Jan. 28, 1941. E. C. ARMSTRONG ET AL 2,230,208

ELECTROLYTIC CONDENSER

Filed May 11, 1938

Fig. 1.

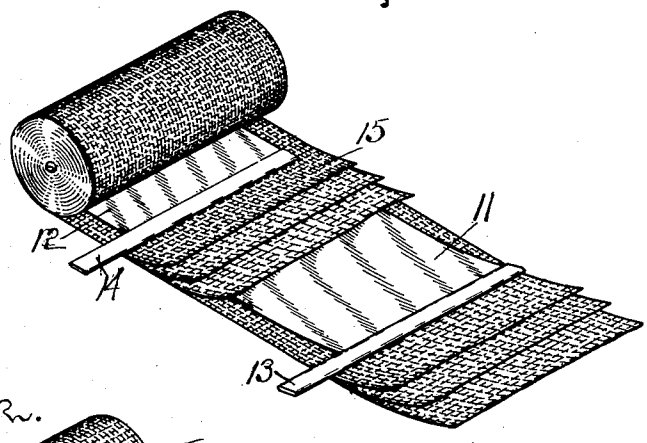


Fig. 2.

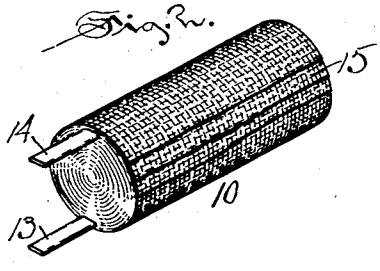


Fig. 3.

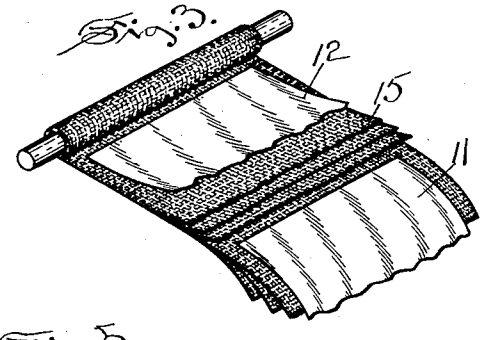


Fig. 4.

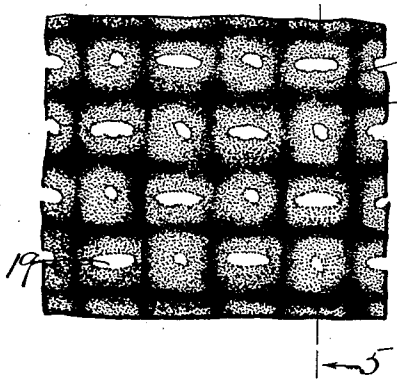
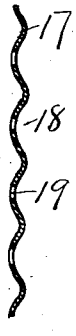


Fig. 5.



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ELECTROLYTIC CONDENSER

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Application May 11, 1938, Serial No. 207,221

1 Claim. (Cl. 175—315)

Our invention relates to the class of devices above named, and an object of our invention, among others, is the production of a condenser of this type that for a given length of conducting strips or plates shall occupy less space and therefore be smaller than those heretofore constructed, while at the same time having a maximum degree of efficiency.

One form of a condenser embodying our invention and in the construction and use of which the objects herein set out, as well as others, may be attained is illustrated in the accompanying drawing in which—

Figure 1 is an isometric perspective view of the roll of a condenser partially unwound.

Figure 2 is a similar view of the roll fully wound.

Figure 3 is another similar view but illustrating the beginning of the winding operation.

Figure 4 is a face view on greatly enlarged scale of a piece of paper such as has been used by us in effecting our purpose.

Figure 5 is a view in section on a plane denoted by the dotted line 5—5 of Fig. 4.

As is well known, condensers of this type herein mentioned comprise conducting strips or plates of very thin material which are wound into very compact form enclosed in a case containing an electrolyte. These conducting strips or plates are of considerable length, being wound many times around the roll, and while they may be very closely associated they must have no contact at any point.

