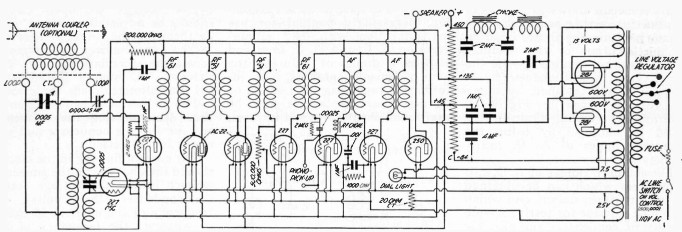
The Magnaformer AC-29 DX Super



LIST OF PARTS REQUIRED

2 Radiart Magnaformer (Shield Grid) R. F. No. 51 coils.
2 Radiart Magnaformer R. F. No. 61 coils.
1 Radiart Unicoupler C.U. No. 71 Long Wave, Plug-in oscillator coil.
1 Radiart drilled aluminum subpanel with 10 sockets.
1 Radiart decorated metal front panel.
1 Radiart No. 250 power unit with mounting base.
1 Radiart 5, panel control unit shield.
1 Radiart panel audio unit shield.
1 Radiart panel R. F. unit shield.
1 Radiart Bakelite tip jack panel for speaker.
1 Radiart Bakelite panel for midget condenser.
1 Radiart Bakelite tip jack panel for phonograph pickup.
1 Radiart .000045 midget condenser for regenerative control.
1 Aerovox Type 992, 1,000 ohm Pyrohm resistor.
7 Yaxley insulated tip jacks.
1 Aerovox Type 985, 20 ohm center-tapped resistor.
1 Aerovox Type 992, 1,200 ohm Pyrohm resistor.
1 Set of miscellaneous Radiart units for wiring and building the receiver.
2 Ferranti A. F. No. 4 audio transformers.
2 Remler No. 639 Universal S.L.W., .0005 mfd. variable condensers.
1 Remler No. 110 single control universal drum dial.
1 Remler No. 112 single control equalizer.
2 Remler No. 110-4 BR knobs.
1 Remler No. 750-12 knob.
1 Remler No. 1103 escutcheon plate.
1 Frost No. 1892, 200,000 ohm variable resistor.
1 Frost No. AC1885 Magnaformer special combination 500,000 variable resistor and A. C. snap switch.
1 Samson No. 125 R. F. choke coil.
1 Aerovox AC-29, filter block.
2 Aerovox No. 200-S, 1 mfd. condensers.
2 Aerovox No. 1475, .00025 grid condensers with grid leak mounting clips.
1 Aerovox No. 1450, .001 mfd. condenser.
2 Aerovox No. 1092 Metalohm, 2-megohm grid leaks.

THE CIRCUIT

As long as radio fans remain interested in DX reception from stations thousands of miles away, just so long will there be a demand for receivers of the Magnaformer type.

Up to the present time, the Magnaformer D. C. receiver has been recognized as an outstanding receiver in its class and the remarkable performance of the receiver during the past year in hanging up new records for distance reception is conclusive proof of the excellence of its design.

For 1929 the same designers who brought out the D. C. Magnaformer have perfected an improved A. C. Magnaformer which bids fair to rival even the performance of its predecessor.

In this new model, a special intermediate transformer is used which harnesses the broad tuning tendencies of the A. C. Shield Grid tubes and makes them tune as sharply as the type 227 A. C. tubes, without sacrificing the tremendous amplification and sensitivity obtainable with the A. C. Shield Grid tubes.

The coils used in the Magnaformer are accurately matched and carefully constructed to maintain perfect accuracy under all conditions. The uniformly fine results obtainable from each kit is due in no small measure to the accuracy with which the coils are made. Every Magnaformer coil is peaked exactly to a frequency of 69.73 kilocycles (4300 meters). This accurate peaking of the transformer to a band just wide enough to pass through only the desired carrier and its sidebands is responsible for the very sharp selectivity which enables the receiver to cut through local interference and bring in distant stations.

The receiver is completely shielded. The radio frequency stages are contained in a separate shielded section with each radio frequency stage shielded from the others. All sections of the circuit which could possibly be affected by coupling with other parts of the circuit are shielded in individual compartments.

A feature which will prove of value to the fan who is interested in short wave reception is the plug-in oscillator coil arrangement whereby it is possible to change the frequency band to which the receiver can be tuned, thus permitting reception both on the broadcast waveband and the short wave band.

This new receiver is equipped with phonograph pickup jacks which permit the audio system of the receiver to be used as an electric amplifier which converts any standard phonograph into an electric phonograph capable of operating the receiver loudspeaker thus giving all the advantages of the best types of electric phonographs.

