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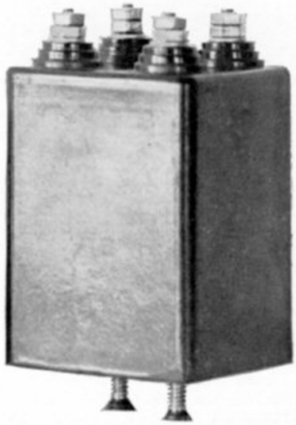

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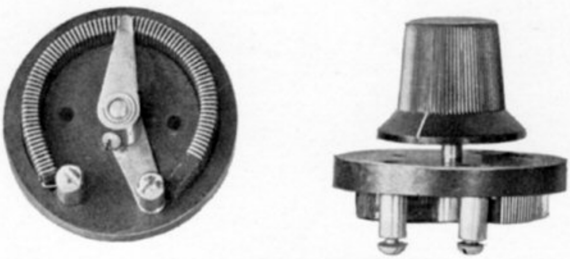

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Almost any rheostat will be found to perform the general functions required of a filament control, but there are many important details which should be given careful consideration before a purchase is made.

The GA-STD-A22 rheostat is designed to meet the most exacting demands for high grade workmanship, unexcelled electrical and mechanical qualicies, neat appearance, and economy. The resistance wire is wound upon its insulated form so tightly that the turns cannot come loose or be pushed together. The form itself is made of a material which will stand a temperature much higher than is experienced in practice. To overcome the annoyance from loosened elements, special attention has been given to the fastening of the resistance unit into the circular groove. A novel feature of the G. A. rheostat is a brass bearing firmly cast into the base to insure a smooth running shaft and thus permit fine adjustments of resistance to be made with ease. The regulating knob is the GA-STD-21 indicating knob which has been popularly adapted to rheostats of practically all makes. Since it is similar in form to the G. A. switch and dial knobs, thru its use it is possible to construct instruments having every knob of a symmetrical shape.

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A Variometer Tuning Unit

A simply constructed instrument adaptable to a large number of receiving circuits.

By W. H. Bullock

Tuners for Concert Reception

SINCE the advent of the radio broadcasting stations and the appearance of radio departments in the daily press, the demand for simple and inexpensive tuners has been enormous. To meet this demand a vast amount of experimenting has been conducted in an effort to design a practical receiving tuner which would best serve the purpose of the concert listeners. The requirements of a piece of apparatus suitable for this field differ from those of an instrument intended for the type of amateur wireless operator we have known for the past twelve years. In the latter case, that receiver was most popular which gave best signal response regardless of its number of adjustments, its critical settings, and its comparative independability in the hands of one not completely versed in the theory of the circuits used. To-day it is found that a more practical equipment is demanded. Dependability under all conditions, a minimum number of ajustments, and general simplicity are the factors upon which the successful tuner for present day requirements should be built. This results in the elimination of the relatively completed circuits which have been foremost in the radio art for a number of years, and in fact all modifications of them seem to give way to the single circuit tuner which is now regarded by most manufacturers as the best all around set for the purpose of radio concert reception.

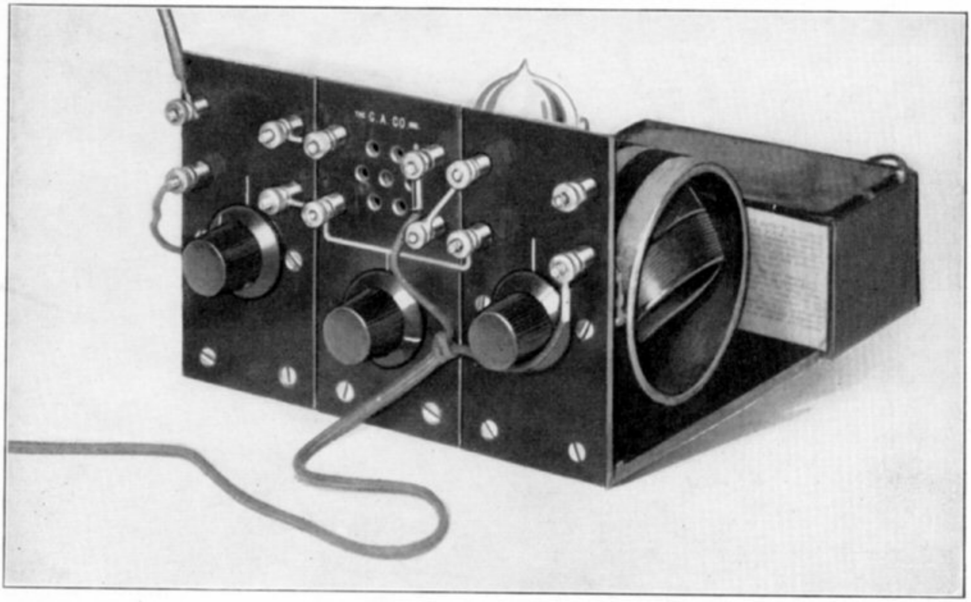

Fig. 1. The variometer tuning units in a simple regenerative receiving outfit

A Variometer Tuner

Where only a limited band of wavelengths is to be covered the variometer is probably the most practical tuner that can be constructed. Most of the variometers now on the market are efficient but it is usually beyond the means of the ordinary man to build an instrument of this type, owing to the difficulty experienced in placing the winding on the inside of the stator. But the variometer here described and shown photographically in Figs. 1, 2, 4 and 5, is easy to construct and permits a wavelength variation sufficient to tune in signals from all of the large broadcasting stations.

As shown in Figs. 1 and 2, the variometer is mounted back of a 2½ by 5 in. L. P. F. panel which carries an indicating adjusting knob and terminals. The two top binding posts are connected together and to one end of the inductance. The two lower binding posts serve as terminals for a .0005 mfd. G. A. gird condenser mounted immediately back of the panel, and to the lower right hand post is also connected the second end of the inductance. By this arrangement the two right hand terminals are the variometer binding posts, the two lower ones, the condenser, while between the two at the left, the inductance and condenser are wired in series.

The panel is maintained in an upright position by an L. P. F. base which is fastened to it thru the medium of a strip of ⅜ in. angle bases secured to both by means of machine screws and nuts. The variometer proper consists of a 3½ in. GA-Lite tube wound with green silk wire, and a mahogany rotor ball wound full with the same conductor. The ball is held in place and rotated by means of a brass shaft in two sections. An end of the rotor winding is soldered to each section and connections made to them by phosphor bronze springs located on the GA-Lite tube. The unit is mounted on the panel thru the use of two nickel plated coil support pillars, tapped for 6-32 screws.

