ELECTRIC CONDENSER

Filed Aug. 1, 1933

Fig. 1

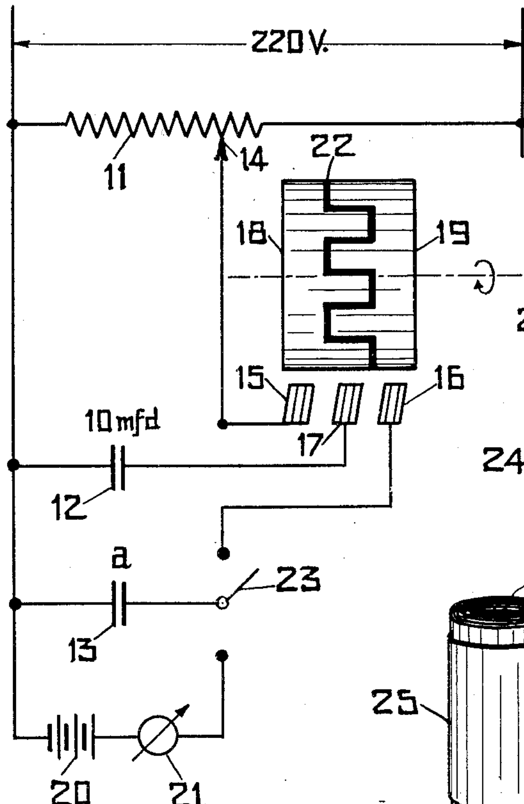


Fig. 3

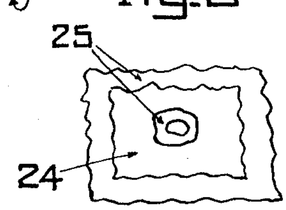


Fig. 4

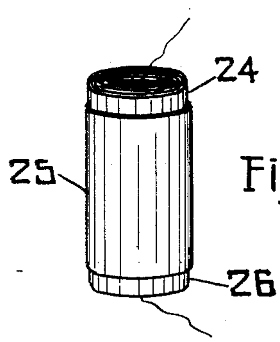
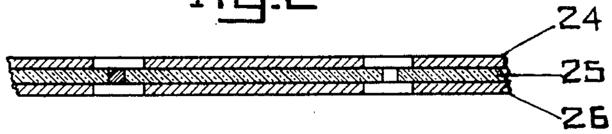


Fig. 2



INVENTOR
JACOB KATZMAN
BY
Edwards, Bower & Pool
ATTORNEYS

UNITED STATES PATENT OFFICE

2,070,435

ELECTRIC CONDENSER

Jacob Katzman, Brooklyn, N. Y., assignor to Dubilier Condenser Corporation, New York, N. Y., a corporation of Delaware

Application August 1, 1933, Serial No. 683,113

10 Claims. (Cl. 175—41)

My invention relates to electrical condensers and more particularly to condensers operated at low voltage, and the process of manufacturing the same.

Heretofore, paper condensers have comprised sheets of foil or metal layers separated by at least two sheets of paper. The two sheets of paper were found necessary because of the microscopic conducting particles which are imbedded in the paper during its manufacture and which would normally tend to short circuit the condenser if a single sheet of paper were used.

If this paper condenser is made with a single sheet of thin paper separating the foils, the electrodes would be short circuited through the conducting particles unavoidably imbedded in the paper in the process of manufacturing. This occurs when the paper is being pressed or prepared through the metallic rolls during its manufacture. In standard specifications for purchasing paper, there is always included the number of conducting particles per square inch, and a good paper at present should have less than ten conducting particles per square inch. These are easily discovered by well known methods.

Normally, thin paper of about .0125 mm. thickness is used. For condensers to operate at lower voltages, two of these sheets are placed between the armatures and act as a dielectric. The conducting particles are very minute and the probability of two particles coming together is rare.

Such a condenser, when properly impregnated, is usually rated to operate at between 200 and 300 volts direct current. There are many cases where condensers are required to operate at voltages lower than 200, say at 50, 25 or even as low as 6 volts across; as for example, automobile batteries. Up to the present, condensers made with two layers of paper and suitable for operation at 200 volts is used at 6 volts. It is therefore evident that this condenser is much larger and more costly than is actually required, but nothing else was available.

Accordingly, I have as the main object of my invention the provision of a condenser in which the dielectric is of a single sheet of paper and in which short circuits are prevented.

A further object of my invention is to provide a novel method of manufacturing a condenser having single layer dielectrics and in which short circuiting through said dielectric is prevented.

Another object of my invention is to provide a condenser, especially of the rolled or compressed type, having thin fibrous dielectric, such as paper with the conducting particles so removed as to prevent short circuits between the armatures.