Careful design at every stage of its development has resulted in a receiver which is able to separate easily stations 10 kilocycles apart without any interference. The sensitivity of the circuit is such as to bring in stations thousands of miles away on a loudspeaker. As a matter of fact one of these sets located in San Diego, Cal., has brought in a station from Iceland, 10,000 miles away.

The power pack which furnishes the "A", "B" and "C" voltages is completely self-contained and forms an integral part of the receiver assembly.

The receiver is simple to tune, is quiet in operation and provides excellent tone quality at high volume.

Experimenters who are interested in further details regarding the circuit and constructional information may obtain this data on request. The coupon below may be used for convenience if desired.

Aerovox Wireless Corp.,
70 Washington Street,
Brooklyn, N. Y.

I am interested in the Magnaformer AC-29 Receiver and would like to have you send me, free of charge, the folder giving a more detailed description of the circuit and constructional information.

Name ....

Address ....

City .... State ....

Complete Catalog of Aerovox Products May Be Had Free on Request to
Aerovox Wireless Corporation, 70 Washington Street, Brooklyn, N. Y.

The Aerovox Research Worker

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How To Test Condenser Capacities

PART 1

By the Engineering Department, Aerovox Wireless Corp.

There are many instances in the course of experimental work where the testing of condensers is desirable.

Such tests usually fall into two general classes. In one, all that is desired is to test a condenser to make sure that there are no open or short-circuits. In the other, the actual capacity of a condenser is desired.

To test a condenser for a possible short-circuit, all that is necessary is to connect the condenser in a series circuit consisting of a voltmeter, a source of fairly high voltage, and the condenser under test. If no steady deflection is obtained on the voltmeter it can be assumed that there is no short-circuit in the condenser.

In making this test it should be borne in mind that if the capacity of the condenser under test is fairly high, a slight displacement current will be set up which will give a slight deflection of the needle. However, this deflection will be comparatively small and the needle should immediately return to zero.

This slight deflection of the needle and its immediate return to zero in testing condensers having a capacity of from about .01 to 10 mfds. and over is positive proof that there are no open or short-circuits in the condenser.

In testing small capacity condensers ranging from .01 and less microfarads, the displacement current is so small that the average meter is not sensitive enough to record it. In testing such condensers therefore, it is best first to perform the short-circuit test to make sure that there are no short-circuits in the condenser and then make the open circuit test by connecting the condenser across the terminals of a 45-volt "B" battery for a few seconds after which the battery

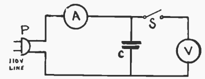

Fig. 1

should be disconnected and the tips of a pair of phones touched across the condenser terminals. In making this test on small capacity condensers, do not grip the phone tips in the fingers, but hold them by the cords to avoid discharging the minute charge on the condenser. If a click is heard in the phones as the phone tips are touched across the terminals of the charged condenser, you can be sure that the condenser is capable of holding a charge and is therefore in good condition. The intensity of the click received in the phone will depend on the capacity of the condenser, being louder on the higher capacities than on the lower ones.

While numerous instruments, such as microfarad meters and capacity bridges, are available which give direct readings of capacities, within their ranges, the cost of such instruments is prohibitive where only occasional tests are to be made.

The capacities of the average condenser of from .01 to 10 or more mfds. can be measured very easily if the ordinary 110 volt A. C. current, a high resistance A. C. voltmeter and an A. C. milliammeter are available.

The circuit used to make the measurements is shown in Fig. 1. This consists simply of an A. C. milliammeter, "A" connected in series with the condenser whose capacity is to be measured, "C", and provides for an A. C. voltmeter, "V", to read the voltage being applied across the terminals of the condenser.

The circuit may be connected to the terminals of a standard plug, "P", which will serve as a double pole switch to connect the apparatus into any convenient 110 volt A. C. outlet.

The first step in making the tests is to be sure that the condenser is not short-circuited, by connecting it into a test circuit consisting of a battery and voltmeter as shown in Fig. 2. This test is important because if the condenser is short-circuited the high current that will be drawn by connecting across the

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line will blow out the milliammeter and may blow out fuses in the line.

After the soundness of the condenser has been tested it can be connected into the circuit shown in Fig. 1, the plug inserted into a receptacle and the reading on the milliammeter noted. The voltmeter switch should then be closed and the voltage across the condenser noted. It will be noticed that upon connecting the voltmeter across the condenser, the reading on the milliammeter will jump to a higher reading because of the additional current drawn by the voltmeter.

If the voltmeter is connected across the condenser when the milliammeter reading is taken, the results obtained will be erroneous because of the additional current drawn by the voltmeter over and above that drawn by the condenser. The importance of taking the current reading first therefore, before

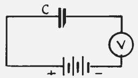

Fig. 2

the voltmeter is connected across the • condenser, cannot be overemphasized.