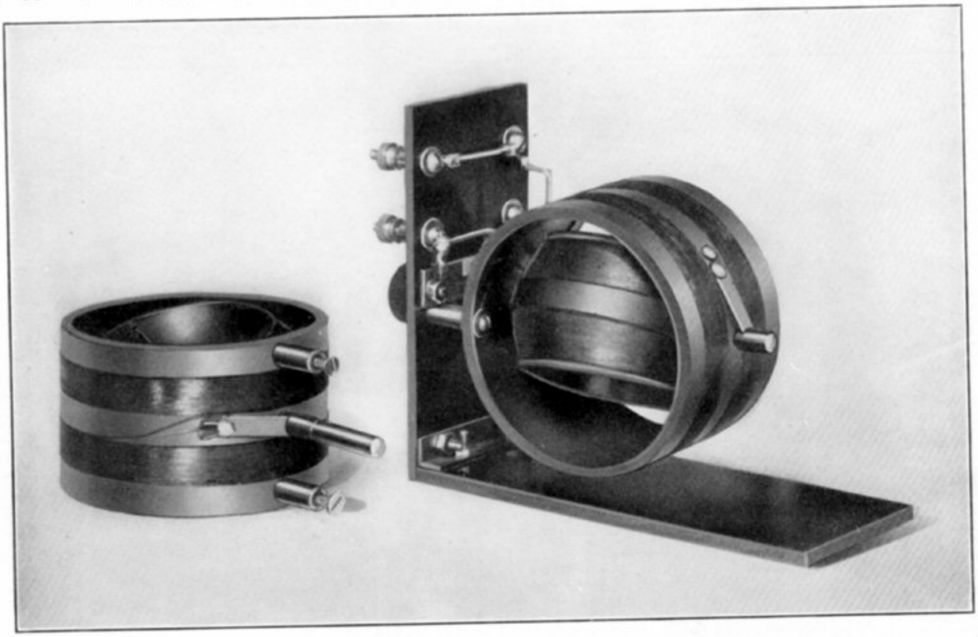

Fig. 2. The unmounted variometer and rear view of the unit, showing details in construction

Preparing and Winding the Forms

The first step in the construction of this instrument is the winding of the two coils. The tube for the stator coil is a 2⅛ in. length of 3½ in. GA-Lite, cut from a standard 9 in. piece. A sharp thin knife should be used for cutting the tubing in order to get a smooth edge. Draw a line around the tube where the cut is to be made and then carefully trace over this mark with the cutting tool until the tube comes apart. Don't try to rush the job by applying too much pressure to the knife. Next drill two ¼ in. holes for the shaft, and ⅞ in. from each, a No. 27 hole for the shaft contact springs. In line with one of the shaft holes drill two more No. 27 holes 3-16 in. from each end of the tube. These are to accommodate ¼ in. 6-32 R. H. machine screws for fastening the support pillars.

Near one of the support pillars make two holes just large enough to clear the wire, ⅜ in. in from the end of the tube, and about ¼ in. apart. Using No. 24 B. & S. gauge S. S. C. wire, start the winding by inserting about three inches of the end of the wire in one of the holes just drilled, and bringing it up thru the other. This will hold the wire securely enough to go on with the winding. Put on twenty-three turns, then leave a space ⅜ in. wide for the rotor shaft and wind on twenty-three more. Each section will be about ½ in. in width. Insert the end of the winding thru a small hole, near the hole drilled for the rear contact spring, and bring the wire back thru a second hole drilled in the margin between the windings, so that it may be conveniently soldered to the rear shaft contact.

Before winding the rotor, drill four holes for the ends of the winding which is in two sections. The first one is drilled near a shaft hole and just inside of one flange. A similar one is placed near, the second shaft hole inside the other flange. Two more are drilled—one on each side of the center rib,—at an angle that will bring them both out on the same side of the web of the ball. Start winding by securing the end of the wire in one of the outside holes, and wind that side of the ball full. Cut the wire and run the end down thru one of the holes at the center. Now wind the opposite side in the same manner, twist the two center ends together and solder them. Be sure that both halves of the balls are wound in the same direction.

Assembling the Variometer

The shaft contact springs are of No. 24 spring phosphor bronze stock, ¼ in. wide and 1⅛ in. long. A No. 27 hole is located 5-16 in. from one end, to take screws for fastening them to the tube. Secure the rear spring by means of a ¼ in. R. H. 6-32 screw, with a nut on the inside of the GA-Lite tube and follow this by soldering the end of the stator winding to the fixed end of the spring. Mount the front shaft contact spring in a similar manner but place a small soldering lug under the head of the screw. The coil support pillars are next to be fastened to the tube, where they are held by ¼ in. R. H. 6-32 screws.

From a 1 ft. length of ¼ in. round brass rod, cut one piece 2 ins. in length and another 3¼ ins. These are the rear and front sections of the shaft. Place the long or front piece in its shaft hole in the tube just far enough to hold two fibre spacing washers on its end. Now put the ball in place and force the shaft into it. By the same means insert the rear section of the shaft. The two ends should be kept about ⅜ in. apart so as to facilitate the next operation which is to solder an end of the rotor winding to each section of the shaft. This completes the variometer itself.

Drilling the Panels

The front panel upon which the variometer is mounted is a standard 2½ by 5 by 3-16 in. piece of polished L. P. F. The L. P. F. base is of the same thickness and width but has a length of 6 ins. Since these panels come already cut to size the only labor that has to be applied to them is the drilling of the holes. From the drawings in Fig. 3 the location of the holes may be determined by making measurements upon the drawing and multiplying them by two before transferring to the work. The numbers appearing beside each hole represent the size of drill to be used, and concentric circles indicate that holes are to be countersunk to take flat head screws.

Mounting the Variometer

After the panels are drilled make up the bracket for holding them together. This is simply a 2½ in. length of ⅜ in. angle brass cut from a stock 12 in. piece. Drill two No. 27 holes in one side, ½ in. from each end and in the other side drill two more, ¾ in. from the ends. Using ½ in. F. H. 6-32 nickel plated machine screws and nuts fasten both panels to the bracket. Since the two sets of holes are only ¼ in. apart, it may be necessary to file down the edge of two of the nuts to permit them to be placed so closely together.

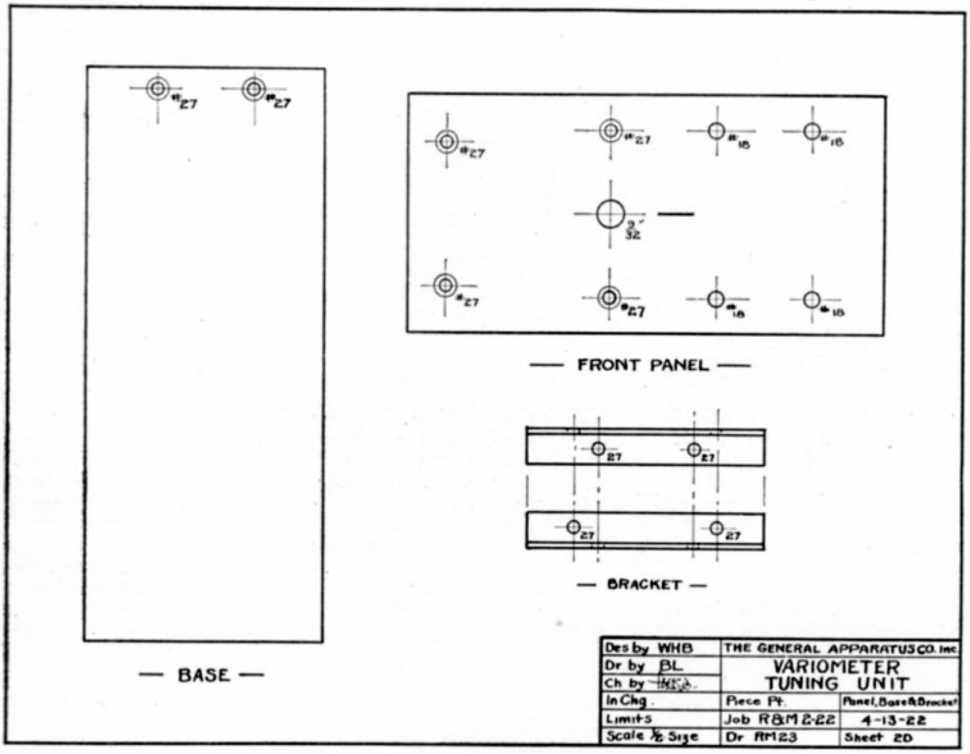

Fig. 3. Scale drawing of panels and bracket

Now put the four binding posts in place, clamping one soldering lug under the lower left hand and upper right hand terminals, and two lugs to each of the other two.

