

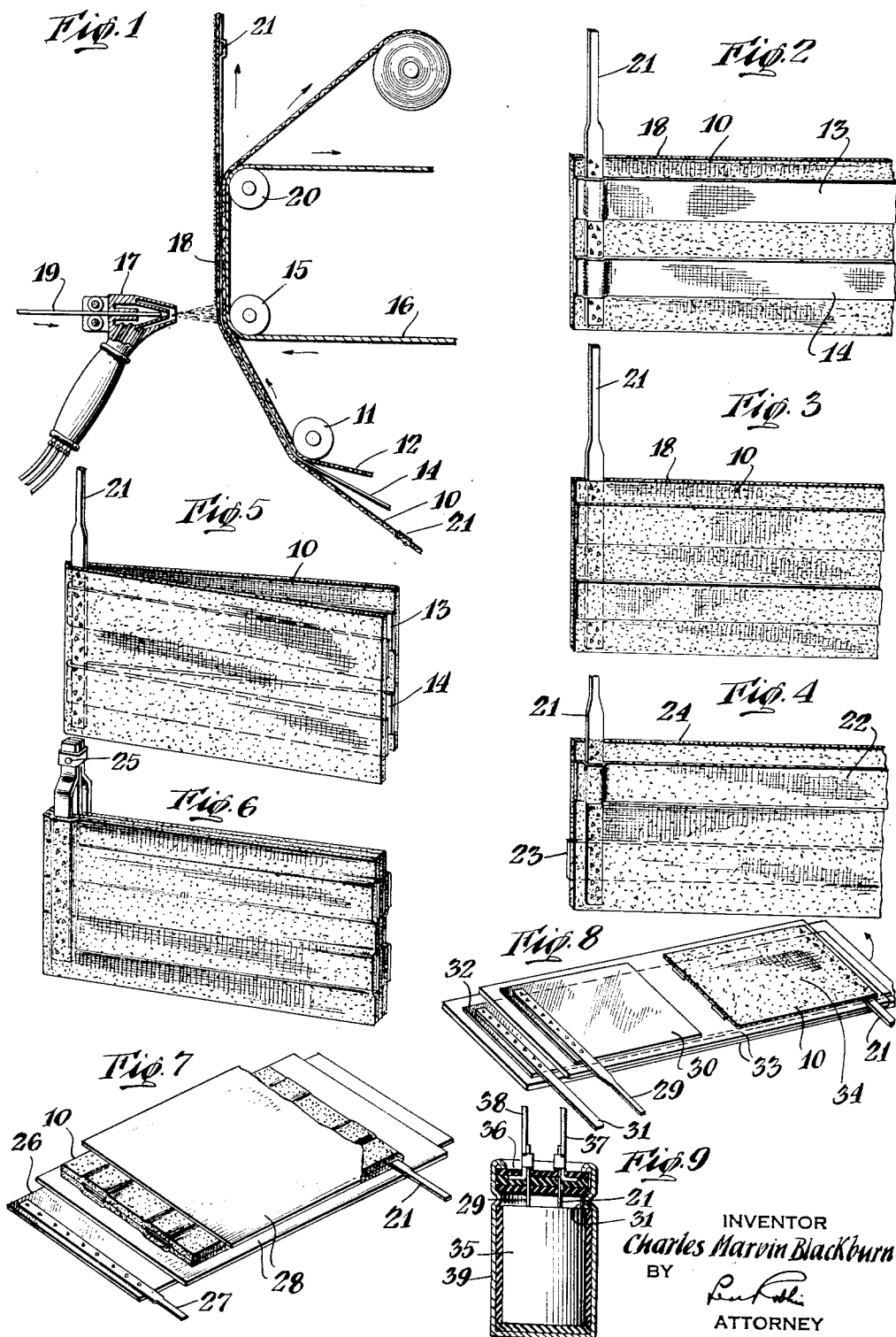
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DRY ELECTROLYTIC CONDENSER

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DRY ELECTROLYTIC CONDENSER

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This invention relates to electrolytic condensers and particularly to electrolytic condensers of the "dry" type and electrodes therefor.

