that a ray of light could be rotated by an electric field about it. He accomplished this with several different pieces of apparatus and one of these could be used today as a light valve for television reception (and was so used by Nipkow in 1884). It consisted of a helix, through the core of which was placed a glass tube containing carbon bisulphide. A Nicols prism was placed at each end of the glass tube and so adjusted, that light, passing through them, would just be cut off, i.e., they were crossed. Using a beam from a powerful arc light, Faraday attempted to pass a beam through the system, but no result was obtained until a current was sent through the helix, when an electric field was created and a stress set up in the carbon bisulphide, which rotated the plane of polarization and allowed the light from the arc to fall on a screen. The action was practically instantaneous and it really makes Faraday the originator of the first light valve. This effect—now that it has found a practical demonstration—will no doubt be utilized by others in furthering television.

In 1875 Kerr discovered that Faraday's result could be duplicated by creating an electric stress in a glass cell containing either carbon bisulphide or nitro-benzene (benzol).

Used Plates as Electrodes

Kerr used two small plates immersed in the liquid, and placed about ⅛ inch apart. When connected to a source of current the plates became electrodes and the plane of polarization was rotated, just as it was in Faraday's case. Kerr also showed that this result could be obtained by drilling holes in the opposite edges of a piece of heavy plate glass—until the holes were about ⅛ inch apart. Wire electrodes were inserted in the holes and when a current was passed, a stress resulted in the glass, which rotated the polarized ray. Faraday suggested, and Kerr proved, that polarized light could be rotated when it was reflected from the polished pole of an electromagnet.

These experiments were performed from 50 to 75 years ago. Any practical attempt to utilize them for television came to nothing for the good enough reason that the photo-electric cell and the vacuum tube had not yet been evolved, though the groundwork for them was being laid during those years. Karolus was probably the first one to apply the Kerr cell to a usable device. There is nothing patentable about the Kerr cell, Nicols' prism and Faraday's combination for the polarization of light, and clever experimenters can make use of any of them, to duplicate the results above mentioned, and perhaps hit upon some new angle that will advance the cause of television.

Scanning Disc Patented in 1884

The scanning disc, too, was patented in 1884, by the German, Paul Nipkow, who tried to use it in combination with Faraday's scheme for polarizing light. If Nipkow could have had a modern photo cell and vacuum tube amplifier it is almost certain that he would have sent the world's first television pictures by wire, at least, for Hertz's experiments that laid the foundation of radio were to come four years later. Nipkow was balked by the use of selenium for his light sensitive device, and like many others after him, learned that it was far too slow for the enormous number of changes that are needed for television.

Ever since the discovery of the light sensitivity of selenium, in 1873, by the Englishman, Willoughby Smith, the use of the metal in a possible electric eye was the quest of many earnest workers. Fourteen years after Smith's discovery came the real birth of the photo-electric cell by none other than Hertz himself. In 1887 Hertz first noticed a peculiar effect in the passage of the spark across a gap, when an adjacent spark was oscillating during his classical experiments, to substantiate Maxwell's and Faraday's theory. The actual demonstration of the photo-electric effect came the following year, when Hallwachs made use of Hertz's observation.

The Birth of the Cell

From then on the attention of a host of pioneers was conconcerted on the search and the cell, as we know it, came to take form in 1893, when the first potassium cell, filled with hydrogen, was produced by J. Elster and H. Geitel. Both of these workers have spent some thirty years in the task. From 1893 an improvement was made, until we now have cells that can distinguish on off-shade cigar from a standard one.

During Edison's experiments that led to the first incandescent lamp he noted an effect which found practical application in 1905 by the Englishman, J. A. Fleming. The result was a two-electrode vacuum tube detector for radio-frequency signals. Two years later the addition of the grid by Lee De Forest made possible the modern tube and the curtain was about to rise on radio broadcasting. The ships of the U. S. fleet broadcast songs and music during the world tour in 1907-8, and in 1909 De Forest sent the voice of Caruso on the air from the Metropolitan Opera House. Broadcasting, as we know it today, had its first demonstration in 1919 at the Third Dutch Trade Fair in Utrecht, and the pioneer effort in the United States was made in November, 1920, by the Westinghouse station, KDKA.

Baird and Jenkins Demonstrate

While broadcasting was developing, a number of intense workers set themselves to the task of adding eyes to our receiving sets. John Baird, in England, is generally credited with the first practical demonstration in 1926. C. F. Jenkins in the United States also made progress about the same time, and in 1927 the Bell Telephone Laboratories thrilled the country by a two-way demonstration, utilizing both wire and radio facilities.

In Germany, Mihaly and Karolus were hard at work.

Moore had developed the neon glow lamp in 1904, and its use has made satisfactory results slow in coming. But it was a beginning, and still is probably the simplest method of forming the image. The problem of an image that can be thrown upon a screen, and in a simple manner, has now been shown by Alexanderson's recent experiment. We certainly owe untold credit for these results to the early workers in the unknown and virgin field of light research, and any true account of television and its development would be unjust if it did not mention Malus, Faraday, Maxwell, Kerr and Nicols.

Fleming Seeks Something Better

Speaking before the Television Society at University College in London, on March 18th, last, Sir Ambrose Fleming (inventor of the thermionic vacuum tube)—mentioned by Kerr cell, Nicols' prism and the Nipkow disc, and suggested that this combination "might give quite a large field of light sufficient to contain a full-length reproduction of the human figure. It would have the advantage of being a field of white light or of any other color. The neon tube, as a receiver, has the disadvantage that it affords a relatively small area for building up the image. I am strongly of the opinion that we have not reached the final or best form of television detector in the neon tube. What is required is some form of light valve that is capable of being actuated by an electric current of a few microamperes, which would control the illumination of a perfectly white light so that the brightness would correspond instantly, and without lag, to the change in the current, and be proportional to it—it does not follow that the possession of very elaborate or costly apparatus is necessary." Sir Ambroses's suggestion is apparently realized in the latest news from Schenectady.

Bibliography

Now that the use of polarized light for television reception has been actually demonstrated, many readers of RADIO WORLD might like to know more about this interesting subject. For those who are inclined towards research—the following list of books is offered. Any good public library will probably contain all of them.

1867 Report of the Smithsonian Institute. Page 240 and on covering Faraday's work on electrical rotation of light.

Volume 2. Physical Treatise on Electricity and Magnetism by J. E. H. Cordon. On page 206 is a complete account of Faraday's work and on 245 a description of Dr. Kerr's discoveries.

Polarization of Light, By William Spottiswoode.

History of Physics—Page 145—By F. Cajori. Also page 248.

I may also mention the English magazine, "Television," which has carried a splendid series of articles on light, by H. Wolfson, since the first of this year.

Side Frequency Formulas

By J. E. Anderson

Technical Editor

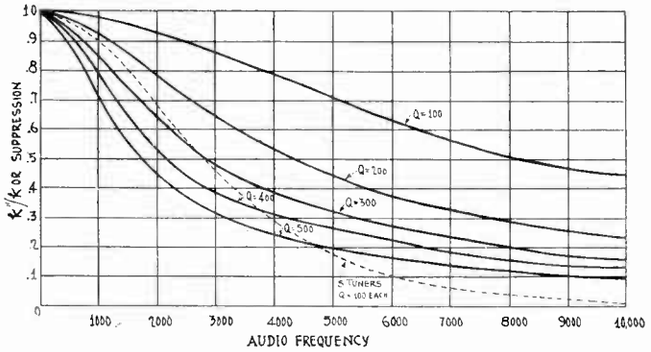

FIG. 1.
CURVES SHOWING THE SUPPRESSION OF AUDIO FREQUENCIES BY TUNERS OF FIVE DIFFERENT VALUES OF SELECTIVITY.

$$e = E(1+k\cos qt)\sin pt \quad \text{-------(1)}$$

$$E_1 = E(1+k\cos qt) \quad \text{----------(2)}$$

$$E_2 = E[1+k'\cos(qt-\phi)] \quad \text{---------(3)}$$

$$k' = \frac{k}{2}\left[\frac{1}{\sqrt{(1-r)^4+Q^2r^2(2-r)^2}} + \frac{1}{\sqrt{(1+r)^4+Q^2r^2(2+r)^2}}\right] \quad \text{--(4)}$$

$$k'' = \frac{k}{\sqrt{1+4r^2Q^2}} \quad \text{----------(5)}$$

$$r = \frac{q}{p} = \frac{fm}{fc} \quad \text{----------(6)}$$

$$Q = \frac{Lp}{R} \text{ (at resonance)} \quad \text{-------(7)}$$

TABLE OF MODULATION FORMULAS

THERE has been much discussion about the existence of sidebands and side frequencies. Some contend that they are nothing but mathematical abstractions while others contend that they are quite real. Some experimenters have proved to their own satisfaction that the side frequencies are mythical and others have proved to the satisfaction of themselves by experiment that they are realities. That leaves much room for discussion.

The question usually comes up in connection with the suppression of modulation by tuned circuits. A few contend that the suppression is as unreal as the side frequencies, but only a very few take this position. Most people who have studied the question admit, or contend, that tuned circuits adjusted to resonance with the carrier frequency do suppress the modulation. Those who admit often find it convenient to seek an explanation in terms of the decrement of the circuit, while those who contend say that the suppression of the modulation is due to the suppression of the side frequencies.

Experiment Checks Computation

It has been proved by oscillograph records that when a modulated wave goes through a tuner adjusted to the carrier, the degree of modulation is reduced. Calculation on the assumption that side frequencies exist leads to the same conclusion, both qualitatively and quantitatively. Such agreement between theory and experiment is usually interpreted to mean that the theory is correct. Of course, it does not prove that side frequencies are real. Neither does it disprove it. It merely proves that the mathematical procedure is justified. The mathematical conception of side frequencies and carrier may be entirely wrong, but right or wrong, it leads to the right results.

Perhaps the entire controversy could be avoided by calling the various mathematical components something besides carrier and side frequencies. But there is no need of doing that, since the terms have been established and their meanings are quite widely known. We shall retain them without saying whether they are real or merely stepping stones of the mathematician in his solution to the problem.

It has been customary in estimating the suppression of the modulation by a tuner to take one side frequency only and to compare its suppression relatively to the resonant frequency. This leads to a very simple result and is the ratio of the impedance of the tuned circuit at the resonant frequency to the impedance at the side frequency. However, this does not take account of the other side frequency, which also contributes something to the detected signal. Neither does it take account of variations in the radio frequency resistance with frequency variations. In other words, the simple method does not give exactly correct quantitative result.

A Modulated Wave

Equation (1) in the table of equations gives the mathematical form of a modulated emf such as may be induced in a tuned circuit in series with the coil. E is the maximum value of the carrier part of that voltage, k is the degree of modulation, which always lies between zero and unity; q is the angular velocity of the audio frequency wave impressed on the radio wave, or it is 6.28 times the audio frequency; p is the angular velocity of the carrier, or it is 6.28 times the carrier frequency, and it represents the time and shows that *e* varies as time progresses. Cosqt and sinpt show how it varies.

Equation (2) shows the modulated amplitude of the carrier wave, and is simply equation (1) with the sinpt left out.

The question is, what happens to E1 when e is impressed on a tuned circuit, or more particularly, what happens to k, the degree of modulation. A rather long and laborious, though straightforward, process of mathematics will yield equation (3) for the variable amplitude of the modulated wave as it appears across the tuning condenser and across the grid circuit of the tube following the tuner. Just as (2) gives the equation of the **envelope** of the carrier wave as impressed on the tuned circuit, so (3) gives the envelope of the voltage wave impressed on the grid of the tube.

Equation (3) is not strictly exact, for it was derived on the assumption that sum of the phase angles of the two side frequency current components was zero, or that the phase angles were equal in absolute value but opposite in sign. For values of q/p met in ordinary broadcasting this approximation is so close that it may be said to be exactly correct.

New Modulation Factor

There is a phase angle *phi* in the cosine term of (3). This need not be considered for it has nothing to do with the degree of modulation. We are primarily interested in k', the new factor of modulation. Its value is expressed in (4), in which k is the original factor of modulation, r the ratio of q to p as defined in (6), and Q the selectivity as defined in (7) . In (6) f_m is the audio or modulating frequency and f_c the carrier frequency. In (7) L is the inductance of the tuned circuit, p as defined above, and R the resistance of the coil at the resonant frequency.

Equation (4) is exact to the same extent that (3) is exact. The first term in the brackets is the contribution of the lower side frequency and the second term is the contribution of the upper side frequency. In deriving this equation of the new factor of modulation it was assumed that the resistance of the circuit was directly proportional to the frequency. While this is not strictly true, a much closer approximation is obtained on this assumption than if it is assumed that the resistance is constant. When only a small frequency range is considered, which is assumed in arriving at (3), the assumption that the radio frequency resistance varies directly with frequency is well justified.

Further Simplification

Formula (4) is complex and is not convenient for computation. We can simplify it greatly. Since r is very small by assumption, it can be neglected in comparison with unity, and hence also in comparison with twice unity. If we make this approximation we note that the two terms in (4) reduce to the same value and that (4) reduces to (5).

The approximation obtained by neglecting r in comparison with unity is really much closer than appears at first. It will be noted that the first term is decreased by the approximation and that the second term is increased by almost the same amount. Hence the average of the two terms is almost identical with (5) even when r is not negligible compared with unity. However, when r is not negligible compared with unity the approximation used in arriving at (3) is not good, so it is just as well to impose the condition that r must be small compared with unity.

Well, then, we have an expression for the new modulation

(*Concluded on pages* 10 *and* 11)

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. The reply is mailed to the member. Join now!

RADIO UNIVERSITY

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WHAT IS MEANT by the Q of a tuned circuit? Does this have anything to do with the selectivity?—J. J. F.

The Q of a circuit is a symbol for the quantitative measure of the selectivity of the circuit, or more simply, it is the selectivity. If L is the inductance of the tuning coil in henries, w the angular velocity of the current, that is, 6.28 times the frequency, and R the resistance of the circuit in ohms at resonance, then $Q = Lw/R$. That is, the Q is the ratio of the inductive reactance to the resistance at resonance. At first thought it would appear that the selectivity is directly proportional to the frequency, but this is not the case because R is not a constant. Neither is the selectivity a constant, because R does not vary directly with frequency but increases more rapidly. Therefore the selectivity of a circuit is less, the higher the frequency. If we take a small frequency region such as that covered by a broadcast frequency and its two sidebands the resistance may be assumed to vary directly with the frequency so that in that small range the selectivity may be regarded as a constant.

* * *

I HAVE NOTED that the sensitivity of receivers is expressed in terms of microvolts per meter and that the smaller the number, the greater the sensitivity. Will you kindly explain how the sensitivity is obtained or defined so that this apparent contradiction is reconciled with the facts—K. J. K.

First of all we have a standard output measured in so many watts. Then we have a standard antenna. The field strength is measured in microvolts per meter. It is clear that the more sensitive the set is, the weaker need be the signal which will turn out the standard output under these conditions. We might illustrate this with an example from mechanics. Suppose we have a given weight to lift (the standard output) and that we have a lever with which to lift it. The ratio of the long lever arm to the short one represents the amplification. It is clear that the greater this ratio the less the force that is necessary to apply to the end of the long arm to liit the weight. We can express the sensitivity of the mechanical apparatus by the force necessary to lift the weight. That we do when we express the sensitivity of a receiver in terms of the microvolts per meter that will turn out the standard signal.