Secure two lugs to the condenser with ¼ in. 6-32 screws and nuts and connect it across the two lower binding posts with square tinned copper bus bar. Next mount the variometer on the panel by means of two ½ in. 6-32 F. H. nickel plated machine screws turned into the coil support pillars. Bend a short piece of square tinned conductor to connect the front shaft contact spring to the lower right hand binding post. Another is soldered in the lugs of the two upper binding posts which serve as terminals for the end of the variometer winding.

Secure a GA-STD-12 indicating knob to the shaft and scratch a deep zero line on the panel directly above it. Fill in the line with a white wax crayon and the variometer tuning unit is complete.

to wavelengths between 300 and 500 meters, altho the exact range will be governed by the form of the antenna, as 100 feet of wire seldom shows the same electrical characteristics when erected at different places.

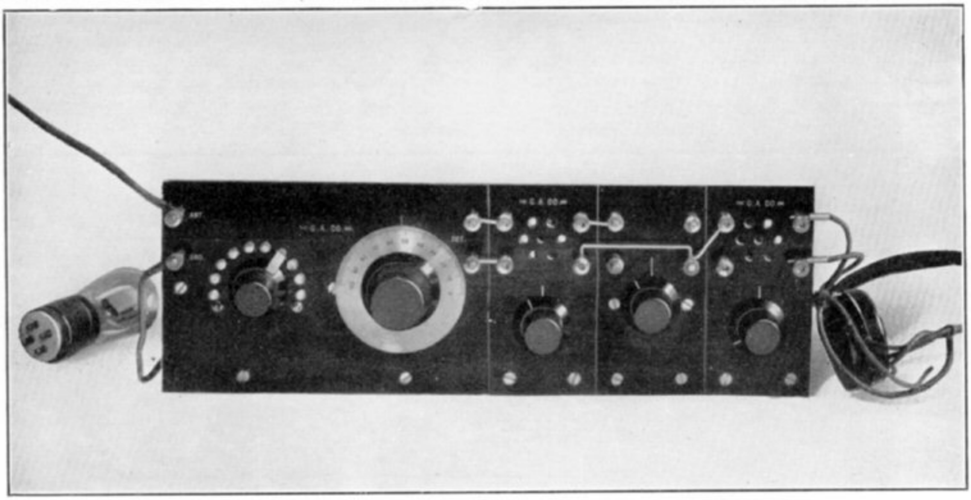

Fig. 4. The variometer tuning unit as a plate variometer

It is evident that the entire job of building the instrument is a simple one, requiring but little time to make a neat appearing piece of apparatus with a wide range of usefulness.

Uses of the Variometer

For a simple receiving outfit connect the upper left hand binding post to an antenna, the lower one to the ground and wire a crystal detector and telephone series around the other two terminals. Using a single wire antenna, 75 to 100 feet long such a receiver should respond

Two of these variometers used in conjunction with the variocoupler previously described make a very selective regenerative tuner for short wave work. In Fig. 5 this outfit is shown wired to a standard detector control panel. The antenna and ground are connected to the variocoupler switch blades, one variometer is placed in series with rotor to tune the secondary or grid circuit, and the second variometer is used to tune the plate circuit of the detector tube for obtaining regeneration.

By employing the universal tuner that has

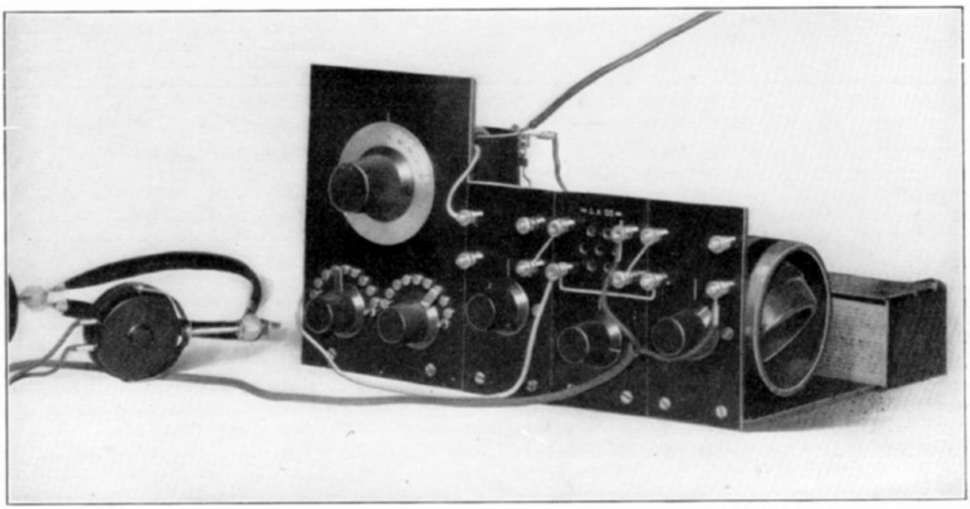

Fig. 5. Variometer units in a three circuit regenerative receiver

already been described, two detector control units and one variometer, a very neat equipment using one stage of radio frequency amplification is secured. The connections between the different units is clearly seen by referring to Fig. 4. In this case the fixed condenser mounted with the variometer is not used. The grid leak condenser of the first detector panel must be short circuited to permit both alternations of the radio frequency currents to properly affect the potential of the grid, and the grid leak condenser of the second control panel is replaced by a plain grid condenser to keep the detector tube grid from being charged with a positive potential by the B battery. An outfit of this kind gives extremely sharp tuning. Besides this advantage over the use of transformers for radio frequency amplification, the internal capacity of the tubes have practically no effect upon the degree of amplification obtained, thereby making possible the efficient use of tubes of various makes and constructions.

In Fig. 6 other suggestions for the use of the variometer tuning unit are given and the experimenter may think of many more which he will find useful, interesting, and instructive to try out.

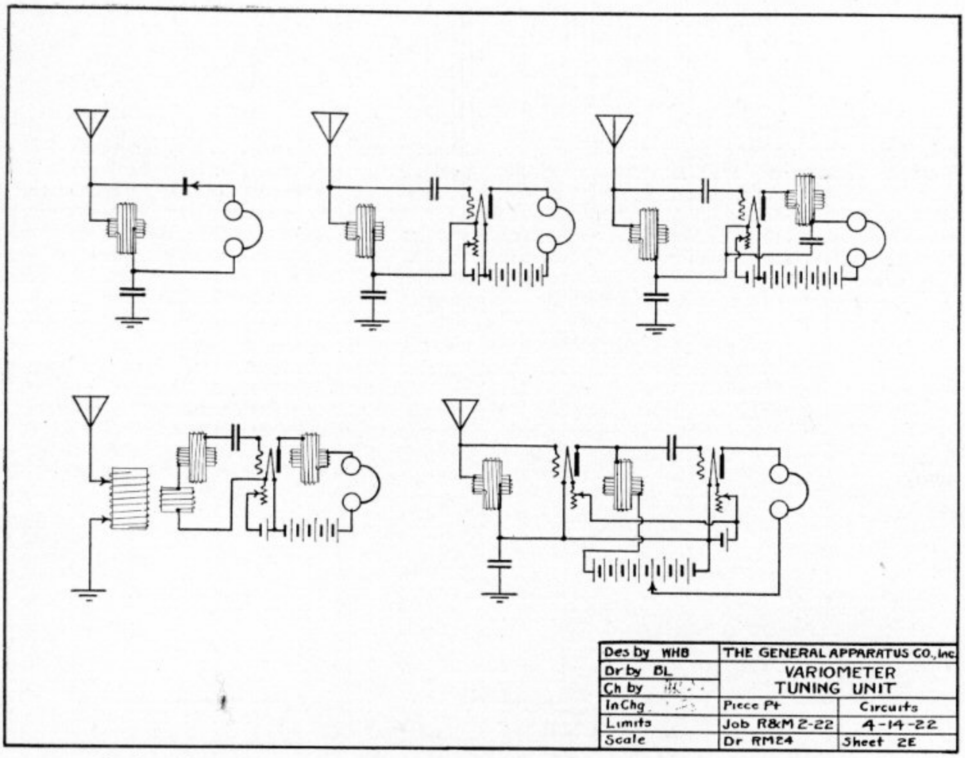

Fig. 6. A few of the many circuits in which the variometer tuning unit may be used

A Novel Condenser

Altho fixed condensers are comparatively reasonable in price as well as easily constructed, it very frequently happens that while trying out a new circuit or doing other experimenting a fixed capacity is needed just when one is not conveniently at hand. Then it is always a case of going out to purchase a condenser or take almost an equal length of time to build one if the required material is available.