It might be mentioned that the voltage reading should be taken immediately after the current reading so as to avoid any possibility of error because of any fluctuations in line voltage after the current reading has been taken. It is advisable to reduce any possibility of error from that source by making several current and voltage readings and taking the average of all of them.

When the current drawn by the condenser is determined and the voltage across the condenser measured, the capacity of the condenser can be determined by a simple calculation.

The formula used to calculate the capacity of the condenser when the current drawn by the condenser, the voltage across the condenser and the frequency of the current source are known is shown in Fig. 3.

In this equation, "C" represents the capacity in farads, "I" is the current in amperes, "f" is the line frequency, in cycles per second, "E" is the voltage in volts and the Greek letter "pi" represents the constant 3.14.

Since the capacity units which will be measured will be in microfarads and the current readings will be in milliamperes, the equation shown in Fig. 3 can be changed to read in microfarads by multiplying the right hand side of the equation by 1,000,000. The current readings can be changed to milliamperes by dividing the right hand side of the equation by 1,000. The equation shown in Fig. 4 is the same as that shown in Fig. 3 except that now the capacity is in microfarads and the current in milliamperes.

$$C = \frac{I}{2\pi f E}$$

Fig. 3

To show a concrete example, a condenser was picked at random from a stack of condenser units which were ready to be tested for capacity and was found to draw a current of almost 48 milliamperes. The voltage tested 119 volts. By substituting in the formula shown in Fig. 4, keeping in mind that the frequency of the A. C. current is 60 cycles, the following results were obtained. The capacity in microfarads was found to be equal to the current, 48 milliamperes times 1,000 and divided by (2x3.14-x60x119) which equals 1.07 microfarads. The condenser was then measured by means of one of the accurate, direct reading microfarad meters used in the Aerovox Testing Department and the capacity was found to be 1.06 microfarads or less than 1% off, an error that is negligible when it is remembered that condensers are made commercially only to within 10% of their ratings.

It might be mentioned here that the actual energy consumed by a

$$C = \frac{I \times 1{,}000}{2\pi f E}$$

Fig. 4

condenser connected across a 110-volt, 60 cycle line is practically negligible, although it might be assumed at first glance that a condenser which draws a current of 48 milliamperes at 119 volts is consuming 119 times .048 or 5.7 watts. Actually this is not so because we must remember that we are dealing with A. C. current in which a condenser is connected. In such a circuit the voltage and current would be 90 degrees out of phase if the condenser were a perfect condenser having an infinitely high resistance. Actually, however, condensers are not perfect, but have a resistance, which while high must nevertheless be taken into consideration.

In a direct current circuit, the power or wattage in watts consumed in the circuit is obtained by multiplying the voltage in volts by the current in amperes, or by multiplying the resistance of the circuit by the square of the current flowing in the circuit. In an alternating current circuit it is necessary in addition to take into account the reactances of condensers or capacities which may be connected into the circuit.

Without going into technical details, it may be stated that the power consumed in an alternating current circuit by a condenser connected into the circuit may be obtained by using the equation given in Fig. 5, in which "W" is in watts, "f" is the frequency in cycles per second, "C" is the capacity in

$$W = \frac{2\pi f C E^2 P}{1{,}000{,}000}$$

Fig. 5

microfarads, "E" is the voltage in volts and "P" is the power factor of the condenser.

Since the power factor of the average paper condenser rarely exceeds .01, we can easily determine the power consumed by the 1.07 mfd. condenser which was tested when applied directly across the 110 volt line, as it might be used for instance in an interference eliminator, or as it was used in making the test.

The answer will be .057 watts, a value so low it can be neglected from the standpoint of power loss. It can be seen that keeping such a condenser across the line continually for one month would be equivalent to the use of approximately 041 kilowatt hours, which at the prevailing rates of approximately seven cents per kilowatt hour would cost a householder in the neighborhood of less than half a cent a month.

The reason why users of interference eliminators are instructed to disconnect the interference eliminator from the lighting line when not in use, is due not to the cost of current involved but to the important fact that when a condenser is connected across a line, it is constantly being charged and discharged and this constant action tends to reduce the life of the condenser.

To return to our test circuit for testing the capacities of condensers, the circuit shown in Fig. 1 can be used for testing practically any capacity within the limits imposed by the accuracy of the readings which can be obtained with the usual types of milliammeters. It is possible for instance, by using the formula given in Fig. 4 to determine the testing limits which could be obtained by using the standard ranges of A. C. milliammeters.

The standard ranges of A. C. milliammeters which can be obtained for under fifteen dollars and which would be suitable for testing a wide variety of condensers and also for a wide variety of A. C. testing work are .5 to 15 milliamperes, 2 to 100 milliamperes and 10 to 500 milliamperes.