* * *

IS IT PRACTICAL to build a Loftin-White non-reactive amplifier with direct current tubes such as the 222 and the 171A? If not, please explain why?—S. G.

It is not practical unless it can be considered practical to use a separate A battery for each tube. The direct coupling is possible in AC circuits because the heater of the type tube used is independent of the cathode of the tube.

* * *

WHAT IS NEEDED to impress radio programs on a phonograph record? —J. H.

It depends on the kind of recording. Perhaps the simplest is to impress the programs on wax discs. For this is needed a phonograph pick-up unit connected in place of the loudspeaker and carrying a diamond cutting point, a means of turning the blank record at the proper rate, say a synchronous phonograph motor, and a means for forcing the cutting needle to travel in a groove of the correct pitch. Blank discs with the groove cut may be purchased. If a little more elaborate recording equipment is desired the programs may be impressed on a film such as is used in motion picture machines. In this case the signals would have to be converted to variations in light impulses as is done in television reception. The light of varying intensity would then be focused by means of a lens system into a very narrow slit on the moving film. A means for driving the film at the proper rate would also have to be provided. After the film has been exposed it would have to be developed and fixed.

* * *

IF ONE TUNED circuit is capable of separating stations to a certain degree, will five of them separate the stations five times as well, or is there some other relationship between selectivity and the number of tuned circuits?—I. C. V.

To a first approximation it may be said that five circuits will give five times the selectivity of one. This assumes that all the tuned circuits are adjusted to exactly the same frequency, and that there is no change in the selectivity of any one as a result of the presence of the others. It is difficult to satisfy either of these conditions and therefore the selectivity of five tuned circuits in practice will be considerably less than five times that of one. If this were not so the five-tuner circuit would be so selective that all the side frequencies would be tuned out except those representing very low audio frequencies.

HOW IS IT possible to synchronize two broadcast stations so that there will be no audible heterodyne between them in a receiver capable of picking up both? —E. S. T.

There are many methods of synchronization. In one the carrier of one station is picked up the operator of the other and this operator changes the frequency of his station until the beat frequency is as low as is required. In another method an audio frequency is transmitted by wire from one station to the other and the carriers of both stations are derived by using the same harmonic of the audio frequency. For example, the audio frequency transmitted may be 5,000 cycles. If the carrier is to be 1,000,000 cycles the 200th harmonic of the 5,000 cycle note is used by both stations. Still another method is to grind two crystals to the same frequency and then use these crystals for controlling the carrier frequencies of the two stations. These crystals are operated under the same conditions and are thermostatically maintained at one temperature. There are means for making very small changes in the frequencies of these crystals should this become necessary to eliminate an audible beat between the two stations.

* * *

RECENTLY I BUILT a screen grid receiver using coils I made myself. I made the coils as near alike as I could and trimmed the tuned circuits with small condensers. The volume is good but the set is not as selective as I expected it to be. As I tune through a station I note the signals come in at two points quite close together. In between these points the signals can be heard but they are not nearly as loud there as at the two other points. Does this behavior indicate that the condensers have not been lined up properly? If not, what does it indicate?—A. B. S.

A circuit behaves this way when the coupling between the two windings of a radio frequency transformer is too close. Use fewer turns on the primaries, or, preferably, put the primaries, farther away from the secondaries. If you wind the primaries on forms that just fit inside the secondaries you can vary the coupling by adjusting the position of each primary with respect to the secondary. This is well worth while.

* * *

WILL YOU KINDLY suggest a method for lowering the bass response in a receiver? I have a dynamic speaker which seems to favor the bass. Feeding this is a very selective receiver and a resistance coupled amplifier. This job was designed especially to get the low notes and from this point of view it is a great success. But I also want to hear the high notes. If there is a simple way of changing the tone I should like to know about it.—P. C. C.

Since you have a resistance coupled circuit there is a very simple method of reducing the bass. First, you might use lower values of grid leak. If this does not reduce the bass sufficiently you can also reduce the capacity of each stopping condenser. These changes should be confined to the audio amplifier. No changes are necessary in the detector. However, reducing the grid leak in the detector has the same effect. Another way of reducing the bass is to connect a small inductance across the speaker, or across some other part of the line, for example, across a grid leak in the audio amplifier. This inductances should be many henries or it will not only cut out the low notes, but all notes. Try changing the grid leaks first. Substituting an inductance for a grid leak cuts down the low notes and builds up the high, relatively. Lowering a grid leak cuts down all notes, but cuts the low more than the high.

* * *

WHAT IS the practical effect of putting a radio frequency choke coil in the plate-to-transformer lead in an amplifier?—J. F.

If the audio amplifier is transformer coupled and the detector circuit is not regenerative there is practically no good effect. If the circuit is resistance coupled it prevents radio frequency voltages from being amplified. The distributed capacities in the transformer windings serve this purpose nicely in a transformer coupled circuit. When the circuit is regenerative and when the tickler is not connected in series with the plate to transformer lead, but in parallel, the choke prevents the escape of the RF currents from the tickler, or the choke forces the radio frequency currents through the tickler.

* * *

IN what direction does B supply current flow in a radio tube plate circuit?—M. M. W.

The current path is from the positive post of the B voltage source to the plate, through tube to filament and from filament to the negative post of the B voltage source. The tube electrons move from the filament to the plate, because the electrons are negative charges and the positively charged plate attracts them.

Resolved: Automatic Volu

AFFIRMATIVE

By James Morse

AUTOMATIC volume controls have been proposed as a remedy against fluctuations of signal strength, especially as a remedy against fading in the reception of long-distance signals. Are such controls necessary or desirable?

There is no doubt about the desirability of having an automatic feature in the receiver which holds the sound output the same no matter how much the strength of the signal varies. It is very exasperating to tune in a station that is so loud one instant that all the tubes are overloaded and the next instant so weak that little can be heard.

Obviously, when the signal strength varies in that manner there can be no enjoyment of the programs from the distant station. It is even more trying to test a receiver for distance getting ability. The signals may come in fine for several minutes, but just as the announcer gets ready to tell what station it is the signals begin to fade out so that even coaxing them with the manual volume control will not bring them in clearly enough to hear what the announcer says. Having missed one announcement because of fading there is nothing to do but wait for the next, to learn the call letters, which may mean a long wait, indeed. And what happens at the second announcement? Maybe the same thing.

Without an automatic volume control it is practically useless to listen to distant stations for entertainment except on those rare days when fading is negligible.

Fading on Local Stations

Well, who wants to listen to distant stations for entertainment? To say nobody would be a rash statement, for there are many who want to listen to distant stations, for they have no other. Not all radio listeners live under the shadow of a powerful broadcast station. More people live in the fading zone of one or more broadcast stations which they would like to hear regularly if they only could.

Then there are many local causes for signal fluctuations. If the antenna circuit of a receiver nearby is tuned the signal received by other receivers might be almost cut out. This source of trouble is not so frequent as it once was, but there are still many receivers having a tuner in the antenna circuit. There are, for example, still many loop-operated Superheterodynes, and every one of them might cause fading effects in receivers near it. True, those who have receivers do not always change the "tune" but they do it often enough to cause much trouble.

One change in the middle of a program is sufficient to spoil the program for some neighbors, and those who have Superheterodynes usually are not satisfied to listen to one station for any length of time. They may like a certain program from a distant station and discover that it is a chain program. Then right away they want to know how that program comes in from the other stations on the chain. That means that the loop tuning will be changed from station to station as long as the program is on. And every time it is changed it will affect the reception on some other receiver.

Signal Held Constant

With an automatic volume control in the circuit the receiver will not be affected by such changes, whether they are due to natural fading or to fluctuations by tuning an antenna nearby. The volume is set once, by hand, and the automatic volume control holds it at that level until it is again changed by hand. There is no need at all for getting up and resetting the manual control for any signal intensity changes. That this condition is desirable no one can deny.

But is it necessary to have a volume control that without attention holds the volume at a given level? No, it must be admitted, it is not necessary, for it is not necessary to listen to a program at all. It is not even necessary to have a radio set in the house. It is not necessary to listen to a program from a distant station if there are other stations to listen to, or even if there is no station near. It is entirely optional to listen or not to listen. It is also optional to listen to fluctuating signals or to steady signals.

However, if we choose to have steady signals on distant as well as local stations, then an automatic volume control is necessary, for there is no other way of holding them steady if they come in fluctuating. And they surely come in fluctuating at times.

The received signal often varies considerably due to causes other than those mentioned above. For example, the line voltage supplying AC receivers varies a good deal and when the line voltage amplification varies, and hence the output of the receiver. Again, some broadcast stations change power at a certain hour of the day. This change might occur while a set is tuned to it and the volume control adjusted to either the high or the low level. Again, the strength of the signals from a given station may change during twilight.

All these fluctuations in the signal strength result in corresponding fluctuations in the sound output of the receiver. In some instances the fluctuations will be so great that the volume will change from bare audibility to overloading of all the tubes.

Sound Equalizer

Troubles from all these volume variations can be avoided by the use of an automatic volume control in the receiver. When the volume rises from any cause whatsoever, the volume control effects a reduction of the amplification in the receiver just enough to offset the rise in the signal intensity. When the volume decreases, the reverse series of events takes place. The amplification goes up just as soon as the signal intensity goes down, and by the amount required to keep the sound output at nearly constant value. There is no other device that will do this, and for that reason it may be said that an automatic volume control is essential.

Fancy the great inconvenience of a manually operated volume control when the signal is varying. The radio receiver may be in the front room and the lady of the house and the receiver operator may be in the kitchen. She likes to hear the radio but she must do her work. She may set the volume at a moderate value when she tunes in a certain program. Then she proceeds to the kitchen and all is well for a minute. But then the radio starts to "act up." Maybe the signal fades out. The operator leaves her work in the kitchen and turns up the volume. She returns to the kitchen and in a minute the volume is up several times as high as the upper tolerable limit. Running back and forth between the kitchen and the front room is conducive neither to a good program nor to a good meal, so the lady turns off the set and on the kitchen range. Thus she has to forego the radio program just because there is no automatic volume control in the set.

That automatic volume controls are highly desirable and necessary if steady signals are to be received on most stations is born out by the fact that the radio manufacturers of sensitive receivers feature an automattic volume control. Before the manufacturers incorporated the device in their receivers they investigated signal fluctuations thoroughly and satisfied themselves that an automatic volume control would make the receiver render satisfactory service where a receiver not provided with such a control would be entirely unsatisfactory.

Suppression of Side Fre

(*Concluded from page 8*)

factor k" is given in (5), which for all ordinary broadcasting is quite accurate. If we plot equation (5) for various values of r we get a curve which shows how the side bands are suppressed by a tuner having the selectivity Q used in the plot. Such curves are given in Fig. 1 for five different values of selectivity. The abscissæ in the graph are f_m rather than r and the carrier frequency was assumed to be 1,000 kc.

Equation (5) can be obtained directly by multiplying the original modulation factor of k by the ratio of the resistance of the tuned circuit by the impedance of the circuit at either side frequency, and neglecting r in comparison with unity.

The curves in Fig. 1 really show the ratio of k" to k rather than k". Thus all the curves start with unity when the modulation frequency is zero. The curves show that low modulation frequencies are not tuned out as much as the high, in fact, they show that the frequencies are reproduced practically in full below 1,000 cycles. Above 1,000 cycles the suppression becomes quite great, and it is greater the higher the selectivity.

The values of Q, the selectivity, for the curves are 100, 200, 300, 400 and 500, starting at the top. The curve for Q equals 100, shows that there is little suppression up to 10,000 cycles while the curve Q equals 500 shows a suppression of about 80 per cent. at 10,000 cycles.

These values of selectivity are quite arbitrary and one may wonder whether they occur in practice. We find the answer in Technologic Paper No. 298, of the Bureau of Standards, which has been prepared by August Hund and H. B. DeGroot. This paper contains a large number of curves on different coils used in radio receivers, curves showing the variation of resistance with frequency as well as curves showing the ratio of inductance to resistance.

Since the curves in Fig. 1 are for a carrier frequency of 1,000 kc we shall take the resistance from the Bureau of Standards curves for this value. The inductance of the coils used was 291 microhenries. We find that a coil wound with No. 28 wire in a single layer had a resistance of nearly 10 ohms. Thus the selectivity would be 291x6.28/10, or 183. Another coil

me Control is Neccessary

NEGATIVE

By R. C. Latrope

AN automatic volume control on a radio receiver is just one more appendage which may be cut out without making any noticeable difference. Most radio reception is done on local stations the signals from which don't vary enough from hour to hour or from day to day to cause any appreciable change in the sound output of the receiver. Why, then, is it necessary or even desirable to have an automatic volume control to hold something steady that is already quiute steady? There can't be any necessity.

If the automatic volume control is used on sensitive receivers in the reception of distant stations the signals of which are subject to fading there is some advantage in having an automatic control, but only when it is absolutely necessary to receive those fading signals. However, when there is considerable fading there is practically no entertainment value in the signals even when the volume is held constant. Why not? Because when the signals fade in and out there is a periodic rise and fall in the amount of noise brought in with the signals. One minute the signals may be quite clear and free of noise. The next minute the noise may be 95 per cent. of the total sound output.

Cacaphony of Noise

Imagine listening to an orchestra which is drowned out every other minute by the hand-clapping of 10,000 persons, the racket from a boiler factory, and the noise from a dozen riveting machines! The noise from a radio set is at times as great as from all these combined.

Of what avail is an automatic volume control when it cannot keep out the noises which render the signals unintelligible or unenjoyable? None whatsoever. When reception is so bad as to require an automatic volume control it is also so bad that the signals are not worth listening to even if they can be brought in with fairly uniform intensity.

When the reception conditions are good enough to listen to there is no need for an automatic volume control for the signals will be good and steady without it.

There is another objection to the use of an automatic volume control and that is it is not possible to tune in a station by tuning for maximum sound. It is necessary to have the receiver accurately calibrated or to have a visual indicator of resonance.

The reason for the failure of the usual method of tuning is apparent. In the receiver without an automatic volume control the signals increase in strength gradually as the tuning point is approached. The proper tuning point is that which gives maximum signal strength. When the receiver with an automatic volume control is tuned in there is no such indication of optimum tuning because the automatic feature enters to level out the resonance curve.

Just as the automatic volume control is effective when the signal strength varies at the antenna so it is effective when it varies on the grid of the volume control tube due to an increase by virtue of resonance. The volume may be up to the full value allowed by the control when the tuning is 10 kc off resonance. If the control is effective it is no stronger at 5 kc off resonance, and again no stronger at exact resonance. How, then, can one tune in a station by the intensity of the signal? It cannot be done. That is the reason a meter is incorporated in every receiver provided with automatic volume control. Or if a meter is not incorporated, the circuit is calibrated so accurately that the dials may be set by the calibration.

Greater Cost

The cost of a receiver incorporating an automatic volume control is invariably greater than one in which this feature is not included, because the volume control requires at least one more tube with its associated socket, resistors, and condensers. Then the meter which is almost invariably used as a tuning aid cannot be had for nothing.

Now if the receiver must be built to a given price, when the automatic feature is included sacrifices must be made in the quality of the other parts. This, naturally, makes an inferior receiver. Is the slight improvement on distant, fading stations worth an all-around sacrifice in quality? Fans will chorus an emphatic "No."

The Sales Appeal

Engineers will be no less emphatic, but the salesmanager vetoes their verdict because he believes that an automatic volume control makes a strong appeal to the prospective purchasers of new receivers. It may do so once, but when the owner of a set with this feature in it discovers that there is no appreciable benefit derived from it he will neither recommend it to others nor will he buy another receiver like it the next time.