The present application is a continuation-in-part of my previously filed co-pending application, Serial Number 163,431, filed September 11, 1937.

An object of the invention is to improve the electrode assemblies and arrangements for "dry" electrolytic condensers.

Another object is to improve the method of making the electrodes and assemblies thereof.

Other objects of the invention will be apparent from the following description and accompanying drawing taken in connection with the appended claims.

The invention comprises the features of construction, combination of elements, arrangement of parts, and method of manufacture and operation referred to above or which will be brought out and exemplified in the disclosure hereinafter set forth, including the illustrations in the drawing.

In the drawing:

Figure 1 illustrates diagrammatically a step in the manufacture of the condenser electrodes;

Figure 2 shows an electrode produced thereby;

Figure 3 shows an electrode which has been further processed;

Figure 4 shows a modified form of electrode;

Figure 5 illustrates one way of arranging an electrode for assembly in a condenser;

Figure 6 shows another electrode arrangement;

Figure 7 illustrates a condenser assembly prior to winding;

Figure 8 represents another assembly; and

Figure 9 is a section through a completed condenser.

A feature of the present invention resides in the novel method of making the electrodes. Another feature is the structural arrangement of the electrodes themselves and a further feature is the method of assembly in a condenser unit.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the construction of parts without departing from the spirit of the invention. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

In the drawing Figure 1 shows the arrangement for producing the electrode of Figure 2, 55

According to this arrangement a strip of cloth or gauze 10 or other sheet material of suitable characteristics and purity, and of appropriate width for a condenser electrode, is led over a roller 11 along with a second strip 12 of cloth or gauze, or other suitable material, and two parallel narrow strips of aluminum foil 13 and 14 so that the foil strips are sandwiched between the gauze strips in spaced parallel relation.

The sandwich assembly is then led over a second roller 15 and simultaneously a backing layer 16 of paper (brown paper or cheap newsprint is suitable) is led over roller 15 underneath the sandwich assembly. Paper 16 is somewhat wider than the gauze strips so as to protect roller 15.

As the sandwich assembly and paper layer are led over roller 15 a deposit 18 of film-forming metal (preferably aluminum) is applied to the sandwich assembly by metal spray gun 17, commonly known as a Schoop gun, the metal being supplied to the spray gun as wire 19, melted by an oxy-acetylene flame and sprayed onto the cloth. The gun may be oscillated back and forth across the sandwich strip during spraying, if desired, to give a more uniform deposit. Due to the porosity of the cloth or gauze the sprayed metal penetrates through the top gauze layer 10 and to some extent through the other gauze 12 where it is not protected by the narrow foil strips 13 and 14. The sprayed metal welds the foil strips to gauze 10 and, in so doing, develops a roughened or embossed surface on the back surface of the foil.

The sprayed assembly is then carried forward with all layers in contiguous relation until it cools considerably after which it passes over a roller 20 where the paper backing 16 is carried off and the gauze backing 12 is also stripped away from the front gauze 10 and foil strips 13 and 14. Gauze 12, which has some metal deposited in it, is wound up in a roll and can subsequently be used for the front gauze in making another electrode.

Prior to the spraying operation a plurality of flattened aluminum terminals 21 are fastened to gauze 10. Terminals 21 consist of lengths of wire which have been flattened for part of their length. The flattened part is laid across the cloth or gauze strip and a plurality of holes are punched in the flattened portion so that the burr raised on the cloth-contacting side by the emergence of the punch projections extends through the layer of cloth. The assembly is then rolled to flatten down the burr onto the cloth and thus rivet the terminal thereto. In spraying the ter-

minal becomes spray-welded to the gauze along with the foil strips.

The resulting electrode is shown in Figure 2. It comprises a single layer of cloth or gauze 10 having a spray-deposit 12 of aluminum (or other film-forming metal) on one side thereof and more or less distributed through the layer, a pair of parallel foil strips 13 and 14 integrally bonded to the cloth layer by the spray-deposit and presenting a more or less embossed outer surface, and a flattened terminal riveted and spray-welded to the cloth.

