Feb. 10, 1959 J. B. BRENNAN 2,873,219

METAL-COATED BATT AND METHOD AND APPARATUS FOR PRODUCING SAME

Filed Dec. 20, 1954

2 Sheets-Sheet 1

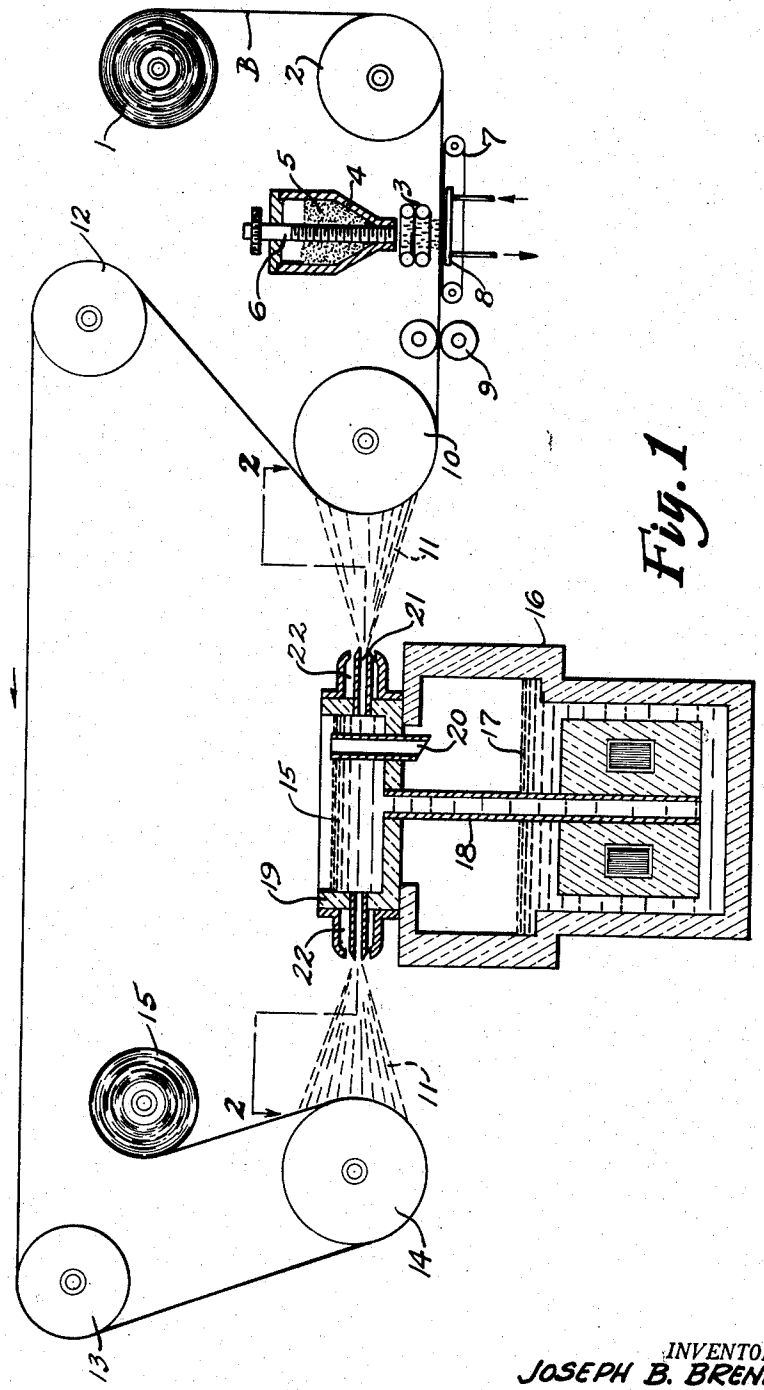


Fig. 1

INVENTOR.
JOSEPH B. BRENNAN
BY
Oberlin & Limbach
ATTORNEYS

Feb. 10, 1959 J. B. BRENNAN 2,873,219

METAL-COATED BATT AND METHOD AND APPARATUS FOR PRODUCING SAME

Filed Dec. 20, 1954

2 Sheets-Sheet 2

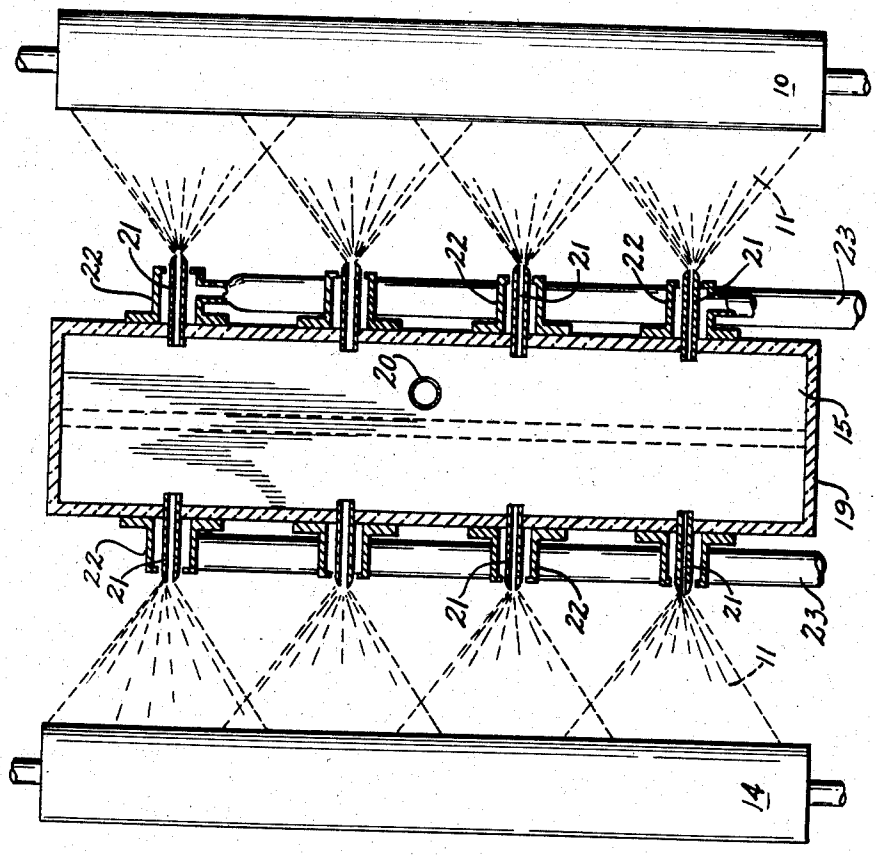


Fig. 2

INVENTOR.
JOSEPH B. BRENNAN
BY
Oberlin & Limbach
ATTORNEYS

United States Patent Office 2,873,219
Patented Feb. 10, 1959

2,873,219

METAL-COATED BATT AND METHOD AND APPARATUS FOR PRODUCING SAME

Joseph B. Brennan, Cleveland, Ohio

Application December 20, 1954, Serial No. 476,519

8 Claims. (Cl. 117—227)

The present invention relates generally as indicated to a metal-coated or reinforced batt and to the method and apparatus for producing the same, and has for its principal object the provision of such batt which is uniformly porous and is ideally suited as in the production of electrodes for electrolytic condensers and the like wherein such batt in strip form together with paper is adapted to be wound into coil form and impregnated with electrolyte.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a side elevation view of one form of apparatus, of which a metal powder feed device and a metal spray device are shown in vertical cross-section; and