There is no one so foolish as to sacrifice the quality of the receiver for a lot of useless appendages, and there is no one so foolish as to get an automatic volume control when he is entirely satisfied with listening to local stations which do not change in intensity.

Few Worthy Distant Stations

If there were many distant stations having good programs there might be some excuse for having an automatic volume control. Now all the good stations are sending out mostly chain programs. There is no sense in tuning in on a given program coming from a station 1,000 or 2,000 miles away when the same program can be obtained from a station at most 100 miles away.

Independent stations sending out original programs are rarely worth listening to, for the talent is mediocre or worse and the stations are not capable of doing much with what they have About 99 per cent. of the listeners have three or four stations to which they tune 99 per cent. of the time, and these stations are local and not subject to fading or any other signal variation. That does not leave much room or time for receivers with automatic volume controls.

Intensity Changes Rare

There are many kinds of signal variation which the automatic volume is supposed to prevent.

A few examples are, the change in signal intensity when day changes to night, when the voltage supply changes in the late afternoon or late at night, when a station changes from one power to another, and when there are local signal disturbances.

In a way, the automatic volume control does prevent the sound output from varying with these changes in the signal, but these changes do not occur often enough to justify the use of an automatic volume adjuster.

Chances are that most of these changes will occur when the set is not on at all, or when it is not tuned to the station when it is changing.

Since the volume has to be adjusted manually whenever the set is tuned from one station to another there is no good reason for having an automatic control to provide for a possible change that may occur in the signal that happens to be tuned in. Possibly such a change would not occur more than once a week, and when it does happen it is more than likely that the operator is sitting within reach of the manual control.

quencies By Tuning

having the same inductance and wound with No. 32-38 litz in loose basket weave fashion had a resistance of 5.5 ohms. Thus the selectivity is 333.

The effective inductance of a coil varies also. If this fact is taken into consideration the selectivity becomes slightly different. The 291 microhenry solenoid coil then has a selectivity of 207.5.

These values of selectivity are for a single coil. In a receiver there are several coils, all tuned to the same frequency. Therefore the effective selectivity of the circuit is much greater than that of any one tuned circuit. Thus is it clear that a selectivity of 500, the highest represented in Fig. 1, is not unreasonably high.

When there are several tuned circuits in the selector a formula of the type (5) cannot be used, because the selection by several circuits does not follow the same law as the selection by one circuit. In fact, the formulas for the several circuits must be multiplied together to get the effect. Thus if there are two identical circuits accurately tuned to the same carrier frequency, then the correct modulation is obtained by squaring the denominator in (5). If there are three identical circuits the denominator has to be cubed, and so forth.

In Fig. 1 the value of the suppression for any number of equal tuned circuits can be obtained from the curve for a single tuned circuit by raising the ordinate to the appropriate power. For example, take the curve for Q equals 100 at 5,000 cycles. The ordinate is .707. For two equal circuits it would be .5, for three, .354, for four, .25, and so forth. On the curve for Q equals 500 at 10,000 cycles the ordinate is .0995. For two equal circuits it would be .0099, or approximately .01.

For the higher selectivities the degree of suppression seems very high indeed, even for a single tuned circuit. But when the suppression is expressed in transmission units it does not seem so great. The maximum suppression is approximately 10 decibels. At a point, on any curve, where the ordinate is .5, the suppression is only 3 decibels, a suppression that could not be appreciated unless the change from one intensity level to the other were made suddenly.

$450,000,000 Radio Center

ROCKEFELLER OPENS TO ART DAZZLING VISTA

An entertainment center, a $450,000,000 project, backed by John D. Rockefeller, Jr., including four theatres on the site, making all productions available for broadcasting, has been decided on, as the result of overtures Owen D. Young, S. L. Rothafel (Roxy) and Hiram S. Brown made to Mr. Rockefeller.

Ground worth $200,000,000 was assembled by Mr. Rockefeller, Forty-eighth to Fifty-first Streets, Fifth to Sixth Avenues, New York City, as it was hoped that the Metropolitan Opera Company would sanction the inclusion of an opera house as part of the development to replace the old house at Fortieth Street and Broadway. This was advocated by Otto H. Kahn, the banker, but other opera directorate members rejected the proposition.

Seek a National Industry

A variety theatre, seating 7,500, will be the largest of the four amusement places on the site. Roxy will be the director. The other theatres will show legitimate drama, musical comedy, concerts and talking pictures, respectively. It is hoped that television will be sufficiently advanced to enable the sending of radio talkies from the amusement center.

One object of establishing the center is to set up broadcasting as a national industry.

A skyscraper and other buildings are to be erected at a total cost of $250,000,000.

After the Metropolitan directors had turned down the site Mr. Young met Roxy, who outlined the future of radio entertainment in the United States on a scale that impressed Mr. Young. As a result, Mr. Young brought together at a conference table Mr. Rockefeller, David Sarnoff, of the Radio Corporation of America; Merlin H. Aylesworth, president of the National Broadcasting Company, and Mr. Brown, of the Radio-Keith-Orpheum Corporation. Mr. Young was present.

Keynote is Diversified Entertainment

Mr. Rockefeller was impressed with the argument that radio ranked as an art and had grown so fast that it proved it had a democratic and unlimited appeal, as distinguished from the limited appeal of opera.

Mr. Rockefeller was desirous of instituting a civic center of wide appeal, and the argument, bolstered up by statements from Roxy and Mr. Brown as to what the public preferred most, struck home. The keynote was diversified entertainment.

The four theatres will be maintained on the same basis as any other theatres, with paid admissions, so that the attendance will support that part of the expense assigned to it.

Official Statement

A joint statement on behalf of the Rockefeller and electrical interests follows:

"A project of building and architectural development that will transform a business and residential area, three blocks square in the heart of New York, into a great institutional centre devoted to the entertainment and cultural arts encompassed by radio progress in the fields of sound and vision, was announced today in an official statement issued on behalf of the John D. Rockefeller Jr., interests by John R. Todd, of the Todd, Robertson & Todd Engineering Corporation, and of Todd & Brown of New York, who are in charge of the entire development.

"Except for one or two structures, the area from Forty-eighth to Fifty-first Street, fronting Fifth Avenue, and from Fifth Avenue clear across to a similar frontage of three blocks on Sixth Avenue, will be leveled, and building operations will be begun this Fall, in a project designed to establish a great centre for the creation and distribution of outstanding dramatic, musical and educational events upon a national and even upon a world-wide scale.

Completed by Fall of 1933

"The development, which will involve a total investment, estimated by building authorities to be over $250,000,000, will be financed by the Rockefeller interests. It will be entirely completed by the Fall of 1933.

"The announcement of the plan to create a great cultural and architectural monument in the heart of New York, necessarily involving a great building program that is expected to be reflected in employment conditions here, followed direct negotiations by Mr. Todd, acting for the Rockefeller interests, and by David Sarnoff, president of the Radio Corporation of America, who represented the radio interests, no brokers participating.

"Definite announcement of the transaction was withheld pending the acquirement of the necessary property on the Sixth Avenue side of the development, so the exits and entrances might be provided from that side.

"Within a few months, according to the plans now announced, areas of brownstone houses reminiscent of the former social glory of that part of Fifth Avenue, structures that housed stores, restaurants and shops and office buildings, will be plucked from their roots to make way for a new metropolis of the entertainment and cultural arts.

Complete Unit Will Arise

"On the site will arise a complete architectural unit that will include four great theatres, devoted respectively to a new conception of variety entertainment, to sound-motion pictures, to musical comedy presentation and to dramatic productions. A great symphony hall that would complete the picture of the musical arts is also under consideration. Twenty-seven broadcasting studios, some of which would be three stories in height, will be built to accommodate the requirements of music, entertainment, education and information that would be radiated from this centre. New office buildings in architectural harmony with the rest of the development will be built to house the various industries and services associated with the development of the electrical communication and entertainment arts.

"The city within the city which the new architectural development entails, as described by Mr. Todd, will radically alter the skyline in midtown New York, establish new standards of city planning and provide an enduring architectural monument that will vie with the world's greatest metropolitan projects.

Beautiful Oval Building

"Fronting Fifth Avenue and forming the central structure on that side of the development will be an oval building of moderate height and great beauty of design. On the first floor will be located many fine shops. The second floor will be occupied by a large banking institution, and on the roof a restaurant will be built, with an outdoor promenade running around the entire building. This oval building will extend to a magnificent garden plaza that will cut through the development and will run parallel with Fifth Avenue from Forty-eighth to Fifty-first Street.

"No efforts will be spared to make the plaza, the width of which will be almost as great as the length of the average city block, the most impressive boulevard of its kind in the world. Fountains, statuary and beautiful garden plots will intersperse the whole extent of the plaza.

60-Story Office Building

"Over the entire development will tower a great sixty-story office building in which twenty-seven broadcasting studios will be located, extending from the west side of the plaza through to Sixth Avenue. From this central office building a grand corridor, about three stories in height, will run to the other office buildings from Fifth to Sixth Avenue.

"The streets surrounding the new development will be widened, it is announced by Mr. Todd, to give the new structures fronting them more light and air, to provide better curb facilities for shops and buildings and to add to the beauty of the whole architectural unit.

"Transportation arteries from every direction will lead to and from this new

Roxy's New Salary Put at $100,000

The mention of S. L. Rothafel (Roxy) as director of the variety theatre, seating 7,000 persons, to be housed in the 60-story skyscraper at the radio capital, recalls that when the stockholders of the Fox Film Corporation were discussing a refinancing plan, Roxy appeared before them to tell how well the Roxy theatre was thriving. This theatre, in New York City, was controlled by the Fox Corporation.

Roxy at that time said that he had received an offer of $100,000 a year and that if the stockholders wanted him to resign he would do so. They shouted down this proposal.

Roxy is under contract with the Roxy Theatre and is said to receive $50,000 a year. The $100,000 offer is believed to refer to the directorship he is slated to fill in the R-K-O theatre in the radio capital that John D. Rockefeller, Jr., is financing.

27 N. B. C. S in Building W

to be Erected in N. Y. City

tudios to Be ith 4 Theatres

radio city, but the traffic problem will be reduced to a minimum by huge underground bus terminals and by subterranean parking arrangements that will take care of many thousands of cars and form underground boulevards for automobile traffic. In addition, plans are now being drawn for a great parking tower to give additional facilities for motor parking.

"All deliveries within the radio metropolis will be effected from underground."

Brown's Statement

For Radio-Keith-Orpheum the following statement from Hiram S. Brown, president, was included in the joint offering:

"With sound, which has revolutionized the motion-picture art, and with other technical developments in the offing, the motion picture has become a relative by marriage to all the entertainment arts. True, it has developed a technique and an artistry that is peculiarly its own, but it has at the same time widened enormously the opportunities for the stage, the opera and for other forms of entertainment.

"In leasing and operating a theatre devoted to variety, a second devoted to sound, a third devoted to musical comedy and a fourth to dramatic productions, the Radio-Keith-Orpheum Corporation is providing itself with the facilities for the greatest possible development of its business. It proposes to use the technique of all the arts in the creation of its entertainment programs and it will obtain this first-hand under this new plan.

To Tap Creative Talent

"In the entertainment centre now to be established, R-K-O will be able to tap the creative talent developed on the variety, musical comedy and dramatic stages and on the air.

It will have the opportunity to test the audience's reaction to any musical or dramatic production before deciding to place it before the country on the screen. The association of motion pictures with the sister arts of radio, electrical recording and other forms of entertainment can only result in raising the values and standard of the screen.

"Of the four theatres to be leased and operated by R-K-O, one will be a great variety theatre with a seating capacity of over 7,000 that will introduce many new conceptions in variety entertainment —an entertainment program that will reflect all the forms of the entertainment and musical arts.

Stage to be Engineered

"Lighting effects made possible by recent electrical progress and a stage built upon an engineering principle that will make it visible from all parts of the house will be among the new features.

"The second theatre, which will have about 5,000 seats, will be especially designed for sound motion pictures and will set new standards.. we believe, in this form of entertainment.

"Theatres built heretofore have been built upon the acoustical and visual principles of the older forms of motion picture entertainment, although sound has since been added to all the larger theatres.

A Beautiful Theatre

"This time we shall create a beautiful theatre structure around the radio and electrical developments that have recently revolutionized the motion-picture art. It will be a theatre built for the opportunities that sound has brought to the motion picture and the possibilities that may flow from further technical developments.

"The third theatre will be especially designed for musical comedy productions. Sound has welded music to the screen. This theatre will provide us both with a source for the development of creative talent and with a public experimental station that will guide our motion-picture directors in the presentation of better entertainment for the screen.

"Finally, we shall have a theatre devoted to dramatic productions of a selective character for the same reasons that apply to musical comedy productions."

Aylesworth's Statement

Merlin H. Aylesworth, president of the National Broadcasting Company, contributed the following as his part of the joint statement:

"Television, it is true, is still largely in the toddling stage, but the vast possibilities of sight added to sound in nation-wide broadcasting cannot be ignored in planning for the future.

"We are building our new studios, therefore, for tomorrow, as well as for today. We are taking into account in the development of our plans the fact that broadcasting, established upon a democratic basis in the United States, is not only a medium of mass entertainment, but that it has added to the cultural and educational values of modern life.

"With the great theatrical and musical enterprises to be created in this development, the broadcasting centre of the country will be joined in a vast artery of communications with the dramatic stage, with opera, with variety, with talking pictures, with the symphony hall. The artist will be at the door of the broadcasting studio, and broadcasting facilities will be at the side of every artist whose performance deserves a wide audience.

Broadcasting's Recognition

"Radio broadcasting has become the recognized means for the syndication of entertainment, education and information upon a nation-wide, and on occasion, upon a word-wide scale. It has far from exhausted all the services that might be rendered through the medium of sound; it will have vastly greater opportunities when television emerges from the laboratory to give radio the new dimension of sight.

"The technical and artistic experience which the National Broadcasting Company has gained in years of operation will be embodied in the twenty-seven new broadcasting studios to be completed within the next two or three years.

"Some of these studios, to be two or three stories in height, will be concert halls in effect. In addition, however, every one of the four great theatres to be erected on this development will be equipped for broadcasting service.

"All the theatres, in effect, will be broadcasting studios; all will be equipped for the broadcasting of sound, and eventually, when technical progress has made sufficient headway, for the broadcasting of sight directly from the stage.

"Ten of the twenty-seven broadcasting studios will be designed for photography and recording. The broadcasting building will be constructed so that radio fans may have the opportunity to see the artists at work.

"Thus, with the entertainment and cultural project now announced, broadcasting will have at its call new reservoirs of dramatic, musical and entertainment service."

RCA Will Move Into Skyscraper

The sixty-story building to be erected at the radio capital will be occupied in part by the interests associated with the enterprise, but also will be open to others for office purposes.

To date the building is scheduled to house:

A variety theatre, seating capacity, 7,000, to be conducted by Radio-Keith-Orpheum.

A musical comedy theatre.

A "legitimate" theatre.

A sound picture theatre, seating about 5,000.

A symphonic hall (tentative)..

The executive offices of the Radio Corporation of America.

Twenty-seven studios of the National Broadcasting Company.

Offices of the NBC, R-K-O, Radio Pictures, RCA-Victor Corporation and RCA Photophone, Inc. The radio group will use 1,000,000 square feet.