The terminals 21 can be attached at any desired spaced intervals along the cloth strip prior to spraying and after spraying the finished electrode may be cut to the required length, leaving one or more terminals in each cut electrode strip. The terminals may be at the end or ends of the strip or at an intermediate point. It is also contemplated that the terminals may be attached after spraying, if desired.

The sprayed electrode, preferably before cutting into lengths, may be film-formed by passing through a suitable bath of film-forming electrolyte while applying A. C. or D. C. potential between the electrode and the tank.

Two or more of the electrodes thus formed may then be wound up with interposed porous sheet spacers of paper, cloth, regenerated sheet cellulose or other spacer materials suitable for dry electrolytic condensers and impregnated with a suitable dry electrolytic condenser electrolyte, such as one of those mentioned in my prior-filed co-pending application, above identified. Due to the porosity of the spray-deposit, which is further enhanced by the gauze base, the electric capacity of the condenser is several times that of a similar unit made of aluminum foil of the same dimensions. The electrolyte used for impregnation is absorbed by the electrode gauze as well as by the spacers and hence the back, as well as the front surface of the spray-deposit, is effective for increased capacity. The foil strips 13 and 14, while serving principally to maintain a good electrical circuit longitudinal to the electrodes, also contribute to the electric capacity, and due to the embossing or roughening of the exposed surface from the spraying operation, the capacity is still further increased. Such a condenser is suitable for A. C. or D. C. uses. When used for D. C., the cathode may be of foil instead of sprayed gauze, if desired.

According to a modification the electrode of Figure 2 is run through the spraying process a second time with the foil side nearest the spray gun. This applies a spray deposit to the exposed surface of the foil strips and adds further sprayed metal to the gauze, thereby giving a still higher capacity. The modified electrode thus produced is shown in Figure 3. Another advantage in this electrode resides in the fact that the foil is covered on both sides with sprayed aluminum and hence a lower purity foil can satisfactorily be used than would be required where the foil itself is in contact with the electrolyte.

Figure 4 shows another modification in which a pair of narrow strips of foil 22 and 23 are laid in staggered relation on the two faces of a strip of gauze 24 and the assembly is sprayed on both sides to form an integral electrode. The thin aluminum foil is simultaneously embossed by the spray in the design of the cloth backing.

I have discovered that the electrodes above described, as well as those disclosed in my above identified copending application, may advantageously be used in multiple layers in forming condenser electrodes. That is, instead of using a single electrode strip for an electrode, as has heretofore been the practice, two or more strips are placed face-to-face and their terminals connected together. I have found that the electrode produced from two strips put together in this manner has substantially twice the effective capacitance of a single strip. Three strips give three times the capacitance, etc. This is due to the fact that the layers are porous and when impregnated with electrolyte permit a current path through the electrolyte to all parts of the several layers. The series resistance, due to the longer current path through the electrolyte, is increased somewhat by this arrangement but is well within acceptable commercial limits.

It will be noted that by this expedient, using a double electrode, only half the length of spacer material is required of what was formerly necessary. And where the condenser is intended for D. C. uses, in which case the cathode plate may be a single thickness of foil or sprayed gauze, the amount of cathode material required is correspondingly reduced.

Figure 5 illustrates a preferred method of producing this construction. This comprises folding the electrode of Figure 2, 3 or 5 back upon itself to form the double layer, the fold preferably being made near the tab 21. The foil strips 13 and 14 should preferably be on the inside.

Figure 6 illustrates how three electrode strips might be placed face-to-face and attached together by their terminal tabs 21, which are riveted or punched together at 25.

Figure 7 shows a D. C. condenser assembly made up using the electrode of Figure 5 as an anode with a foil electrode 26 (having terminal 27) as a cathode and spacers 28 of paper, cloth or other suitable material, laminated if desired, between the anode and cathodes. The assembly can be rolled up, impregnated with electrolyte, and inserted in a suitable can according to well known procedure. Due to the multi-layer nature of electrode 10 it is more flexible than a single thick layer would be and the individual layers will slide on each other during winding. Hence undue fibre stresses and resultant cracking are avoided.