When a fixed condenser is needed the experimenter nearly always thinks of tinfoil and paper as the only material to use for constructing a cheap device in the shortest possible time. There is, however, even a simpler way to build a condenser and yet have it in a form which requires no special base or case for holding the elements together and providing a place for terminals. A short piece of Litzendraht wire or radio cable is all that is required.

The length of the wire will depend upon the value of capacity that is desired, but for ordinary capacities, such as grid condensers, a piece twelve inches long is quite sufficient. At one end spread

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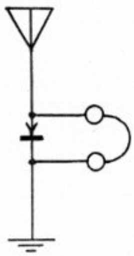
101 Receiving Circuits

First Installment



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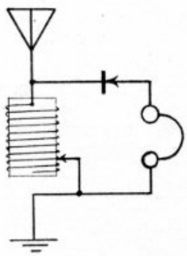

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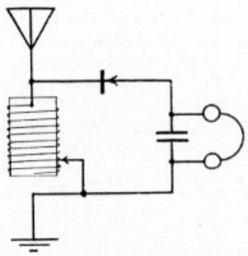
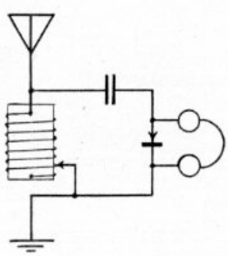


3

1. This is the simplest of radio receiving circuits. A crystal detector is placed between the antenna and ground, and the telephones are shunted around it. Signals on wavelengths nearest that of the natural period of the antenna will be received strongest, altho none will be heard with intensity as great as where a tuner is employed, on account of the aerial circuit being highly damped by the presence of the detector.

2. In this circuit we have a variable inductance inserted between the antenna and ground for the purpose of tuning the aerial wire system to the wavelength of the transmitter from which reception is desired. The telephone and detector are placed in series across the inductance for the purpose of rectifying and converting into sound the wave trains traveling thru it. This is a marked improvement over circuit No. 1, for the high resistance detector is removed from the antenna circuit, and the tuning coil permits adjustments to various wavelengths without undue interference from others. This circuit is employed in most of the lower priced receiving outfits now marketed for the reception of broadcasted radio concerts.

3. Here we have a system very similar to the previous one, except that a fixed condenser is shunted across the telephones. This has a capacity of about 0.001 mfds. and is usually referred to as a stopping condenser or a phone condenser. Its purpose is to store up energy while the current is flowing thru the detector and discharge it thru the telephones during the opposite alternation.



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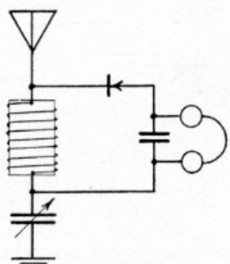

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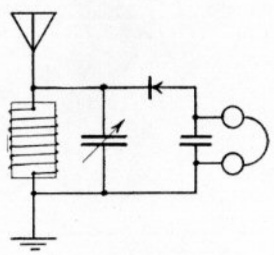

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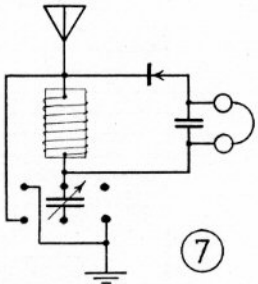
4. This shows another means of connecting the same instruments employed in circuit 3. The tuning inductance occupies the same position, and a fixed condenser and detector are shunted around it, but the telephones are connected across the crystal detector rather than across the condenser. With some crystals better signals are obtained with the telephones in this position while with others the opposite is true.

5. In this circuit tuning is accomplished by means of a variable condenser placed in series with the ground. For a limited range of wavelengths the inductance can be fixed, and may either take the form of a simply wound solenoid or a honeycomb coil. With the condenser in series, no wavelength can be obtained as great as if the condenser were omitted, and the lower the capacity used, the shorter will be the wave to which the set is tuned.

6. Again we have variations in wavelength of the receiver made possible by the use of a variable condenser. The inductance of fixed value is connected between the antenna and ground with the variable capacity across it. With this arrangement only wavelengths greater than that which would obtain if the condenser were removed, can be tuned in. It is not as selective as circuit 5, and with the majority of antennas it is found that two wavelengths are almost always covered by systems of this kind.



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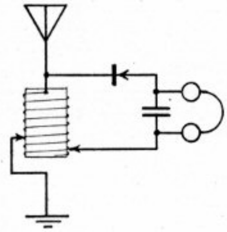

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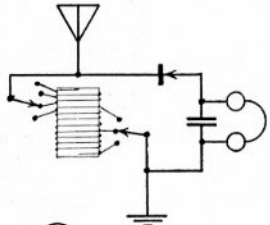

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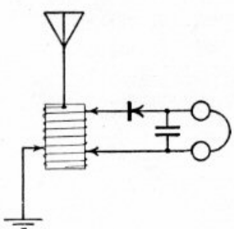
7. Since by the use of circuit 5 we get variations of wavelengths below that resulting from the effect of the antenna, inductance and ground alone, and wavelengths above that by employing circuit 6, many experimenters use a switch for changing the variable condenser from one position to the other in order to cover the whole wavelength range with but one set of instruments. Here we have a simple method for accomplishing this. The variable condenser is connected across the two blades of a D.P.D.T. switch, the antenna on one pole, ground on two diagonally opposite poles, while the fourth one is left dead. By throwing the switch to the left the condenser is placed in parallel with the inductance, and when in the opposite direction the capacity is inserted in the ground lead.

8. This is a simple circuit for a two slide tuning coil. While all of the hook-ups previously shown have but one tuned circuit, this one has two, which are conductively coupled to each other. The antenna circuit is tuned by the slider connected to the ground, while the secondary or closed circuit is adjusted by the other slider. Tuning of a little more selective variety is the advantage of this type of receiver over the single slide outfits.

9. Again we have a single circuit tuner but in this case the use of taps rather than sliders on the inductance is illustrated. In order to get any number of turns, from the first to the last, it is necessary to use two switches. At one end the coil is tapped for one switch at every turn until a number equal to the square root of the total number of turns on the coil, is taken off. The points of the second switch are connected to taps which are separated by a number of turns equal to the number of taps on the first switch. The advantage of this system of tapping the coil is that it gives the minimum number of switch points that may be used to give one turn variations of inductance throughout the length of the coil.

Switches have gradually replaced sliders on variable inductances because they permit the instrument to be conveniently mounted on a panel, prevent the wearing of the wire and the short circuiting of turns due to metallic particles getting between them, make adjustments easier, reduce the capacity effect of the operator's hand by keeping it farther from the coil, and make contacts which are less affected by dust.