GIANT CAPITAL IS RECOGNITION OF BROADCASTS

Stokowski Hinted As Concert Leader

The symphony hall, which will be a part of the cultural and entertainment center to be built in New York City, is intended for Leopold Stokowski, conductor of the Philadelphia Symphony Orchestra, which post he has held since 1912.

Dr. Strokowski at first refused to broadcast, although he received many offers from New York City, but in October, 1929, he experimented by playing to the radio audience.

"Write me," he told the listeners, "and if you don't like such music, say so, and we won't play any more radio concerts; for I will not play popular music."

The radio fans like it, and said so emphatically in an avalanche of mail, and Dr. Stokowski was delighted. Since then he has been studying the technique of broadcasting, so that he will be able to control his own tonal volume by apparatus on the conductor's stand instead of entrusting it to a broadcasting engineer in another room.

20,000,000 IN U. S. HEARD BIG FIGHT ON AIR

Although only 80,000 persons personally saw the world championship heavyweight fight between Jack Sharkey, United States aspirant to the title vacated by Gene Tunney, and Max Schmeling, German contender, at the Yankee Stadium, New York City, millions of persons in the United States, estimated at 20,000,000, heard the narrative of Graham McNamee, announcer, as he told of the event from the ringside For personal attendance at the Stadium, however, 80,000 was a big showing. It has never been exceeded there, although the Dempsey-Sharkey fight drew just as many.

McNamee is a veteran at reporting world championship fights for the National Broadcasting Company, and on this occasion he used the same exciting style as characterized his former broadcasts of similar events. He resorted to his habit of uttering ejaculations, particularly "oou!" Once he shouted that, but did not follow it up with any explanation of what the excitement, if any, was about, and left listeners wondering.

Crowd Drowns Announcer's Voice

The reporting on the air of a championship fight is an extremely difficult assignment, due to the quickness of the action, the necessity of instantaneous report, and the general excitement, to which the crowd contributes much. In this particular instance the crowd often did so much shouting as to drown out McNamee's words, but the sequence of events could be followed fairly well from McNamee's description.

The microphones of WEAF and WJZ, New York stations of the N.B.C., were at the ringside, and listeners tuned in to either station heard exactly the same thing. Some listeners, however, finding that the reception was rather hoarse, due really to acoustical difficulty in the ringside installation, tuned out one of these stations in favor of the other, in the vain hope of improving the reception. However, McNamee's voice was clear enough to be understood at all times when the crowd's noise did not overwhelm his voice.

The crowd, as was to be expected, shouted loud and hoarsely at the very moments when the listeners were most eager to hear what McNamee had to say, but there was no hearing him on these occasions, as any lone voice was lost against the furor of the multitude.

McNamee Tries to Be Heard

McNamee tried hard to raise his voice, as he recognized the difficulty, but numerically the chances were 80,000 to 1 against him, as virtually every one was shouting, and even the veteran announcer could not cope with these odds. Acoustically the crowd's shouting at the most exciting moments was about 2,000 times as loud as McNamee's voice alone.

The fight lasted four rounds, Schmeling being declared victor due to a foul blow struck by Sharkey, the Lithuanian who took an Irish name for his ring career. At the end of the first round McNamee said the round unquestionably went to Sharkey.

The fight was intended to be fifteen rounds, and under the New York State rules decisions on who prevailed in each round are not officially given, if the fight fails to go the full limit. Therefore McNamee voiced his own opinion of the result of the round, which was in general supported by the opinions of newspaper experts, in accounts published later, except that some thought the first round was pretty nearly even.

As for the round results in the second and third sessions, McNamee did not say.

At the end of the third round Paul Dumont, another N.B.C. announcer, gave a brief summary of the action that had taken place in the three rounds.

Then came the now-famous fourth round. McNamee painted a word picture of the action, saying it was the slowest round so far, and that Schmeling was taking plenty of punishment, and had been taking it for three and a half rounds.

Called Sharkey's Reach Longer

During his narrative McNamee stated a few times that Sharkey was showing the advantage of the longer reach. Official measurements, as obtained and widely published prior to the fight, showed that Schmeling had a reach one-half inch longer than Sharkey's.

"Jack's long reach and superior boxing ability," said McNamee, in the fourth round "has the German boy pretty well baffled, as a general thing. Schmeling swung a long left and missed Jack. Jack knocked Schmeling in the middle and Schmeling goes down, claiming a foul. Schmeling is down, claiming a foul, and Jack has walked over to his (own) corner and is sitting down. At the same instant that blow was struck the bell ended the round. No one here is committing himself as to whether the blow was low. It rather looks as though the blow was just about in the pit of the stomach. (This would be a fair blow.—Editor.)

"Jack looks very much worried over in his corner as Schmeling is carried over to his (own) corner and they are making an examination to determine whether or not it was a low blow," continued McNamee. At about this point McNamee announced that Sharkey had fainted in his corner.

"The decision is that it was a low blow," said McNamee.

Schmeling Can't Rise

"The bell ended the round just as it (the blow) was struck. Jack is up, has come over to Schmeling's corner and Schmeling evidently can not rise.

"This is the opening of the fifth round. "Evidently Schmeling can not rise. Jack Sharkey has gone over in an attempt to get Schmeling to continue.

"It was a terrific left to the pit of the stomach that put Schmeling down. It was just at that instant that the bell rang for the end of the fourth round. The card for the fifth round already has been raised and we do not know what is going to happen, but I believe that Mr. Schmeling will lose by a knockout in the fifth. It is not in the fourth, I believe. It is the fifth, because he was still fighting at the end of the fourth round.

"The decision has not been reached. We do not know, but that is merely our opinion. Jack Sharkey is over in his corner, standing quietly with a trainer, with a towel around his shoulders, and Max Schmeling seems utterly unable to rise."

Here McNamee announced that the decision of the referee was that Schmeling had been fouled.

Spectator Butts In

"Certainly it couldn't have been an intentional foul," McNamee explained, "because he had hit the German five or six times to every one—"

Somebody at McNamee's side, as if a spectator who had reached his neck over to get his protesting voice into the microphone, said:

"Don't say that; oh, don't say that."

"—five or six times to every one time that Schmeling hit him," McNamee went right on. "But Schmeling evidently is injured and hurt very badly."

He explained that Schmeling was too badly hurt to be brought before the microphone. It is the custom to have each fighter, if possible, say a few words to the radio audience. McNamee said he went over to try to get Sharkey before the microphone, but Sharkey didn't want to say anything.

"When the decision was announced," commented McNamee, "Jack Sharkey swayed in his corner, and we thought for a moment he was actually going to faint. One of his handlers jumped up and smacked Jack's face so hard it brought Jack to his senses."

For Benefit of Bettors

McNamee called Joe Humphries, ringside announcer, to the microphone, and Humphries explained the fight ended in the fourth round, as the referee had to give his decision on the punch delivered prior to the actual commencement of the fifth round, and that put the punch in the fourth round. McNamee thanked Humphries and explained to the radio listeners that the identity of the round was significant to those "who had a dollar or so" on the fight, meaning bets which were to be decided on the basis of which round terminated the fight.

"A Mighty Nice Boy"

In his description prior to the actual beginning of hostilities McNamee said:

"Sharkey is not glaring at all. We read a lot about Sharkey's glare and about Sharkey's talk, and all that. Jack Sharkey is a mighty nice boy, if you want to know."

For a few days prior to the fight, as usual, sale of radio sets and accessories increased abnormally, to recede to normal the day after the fight.

Mother at Sea Radios to Kids

Chicago

The two sons of Mrs. John J. Zoly were uneasy about going to bed. It had been hard to put them to sleep since mother went away. She was on her way to Europe.

The telephone rang. Who was on the phone but mother. The two brothers were joyfully excited. Buddy, two years old, held the receiver.

"Hello mamma," he greeted. Where are you?"

"I'm on the Leviathian, at sea, Buddy," she replied.

"Mother, did you get seasick?"

"No, dear. The voyage has been very pleasant."

"Are there any ducks where you are?"

The answer was not understood by the boy. So his brother, Junius, six years old, took the receiver. He told his mother they were lonesome for her. He asked about the machinery that runs the boat. His mother replied that she would bake a nice pie for the boys when she returned. The two boys went to bed and immediately fell asleep.

The conversation was the first one by radiophone between Chicago and a passenger ship at sea.

SHARKEY FOUL NOT INTENDED, SAYS McNAMEE

STATION IS PUT OFF AIR DUE TO DOCTOR'S TALK

Washington.

For the second time within a month, and the second time in its history, the Federal Radio Commission revoked the license of a station for abuse of its broadcasting license. The station now ruled off the air is KFKB, Milford, Kans., 1050 kc, 5000 watts although it lost its license by only one vote. The Commission voted 3-to-2 in favor of refusing the renewal of the license which was about to expire.

The station was charged with permitting the unethical practice of medicine, against the public interest, convenience or necessity. The operation was adjudged to be against the public interest by the majority of the Commissioners.

Dr. John R. Brinkley, of Milford, broadcast from the station on a regular schedule. The American Medical Association and other medical Associations charged that the physician invited letters about ailments, and gave descriptions over the air, assigning numbers to correspond to particular medicines, and without personal diagnosis of cases.

Store Attaches Meaning to Numbers

At the hearing it was said that these numbers could be deciphered only at drug stores that were members of the Brinkley Pharmaceutical Association, and that when the "patient" uttered the magic number at any one of these member stores he got the medicine corresponding to that number, at a price.

It was also charged at the hearing that Dr. Brinkley had used "obscene, profane and indecent language" over the station.

The Commissioners who voted in favor of the refusal of license renewal were Saltzman (chairman), Starbuck and Lafount. Those who favored giving the station a probationary license were Robinson and Sykes.

A point raised by the two dissenting Commissioners was that the mailed submission of symptoms by listeners and the sending of the reply over the air constituted one-way point-to-point radio communication. Robinson, former chairman of the Commission and a former Judge, brought this up.

Appeal Is Taken

"The minority favored issuance of a probationary license," said commissioner Robinson, "on the condition that Dr. Brinkley cease the practice of prescribing medicines for listeners over the air. This practice was in the nature of point-to-point communication, in violation of international radio law.

"The conduct of the station is a mere sponsorship of the hospital conducted by Dr. Brinkley was not in violation of the terms of the radio law."

The promise had been given of discontinuing the prescriptions by air. George Strong, counsel for the station, immediately took an appeal to the Circuit Court of Appeals of the District of Columbia. He expressed confidence that the decision of the Commission will be overruled by the court.

The station previously denied a renewal of license was KVEP, Portland, Ore., the first one to be so treated by the Commission. Over KVEP the Oregon Wildcat, Robert Gordon Duncan, broadcast attacks on individuals, banks and newspapers, and he was also charged with using indecent and profane language.

Forum

No Overcoats in Summer!

RADIO publications, RADIO WORLD included, seem not to pay sufficient attention to the seasons. You will find a clothing store selling Winter clothes in Winter and Summer clothes in Summer. But you will find the radio publications printing circuits of heavy-duty power amplifiers, enormous multi-tube AC tuners, and other Winter stuff right through the Summer, without due regard to automobile radios, portables for camp, canoe and similar use and short-wave portables, which can give you better service in Summer than broadcast portables in Winter.

While something is indeed published about these things of Summer importance in Summer issues, it is altogether too true that the magazines do not adapt themselves sufficiently to the seasons. A little is not enough. An abundance would be just about sufficient.

Otherwise I have no complaint to make against RADIO WORLD.

Arthur Braham
Minneapolis, Minn.

* * *

Short-Wave Correspondent

MY hobby is short waves. I would like to correspond with any one pertaining to short-wave transmitters or receivers. I am glad to answer letters. I am a licensed operator and my call is W4AV.

William T. Colson
501 South Appletree Street
Dothan, Ala.

* * *

Starving!

I WOULD like to add my approval to V. H. Broyles' letter in Forum of June 7th issue.

We do not seem to be getting such beneficial result from multi-tube sets as one would expect. It may come in time, but I too feel that one stage of TRF (preferably SG) and a good regenerative detector should satisfy almost any one.

I suppose you receive letters knocking RADIO WORLD, but I am glad you do not print them. The real "fans" are always glad and anxious to read and try out new ideas. Where can we find a better source?

It must take considerable thought and effort to give us the good issues you do each week and I wish you to know that I for one more than appreciate them.

Some time I hope you will give us full data for building a **real** Superheterodyne. Probably it would take several weeks to cover it properly, but I am sure that the great majority of your readers would welcome it.

All real fans are starving for construction articles regardless of what a few have to say. One of the monthly radio mazazines ran a questionnaire in regard to this very question, and although I have never seen any printed result of the questionnaire I have been given to understand that over 80% of the readers wanted construction articles and plenty of them.

Gilman Wilson,
159 West 85th Street.
New York City.

SLUMBER HOUR RESTORED

The Slumber Hour, conducted nightly until three months ago by WJZ, New York City, as a sustaining feature, has been resumed, due to the great number of requests received. Ludwig Laurier conducts the eight-piece orchestra. Milton J. Cross, announcer, will be tenor soloist during Monday, Wednesday and Friday presentations.

BILL PROVIDES NEW AIR RULES ENDING BOARD

Washington

While a bill, passed by the Senate, for transfer of the Department of Commerce's radio duties to the Federal Radio Commission, was before the House, Representative Sirovich (Dem.) of New York City, introduced a bill to transfer all administrative radio duties to the Department of Commerce. This would put an end to the Federal Radio Commission.

The Secretary of Commerce would be empowered to appoint a director of radio, and instead of the Commission there would be a legal body, also of five members, and similarly chosen geographically, to pass to legal questions raised on appeal, rather than questions of technical fact. This would take away from the Court of Appeals of the District of Columbia the deciding of appeals from administrative decisions of the Commission, but would permit appeal from the judicial board's decisions to the court on questions of law.

"Under recent decisions of the United States Supreme Court, the Court of Appeals is a virtual super-Radio Commission," said Dr. Sirovich.

He added that 300 members of Congress favor his bill, and that Secretary of Commerce Lamont was sympathetically inclined.

Auto Sets Likened To Lighters for Safety

Misinformation and unfounded prejudices are responsible for criticisms of radio installations in automobiles whose safety and utility have been widely demonstrated, according to the Radio Manufacturers Association. Bond Geddes, executive vice-president, said:

"Motor car radio is simple and easily operated with as little attention as cigar lighters and other automobile dashboard instruments. It is especially enjoyable and useful on long motoring trips and will not largely contribute to street noises. Motor car radio, being battery operated and without high-powered speakers, is virtually soundless beyond the car in which it is installed and thus will not materially increase street noises. In fact, its utility largely is for the open highways and it will be used comparatively little in congested districts."

Cubans Want Spanish from Canadian Stations

Montreal, Canada.

Programs of the Canadian National Railways radio department broadcast from here reach Cuba frequently. The chief complaint of the Cubans about them is that they are not in Spanish.

A resident of Cardenas, Matanzas, Cuba, writes: "For myself, I understand the beautiful language of Shakespeare, but the majority of radio fans in Cuba speak only Spanish. Why don't you have a Spanish announcer?"

Canadian National programs already are broadcast in both French and English to cater to the needs of the French-speaking population in the Province of Quebec.

NEW SOS WAVE CITED SO MUSIC WILL NOT STOP

Washington.

Cessation of broadcasting due to an SOS is necessitated only because the channel for the distress signal, 500 kc, or 600 meters, is so close to the lower frequencies of broadcasting that broadcasting stations on these frequencies would interfere with weak SOS signals, Orestes H. Caldwell said in a communication to the Federal Radio Commission, of which he formerly was a member.