Still a further object of my invention is to provide a novel condenser and methods of manufacturing the same.

There are other objects which together with the foregoing will appear in the detailed description which is to follow.

In constructing a condenser in accordance with my preferred structure, metal foil of preferred thickness, such as in the range of .0075 mm. is wound with a single layer of thin paper separator in the ordinary and usual manner. In such a condenser there are many short circuiting points where conducting particles are imbedded in the paper, as mentioned above, usually between six and ten microscopic particles per square inch.

When the condenser is wound and before being impregnated, the electrodes are connected across a source of energy in a manner about to be described, which will result in a relatively heavy surge of current flow across the short circuited portions where, as stated above, the minute conducting particles are found. The thickness of the metal foil and of the paper and the value of the current discharge are such that the metal foil surrounding these short circuiting points is burned away from the conducting particles and, from experiments, I have found that it burns away faster than the paper surrounding the conducting particles, leaving a small space where formerly the condenser would have been short circuited. The foil, I have discovered, if sufficiently thin, will burn faster than the paper so that with the proper application of a discharge current there will always be a space between the edges of the foil at the burnt spot and the edge of the paper at the same spot.

Referring to the drawing for a more detailed description,

Figure 1 is a circuit diagram of the system used for forming the condenser.

Figure 2 illustrates my condenser considerably magnified to show in exaggeration the perforations formed in the foil.

Figure 3 is a view of the unrolled condenser showing the surface of the foil and the hole in the foil larger than the hole in the paper and the inside edges of the burnt-away foil spaced from the conducting particles.

Figure 4 shows the condenser when wound up and ready to be assembled in a container. The unit in appearance is no different from those being made at present with double paper.

Referring more specifically to Figure 1, a large capacity, in this particular case a ten microfarad condenser 12, is connected through brush 17 on a distributor comprising sections 18 and 19 across a potentiometer 11 in a 220 volt circuit. Brush 15 on distributor 19 is connected to the variable contactor 14 on the potentiometer 11 and the brush 16 on the distributor is connected through switch 23 to the condenser 13 to be constructed in accordance with my invention. Condenser 12, as will appear from the following, is alternately charged and then discharged through the condenser being produced in accordance with my invention to produce the necessary surge currents for burning the short circuited spot in the foil.

In making my preferred condensers up to two or three microfarad capacity, I found a ten microfarad condenser suitable for producing the necessary surge. To manufacture condensers of larger capacity, condenser 12 may be of a much larger capacity. The capacity of this condenser is governed by the size of the condenser to be manufactured. The condenser 12 is permanently connected to the distributor and as the distributor rotates, as shown by the arrow, it is alternately connected first through brush 15 to the contactor 14 of the potentiometer and then through brush 16 to the condenser 13, the condenser being manufactured.

The contactor 14 of the potentiometer is first moved to its extreme left position so that there is substantially no voltage across the ten microfarad condenser. The commutator is then started into operation. A relatively small charge is applied to the ten microfarad condenser as the commutator connects the ten microfarad condenser across the potentiometer. At the next instance, as the commutator connects the large capacity condenser 12 across my novel condenser 13 with switch 23 in its upper position, condenser 12 discharges through the condenser 13, which results in a sudden surge of heavy current through the condenser 13, particularly across the short circuiting portions of the paper. Some of the foil adjacent these short circuiting points are burnt away by the current flow thereat and condenser 13 now has a break-down voltage determined by the spacing of the foil at the burnt edges from the conducting particles in the paper.

In order to increase the break-down voltage of condenser 13, the contactor on the potentiometer is now gradually moved along the potentiometer until substantially the required potential is applied to condenser 12 and which in turn produces increasing discharges through the conducting particles of condenser 13. The entire 220 volt charge may thus be applied to the ten microfarad condenser. At each increasing current discharge, portions of the foil surrounding or in contact with the conducting particles of the paper are burned away, causing a small opening in the foil around the spot where the conducting particles appear, the size of this opening depending upon the voltages required and for which the condenser is to be rated. It is quite evident, and I realize, that I can supply higher voltages than 220 across the rheostat 11 and produce condensers to operate at higher voltages, the same principle and operations being applied. In this manner, the condenser can be made to withstand any voltage up to approximately and in the range of 100 volts or more.

After this treatment of condenser 13 has been completed, switch 23 is moved to its lower position and connected to a second circuit which may include an indicating instrument and any desired voltage supply and voltmeter 21. This instrument, when the switch 23 is connected to the second circuit, will immediately indicate whether the condenser is still short circuited. I have found it practical to apply a much lower voltage here, merely to indicate short circuits. A test is made to determine whether the condenser still has any short circuits. If no short circuits are revealed, the condenser is prepared for usual operation.