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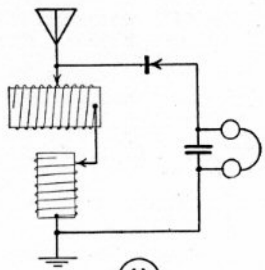

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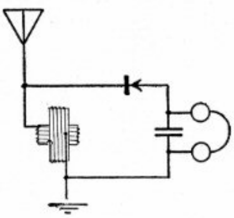

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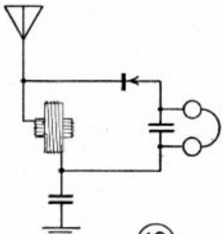
10. This circuit shows the connections of a receiving outfit employing a three slide tuner. This may be considered a two circuit tuner, conductively, but variably coupled. The primary or antenna circuit is tuned by changing the position of the ground slider, the secondary is tuned by varying the distance between the other two sliders, and the coupling may be altered by moving the secondary sliders together, to or from the antenna end of the inductance. It is evident that when the number of turns separating the secondary sliders is comparatively small, a greater range of coupling may be obtained. This circuit gives the greatest selectivity of all single winding tuners.

11. This diagram illustrates a means of increasing the wavelength of a single circuit receiver by the addition of a second inductance or loading coil. The two coils are placed in series and treated as but a single winding. For relatively long waves, when the last turn of the first inductance has been reached, the slider on the loading coil is moved from its position of minimum inductance toward the opposite end until the desired wavelength is obtained. It is well to mount the two coils at right angles and several inches apart so that when the loading coil is not required, losses which would otherwise be high on wavelengths near its natural period will not be so greatly felt.

12. In this circuit another means of tuning is shown where a variable inductance of the variometer type is used for changing the wavelength of the system. The inductance of the circuit is altered by varying the mutual inductance between two coils connected in series and mounted in such a way that the self inductance of one may be made to assist or oppose that of the other. This gives gradual variations of wavelength and therefore has the advantage of permitting close adjustment to sharp waves. Another point of superiority over the types of inductance previously considered is that there are no dead ends to reduce the efficiency of the system, as the whole winding is in the circuit at all times. Opposed to these advantages, however, are the facts that all variometers have a limited range of inductance variation and since the resistance in the circuit always remains the same the efficiency is low when comparatively small values of inductance are used.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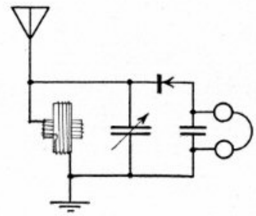
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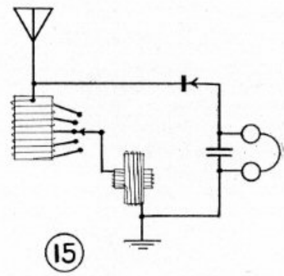
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13. Because the minimum inductance obtainable in a variometer is comparatively large, it often happens that when this instrument is used as a tuner the wavelength at the lowest adjustment is longer than that of the desired signals. To overcome this difficulty and permit shorter waves to be reached, a condenser is placed in series with the ground lead. This may be of the variable type but if only a relatively narrow band of waves is to be covered, a fixed condenser will serve the purpose since the variometer is capable of fine adjustments to the incoming signals.

14. This circuit employes a variable condenser in shunt with a variometer for tuning the receiver. An arrangement of this sort is intended for wavelengths greater than those obtainable by the use of the variable inductance alone. As in circuit 13, a fixed capacity will suffice if a comparatively small range of wavelengths is to be covered, but otherwise a variable condenser should be used. Since the variometer provides for gradual changes in the wavelength of the outfit, the capacity may consist of a condenser which is varied in steps by means of a fan switch passing over contacts connected to the plates.

15. In this circuit we again make use of the quality of the variometer which permits minute variations of inductance. Here we have the variometer connected in series with a tapped loading coil. One set of switch points is all that is necessary, and the taps are separated by a value of inductance equal to the range of the variometer. In this way any degree of inductance may be obtained, from that of the minimum of the variometer to the total of the tapped coil plus the maximum of the variometer.

A Novel Condenser

(*Continued from page 23*)

the strands so that no ends touch, and dip them into molten sealing wax or other insulating compound. This is merely to prevent the strands from coming in contact with each other and thus short circuit the condenser at that end.

Clean the enamel insulation from the conductors at the opposite end so that good electrical connections can be made. This is most easily and effectively accomplished by holding the end of the cable in a flame until the strands turn red, and then quickly dip them into alcohol. It may require several attempts to get the correct temperature for dipping, but when this condition is attained it will be found a simple matter to clean the ends of the wire of every particle of enamel.

For a comparatively low capacity connect two strands to terminals and bend the others so that they will not come in contact with each other. The two conductors act as condenser plates and the thin film of enamel between them serves as the dielectric. The capacity may be increased by grouping the strands in such a way that several are connected to one terminal. A condenser with its capacity variable in steps can be readily constructed by leading some of the strands to switch points used with a fan type switch blade. One strand or a number of strands are connected to one terminal and the switch blade is wired to the other.

A condenser of this type in spite of its simplicity and low cost can be mounted in any form, as the wire may be rolled up in a ball, wound into a coil, wound around the base of another instrument, or in any number of ways which would best suit the conditions under which it is used.

RADIO AND MODEL ENGINEERING

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EDITORIAL

WITHIN the last month no less than eighteen new radio magazines have put in appearance for publishers and printers, men who have no interest in radio other than exploitation for financial gain, have been as quick to take advantage of the eager novice as the operators of machine shops who have jumped into the manufacture of such radio atrocities as appear in the windows of electrical and hardware stores, even shoe stores and millinery shops in New York.

The familiarity of these publishers with the development of the radio art is indicated by a statement which appeared recently to the effect that "Radio has been exceedingly fortunate in that its popularity and acceptance by the public was almost instantaneous. Thus the lean, hard years and the failures and disappointments experienced in the phonograph and automobile industry are unknown to the wireless concerns."

Obviously this comes from a man who never knew there was such a thing as radio until, after broadcasting started, he read in the newspapers that many millions of dollars would be spent on receiving equipment. If there had not been men who, for the love of their work, stuck to the development of equipment with their accomplishments as their only remuneration, and dealers who sold apparatus because they were interested in promoting radio in what was then a limited field, the achievement of broadcasting would not have come to pass.

These new comers do not know that the manufacturer of one of the most widely used regenerative receivers used to go to the buyer for one of the old, established radio supply dealers and ask him to scrape up an order for four or five sets because he simply had to get a new pair of shoes that week. And this company paid cash on delivery to help out the manufacturer. Yet these newcomers who "see a good thing" in radio cannot understand why preference should be shown to the old timers who have made radio what it is to-day.

On the first of May the New York broadcasting station, a Western Electric set located on the top of the Telephone Company's Walker Street building, comes into action. The transmitter is the same that was used in tests made by the Western Electric a short time ago. Signals from this half-kilowatt station were heard a thousand miles west of the Pacific coast, and in California the music was used for dancing. Practically every state in the Union reported this station, even tho it was working above the usual amateur wavelengths.

If the new outfit meets expectations it will do much for the Philadelphia section and other parts where broadcast reception has been difficult. Moreover, the speech should be of much better quality than from Newark because the coated filaments of the transmitting tubes allow much greater latitude of electronic flow. Thus, when the plate current is modulated it will increase as well as decrease over the normal value. This gives full tone value while tungsten filaments, from which the normal emission can be increased only slightly, give somewhat distorted speech.