Program interruption could be avoided by resort to a much lower frequency, he pointed out, recalling that an effort was made in that direction at the last international conference in this city, when 750 meters, or some other wave far removed from the highest broadcast wave, was suggested. It would be necessary to have the plan ratified, and as 75 nations, many of them maritime nations, had to be consulted, no agreement could be reached.

Balked at Risk

There was no disposition to run any risk of marine disasters being denied assistance because the ship apparatus was not tuned to send out an SOS on the new wave. This difficulty arises because some ships are away from the home port for a few years.

Concerning the SOS Mr. Caldwell's statement was as follows:

"Recent SOS interruptions to important broadcasting program features have caused many persons to ask why it should be nessary to shut down great stations, with audiences numbering millions, in order not to impair the reception of distress signals from ships at sea.

"These inquirers are right in their comment that way should be found to separate the wavelengths employed, so that the two services could proceed independently of each other. From a radio standpoint, it would be a simple matter to reallocate the channels so that broadcasting could continue at all times without risk of any interference with the paramount service of rescuing life on the high seas.

Difficulty Epitomized

"But here the stubbornness of human nature comes in, and no success has yet been attained in efforts to get either the ship operators or the broadcasters move over.

"The whole difficulty, of course, lies in the fact that the SOS calling wave is 600 meters, while the broadcast band ends at 547 meters, so that powerful broadcast signals spill over and blanket faint SOS signals.

"At the last international conference in Washington we urged the moving of the SOS or ship-call channel from 600 meters to either 750 meters or some other remote channel.

Grim Old Sea Dogs Refused

"But 75 nations would have to ratify this change, and thousands of ships which sail the seven seas, sometimes on voyages of several years' duration, would have to have their apparatus converted to a new calling wavelength.

"The grim old sea dogs refused to take the chance of marine disasters during the period of change, and all efforts to move the SOS channel were unavailing."

Works on Great Lakes

"But on the Great Lakes, where only Canada and the United States were involved, the reform came more easily, and now all ship calls on our inland lake waters are made at 750 meters. Broadcasting does not interfere with this wave length, and so station programs are undisturbed by lake-vessel calls. The same separation could be arranged on the high seas as well."

They Say

ARTHUR WALSH, vice-president, Thomas A. Edison, Inc.: "The gradual perfection of radio receivers and radio reception has gone hand in hand with the development of broadcasting until now it is no longer exceptional to hear programs from the other parts of the world. Broadcasting activities have also been improved to the extent that radio listeners have the choice of hearing the finest of musical entertainment and lectures of wide educational and cultural interest. More and more are the radio facilities being used to carry at-the-spot reports of all kinds of events. Truly a miracle is radio—making possible audiences of millions. Looking back ten years, we see a most marvelous development—the growth of a radio industry of billion dollar proportions—the acceptance of radio as a necessary adjunct of our lives. And looking forward into the future, one can vision the added conveniences and comforts which this pioneering in radio research and development will make possible. The applications of radio principles are proving to be almost limitless. Radio is opening the way to the most glorious achievements for better living in humanity's history."

* * *

J. L. RAY, vice-president, RCA-Victor Co., Inc.: "Substantial progress has been made toward raising and maintaining the high standards of broadcasting set for it by its sponsors. Millions of dollars are being expended each year to bring the most glorious aggregation of talent ever assembled into the home. The greatest talent of the concert and dramatic stage, of vaudeville and of those artists who but for broadcasting would be unknown, pass in continuous and never-ending review on the stage of the greatest theatres of the air and all of it is available in the most humble homes."

* * *

WALTER E. HOLLAND, chief engineer, Philco: "Tone control conveniently accessible on the front panel will probably prove to be the outstanding improvement of the current season. This comprises a receiver and speaker system in which an excess of high frequencies is normally reproduced; with an adustable unit to filter out more or less of the high frequencies. There appears to be a real need for tone control on account of the different tastes of listeners due to variations in ear sensitivity. It is well known that two persons listening to the same music will hear quite different effects owing to differences in the sensitivity of their ears to different frequencies or tones. One person, for instance, will hardly hear the high frequencies which to another will produce a sound impression so strong as to be unpleasant. This is not exceptional, but it is more or less generally true that no two people hear alike. Tone control is also needed to correct the balance between low and high frequencies of broadcasting stations which overemphasize either high or low tones, owing to incorrect placement of the musicians with respect to the microphone, to faulty equipment or to unbalanced transmission lines."

New Incorporations

Overall Radio Corp., Wilmington, Del., patents—Colonial Charter Co.

Commercial Radio Advertising Service—Atty., H. K. Faulk, 9 Park Place, New York, N. Y.

NEW FORMULA USED IN FIXING STATION SHIFT

Washington.

A new interference formula has been developed by engineers and accepted by the Federal Radio Commission for the determination of minimum geographical separation between two stations operating on the same frequency or on adjacent frequencies. This formula considerably reduces the distance below that established by the previous method as accepted by the Commission more than a year ago. On the previous basis, 40 cleared channels were established in the November 11th, 1928, reallocation, for exclusive use by stations of 5,000 watts.

The commission recently proposed to shift 26 of the stations operating on 13 of the cleared channels. One of the clear channels stations was WHAS, Louisville, Ky., operated by the "Courier Journal" and the "Louisville Times," to be shifted from 820 to 1,020 kc.

Injunctions Stopped Changes

The station, like some other stations affected, obtained an injunction, and the order was never put in effect, but is in abeyance pending determination of the suits. July 31st is the postponed effective date, subject to further postponement if the Court actions are not determined by that time.

The type of interference suffered when two stations on the same channel are close together geographically is known as hereterodyne interference, because the two waves, by slight accidental deviation, set up a reproduced audible note of the frequency equal to this slight difference. The interference is usually a growl. When stations are on adjoining channels the interference is a whistle.

The new basis of reckoning sets up the minimum geographical distances between two stations on the same frequency or adjacent frequencies, which would permit two 5,000-watt stations to be on the same frequency, if more than 1,850 miles apart, where now only one station is on that frequency. WHAS's case is in that category, but the station is fighting for exclusive channel retention.

Table of Distance-Power

The formula develops the following table:

Power (*Watts*)	*Minimum Distance* (*Miles*)
50,000	3,000
25,000	2,600
15,000	2,400
10,000	2,200
5,000	1,850
1,000	1,200
500	900
250	650
100	300
50	220

Commission hopes to convince the court that the formula is highly accurate and that therefore no injury in inflicted on a station if it uses the same frequency or adjoining frequency as another station of stated power, where the geographical distance exceeds the tabulated requirement.

PERMANENT EXHIBIT AT SHORE

Atlantic City.

A permanent exhibit of the RCA Victor Company, Inc., in which is shown all of the newest products of both the Victor and Radiola Division of that company, has been opened, overlooking Park Place at the Boardwalk.

FIVE STATIONS TO A CHANNEL IS NEW GOAL

The fineness of grinding quartz crystals for frequency control, to the attainment of a delicate accuracy heretofore not accomplished, not only makes possible the synchronized operation of WOC, Davenport, and WHO, Des Moines, both in Iowa, on the same frequency, 1,000 kc, both at 5,000 watts, although only 190 miles apart, but also gives promise of enabling the assignment of as many as five different stations to any one frequency.

In the case of the two Iowa stations, both owned by the Central Broadcasting Co., they felt that the signal strength was not consistently good when the transmitters shared time on the air, as some areas would not be served well when one of the transmitters was on the air, and when it went off and the other one went on, another area was slighted. It was decided to consolidate the two stations, so at least the one resulting station would enjoy full time on the air. Then came the suggestion to attempt synchronization.

Nelson Devised System

The Bell Telephone Laboratories were consulted. Engineers of the Western Electric Company, the manufacturing concern, much of the laboratory work for which is done in the Bell Laboratories, were called in. It so happened that E. L. Nelson, developmental engineer of the Bell Laboratories, had perfected a system of crystal control accurate to one-twentieth to one-thirtieth of a cycle. This system was installed.

A receiving station is maintained at Marengo, Ia., about halfway between the two sending stations. At this point the signal intensities from the two transmitters are equal. A land wire enables the operator at the monitor board of WOC, the Davenport station, to register any interference due to the two waves not being exactly the same. The difference between them may be so small that no audible beat results, but the difference could be determined on an oscillograph. Therefore any off-frequency effects could be corrected even before they become the familiar heterodyne whistle or growl. In this manner, also, preliminary interference such as fractional cycle variation could be corrected to eliminate fading. Moreover, a new aspect of fading is thus presented, so that besides the possibility of providing ample room for all stations in the present spectrum, avoiding all overcrowding, means may be achieved for minimizing, if not wholly correcting, fading.

Excellent for Chains

The monitor at WOC does all the correcting, as the apparatus at WHO, Des Moines, is sealed. The observation need be taken at Marengo only once each half hour, and most often there is no need for correction.

At present there are almost 600 broadcasting stations in the United States, assigned to frequencies and powers according to zones, which are based largely on population. The system lacks flexibility and results in spacious States, not thickly populated, having fewer broadcasting stations than required to give them the equality of service that the law attempted to establish.

If the sychronization system can be worked, as promised, so that five stations, properly separated geographically and powered proportionately, could occupy the same frequency at the same time, a boon to radio reception would result.

Such stations might send out different programs, but for the present it is deemed most expedient that synchronization be attempted where the same program is sent out, as by WHO and WOC, and the method therefore would apply most strongly to chain broadcasts.

However, as accuracy was the stumbling block, it is believed that stations sending different programs could use the same frequency, particularly under a new formula of geographical separation and power as worked out by engineers and accepted by the Federal Radio Commission as standard.

$40,000,000 for Year's Advertising

Radio manufacturers spent more than 10% of 1929 sales in advertising, it was disclosed in a report to the Radio Manufacturers' Association. The report was made by Major Herbert H. Frost of New York, chairman of the Merchandising Committee and former president of the RMA.

The expenditure of 10% means that between $40,000,000 and $50,000,000 was spent by radio manufacturers alone for advertising last year, it was estimated. The report did not disclose actual dollars and cents figures.

'TELEVISION ON WIRES'—LAFOUNT

Washington.

Soon after the expression by Dr. Lee DeForest, inventor of the vacuum tube, that television, when it becomes a commercial feasibility, will be a wire service, rather than space radio, Radio Commissioner Harold A. Lafount in an interview expressed the same idea.

"The Alexanderson experiment at Schenectady the other day saw television graduate from the peephole stage to be flashed on a screen, visible to an entire theatrical audience," the Commissioner said.

"It must be understood that the ether presents limitations and therefore when practical television is attained it must be expected that it will be transmitted along wire lines, thus entering homes and theatres alike.

"Systems have been devised whereby both voice and vision can be transmitted along wire lines entering the home. These may be electric power lines, telephone lines or other lines."

The Commissioner added that television, as so many others have said, is still in the experimental stage, and that even the experts working on its problems will not venture a prophecy whether practical commercial television will be achieved within a few months or a few years, or more.

Five of the experimental bands on the continental short-wave spectrum have been assigned for television experiments in radio, the channel width being 100 kc, instead of the 10 kc separation familiar on broadcasting frequencies. The extra width is needed for definition of the image reproduced, under the systems now in experimental vogue.

PRICE-FIXING DEBATED ON AIR AS PUBLIC'S AID

A debate on price-fixing was broadcast recently over WOR, Newark, N. J. The Capper-Kelly bill, then before Congress, enabling manufacturers of trademarked products, nationally advertised and distributed, to fix the retail selling price, was the debate subject.

Two Notables Contend

Milton Dammann, president of the American Safety Razor Company, spoke in favor of price-fixing, while Maj. Benjamin H. Namm, of the Namm department store in Brooklyn, New York City, opposed it.

Mr. Dammann said that price-cutting was ruinous to retailers, in that it did not give them a fair margin of profit on the sale made, and stated that the practice was resorted to in many instances just to attract people to the store, when an attempt would be made to sell them some other but unknown brand of similar merchandise, or to induce them to buy additionally merchandise on which the retailer made an enormous profit. Therefore, he argued, price-cutting was not in the public benefit.

Cites Auto Industry

Being of no benefit to public or retailer, it was neither of any benefit to the manufacturer, who soon finds his market riddled and shaken, said Mr. Dammann, due to the disastrous effects of the price-cutters' tactics on other retailers, who do not cut prices, and are thereby discouraged from handling the line at all. He cited the automobile industry as one which prospered on a standard price basis, and said the cost of automobiles has been going down steadily, and value increasing just as steadily, under this wholesome system of price stabilization.

He cited beneficial effects in England and other foreign countries where price-fixing is legal.

Wants Freedom

Opposing the bill, Mr. Namm said that American industry is built up on the basis of free competition, and that price-fixing tends to cramp competition, since price is a vital element in the attraction of customers. He did not want manufacturers, who have no money invested in retail stores, to become dictators of retail store policies, to the extent of telling a store what it must charge, since service costs and other overhead, including rent, determine selling prices. Also, if pressed for money, a retailer should be able to conduct a clearance sale, as even a 20 per cent. turnover of stock would keep him going.

Price-fixing opposes the law of supply and demand, he argued, and our industrial history proves there is no necessity for such a law.

Sees Change in Status

He said, also, that the law would be un-American, was opposed by labor and farmers, would raise the cost of living, and would foster monopolies among manufacturers. He said it was class legislation against both the consumer and the retailer. It will change the retailer from a buyer for the public to a seller for the manufacturer, he contended.

RADIO WORLD
Title Reg. U. S. Pat. Off.

The First and Only National Radio Weekly
Ninth Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.

Roland Burke Hennessy, editor; Herman Bernard, business manager and managing editor; J. E. Anderson, technical editor

A Nation's Asset

IT is not a dream that a gigantic and beautiful radio capital will be built on one of the choicest locations in New York City, at a construction cost of $200,000,000, on ground estimated to be worth $250,000,000, and that broadcasting and the theatre and concert stages will be linked more closely and more lavishly than ever, with provision even for television. No, not a dream, but a business-like reality, fired by the imagination of men of high intellect and of stupendous purpose, practical men, who have gone into this huge undertaking to develop the cultural, educational and entertaining phases of modern life, in conjunction with broadcasting. It is not a philanthropic undertaking but has the self-respecting and business aspect of being schemed out to be self-supporting. Probably nobody intends that the radio capital itself make any profit. The Rockefeller interests are financing the great development, besides contributing much of the inspiration that makes such an undertaking possible.

In assembling the plot a few years ago John D. Rockefeller, Jr., had hoped that the Metropolitan Opera House would grace a cultural center within the boundaries of Forty-eighth to Firty-first streets, and Fifth to Sixth avenues. A new opera house is needed. But the opera house directors decided against the plan, much to the good fortune not only of radio but of the public as a whole, for the aims and purposes Mr. Rockefeller had in mind, though changed in method of achievement, are changed for the better, giving a far wider effect to the dissemination of culture by audition and vision. For every hundred persons to be benefited by the former plan there will be a million under the new scope.

A garden spot to be developed on the famous thoroughfare of fashion and business will be dominated structurally and aesthetically by a sixty-story theatre-studio-office building, in which will be four, or possibly five theatres, all equipped for broadcasting of the stage performances, as well as 27 studios of the National Broadcasting Company, including photographically equipped studios, to be used, if and when practical, for television. Indeed, the provisions made for accommodating television constitute one of the most encouraging and optimistic stands taken by any responsible agency regarding the early likelihood of practical television.