In some cases it is desirable to make a condenser having a common cathode and two or more anodes, one of which is required to be of only small capacity and which serves as an audio by-pass condenser in certain circuits. Because of the extremely large capacities per unit area obtained with sprayed electrodes a very small section of electrode strip would be required for this by-pass condenser. While it is feasible to use such a section it introduces some mechanical handling difficulties. I have found that it is of advantage to use a piece of plain or etched aluminum foil for the small capacity unit. The amount of foil required, while greater than the amount of sprayed gauze which would be necessary, is still very little. Moreover the use of foil gives a somewhat better power factor on these smaller units.

Figure 8 illustrates a condenser assembly comprising an anode 10 of sprayed gauze, a second anode 30 of foil, and a common cathode 32 of foil separated from the anodes by spacers 33. Instead of common cathode 32, two foil cathodes can be used, one opposite each anode.

It is preferred that the assembly be wound by starting at the right-hand end as indicated by

the arrow. It will be noted that this rolls electrode 10 so that its top sprayed surface 34 is on the inside of concave face of the turns. This tends to press the particles of sprayed metal together and insure the highest conductivity parallel to the sheet. This is of particular advantage with the electrode of Figure 2 wherein only one side is sprayed.

Figure 9 shows a completed condenser comprising a can 39 containing a roll 35 produced by rolling up the assembly of Figure 8. Anode terminals 21 and 29 are brought up through insulating top 36 and provided with lugs 37 and 38, and the cathode terminal is inserted between the top and the can and spun under the edge of the can.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. An electrode for dry electrolytic condensers comprising a layer of fibrous material, a terminal riveted thereto, and a deposit of film-forming metal on and in said fibrous layer, said spray-deposit also bonding said terminal thereto.

2. An electrode for dry electrolytic condensers comprising a strip of cloth, a metal terminal strip laid transverse of said cloth strip and attached thereto by integral upset metal projections, and a spray-deposit of film-forming metal on and in said cloth and further bonding said terminal thereto.

3. The method of making an electrode for dry electrolytic condensers which comprises securing a terminal strip across a strip of fibrous sheet material by punching through said terminal strip and said fibrous strip and flattening the projections thus produced on said terminal once onto said fibrous sheet surface, and then spraying a deposit of film-forming metal onto said fibrous sheet.

4. The method of making an electrode for dry

electrolytic condensers which comprises running together two strips of cloth with at least one narrower strip of metal sandwiched therebetween, spraying a deposit of film-forming metal into one side of the sandwich assembly whereby said metal strip is bonded to the cloth which is directly exposed to the spray and subsequently stripping off the cloth not directly exposed to the spray.

5. The method of making an electrode for dry electrolytic condensers which comprises running together two strips of cloth with at least one narrower strip of metal sandwiched therebetween, spraying a deposit of film-forming metal into one side of the sandwich assembly whereby said metal strip is bonded to the cloth which is directly exposed to the spray and subsequently stripping off the cloth not directly exposed to the spray, and then spraying the foil side of the cloth strip to which the foil is attached.

6. An electrode for dry electrolytic condensers comprising a pair of layers of open-mesh fibrous sheet material and a spray-deposit of film-forming metal thereon and therein, said layers being disposed in face-to-face pressure contact and joined by a folded edge, and a terminal connected thereto.

7. The method of making an electrode for dry electrolytic condensers which comprises placing a thin aluminum foil against a backing having a multiplicity of closely spaced raised portions separated by depressions and spraying the exposed surface of said foil with a deposit of aluminum to simultaneously emboss said foil and attach said deposit thereto.

8. The method of making an electrode for dry electrolytic condensers which comprises placing a thin aluminum foil against a backing having a multiplicity of closely spaced raised portions separated by depressions, placing a layer of cloth over said foil and spraying a deposit of aluminum into said cloth and against said foil to simultaneously emboss said foil and attach said sprayed aluminum to said foil and said cloth.

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