Fig. 2 is a horizontal cross-section view taken substantially along the line 2—2, Fig. 1.

Referring now more specifically to the drawings, and first to Fig. 1, a fibrous batt as of cotton or ceramic fibers, such as of aluminum oxide, is unwound from coil 1 and passes under a roll 2. Adjacent the roll 2 and above the horizontal stretch of the batt B is a heating means 3 which may comprise, for example, gas pipes for directing flames toward each other. Centered above said heating means 3 is a feed hopper 4 containing metal powder, such as aluminum of 10 micron size, the powder being fed out of the bottom of said hopper 4 as by means of a series of rotary feed screws 6, said hopper extending all the way across the 36" wide batt B.

The metal powder 5 thus discharged at a uniform rate from the hopper 4 drops down inside the heating means 3 wherein it is melted or at least rendered molten on the particle surfaces, and then drops gently onto and in between the fibers of the batt B traveling therebeneath at a uniform lineal speed. At this stage, the batt B is composed of loose longitudinal fibers and is about ¼" thick.

The longitudinally traveling batt B is supported as on a traveling belt 7 made of stainless steel or anodized aluminum, and said belt is cooled as it passes over the water-cooled support plate 8 therebeneath.

If heating flames are employed, these will preferably be at a temperature in excess of 2000° F.