One might assume that here is another example of New York City adding laurels to its wreath of glory, but if this is merely something in the crown of New York City it is nothing at all. It is modest to say that the radio capital to be erected beside New York City's proudest boulevard will be a national institution. It is a contribution of the United States to world broadcasting, for the programs will be heard the world round on short waves, and television itself may carry to as great distances.

Indeed, the four or five theatres in the skyscraper will be like other theatres, charging admissions and conducted on a business basis. In the vastness of the scheme these theatres for local attendance are secondary. While what is sung, said, and perhaps what is acted on these boards, may go on the air, programs from all parts of the United States will be sent out from the broadcasting studios, being received by telephone wire, as now, or perhaps received by radio for retransmission.

Such an area of great radio and television activity has to be concentrated somewhere, and it is merely New York City's good fortune to have the honor of affording the site and facilities. The center is the asset of a nation.

SOS Without a Shutdown

THE interruption of broadcast programs, due to SOS signals, whereby stations may be off the air for hours, has come to be regarded by the public as necessary. The cry is that human life comes before entertainment, and that nothing must interfere with succor to the distressed ship. Nothing need interfere, and still the programs may go on without interruption. It is not the silencing of the broadcasting stations that saves any lives at sea, but the assistance rendered by rescue ships and planes.

A rather simple situation has become confused in the public mind, because the distress signals are sent on a frequency so close to the lowest broadcast frequency that stations must be shut down to prevent interference with faint SOS calls. The fact has never been driven home to the public that some other frequency could be used for SOS signals.

Former Commissioner Caldwell has stated the situation regarding a new frequency for distress calls, in a communication laid before the Federal Radio Commission. Now the frequency used is 500 kc (600 meters), and he mentions 400 kc (750 meters) as suitable, but points out that 75 countries would have to assent. General distribution of radio frequencies is governed by international agreement. There has been no success whatever in getting the countries to agree, because some ships are at sea for several years and meanwhile their transmitters might not be able to send on the new frequency, and peril to life and property at sea might result.

It should not be difficult to assign two frequencies to such important service, maintaining the present 500 kc channel, and sanctioning, say, 400 kc as well. Then if the two frequencies are authorized for three years, for instance, the 500 kc could be dropped, leaving only 400 kc, which then would require no shutdown of broadcasting stations during an SOS.

At many broadcasting stations an operator is constantly listening on 500 kc for an SOS signal, on receipt of which he communicates with the Navy Department, the station often shutting down at once, before the official order comes through.

If two frequencies were used there would be no necessity for two operators to listen, as it makes no difference whatever on which requency the signal is heard. The same operator simply would be listening to two waves at the same time. Without any trouble could always tell in a jiffy, anyway, on which frequency the SOS was heard.

Risky Business

THE Federal Radio Commission, which had never revoked any broadcasting station's license, ordered a substantial revocation of the license of two stations within a few weeks of each other. Technically, license renewal was refused to two stations. In both instances toleration of obscene and indecent language in broadcasts from the station was charged.

While the Commission has the authority to issue, supervise and deny licenses, as well as to refuse renewals and order revocations, the main legal reason relied on in attacking a license is that the station is not operating in the public interest.

The phrase "public interest" has been legally construed in another branch of the law, affecting interstate commerce, and only such judicial interpretation confers any concrete meaning to the wide phrase. In radio what constitutes acts in or against the public interest has not yet obtained much judicial definition.

Commissioner Robinson voted against refusal to grant KFKB, Milford, Kans., a renewal of license, because of promise to desist from the complained acts. A doctor had invited the receipt of mail from persons with physical ailments, and had given these prescriptions over the air. This, in the Commissioner's opinion, constituted point-to-point communication, which is not authorized in the broadcasting license and is contrary to international radio law.

The Commissioner, formerly a Judge, thus presented a valuable legal viewpoint and gave other stations something to think about. If a broadcasting license can be lost for point-to-point communication, fortune tellers and others now heard regularly on the air, using similar methods, are tolerated by the stations at a high risk.

A Technical Debate

STATIONS affected by the recent attempted reallocation of twenty-six stations on thirteen channels noticed that the geographical separation in some instances was less than that called for in the Federal Radio Commission's formula for areas of non-interference at given power on the same frequency or adjacent frequencies. Some of the stations obtained temporary injunctions, pending adjudication of which the rellocation is in abeyance.

The answer of the Commission is that it has a new formula of geographic separation for given power, and that the reallocation is consistent with the new method. So the quarrel over the reallocation may resolve itself into a technical debate on the presence of interference within narrower geographical limits, at the same power that formerly called for much larger minimum geographical separation between stations on the air on the same frequency at the same time.

Cornerstone Laid by "Electric Eye"

Pittsburgh.

The photo-electric cell, or "electric eye," was utilized in the laying of the cornerstone of the new $2,000,000 engineering laboratory of the Westinghouse Company at East Pittsburgh, Pa.

The big cornerstone swung into place without the aid of human touch in perfect synchronism with the movements of a model cornerstone in the hands of Vice-President W. S. Rugg. The large stone, suspended from a specially designed crane, automatically descended into the place provided for it.

The secret of the impressive performance was a complicated interlocked system of switches, motors, relays, controls and tubes, but the basis was the photo-electric cell.

Tiny beams of light from concealed sources played across the speaker's stand and were focussed on the photo-electric cells hidden in supporting pillars. As the model stone was moved it interrupted these light rays, affecting the sensitive cell and establishing successive electrical circuits which in turn controlled corresponding stages of movement of the crane and large suspended stone.

NEW POST GOES TO BATCHELLER, CHIEF OF FIELD

Washington.

Arthur Batcheller, for nine years prominent as Federal radio superviser in the New York area, has been promoted to occupy the new position of travelling radio superviser, with the whole United States under his jurisdiction. He has entered upon his new duties, to which he was appointed by William D. Terrell, chief of the radio division of the Department of Commerce, with the hearty approval of the chief, Secretary of Commerce Lamont.

In fact, the position was created by Secretary Lamont, and he selected Mr. Batcheller for the post on the recommendation of Mr. Terrell, who felt keenly joyous actually to announce the appointment to his old friend and associate.

Will Be Liason Officer

The function of the radio superviser in each district, aided by his assistants, is to police the air, seeing that stations are maintaining accurate adherence to assigned frequency, not exceeding their authorized power, responding properly to instructions when an SOS is on the air, maintaining an efficient plant, and otherwise comporting themselves consonantly with the radio law and the regulations of the Department of Commerce.

There are twenty field forces of the radio division, and Mr. Terrell will act as executive liason officer, thus coordinating the work of the forces, especially where jurisdictions seem to overlap.

So greatly have radio activities grown, and so large has been the increase in inspectional work, that it is becoming increasingly more difficult to make certain that all the laws and regulations are being respected all the time by all the stations, said Mr. Terrell.

Will Tour Country

"Mr. Batcheller will be an itinerant radio traffic inspector, with the whole nation as his beat," added Mr. Terrell. "He has been in charge of one of the most important offices in the service. At New York the supervision of the activities of all broadcasting stations, transoceanic communications stations, and the radio installations on incoming and outgoing vessels have been but a portion of his duties."

Mr. Batcheller will visit the nine districts and ten sub-offices early in July, and also the constant frequency monitoring station maintained by the Government at Grand Island, Neb. Once each year a complete field survey is to be made.

A successor to Mr. Batcheller is being considered. Meanwhile E. H. Lee, former assistant, will be acting superviser.

RECEIVER GIVEN TO U.S.S. PENSACOLA

The City of Pensacola, Fla., gave a complete receiving installation to the U. S. S. Pensacola. It is usual for the city or state for which a navy ship is named to make a gift, and it often has been a silver service. But Pensacola gave the Pensacola a centralized radio, a product of the RCA Victor Company, so programs can be received on a superheterodyne and heard on dynamic speakers in the quarters of officers and of crew, and at mess and on decks.

GRIN AND BEAR IT

THE Rockefeller amusement capital for New York City will have four or five theatres in one building, equipped for broadcasting. We favor five, so that if we want to see five shows in a rainy day we can do so and still stay dry. This country can't build enough taxicabs to serve five more New York theatres in the rain.

* * *

NOW an electric eye lays a cornerstone. If it will silence the speech, O. K.

* * *

A NEW SOS wave to enable all stations to keep going even after the distress signal has been heard will be a comfort to artistic temperaments despoiled when told the microphone had been dead all the while. It hurts enough to warble high C when anybody's listening.

* * *

THE new formula comparing power and geographical distance of stations on the same frequency sounds interesting, but what a station prefers is that all the other fellows be on one frequency. There's happiness in that kind of solitude.

* * *

HALF an hour of broadcasting was all there was to the Sharkey-Schmeling fight. Radio listeners complain that's not long enough for $700,000 paid attendance.

* * *

A LITTLE fellow can't kick a fuss in his home bed nowadays even with mother at sea. Up she pops by radiophone, hang the cost. Is radio going to rob childhood of its few remaining snatches of precious freedom?

* * *

KFKB'S voice in Milford, Kans., is silenced forever, because a doctor gave prescriptions over the air. A few testimonials from satisfied patients, not necessarily movie actresses, might have saved the day.

* * *

CONGRESS celebrates the Radio Commission's plans for the rectification of all alternating currents of public opinion by receiving a bill to wipe out the Board. A little gratitude is a dangerous thing, but none at all is positively devastating.

* * *

A FINE of $100 on a radio retailer for a noisy speaker in the street proves how important it is to match impedances.

* * *

WHEREVER my wife goes this Summer one receiver goes along. Women must have their portables and men their potables.

* * *

FUTURE five stations to a channel, with no interference, is rather different than present five interferences to a channel on which there's no station.

* * *

TELEVISION on wires, is the prophecy, but so long as it doesn't come on wire wheels we're satisfied. We're sold on artillery wheels, with plenty of mustard on the side.

* * *

NOW that good radio sets are in autos, let's build better autos around the sets.

* * *

IF all the members of the Radio Manufacturers Association who weren't satisfied with the way the other fellow was running his own business would resign, how many members would be left, and what business would he be in?

* * *

AIM at an audience with a mental age of 13, is the advice of the government to radio talkers. No wonder we can't understand those big words we hear.

* * *

OUR Ambassador to Germany tells the world that power costs too much, due to high cost of distribution. Things will be different when a fellow can tote a bucket to the power station and bring home a few quarts.

LEAGUE TO USE STATION WITH WORLD RANGE

Geneva, Switzerland.

The maintenance of a League of Nations transmitting station, to send code and voice, to which the Swiss entered preliminary objection, has been solved by a compromise, so that the League will have at its disposal the facilities of a station with a world-wide voice, but when it works the station it will be only with a Swiss representative or observer present.

The intention is that the League shall use the station only in case of emergency, and that otherwise it is to be conducted by the Radio Suisse Company.

A "message to the world," counseling good will among nations, was broadcast from Geneva a couple of years ago, and heard all over the world, particularly by amateurs. Since then several other tests have been made successfully. Now the League feels able to go about broadcasting and message-sending in a big way, should the occasion arise, and is equipped with a complete personnel for the purpose.

New Rule for SOS Listening

Washington.

Under a new ruling of the Federal Radio Commission broadcasting stations operating on 550 to 1,000 kc, inclusive, or 547 to 300 meters, must maintain an operator to listen for SOS calls on 500 kc (600 meters), but only if the power used and the distance from seaboard so require. The table follows:

Watts	*Miles from Seaboard*
5,000 to 10,000	45
10,000 to 25,000	100
25,000 to 50,000	100

Instead of the seacoast, the Great Lakes will be the determining factor, in cases where the distance from lakeside is less than that prescribed above for stated powers. Also, the distance applies, regardless of seacoast or lakecoast, if the station has the stated power and the distance is less than that prescribed from any commercial or Government receiving station engaged in marine communication.

FACSIMILES, ARGENTINA TO GERMANY

Buenos Aires, Argentina.

Facsimile radio transmission has been inangurated between this country and Germany. Rogues gallery photographs and fingerprints were exchanged in the final test. The commercial charge is 32 cents per square centimeter.

ADVISES TALKS AIM AT MENTAL AGE OF 13 YRS.

Washington.

Rules for radio talks are set forth in a statement issued by the Office of Education, Department of the Interior. There is need for adequate speakers on the air, says the statement. Fundamental principles are set forth, especially for educational talks. Aim at the 13-year-old mental level, it is advised. The statement follows:

With more than 500 broadcasting stations now operating in this country, and with from one to six announcers at each station, together with the other radio speakers and teachers, the vocation of broadcasting has grown very rapidly; too rapidly in fact, for sufficient time to properly train radio speakers.

According to the advisory committee on education by radio, in summing up its study for the Office of Education, among these 500 radio stations, 77 are owned and operated by colleges and universities, and 80 other institutions of higher learning that do not own their stations also broadcast educational matters. Eight of these institutions offer some form of credit for successful completion of radio courses.

Radio Has Taken Its Proper Place

It can thus be seen that radio, along with the school, the library and the newspaper, has taken its place as a medium for the dissemination of educational material.

It is manifestly evident, says the statement, that in order to be most effective, the broadcaster should possess a resonant voice, a faultless diction, a distinct enunciation, a correct pronunciation, together with the subtle ability to stir thought in the listener.

These qualifications cover a wide field of endowment, culture, and education, and teachers of education and English have opportunity to make a large contribution to the preparation of broadcaster by giving special attention to the above-noted essentials, and by stressing the spoken word equally with that of the written word.

Both commercial and educational broadcasters are searching tirelessly to find what successful broadcasting is, and how it can be measured with certainty enough to determine methods and practices.

Classes Conducted

A number of commercial companies conduct studio classes in vocal technique which their announcers are required to attend. The American Academy of Arts and Letters has interested itself to the extent of offering an annual award for the highest excellence in announcing.

It is clear, however, that successful broadcasting, particularly of matter that seeks educational results, must begin far back of vocal technique, and must go far beyond it.

Since humanity uses and depends on the sense of sight more than on any of the other senses, and since radio, at present, reproduces in the classroom only the sounds made by the radio teacher, it is most necessary that he put into his voice all the personality and appeal that might be expressed in part by his appearance and movements were he in the presence of his class.

Needs Skilled Direction

In order to do this, the broadcaster should be well poised and well prepared. He should write his radio talk, thoroughly memorize it until every expression sounds spontaneous, and yet every syllable is uttered with exactly the correct expression.

Having prepared his talk, the broadcaster should endeavor to adapt himself to the radio medium by having the technicalities of voice placing, diction, articulation, pronunciation, and interpretation taken care of under skilled direction.

Success with the radio can not be achieved by merely saying words. Ideas must be communicated. The public is hungry for something worth while. Teaching by radio requires a particular kind of competence, and the right kind of a voice is much more important than the right kind of a degree.

Definite suggestions for the preparation of material for broadcasting are given in an instruction sheet issued for radio speakers by Dr. A. S. Burrows, superintendent of schools of King County, Wash., as follows:

"Write out your exact wording. Begin with one or more striking statements. Present your specialty on the level of 13-year-olds. Do not overrate the intelligence of your listeners. Use a few pertinent historical allusions.

Give informational details of your subject even though these seem too simple to you. Anecdotes, short and clearly to the point, are good. Avoid too much generalization. Minimize preachment and advice. Close with three or four short sentences of five or six words each, clinching the main points presented.