By substituting in the equation shown in Fig. 4 we find that the A. C. milliammeter with a range of .5 to 15 milliamperes would permit testing of condensers of from approximately .01 mfd. to .33 mfd. with a fair degree of accuracy. The milliammeter with a range of from two to 100 milliamperes would permit testing of capacities of from .044 to 2.2 mfds. while the milliammeter with a range of from 10 to 500 milliamperes would permit testing of capacities of from .22 to 11 mfds.

It is important to remember that the 110 volt A. C. line should not be used unless the condenser being tested is able to stand at least 200 volts D. C. but since most paper condensers of the type used for bypass and filter work are rated for use with 200 volts D. C. or 125 volts A. C., or higher, the use of the 110 volt line is perfectly safe provided the condenser is not short-circuited.

As we have seen, the method outlined above, using the standard types of A. C. milliammeters can be used for all practical purposes involving the measurements of capacities of from .01 to 10 mfds.

For measuring smaller capacities, the use of much more sensitive meters capable of measuring currents of a few microamperes would be necessary and since these are very expensive, it is hardly likely that they would be found in the laboratory of the average radio experimenter.

The construction of a simple piece of apparatus by means of which small capacities may be measured will be described in the next issue of the *Research Worker*.

In view of the fact that condensers such as the Aerovox "A" condensers, which have capacities of from 1,500 to 4,000 mfds. are becoming increasingly popular for use in connection with "A" eliminators on A. C. and D. C. lines and also as a means of reducing the hum in dynamic speakers, some information regarding the method of testing these condensers may be useful and should prove of interest.

These condensers are designed for use on circuits having a maxi-

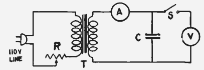

Fig. 6

mum voltage of about 12 volts. Overloads up to approximately 20 volts will not seriously damage the condensers but will reduce their life and under no circumstances should they be used at higher than 20 volts unless the condensers are specially designed for use on such higher voltages.

The method used to test the capacities of these condensers is essentially the same as that used to test the fairly high capacity condensers by the method shown in Fig. 1, except that the voltage applied across the terminals of the condenser must be reduced to three volts, the standard voltage at which the condenser capacities are measured and rated.

The circuit used is that shown in Fig. 6. An ordinary step-down transformer such as a toy transformer or the 5-volt winding of the standard type of filament transformer used to step down the 110-

$$C = \frac{I \times 1{,}000{,}000}{2\pi f E}$$

Fig. 7

volt line to the five volts required for the filaments of CX-371A tubes may be used. While the current flowing through the low voltage winding of the transformer may run as high as five amperes in testing high capacity condensers, the fact that a condenser is connected in the circuit means that the current will be out of phase with the voltage thus eliminating the danger of a burnout.

The rheostat "R" should have a range of zero to 2,000 ohms. The A. C. voltmeter "V" should have a range of zero to five volts and the A. C. ammeter "A" should have a range of zero to 10 amperes.

The voltage on open circuit should be adjusted to three volts by throwing the single pole switch "S" so as to connect the voltmeter across the secondary circuit. The rheostat "R" should be adjusted till the voltmeter reads three volts.

The switch can then be opened, thus disconnecting the voltmeter and leaving the condenser and ammeter in the circuit.

The current flowing in the circuit should then be read on the ammeter, whence having the voltage across the condenser (three volts), the frequency of the current, 60 cycles or whatever the frequency of the line may be, and the current in amperes we may substitute in the formula shown in Fig. 7, in which "C" is the capacity in microfarads, "I" is the current in amperes, "f" is the frequency in cycles per second and "E" is the voltage in volts. It will be noticed that this formula is exactly the same as that shown in Fig. 4, but due to the fact that "I" in Fig. 7 is in amperes while the "I" in Fig. 4 is in milliamperes the equation must be multiplied by 1,000 to make the two equations equivalent to each other.

Simple Method Tests Values of Resistors

All that is necessary to find the resistance of a unit is to apply Ohm's Law which states that the resistance in a circuit in ohms is equal to the voltage in volts divided by the current flowing in the circuit in amperes. If the current is in milliamperes, then the equation is changed to resistance in ohms is equal to the voltage in volts times 1,000 and divided by the current in milliamperes.

In testing unknown resistance values all that is necessary is to connect a battery of a known voltage in a series circuit consisting of the battery, an ammeter or milliammeter with a range depending on the possible value of the resistor and the voltage of the battery, and the resistor under test.

If the approximate value of the resistor is known the approximate value of current that will be drawn can be calculated and the range of the meter to be used in measuring the resistor can be found by substituting in the equation of Ohm's Law.