Present day requirements in the use of modern instruments, such as radios and other apparatus, have necessitated radical and rapid changes in the structures of the condensers employed, the present needs demanding that the various parts, and particularly the condensers, entering into the structure of the apparatus, shall not only have increased efficiency but that they may be economically produced, and particularly that they shall be of minimum size.

During the early stages in the evolution, condensers of the electrolytic type were devised and came rapidly into use, and great and rapid changes in these have taken place.

One of the very earliest types of electrolytic condensers comprised a case of comparatively large proportions divided by perforated pieces of fibrous material into cells containing sheets or plates of aluminum supported in spaced relation, with no spacing material of any sort, on posts or rods extending through the center of the plates, the rods serving as the positive and negative connections of the condenser. The plates in these condensers were the equivalents of the strips of aluminum foil in the present day condensers. The case was filled with a suitable electrolyte which readily passed through the perforated dividing wall. These condensers were comparatively large and cumbersome and compared with their size were of low capacity.

As the rapid changes in designs demand continually smaller units of greater efficiency, cloth gauze was employed in the electrolytic condensers, surgical gauze having been used as the thinnest available material with the proper characteristics of promoting free flow of the electrolyte through the unit. Different combinations of these materials were employed, some of which included paper to ensure greater efficiency. This gauze was available in very thin strips and of a thickness of seven and one-half mils.

As the demand required even smaller units and consequently the use of thinner material than could be obtained in gauze and also less expensive material than the gauze, this caused a change to the less expensive paper material which could be obtained in thinner pieces, but this of necessity required a change in the principle of impregnation from free flowing electrolyte through open work spacers to absorbency in the spacing material.

This situation created a problem, as the question of absorbency is involved more or less with the characteristics of the individual fibers employed and the physical structure of the paper made from such fibers. As an example, spruce wood fiber from which a kraft paper is made has a flat ribbon-like structure with no central canal capable of introducing capillarity. An absorbency test of such material by well-known methods shows very little capillarity. Changes in the structure of fibers of said kraft and other papers, to obtain better absorbent qualities, may be effected by mechanical action, thereby changing the flat ribbon-like structure to a tubular form, thereby producing a paper having a high degree of absorbency. Such method, however, introduces complications in the way of residual impurities in the papers that render them practically useless for condenser purposes.

On the other hand the fibers of papers made from standardized caroa or abbacca are long, slender and of tubular form, and such papers given the same tests as above mentioned show a high degree of absorbency. For this reason such papers are now employed in the making of condensers, although they are essentially high priced, and there is an objectionable limit to the degree of thinness that may be obtained and yet retain the essential qualities required for condenser use.

A more recent effort has been made to use creped kraft paper which has no inherent feature of absorbency as a result of the sizing employed to help maintain the creped structure during manufacture of such papers, such paper depending primarily for its usefulness in this connection upon capillarity due to the crinkles and crevices

introduced during the creping operation. Such papers, while being cheaper than the standardized absorbent paper now in use, are also thicker than desired.

It thus appears that the makers of electrolytic condensers have continually shifted from one material to another all having different physical principles, this in an effort to get thinner papers at lower prices which are capable of doing the work required.

We have succeeded, in producing the paper forming the subject matter of this application, in overcoming the objections hereinbefore related and have developed a paper material that comes within the requirements now made and avoids the objections herein stated. This paper, which we choose to call paper gauze, is less expensive than the paper now in common use or the materials heretofore used, and it is also thinner than the materials heretofore employed. Its structure is such as to introduce capillary action together with the absorbent features which exist in the individual fibers or sheets before treatment, such absorbency not being lessened but possibly increased by the treatment which really bulks the structure and results in a softer material, more like cloth. In fact there is no real limit to the thinness in which this material may be produced. The only limit is the thinness of the stock before treatment, papers as thin as one-half mil having been produced. This paper gauze may be obtained from a paper manufactured from many kinds of fibers, such as kraft, linen, cotton, caroa, abbacca, etc. In fact our improved paper not only possesses the qualities of absorbency, but adds to this the feature of capillarity whereby free flow of the electrolyte throughout the mass is enhanced.