Revise for clearness and delivery. Reread aloud several times for time and practice (or better still memorize the talk). Speak distinctly directly in front of the microphone. Do not change position while speaking. Sitting position is preferable.

"To train for radio broadcasting a special kind of school is necessary. Such schools are coming into being where training is given in radio technique for both the speaking and singing voice. Such training in the details of technique many of which are quite simple, will eliminate ordinary errors; proper distance from the phone, proper volume, correct pitch, and, most important of all, quality of tone."

Majestic Makers Quit RMA Over RCA

Chicago.

The Grigsby-Grunow Company, makers of Majestic sets and tubes, has resigned from the Radio Manufacturers Association, Inc., on the ground that the association is being prevented by the Radio Corporation of America and a few of its associated companies, all members of the association, from taking a stand against these companies in the suit being waged against them by the Federal Government for dissolution as a conspiring group of monopolists.

B. J. Grigsby, chairman of the board of the Grigsby-Grunow Company, charged that RCA and its associates are maintaining a monopoly in every phase of radio and now are dominating the policies of the association.

"The Radio Manufacturers Association in this public crisis takes the position that it cannot do anything which would interfere with those members," said Mr. Grigsby. "It cannot do anything to prevent a monopoly which would destroy or seriously cripple all of its members except the Radio Corporation of America and its associates, even though they are engaged in a criminal conspiracy to monopolize the radio industry.

"The radio industry, as organized in the Radio Manufacturers' Association, cannot and does not express its true sentiments nor stand, as an industry, for the things in which it believes."

COST OF POWER HIGH, SAYS OUR BERLIN ENVOY

Berlin, Germany.

United States Ambassador Frederic M. Sackett, of Louisville, Ky., who formerly was president of both a gas and an electric company in that city, during the American Hour of the World Power Conference here, delivered an address in which he counselled electric power companies to undertake more intensive research looking toward a reduction of the cost of distribution.

He stated that an economical station in the United States can produce current at from .3 to .4 of a cent per kilowatt hour, but that consumers pay about 6 cents per kilowatt hour, or from fifteen to twenty times the cost of production. He praised the economies established in the production end of the business.

The speech was made despite objections by Samuel Insull, head of the Insull utility interests that control the power utilities in Chicago and other parts of the Middle West, and conduct radio stations. Mr. Insull was here as one of those attending the conference.

Objections Fall Flat

As Ambassador Sackett's speech was given out a week in advance, Mr. Insull saw a copy of it, and raised objections, but the Ambassador refused to be moved by them at all. Those in charge of the conference were glad that the Ambassador did not feel that there would be any hindrance to his making whatever remarks he saw fit.

The subject treated by the Ambassador is of great interest to those radio set owners who have AC receivers, since they use the power that the Ambassador discussed, not only to run their sets, but to produce heat and light in the home and to run motors, as in vacuum cleaners and vibrators.

In the course of his speech the Ambassador said:

"To state concisely, I know no other manufacturing industry where the sale price of the product to the great mass of consumers is fifteen times the actual cost of production.

Defines a Weakness

"My purpose is sharply to define a weakness that calls for the keenest thought in your deliberations. Until the power business is brought in line with other industries in the relationship of its cost of production to the price paid by the consumer, there can be little justification for the thought that this great power industry is rapidly approaching perfection.

"Whether electric current is produced from water power with its stand-by plants or by modern steam units you have by constant improvement driven down thus far the cost of electricity until it can be fairly said an economical station produces current at from 3-10 to 4-10 of a cent per kilowatt hour.

Such a Discrepancy!

"In most great centres of population, in America at least, consumers pay for household service at around 6 cents per kilowatt hour, fifteen to twenty times its cost. Such a discrepancy between the production cost and the delivery price gives a wide field for a study of the distribution engineer.

FINDS GROWTH IN INTEREST IN RADIO TEACHING

Washington.

Use of radio receivers in schools is growing, as is general interest in education by radio, said Armstrong Perry, specialist in education, Department of the Interior on his return from an inspection trip through various parts of the United States.

He cited the fact that music brought in by radio is used in many schools during assembly exercises, and for marching to and from assembly, as well as for brightening up the children on rainy days.

Research by Council

The American Association for Adult Education recently created a National Advisory Council on Radio in Education, Mr. Perry stated to "The United States Daily," which council will conduct research in the field of education by radio with attention primarily upon adult education. A fund of $50,000, half of which was donated by the Carnegie Corporation and half by John D. Rockefeller Jr., has been made available to carry out this research for one year, Mr. Perry explained. If the work is satisfactory, he said, running expenses for the second and third years are assured.

To Pool Information

The juvenile field of education by radio is being investigated by the Payne Fund, Mr. Perry said. It was the Payne Fund, he pointed out, which assisted the State of Ohio start its school of the air. So keen has been the interest in this work that an Institute for Education by Radio has been organized and is convening at the Ohio State University.

The purpose of the institute is to provide the leaders in educational broadcasting with an opportunity of becoming acquainted with each other, to pool existing information about the problems of educational broadcasting, and to make this knowledge available through the publication of the proceedings.

Information Requested

Finally, Mr. Perry said, the institute aims to develop a program for cooperative research. Its concluding session will be combined with that of the National Education Association and it is expected, he pointed out, that a helpful exchange of opinion will result.

Conductor Stokowski of the Philadelphia Orchestra recently called upon the Office of Education for all available information on broadcasts so he can effectively work out a series of concert broadcasts for schools planned by the late Edward Bok, and provided for by his widow, Mr. Perry stated. These concerts, it was explained, may be broadcast by the American School of the air in its program for the next school year.

Great Interest Indicated

Requests come to the Office of Education, Department of the Interior, in increasing numbers from all over the country, Mr. Perry said, and they indicate great interest in the future possibilities of radio in the field of education. A number of colleges and universities are giving the whole matter thoughtful attention, and show a cooperative spirit in evaluating the whole problem, Mr. Perry concluded.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank at bottom may be used, or a post card or letter will do instead.

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H. F. Davis, 32 Hiawatha Road, Toronto 8, Ont., Canada.
T. Kennedy, 3521 W. 28th Ave., Vancouver, B. C., Canada.
Ralph A. Brown, 925 Massena Ave., Waukegan, Ill.
B. L. Lehle, 514 Park Ave., Wilmette, Ill.
B. M. Coulston, 915 Maple, Jackson, Mich.
J. M. Cunningham, 56 Bartley Ave., Mansfield, Ohio.
M. Osborne, 935 W. 34th St., Indianapolis, Ind.
G. W. Kolter, 2302 Valentine Ave., Bronx, N. Y. City.
O. J. Villere, 922 So. Carrollton Ave., New Orleans, La.
Roy E. Greer, 711 Burlinson, Carbondale, Ill.
Nathan Freilich, 292 Bradford St., Brooklyn, N. Y.
R. E. Argoe, 634 Brownwood Ave., S. E., Atlanta, Ga.
Alfred Christiansen, 1926 So. 7th St., Council Bluffs, Iowa.
J. F. Edwards, 2376 - 12th Ave., W., Vancouver, B. C., Canada.
Louis Blair, 1802 Cleveland Ave., Chicago, Ill.
Wilbur Conrad, 203 North Vail St., Montibello, Calif.

U. S. Agency for Education is Asked

Washington.

The Advisory Committee on Education by Radio has reported to Secretary Wilbur, of the Department of the Interior, after an investigation lasting a year, that a Government agency should be set up to cope with the radio education problem, and suggesting that this agency be established in the Office of Education in the Secretary's department.

The chairman of the advisory committee, William John Cooper, who signed the report, is United States Commissioner of Education.

Much investigating still has to be done, and a Governmental agency should do it, aided by educational and broadcasting authorities, the report sets forth. Problems include the difference in time among zones, since broadcasts for children should be made while schools are in session, and also how best to reach the adult, who can listen only at night, usually. Types of educational programs and methods of special training for radio speaking are discussed.

A THOUGHT FOR THE WEEK

LEWIS WINNER through the columns of the New York Star, tells the profession and the theatre going public that a big percentage of players use radio sets in their dressing rooms for whiling away the hours between acts or other periods of waiting. Yet it is only a few years since managers declared that never would they allow one of those pesty, box-office robbing contraptions in their theatres. The wise ones finally adopted the advertising slogan used for a certain brand of flour, "Eventually—why not now?", and the others followed. Thus does the inevitable make copyists of us all.

CHANNELS FOR 50,000 WATTS LIMITED TO 20

Washington.

Of the 40 cleared channels no more than 20 may be used at 50,000 watts, by a new ruling of the Federal Radio Commission. The vote was 4-to-1, Commissioner Robinson dissenting, because he wanted the maximum for all purposes set at no more than 25,000 watts.

Previously each of the cleared channels was unrestricted as to power, except that the Commission allows only 25,000 watts formally, and 25,000 watts additionally for experimental purposes, to constitute the 50,000 watts.

The number of channels is affected, but not the number of stations, since more than one station may use the same channel. However, the allocation is by zones, there being five zones, hence four channels for each zone are limited to 50,000 watts. In every zone there is room for from one to three 50,000-watt transmitters.

There are about a dozen high-powered stations in operation, while the Commission has applications from a dozen more for use of maximum power. No action is intended on these applications until the Fall.

Set Goes Along on Trips This Summer

Cincinnati, O.

Powel Crosley, Jr., said that radio reception no longer is seasonal entertainment.

"High-powered stations that override natural radio interference and screen grid radio receivers with power speakers have broken the back of what we used to refer to covertly as the Summer slump," he declared. "In the midst of hot weather our broadcasting plans for WLW are as extensive as in mid-Winter.

"We wouldn't make these plans unless we were sure of an audience. Broadcast entertainment has become so much an established part of the life of the majority of the population that it is a necessity now rather than a luxury. The popularity of receivers for automobiles shows us, for instance, that wherever people go this summer, radio is going too."

Dealer Fined $100 For Noisy Speaker

A loud speaker on the sidewalk, in front of his radio and phonograph store, at 1,648 Second Avenue, New York City, in a highly congested district, resulted in a fine of $100 being imposed on Joseph Kraus.

A recent amendment to the Sanitary Code was enacted so that makers of unnecessary noise could be punished. Kraus was fined under that law.

NEW OFFICERS OF RMA

The new officers of the Radio Manufacturers Association, Inc., are Morris Metcalf, of Springfield, Mass., president, succeeding H. B. Richmond; Joseph L. Ray, of New York, first vice-president; G. B. Erskine, of Emporia, Kans., second vice-president; Arthur L. Walsh, of Orange, N. J., third vice-president; and E. N. Rauland, of Chicago, treasurer.

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112A	50c	227	50c
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"Audio Power Amplifiers," by Anderson and Bernard	$3.50
"Drake's Radio Cyclopedia," by Manly	6.00
"The Electric Word," by Shubert	2.50
"Elements of Radio Communication," by Morecroft	3.00
"Experimental Radio," by Ramsey	2.75
"Foothold on Radio," by Anderson and Bernard	1.00
"Fundamentals of Radio," by Ramsey	3.50
"Mathematics of Radio," by Rider	2.00
"Practical Radio," by Moyer & Wostrel	2.50
"Practical Radio Construction and Repairing, by Moyer & Wostrel	2.50
"Principles of Radio," by Henney	3.50
"Principles of Radio Communication," by Morecroft	7.50
"Radio Blueprint Library"—AC Hook-ups	.35
"The Radio Manual," by Sterling	6.00
"Radio Receiving Tubes," by Moyer & Wostrel	2.50
"Radio Telegraphy & Telephony," by Duncan	7.50
"Radio Trouble Shooting," by Haan	3.00
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"A B C of Aviation," by Maj. Page	1.00
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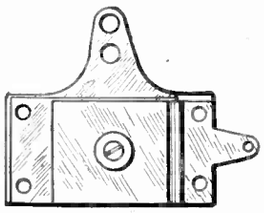
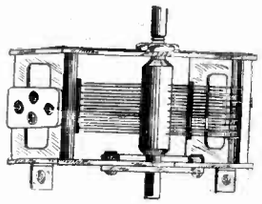


CAT. EQ-100 AT 35c

The most precise and rugged equalizing condenser made, with 20 mmfd. minimum and 100 mmfd. maximum, for equalizing the capacity where gang condensers are used that are not provided with built-in trimmers. Turning the screw alters the position of the moving plate, hence the capacity. Cross-section reveals special threaded brass bushing into which screw turns, hence you can not strip the thread. Useful in all circuits where trimming capacity of 100 mmfd. or less is specified. Maximum capacity stamped on

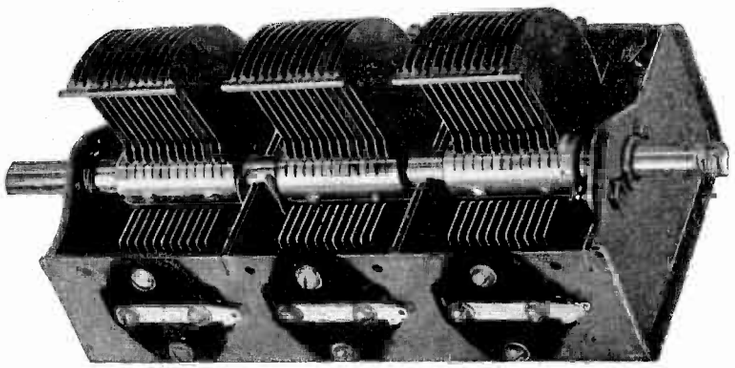
SINGLE .00035



CAT. KH-3 AT 85c

A single .00035 mfd. condenser with nonremovable shaft, having shaft extension front and back hence useful for ganging with drum dial or any other dial. Shaft is ¼ inch diameter, and its length may be extended ⅝ inch by use of Cat. XS-4. Brackets built in enable direct sub panel mounting, or may be plied off easily. Front panel mounting is practical by removing two small screws and replacing with two 3/34 screws ¾ inch long. Condenser made by Scovill Mfg Co.

THREE-GANG SCOVILL .0005 MFD.



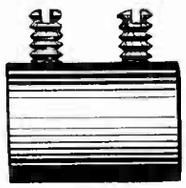
One of the finest, strongest and best gang condensers ever made is this three-gang unit, each section of full .0005 mfd. capacity, with a modified straight frequency line characteristic. The net weight of this condenser is 3¼ lbs. Cat. SC-3G—5 at $4.80.

HERE is a three-gang condenser of most superior design and workmanship, with an accuracy of at least 99¾ per cent. at any setting — rugged beyond anything you've ever seen. Solid brass plates perfectly aligned and protected to the fullest extent against any displacement except the rotation for tuning. It has both side and bottom mounting facilities. Shaft is ⅜ inch diameter and extends at front and back, so two of these three-gangs may be used with a single drum dial for single tuning control. For use of this condenser with any dial of ¼" diameter bore, use Cat. XS-8, one for each three-gang. Tension adjusters shown at right, either side of shaft.