It is then thoroughly impregnated and passes through the usual test of a dry unit and, if necessary, the above described discharge operations are repeated until the condenser is ready for service. When the condenser is impregnated in the usual method, preferably under a vacuum with an insulating compound, the insulating compound will fill in and around the burnt away spots. The unit is then put through a similar testing and burning away operation as described above before impregnation.

In some instances, I have discovered that it may be necessary to provide the condenser with a second impregnation after the second test in the event that the unit is still short circuited after the first impregnation.

It will be clear from the above that my novel condenser shown in Figure 1 comprises alternate layers of metal foil 24, 26 and paper 25. As shown, the foil is perforated at points where conducting particles were present in the paper, sufficient foil being removed to prevent any possible contact with the conducting particles in the paper or with the foil of the opposite polarity through any openings in the paper that may have been caused by burning away the conducting particles.

The foil is very thin, in the range of .0075 mm. or less in thickness. It is understood that while these dimensions are given for condensers used of certain capacity and size, that the same principle can be applied to other units, and if the paper or foil is different than the dimensions herein stated, the capacity of condenser 12 and the voltage applied is varied accordingly in order to obtain the desired results.

For low voltage use in the range of up to 100 volts, my condenser has many advantages, especially over the two layer paper condensers. It enabled me to obtain large capacities with smaller units as compared to double paper sections when used on the same voltages, such as applied to automobile radio sets. The suppressor condenser in these sets used to eliminate the noises and the bypass condensers across some of the filaments operate at from 6 to 12 volts, and condensers made with two papers are being supplied. With my invention, I am enabled to obtain about four times the capacity for use in approximately the same space and size of unit and applied and used in place of the two paper units.

I have discovered that a one microfarad unit can be constructed in approximately one-quarter of the space now necessary for low voltage condensers. It has the great advantage, that it provides an absolute prevention against any short circuits. As already described, good condenser paper at present contains ordinarily from 6 to 10 conducting particles per square inch. According to the law of probabilities, by laying two sheets of paper next to each other as the dielectric, it is not probable that any two conducting particles will be in engagement with each other. Nevertheless, this occasionally does happen and in that

Feb. 9, 1937. J. KATZMAN 2,070,435

ELECTRIC CONDENSER

Filed Aug. 1, 1933

Fig. 1

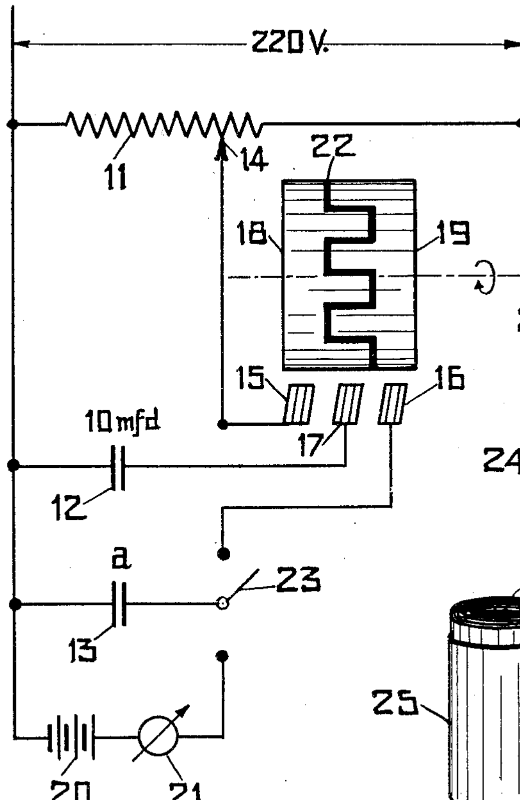
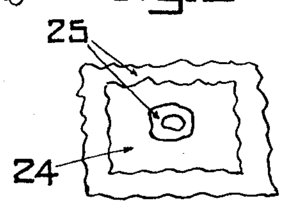


Fig.3



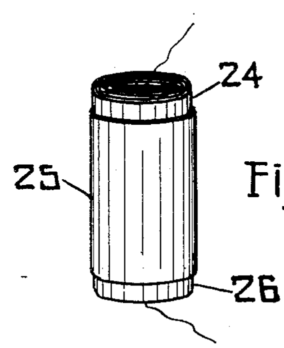
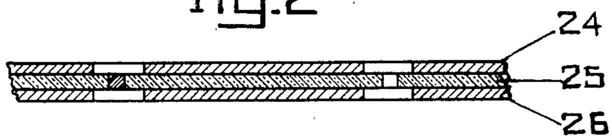


Fig.4

Fig.2



INVENTOR
JACOB KATZMAN
BY
Edwards, Bower & Pool
ATTORNEYS