As the melted metal particles 5 drop onto and into the batt B, and immediately after the deposit of the metal particles 5, the batt B passes between rolls 9 whereat said batt is bonded and made into a coherent, relatively strong strip of about 10 micron thickness and reinforced by particles 5.

Thereafter, the squeezed and metal-reinforced batt B,

yet porous or foraminous, passes over a roll 10 in the path of the metal spray field 11, and thereafer the batt passes over the rolls 12, 13, and 14, and in passing over the last-mentioned roll, the opposite side of the batt B, that is, the side to which the molten metal particles 5 were deposited, passes the molten metal spray field 11, whereupon the completed strip according to this invention is wound up in coil form on roll 15.

The spraying apparatus herein shown comprises a heated container 16 for molten metal 17, aluminum for example, which is fed upwardly into the spray apparatus through a tube 18 as by means of gas pressure in said container 16.

Mounted on the container 16 is an auxiliary container 19 which is provided with an overflow pipe 20 by which a constant level of molten metal for spraying is always contained in the auxiliary container 19.

The reference numerals 21 denote opposite series of molten metal discharge nozzles from which the molten metal is discharged in the form of a finely divided spray 11 (10 micron particle size) under the influence of surrounding air aspirators 22. The aspirator chambers 22 are supplied with air under presusre of say 60 p. s. i., and heated to say a temperature between 700 and 1500° F. by means of the manifold pipes 23.

As is best shown in Fig. 2, the nozzles 21 are so arranged in spaced-apart relation that the individual spray fields 11 overlap so as to produce a uniform deposit of the sprayed metal on the opposite sides of the batt B.

In speaking of the uniform deposit of molten metal spray, it is to be understood that what is meant is uniform impregnation of the batt B with the metal spray, since the finished batt B is foraminous or porous so as to present a large exposed surface area for contact with electrolyte, thus increasing the condenser capacity by 30% or more as compared with known electrodes which are etched or otherwise embossed or roughened.

As a specific example of the present innvention, the batt B may consist of cotton or aluminum oxide fibers which form a batt of approximately ¼" thickness and 36" width. Such batt B is uncoiled from the roll 1 (or drawn from a carding machine) at a constant lineal speed, and the metal powder feed is so arranged as to deposit metal sparsely at a uniform rate of about 1 lb. per 250 sq. ft. of batt B and uniformly distributed over the entire width of the batt B, the metal powder being aluminum of 10 micron size.

Next, the batt B with the melted metal particles 5 gently deposited thereon and therein is passed between rolls 9 which preferably are spaced apart a distance of 10 microns so as to unite the fibers of the batt B by a discontinuous reinforcement provided by the metal particles on the batt B and bonded thereto to provide a coherent, relatively strong strip.

The opposite side of the thus rolled batt is then subjected to the molten, high velocity metal spray field 11, the particles preferably are of 10 micron size deposited at the uniform rate of about 1 lb. per 250 sq. ft. of batt area as the latter moves over the roll 10. Similarly, the side of the batt to which the powdered metal was applied is then subjected to the spray field 11 of aluminum applied at the same rate as aforesaid. The thus completed strip is then wound on the roll 15 and is ready for use as in the making of electrodes for electrolytic condensers.

The batt B as thus completed is of great strength, is so porous or foraminous that one can see through it and thus presents an immense surface area for electrolyte contact.

It is to be understood that powder metal may be uniformly deposited other than by feed screws 6, such as a belt feed having a uniform powder layer thereon which

drops off onto the batt B at one end of the belt as the latter passes over a pulley.

Moreover, the batt B as it issues from between the rolls 9 makes an excellent screen or filter for use in hydraulic systems and elsewhere.

In any event, the pressurizing of the deposited particles and batt B between rolls 9 renders the batt B capable of withstanding the high velocity impregnation by the spray fields 11 without blowing apart. The heated atomizing air prevents excessive chilling of the molten metal particles so that they are yet in relatively soft, plastic condition as they contact the compressed batt B reinforced by the gravity-deposited particles.

This application is a continuation-in-part of my copending application, Serial No. 273,595, now Patent 2,697,671 issued December 21, 1954.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. The method of reinforcing a fibrous base material which comprises gently depositing at least exteriorly molten metal particles onto such base material, pressure bonding the metal particles and fibers of the base material, and spray depositing molten metal particles by velocity impingement onto at least one side of said base material to impregnate the latter.