SALIENT FEATURES OF THE CONDENSER

(1)—Three equal sections of .0005 mfd. capacity each.
(2)—Modified straight line frequency shape of plates, so-called midline.
(3)—Sturdy steel frame with rigid steel shields between adjacent sections. These shields minimize electric coupling between sections.
(4)—The frame and the rotor are electrically connected at the two bearings and again with two sturdy springs, thus insuring positive, low resistance contact at all times.
(5)—Both the rotor and the stator plates are accurately spaced and the rotor plates are accurately centered between stator plates.
(6)—Two spring stoppers prevent jarring when the plates are brought into full mesh.
(7)—The rotor turns as desired, the tension being adjustable by set-screw at end.
(8)—The shaft is of steel and is ⅜ inch in diameter.
(9)—Each set of stator plates is mounted with two screws at each side of insulators, which in turn are mounted with two screws to the frame. Thus the stator plates cannot turn sidewise with respect to the rotor plates. This insures permanence of capacity and prevents any possible short circuit.
(10)—Each stator section is provided with two soldering lugs so that connection can be made to either side.
(11)—The thick brass plates and the generous proportions of the frame insure low resistance.
(12)—Provision made for independent attachment of a trimmer to each section.
(13)—The steel frame is sprayed to match the brass plates.
(14)—The condenser, made by America's largest condenser manufacturer, is one of the best and sturdiest ever made, assuredly a precise instrument.

RIGID AND FLEXIBLE LINKS



CAT. RL-3 AT 12c

The rigid link, Cat. RL-3, has two set-screws, one to engage each shaft, and is particularly serviceable where a grounded metal chassis is used, as the returns then need no insulation.

For coupling two ¼ inch diameter shafts, either coil shaft and condenser shaft, or two condenser shafts, a coupling link is used. This may be of the rigid type, all metal, where the linked units are not to be insulated.

CAT. FL-4 at 30c

Flexible insulated coupler for uniting coil or condenser shafts of ¼ inch diameter. Provides option of insulated circuits

EXTENSION SHAFTS, TWO SIZES

CAT. XS-4 AT 10c

Here is a handy aid to salvaging condensers and coils that have ¼" diameter shafts not long enough for your purpose. Fits on ¼" shaft and provides ⅜" extension still at ¼". Hence both the extension shaft and the bore or opening are ¼" diameter. Order Cat. XS-4.

For condensers with ⅜" diameter shaft, to accommodate to dials that take ¼" shaft, order Cat. XS-8 at 15c.

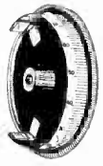
.00035 TWO-GANG

A two-gang condenser, like the single type, KHS-3, but consisting of two sections on one frame, is Cat. KHD-3, also made by Scovill. The same mounting facilities are provided. There is a shield between the respective sections. The tuning characteristic is modified straight frequency line. Order Cat. KHD-3 at $1.70.

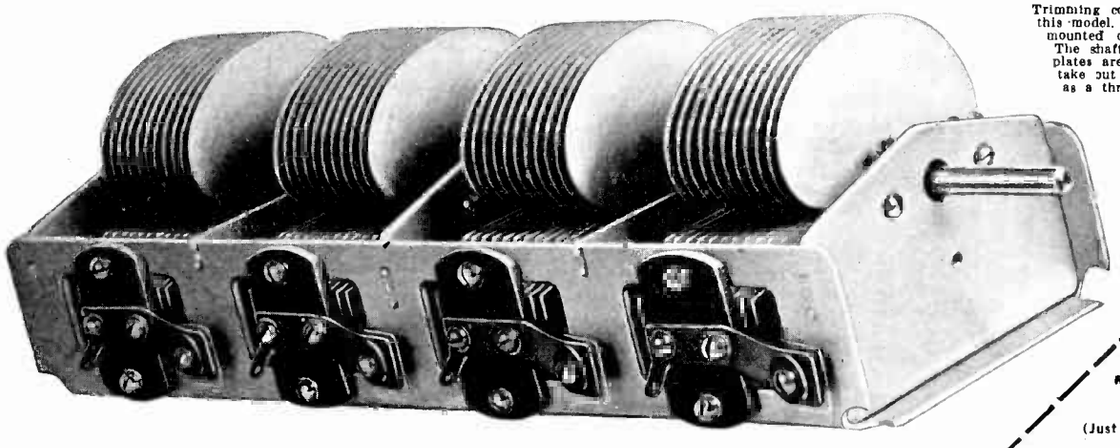
DRUM DIAL

CAT DD-0-100 @ $1.50

A suitable drum dial of direct drive type is obtainable for ¼" shafts or ⅜" shafts, and with 0-100 scales. An escutcheon is furnished with each dial.



FOUR-GANG .00035 MFD. WITH TRIMMERS BUILT IN



Trimming condensers are built into this model. The condenser may be mounted on bottom or on side. The shaft is removable, also the plates are removable, so you can take out one section and operate as a three-gang.

Four-gang .00035 mfd. with trimmers built in. Shaft and rotor blades removable. Steel frame and shaft, aluminum plates. Adjustable tension at rear. Overall length, 11 inches. Weight, 3½ lbs. Cat. SPL-4G-3 @ $3.95.

SHORT WAVES

Tuning condensers for short waves, especially suitable for mixer circuits and short-wave adapters. These condensers are .00015 mfd. (150 micro-microfarads) in capacity. They are suitable for use with any plug-in coils. Order Cat. SW-S-150 @ $1.50. To provide regeneration from plate to grid return, for circuits calling for this, use .00025 mfd. Order Cat. SW-S-250 @ $1.50.

A four-gang condenser of good, sturdy construction and reliable performance fits into the most popular tuning requirement of the day. It serves its purpose well with the most popular screen grid designs, which call for four tuned stages, including the detector input.

Ordinarily a good condenser of this type costs, at the best discount you can contrive to get, about twice as much as is charged for the one illustrated and even then the trimming condensers are not included. The question then arises, has quality been sacrificed to meet a price? As a reply, read the twenty-six points of advantage. The first consideration was to build quality into the condenser. The accuracy is 99¼%.

GUARANTY
RADIO GOODS CO.,
143 West 45th St.,
N. Y. City
(Just East of Broadway.)

Enclosed find $.....for which ship designated parts:

.....

Street Address.....

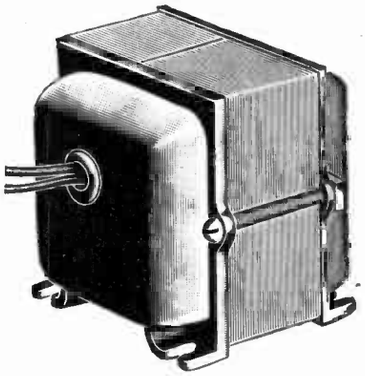
City..... State.....

the following merchandise as advertised:

- ☐ Cat. XS-4 @ 10c
- ☐ Cat. KH-3 @ 85c
- ☐ Cat. XS-8 @ 15c
- ☐ Cat. KHD-3 @ $1.70
- ☐ Cat. RL-3 @ 12c
- ☐ Cat. DD-0-100 @ $1.50
- ☐ Cat. EQ-100 @ 35c
- ☐ Cat. SC-3 G-5 @ $4.80
- ☐ Cat. SPL-4 G-3 @ $3.95
- ☐ Cat. FL-4 @ 30c
- ☐ Cat. SW-S-150
- ☐ Cat. SW-S-250

ALL PRICES ARE NET

New Polo Power Transformers and Chokes

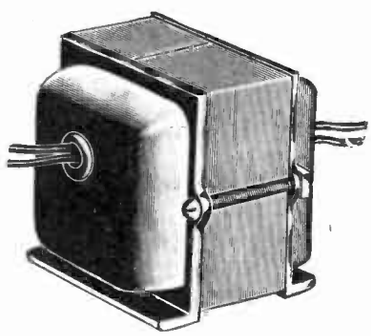


Shielded single choke, 200 ohms D.C. resistance, non-saturable at 100 milliamperes, with two black outleads, each 6 inches long. For filtration of B supplies. Inductance, 30 henrys.
Cat. SH-S-CH, price.....$5.00

The shielded single choke will pass 100 ma. One will suffice if the current is 100 ma. or less, for filtration of B supplies, provided the capacity at the filter output is 8 mfd. or more. Use two such shielded chokes if less than 8 mfd. is used at the filter output. Also, the shielded single choke may be used as in the power tube circuit for an output filter. In this connection use at least 2 mfd. for the capacity section of the filtered speaker output. Order Cat. SH-S-CH @.....$5.00

The shielded double choke may be used for filtration where the B current is 60 ma. or less, with relatively small filter capacities, no less than 4 mfd. at the output, however. This choke consists of one winding, center-tapped. Its use is especially recommended for 171, 171A, 245 or 210 push-pull output. Connect the black leads (extremes of windings) to plates of the push-pull tubes, red center tap to B plus, and the speaker may be connected directly to plates without any direct current, but only signal current, flowing through the speaker. This system is applicable only to push-pull. Order Cat. SH-D-CH @.....$6.00

In the same type of case a 20-volt secondary filament transformer, for 110 volts, 50-133 cycle, may be obtained for use in conjunction with dry rectifiers, such as Kuprox, Westinghouse, Benwood-Linze and Elkon, in dynamic speakers or A battery eliminators. Not made for 25 or 40 cycles. Order Cat. SH-F-20 @.....$2.50



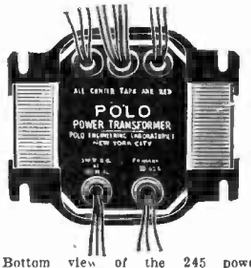
Twenty-volt filament transformer, 110 v. 50-133 cycle input, for use in conjunction with dry rectifiers. It will pass 2.25 amperes.

In a different type case, square, of cadmium plated steel with four mounting screws built in, size 1½ inches wide by 3⅝ inches high by 4 inches front to back, a 50-60 cycle filament transformer is obtainable with the same windings as the 245 power transformer, except that the high voltage secondary is omitted. Order Cat. 245-FIL @.....$4.50
For 40 cycles order Cat. 245-FIL-40 @..... 7.00
For 25 cycles order Cat. 245-FIL-25 @.....6.50
[Any of the above three in the same case as the 245 power transformer, © $1.00 extra. Add PTC after the Cat. number.]

A single choke, unshielded, 65 ma rating, 30 henrys inductance, for B filtration or single output filter of speaker, is our Cat. US-S-CH @.....$1.25

245 Power Transformer for use with 280 rectifier, to deliver 300 volts D.C. at 100 milliamperes, slightly higher voltage at lower drain, and supply filament voltages.
Cat. 245-PT price.....$8.50

The Polo 245 power transformer is expertly designed and constructed, wire, silicon grade A steel core and air gap large enough to stand the full rated load. The primary is for 110v A.C., 50-60 cycles, tapped for 82.5 volts in case a voltage regulator, such as a Clarostat or Amperite, is used. The black primary lead is common. If no voltage regulator is used, connect black lead to one side of the A.C. line, green lead to the other side of the line, and ignore red lead, except to tape the end For use with a voltage regulator (82.5-volt primary) use red lead and ignore the green except to tape the end. The secondaries are: high voltage for 280 plates, with red center tap to ground; 2.5 volts, 3 amperes, red center tap to C plus, for 245 output, single or pushpull; 5 volts, 2 amperes, red center tap, as positive B lead, for filament of 280 tube; 2.5 volts, 16 amperes, red center tap to ground, for 224, 227 and pentode tubes, up to nine heater type tubes. Hence there are five windings.



Bottom view of the 245 power transformer. All leads are plainly marked on the nameplate, including the top row.

A special filament transformer, 110 v., 50-60 cycles, with two secondaries, one of 2.5 v. 3 amp. for 245s, single or push-pull, other 2.5 v. 12 amperes for 224, 227, etc., both secondaries center-tapped. Shielded case. 6 ft. AC cable, with plug. Order Cat. F-2.5-D @.....$3.75

The conservative rating of the Polo 245 power transformer insures superb results even at maximum rated draw, working up to twelve tubes, including rectifier, without saturation, or overheating due to any other cause. This ability to stand the gaff requires adequate size wire, core and air gap, all of which are carefully provided. At less than maximum draw the voltages will be slightly greater, including the filament voltages, hence the 16 ampere winding will give 2.25 volts at maximum draw, which is an entirely satisfactory operating voltage, increasing to 2.5 volts maximum as fewer than a total of nine RF, detector and preliminary audio tubes are used.

The avoidance of excessive heat aids in the efficient operation of the transformer and in the maintenance of good regulation, for excessive heat increases the resistance of the windings.

The transformer is equipped with four slotted mounting feet and a nameplate with all leads identified. It is one of the very finest instruments on the radio market.

Highest Capacity of Filament Secondary

SPECIAL pains were taken in the design and manufacture of the Polo 245 power transformer to meet the needs of experimenters. For instance, excellent regulation was provided, to effect minimum change of voltage with given change in current used. Also, the 2.5 volt winding for RF, detector and preliminary audio tubes, was specially designed for high current, to stand 16 amperes, the highest capacity of any 245 power transformer on the market. Hence you have the option of using nine heater type tubes. The shielded case is crinkle brown finished steel, and the assembly is perfectly tight, preventing mechanical vibration.

The power transformer weighs 11½ lbs., is 7 inches high, 4⅞ inches wide, and 4¼" front to back, overall.

Elevating washers may be used at the mounting feet to clear the outleads, or holes may be drilled in a chassis to pass these leads, and the transformer mounted flush.

Advice in Use of Chokes and Condensers in Filter

With the 245 power transformer either one or two single chokes should be used, or a shielded double choke, depending on the current drain and the capacity of filter condenser used. Where the capacity at the output is 8 mfd. or more for a drain of 65 to 100 ma., a single choke will suffice (Cat. SH-S-CH), but where smaller output capacity than 8 mfd. is used on such drain, two such chokes should be used in series. Next to the rectifier, in either instance, use a 1 or 2 mfd., 550 A.C. working voltage rating condenser (D.C. rating, 1,000 volts). You may use your choice of capacity at the midsection.

If the drain is to be 65 milliamperes or less, the double choke, Cat. SH-D-CH, may be used for filtration, instead of two single shielded chokes.

The Polo 245 power transformer may be obtained for 25 cycles or 40 cycles on special order, as these are not stocked regularly, and remittance must accompany order. The same guaranty attaches to them as to all other Polo apparatus—money back if not satisfied after trial of five days. In these the primary and secondary voltages and taps are the same, only the case is deeper (front to back) because of larger core and wire for lower frequency.
For 40 cycles order Cat. 245-PT-40.....@ $9.50
For 25 cycles order Cat. 245-PT-25.....@ $12.50
[Note: The filter for 40 cycles should consist of two shielded single chokes, Cat. SH-S-CH, with 2 mfd. next to the rectifier and 4 mfd. minimum at the joint of the two chokes and at the end of the filter. For 25 cycles the same holds true, except that the output capacity at end of chokes should be 8 mfd. minimum.]

We Make Special Transformers to Order

Polo Engineering Laboratories, 143 West 45th St., New York, N. Y.

Enclosed please find $———— for which ship at once:

☐ Cat. 245-PT @	$8.50	☐ Cat. 245-FIL @	$4.50
☐ Cat. 245-PT-40 @	9.50	☐ Cat. 245-FIL-40 @	7.00
☐ Cat. 245-PT-25 @	12.00	☐ Cat. 245-FIL-25 @	8.50
☐ Cat. SH-S-CH @	5.00	☐ Cat. SH-F-20 @	2.50
☐ Cat. SH-D-CH- @	6.00	☐ Cat. UN-S-CH @	1.25
☐ F-2.5-D @			3.75

Note: Canadian remittance must be by post office or express money order.

☐ If C.O.D. shipment is desired, put cross here. No C.O.D. on 25 and 40 cycle apparatus. For these full remittance must accompany order. The 25 and 40 cycle apparatus bears the 50-60-cycle label, but you will get actually what you order.

Name .....

Address .....

City..... State.....