Very little in the way of new developments has appeared since the demand for concentrated production on standard equipment. However, much experimenting is being done at the G. A. in order to keep R & M just a little in the lead in the matter of new ideas for its readers. The coming issue will have some exceedingly good data on radio frequency amplification. As a hint of what is lined up for you—we have been getting Pittsburgh on a loud speaker, using a two-foot loop, a non-regenerative circuit, and a three step radio frequency amplifier with a detector and two steps of audio frequency amplification.

With the tremendously increased amount of business which all radio companies have suddenly found pouring in thru the mail have come complications from the necessity for part shipments, the general run of misunderstandings, and errors made by new clerks pressed into service.

The type of misunderstandings most aggravating to the experimenter is that for which he himself is to blame. For example: An order is received calling for various supplies. A town and state address is given, but no name signed. If that man had given his street and number, the package marked "Radio Experimenter" would have found him. Again, the name and address is supplied, but no state. A glance thru the Parcel Post book shows that the same city name is used in as many as a dozen different states. These are not unusual occurrences in a mail running up to several thousand pieces a day.

Help yourself and help the supply companies by printing your full address. Don't trust your handwriting, however good it is, give your complete address, and—if you want questions answered write them out separately from your order.

M. B. SLEEPER,
Editor

A Simple Detector and Two-Step Amplifier

By M. B. Sleeper

Types of Detectors and Amplifiers

SEPARATE detector and amplifier units have always been popular among radio enthusiasts because they permit one to go into the game on a moderate scale and make addition to the equipment later on. But the average person eventually comes to a detector and two step amplifier which is preferred in the form of a single unit rather than three separate instruments with their attendant inter-connecting wires. Quite an elaborate detector and amplifier outfit has been described in connection with the 150 to 2600 meter regenerator. It was very efficient but appearance and convenience as well as working qualities were given more attention than expense and ease in construction. Since a two-stage amplifier is built because strong signals are desired, very little use is made of the jacks in the detector and first step. By doing away with these, considerable expense is saved, the wiring is greatly simplified, and the instrument performs at least as efficiently as the more elaborate type.

A General Description

From Figs. 1 and 3, it is noted that the chief difference between this and the majority of such instruments lies in the fact that no jacks are used. This construction also removes the necessity of employing a telephone plug and keeps the instrument to a size that permits the use of a 5 by 7½ in. panel, which is unusually small for a detector and two stage amplifier. The saving in material alone amounts to about six dollars, not to mention the time saved in wiring.

The front panel is of $\frac{3}{16}$ in. L.P.F. and carries the three rheostats, tube peep-holes, grid and filament terminals to the left, and telephone binding posts on the right. A gridleak and a phone condenser are held under the grid and filament binding posts at the rear of the panel. The phone condenser is used to provide a radio frequency by-pass across the primary of the first transformer and the B battery. Battery connections are made on the back of the 6 by 7½ in. L.P.F. base and plate coil terminals are located on the left end, just behind the front panel. By this arrangement all wiring, except that which should be conveniently accessible, is kept out of sight. In addition to the terminals, the base carries the tube sockets and amplifying transformers. All wiring is done with square tinned copper bus bar soldered into small copper lugs. The bright conductors and polished aluminum tube sockets stand out in attractive contrast to the black L.P.F. and transformers. The wiring diagram of the instrument as shown in Fig. 5 is seen to be extremely simple for an instrument of this class.

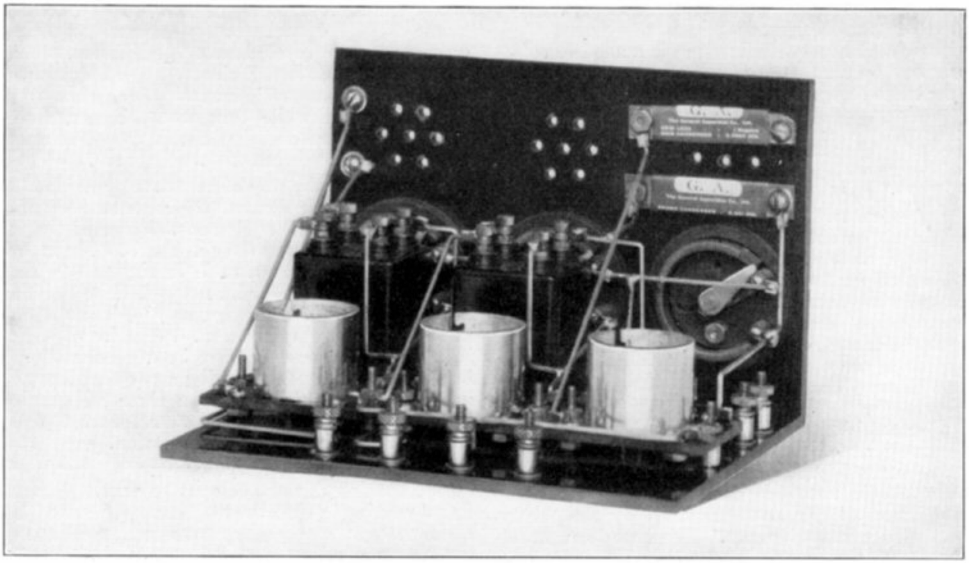


Fig. 2. Rear view of the detector and Two-Step Amplifier

Drilling the Panel and Base

It will be found that the final appearance of the detector and two-step amplifier will greatly depend upon the care used in laying out and drilling the front panel and base. A scale drawing for both is given in Fig. 4. This is one half actual size so all dimensions must be multiplied by two before transferring to the work. The numbers appearing beside each hole represent the size of drill to be used and concentric circles indicate that the holes should be counter sunk. Note that the peep holes are countersunk very slightly. The fact that the circles for countersunk are in full lines shows that the drawings display the front of the panel, but the under side of the base. Lay the panel out on the reverse side and mark each hole with a center punch before drilling.

Assembling the Parts

After the panels have been drilled two brackets each 1 in. in length are cut from a piece of 3/8 in. angle brass. Both pieces should be drilled with a No. 27 hole, on each side, 5/16 in. from holding a soldering lug at the free end of each. Now place lugs on the rheostats and screw the transformers to the base. Connections are most simply made when the transformers are arranged so that both primary terminals are toward the front panel. Clamp small soldering lugs under the knurled nuts of the transformers and then mount the sockets. They are turned so that the two filament connections are toward the left end of the instrument. GA-STD-A8 pillars are used to raise the sockets from the base and two 1 in. 6-32 F.H. screws with nuts hold each firmly in place.

In case of the terminals which are located on the base, the lugs are placed under the bottom section of the binding post rather than under the head of the screw. A No. 8 washer should be placed between the lugs and the base to give the terminals a more finished appearance.