Our improved paper which we are able to produce to a minimum thickness is made under what we term a compression-displacement process which ruptures the paper, producing very minute holes thickly disposed over its entire surface, the treatment resulting in the bulking of the material to such extent that its final specific gravity is substantially one-half or less than that originally possessed. Our improved condenser including our gauze paper in its construction possesses the qualities obtained from the use of very thin paper in which a free admission of the electrolyte between the strips or plates takes place, such electrolyte completely filling the space, and the paper therefore satisfactorily answers all of the requirements as a separator, a condenser thus constructed and embodying our invention being shown in the drawing herein in which the numeral 10 denotes a condenser roll as a whole. This is composed of two conducting strips or plates 11 and 12 provided at their outer ends with terminals or leads 13 and 14 in a manner common to structures of this type.

These conducting plates or strips are separated by a strip or strips 15 of our improved thin gauze paper, three of such strips having been found to satisfactorily answer our purpose, but it will be understood that there is no limitation to the number of strips that may be used, so long as they effect our purpose. These sheets are very finely ruptured, as shown in the enlarged view in Figure 4, the holes or ruptures 16 permitting a free passage of the electrolyte to establish a sufficient insulation between the strips. The paper thus finely perforated acts in substantially the same manner as the gauze to maintain an unbroken film of the electrolyte between the plates or strips, and at the same time it lacks the undesirable features of thickness possessed by the cloth gauze, and as a result it is possible to produce a condenser roll of minimum size and well within the limits desired in the construction of devices of this kind.

Our improved paper of which the condenser is composed is not only ruptured, creating perforations, as hereinbefore described, but it is also corrugated in different directions as will appear from the following description of the manner in which it is made. The corrugations and ruptures are so small as to be scarcely perceptible to the naked eye, except when exposed to light reflection from certain directions, but the structure will be readily understood from the exaggerated or enlarged showing in Figs. 4 and 5, the ruptures or perforations and corrugations, owing to their small size, not appearing in Figs. 1 to 3 of the drawing.

In producing this paper a wire screen of very fine mesh such as is commonly used in paper making is employed, the sheets or strips of paper being passed between rolls with a wire screen on one side at least of the paper. In practice we employ two pieces of wire screen placed on opposite sides of the paper. The pressure of the rolls is such as to produce an impression of the wire screen upon the paper thereby producing the corrugations comprising ribs 17 and grooves 18 on opposite sides of the sheet, the grooves on one side being within those portions of the paper forming the ribs on the opposite side.

At the points where the wires comprising the screen cross each other the paper is ruptured producing very fine perforations or ruptures 19. These ruptures in the sheet of paper are of different sizes and shapes, as shown in Fig. 4, although in effect they are very fine pin pricks scarcely discernible to the naked eye, as above mentioned, but possessing the attributes and effecting the results hereinbefore described.

While we have illustrated and described herein a manner of producing our improved paper which has most satisfactorily answered our requirements, we contemplate that other means for producing the paper may be employed and in which a roughened, uneven, embossed surface of any given design may be produced upon a roll or rolls or upon plates in different ways.

In accordance with the provisions of the patent statutes we have described the principles of operation of our invention together with the device which we now consider to represent the best embodiment thereof; but we desire to have it understood that the device shown is only illustrative and that the invention may be carried out by other means and applied to uses other than those set out above.

We claim:

An electrolytic condenser roll including a plurality of conducting members separated by sheets of paper of a minimum thickness having its surface irregularly distorted to bulk and increase such thickness within minimum limits and including irregularly disposed ridges, humps, and depressions extending in various directions over said sheets to prevent stretching and also including ruptures irregularly forming minute perforations disposed over said sheets.

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