2. The method of forming relatively wide strips of metal-impregnated fibrous batt which comprises the steps of uniformly depositing by gravity action particulate metal, molten at least on its exterior surface, onto one side of such batt as the latter is moved longitudinally at a uniform speed, pressing the batt and deposited metal particles to bond together the fibers of such batt, and then spray depositing particulate metal against and impregnating the same into at least one side of the pressed batt by velocity impingement and by means of overlapping spray fields which insure uniform density spray deposition across the width of the batt as the latter continues to move longitudinally at a uniform lineal speed.

3. The method of forming a porous metal-reinforced fibrous material, which comprises providing a porous fibrous material comprised predominantly of fibers extending longitudinally of the strip, providing discrete particles of metal having at least the surfaces thereof molten, depositing the molten discrete particles of metal by gravity and intermingling the same with the fibers of the fibrous material so that the particles are in discontinuous relationship, and pressing the said material and particles to cause the particles to tightly bond the fibers of the fibrous material together at numerous points to increase the strength of the material while the said material remains porous.

4. The method of forming a porous electrically conductive strip which comprises providing a porous strip of fibrous base material predominantly comprised of longitudinally extending fibers, intermingling discrete particles of metal having at least the surfaces thereof molten with the fibers in a discontinuous relationship of the metal particles with each other so that the strip of base material having metal particles therein is not rendered electrically conductive throughout, compressing the base material and particles to strengthen the bond therebetween for reinforcing the strip and such that the said strip remains porous, and spraying particles of molten metal onto the compressed base material to render the strip conductive throughout and with sufficient velocity to impregnate the base material.

5. Apparatus for forming metal-impregnated fibrous batt which comprises means for feeding such batt in a longitudinal direction, means for gravity depositing at least exteriorly molten metal particles onto one side of such batt as it is fed longitudinally, pressing means to bond together the fibers of the batt and the gravity-deposited metal particles, and molten metal spray means for directing finely divided molten metal particles by velocity impingement against at least one side of such batt to impregnate the latter.

6. Apparatus for forming metal-reinforced fibrous batt comprising means for feeding such batt in a longitudinal direction, means for depositing at least exteriorly molten metal particles onto one side of such batt as it is fed longitudinally, pressing means to bond together the fibers of the batt and the metal particles, and molten metal spray means for directing finely divided molten metal particles against at least one side of such batt, said molten metal spray means comprising a container for molten metal and metal heating means, an auxiliary container to which molten metal is fed and in which the metal is maintained at a predetermined uniform head with excess metal recirculated through said container for re-heating, and a spray nozzle to which molten metal is uniformly fed from said auxiliary container for spraying in finely divided form.

7. Apparatus for forming a metal-impregnated electrically conductive porous fibrous base material which comprises means for moving the base material along a predetermined path, means adjacent said path for dropping at least exteriorly molten metal particles onto the base material as it is being moved past, pressing means for receiving said base material from the last-said means and pressure bonding the fibers of the base material and the metal particles therein into a compacted but porous base material, and velocity impact spray means displaced from said pressing means in the direction of movement of said compacted base material for spraying the opposite sides of the compacted base material with finely divided particles of metal with a velocity to cause the latter particles to impregnate said compacted base material and render the same electrically conductive throughout.

8. In an apparatus for providing a spray of molten metal particles, a main container for molten metal and metal heating means, an auxiliary container to which molten metal is fed and in which the metal is maintained molten and at a predetermined uniform gravity head with excess metal recirculated through said main container for reheating, means for thus feeding and recirculating the molten metal including overflow means for maintaining said gravity head, and a spray nozzle to which molten metal is uniformly fed from said auxiliary container for spraying in finely divided form.

References Cited in the file of this patent

UNITED STATES PATENTS

1,159,155	Ayres	Nov. 2, 1915
1,823,869	Baur	Sept. 15, 1931
1,951,119	Alt et al.	Mar. 13, 1934
2,177,819	Booe et al.	Oct. 31, 1939
2,187,348	Hodson	Jan. 16, 1940
2,228,877	Howell	Jan. 14, 1941
2,321,937	Quinn	June 15, 1943
2,322,787	Brennan	June 29, 1943
2,404,824	Booe	July 30, 1946
2,410,626	Boudreau	Nov. 5, 1946
2,547,371	Brennan	Apr. 3, 1951
2,588,125	Knowland et al.	Mar. 4, 1952
2,588,421	Shephard	Mar. 11, 1952
2,697,671	Brennan	Dec. 21, 1954

FOREIGN PATENTS

196,693	Great Britain	Apr. 27, 1923
230,096	Great Britain	Aug. 27, 1925
139,657	Australia	Dec. 7, 1950