Fig. 3. Front view

opposite ends. These are to accommodate 1/2 in. nickel plated flat head screws for securing the angle pieces to the L.P.F. The angle made by the base and front panel should be tested with a square before anything is mounted on them, for if they should be anything but 90° apart, it is very much easier to correct it by bending the brackets before more of the assembly is done. Rheostats equipped with indicating knobs are next put in place with the terminals toward the left of the instrument. One 6-32 screw and nut is usually found sufficient for holding them firmly to the panel altho two make a little better job. The mounting of the binding posts on the panel comes next in order of assembly. Copper soldering lugs are clamped under the telephone binding posts while a grid leak condenser is held under the grid terminal and a phone condenser with a lug under the filament terminal. The condensers should be fixed in a horizontal position with a 1/4 in. screw and nut

Wiring the Instrument

The next step is the wiring, and the way it is done greatly determines the final appearance of the detector and two-step amplifier. Nearly four 2 ft. lengths of square tinned copper bus bar will be required for the work. By referring to the rear view of the instrument shown in Fig. 2, and the wiring diagram in Fig. 5, the position of the different conductors and the direction taken by them can be readily followed. The most difficult part of the wiring is the connections which pass underneath the sockets. These should be put in place first, in order to take advantage the absence of the other connections which would otherwise give less room for the work. Keep the bus bar perfectly straight, make sharp neat bends and a good looking piece of apparatus will result. The G.A. Company's reputation for neat appearing instru-

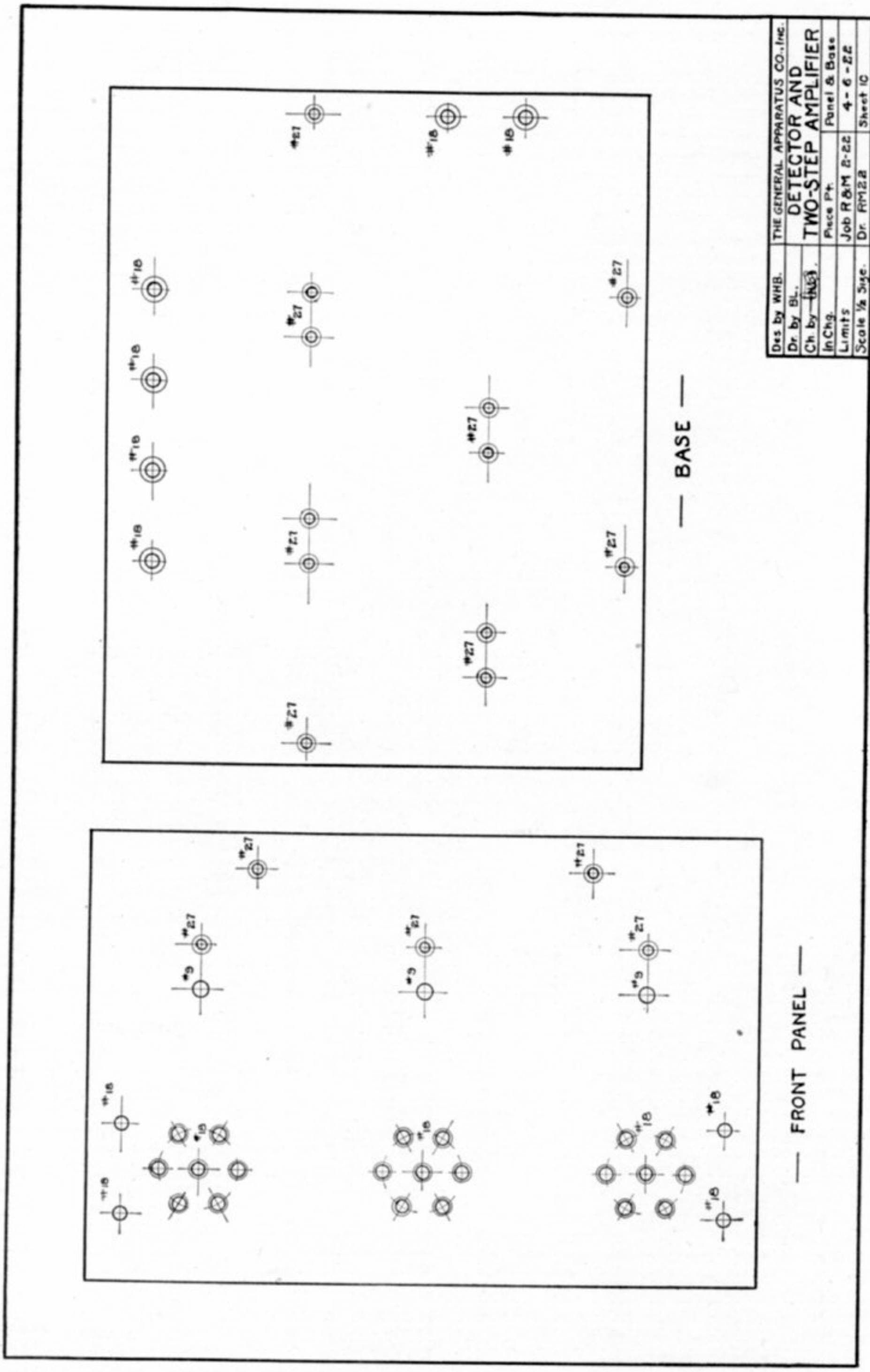


Fig. 4. Showing position and size of holes in front panel and base

ment wiring is built upon this rule. Use as little solder and flux as possible, because the smaller the soldered connections are, the better they will look, and too much flux will spread out over the instrument parts when the hot iron is applied. Hold the iron on the joint until the solder is seen to follow the surface of the copper lug, for it is a common occurrence to have a wire and solder come out of a lug when too little heat has been used.

Notes on Operating

Facing the front of the panel, the binding post to the extreme left of the base is connected to the negative side of a 6 volt "A" battery. The next terminal goes to the positive of the "A" battery and the negative of a 45 volt "B" battery. The 22½ volt tap of the battery leads to the third post, while the one to the right takes care of the positive 45 volt terminal. The plate coil binding posts if not connected to a tickler coil, variometer or other plate tuning system, should be shorted. As previously stated the terminals at the right of the panel are for the telephones and those at the left accommodate the tuner.

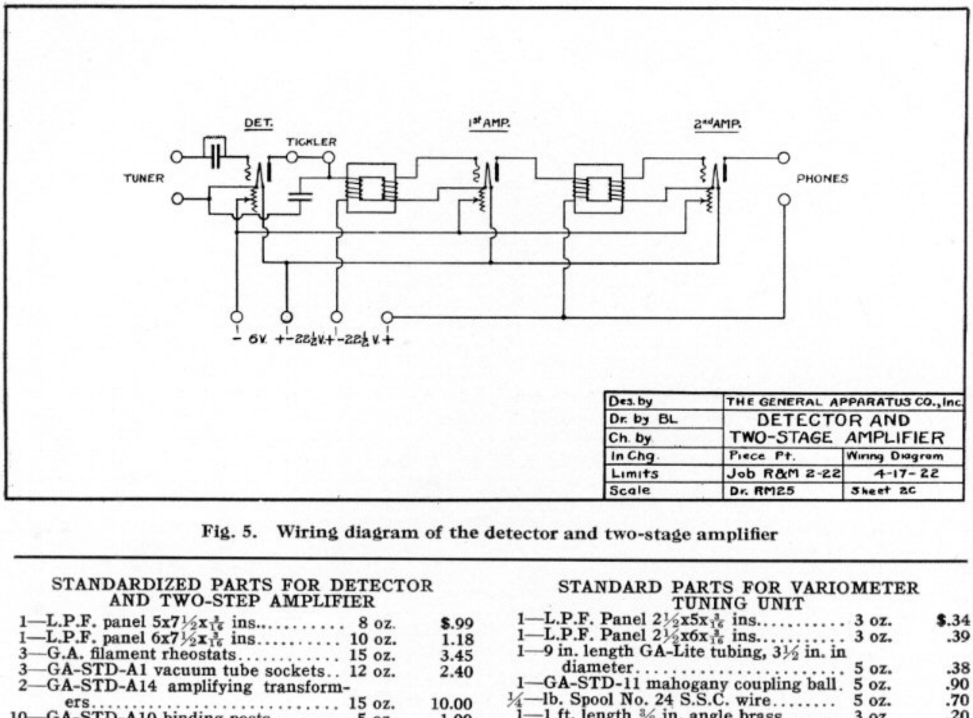


Fig. 5. Wiring diagram of the detector and two-stage amplifier

STANDARDIZED PARTS FOR DETECTOR AND TWO-STEP AMPLIFIER

1—L.P.F. panel 5x7½x$\frac{3}{16}$ ins.	8 oz.	$.99
1—L.P.F. panel 6x7½x$\frac{3}{16}$ ins.	10 oz.	1.18
3—G.A. filament rheostats	15 oz.	3.45
3—GA-STD-A1 vacuum tube sockets	12 oz.	2.40
2—GA-STD-A14 amplifying transformers	15 oz.	10.00
10—GA-STD-A10 binding posts	5 oz.	1.00
1—GA-STD-A4 grid leak condenser	1 oz.	.50
1—GA-STD-A3 phone condenser	1 oz.	.35
2—Pkgs. of 20 small copper soldering lugs	2 oz.	.50
1—1 ft. length ⅜ in. angle brass	3 oz.	.20
4—2 ft. lengths square tinned copper bus bar	8 oz.	.24
1—Pkg. of 10 ¼ in. F.H. 6-32 nickel plated screws	2 oz.	.11
1—Pkg. of 10 ½ in. F.H. 6-32 nickel plated screws	3 oz.	.12
1—Pkg. of 10 1 in. F.H. 6-32 F.H. nickel plated screws	3 oz.	.14
1—Pkg. of 10 6-32 nickel plated nuts	2 oz.	.08
1—Pkg. of 10 1 in. F.H. 8-32 nickel plated screws, for binding posts	3 oz.	.16
1—Pkg. of 10 No. 8 nickel plated washers	1 oz.	.05
COMPLETE SET OF PARTS AS LISTED ABOVE	6 lbs.	20.30
The detector and two-step amplifier complete, ready to use		28.80

AUXILIARY APPARATUS

Moorhead A-P Electron relay	8 oz.	5.00
Moorhead A-P amplifier tube	8 oz.	6.50
GA-STD-A12 plate battery, 45 volts with 22½ volt tap	4 lbs.	3.20
Witherbee, 6 volt, 40-ampere-hour storage battery, charged and ready to use	15 lbs.	14.00
Universal tuner	3 lbs.	15.50

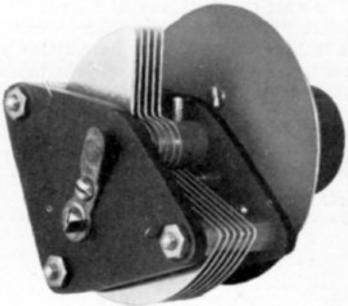
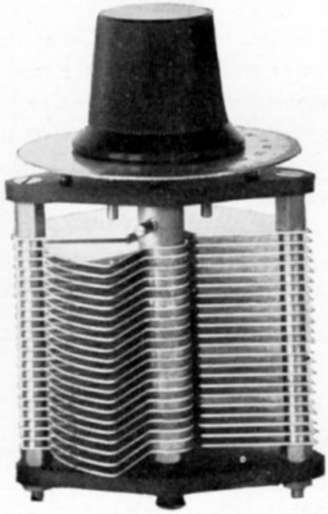
STANDARD PARTS FOR VARIOMETER TUNING UNIT

1—L.P.F. Panel 2½x5x$\frac{3}{16}$ ins.	3 oz.	$.34
1—L.P.F. Panel 2½x6x$\frac{3}{16}$ ins.	3 oz.	.39
1—9 in. length GA-Lite tubing, 3½ in. in diameter	5 oz.	.38
1—GA-STD-11 mahogany coupling ball	5 oz.	.90
¼—lb. Spool No. 24 S.S.C. wire	5 oz.	.70
1—1 ft. length ⅜ in. angle brass	3 oz.	.20
1—1 ft. length ¼ in. round brass rod	4 oz.	.15
1—GA-STD-A2 grid condenser	1 oz.	.35
1—GA-STD-12 indicating knob, ¼ in. hole	2 oz.	.40
2—Shaft contact springs	1 oz.	.08
4—GA-STD-A10 binding posts	3 oz.	.40
2—Coil mounting pillars	3 oz.	.16
4—Fibre rotor spacing washers	1 oz.	.16
1—Pkg. of 10 ¼ in. 6-32 R.H. nickel plated screws	3 oz.	.11
1—Pkg. of 10 ½ in. 6-32 F.H. nickel plated screws	3 oz.	.12
1—2 ft. length square tinned copper bus bar	2 oz.	.06
1—Pkg. of 20 small copper soldering lugs	2 oz.	.25
COMPLETE SET OF PARTS AS LISTED ABOVE	31 lbs.	4.90

The variometer tuning unit cannot be supplied complete or in a semi-finished state until further notice.

AUXILIARY APPARATUS

GA-STD-A5 Laboratory type detector control	1 lb.	$5.95
Radiotron UV 200 detector tube	8 oz.	5.00
GA-STD-A11 plate battery 22½ volts	2 lbs.	1.75
Deveau Gold Seal 2,200 Ohm phones	1½ lbs.	8.00
Universal tuner	3 lbs.	15.50

G. A. Standardized

Air Condenser Meets all Requirements

WHAT do you require of a variable air condenser? Or have you ever stopped to think just what you should require? The following specifications will serve as a guide in judging the merits of a condenser.

Electrical Features: Insulation of such material and design to produce a minimum power factor, high ratio of maximum to minimum capacity, negligible resistance in the leads.

Mechanical Features: Small in size, easy to mount, convenient terminals, permanent construction, smooth bearings, self-retaining movable plates.

Bearing these factors in mind, consider the G. A. Standardized condensers illustrated. There is no moulded composition or "mud" employed, but sheet stock which give the extremely low power factor of 0.7%. The capacity ratio on the 0.0025 mfd. condenser is 20 to 1, and on the 0.001 mfd. size 75 to 1 over the useful portion of the scale. Usual types have a ratio of 4 to 1 and 10 to 1 for the two sizes, respectively. As for connections, on the stationary plates the resistance is zero, and only 7 milli-ohms on the movable plates.

As for the mechanical construction, the G. A. Standardized condensers can be worked in nicely because of their compact design. The end plates are 3½ inches long and 2⅛ inches wide, and the extreme width, with the variable plates out, 3 inches. Mounting screws are 2 inches apart on a line ¼-inch from the shaft center toward the stationary plates. The overall height of the 11-plate condenser, up to the top of the upper end plate, is 1⅞ inches, and on the 43-plate type 3⅜ inches. The ¼-inch shaft protrudes 1 inch above the end plate. The mounting screws, which are threaded into the upper plate, come under the dial and do not show. Terminals in the form of nuts fitted with soldering lugs are located on the bottom panel. As for permanence, you can drop a G. A. Standardized condenser, throw it across the room, and give it rough treatment that no other condenser will stand because it has no soft lead supports or flimsy zinc plates. The smooth running steel shaft is copper plated to prevent rusting. In a horizontal position the plates stay put because of the adjustable friction take-up on the bearing.

When you go over these factors thoughtfully you will understand why the G. A. variable condensers are bought by those who want good equipment at reasonable prices.

Prices:

GA-STD-A15 variable condensers, 0.00025 mfd. capacity, without dial........................$3.25
Postage 10c.

GA-STD-A17 variable condenser, 0.001 mfd. capacity, without dial........................ 4.30
Postage 15c.

GA-STD-A15 condenser with GA-STD-A20 knob and dial.............................. 4.25
Postage 12c.

GA-STD-A17 condenser with GA-STD-A20 knob and dial.............................. 5.30
Postage 17c.

The General Apparatus Co., Inc.

88 PARK PLACE - - NEW YORK CITY

In the center of New York's radio district. Dealers coming to the City are invited to make the G. A. their headquarters. Every courtesy and convenience is at their disposal.