United States Patent

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[33] **Great Britain**
[31] **25031/67**

[54] **DRYING PASTED BATTERY PLATES**
8 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **118/309,** 118/324
[51] **Int. Cl.** **B05c 5/00**
[50] **Field of Search** 118/308, 309, 312, 19, 24, 324; 198/213

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ABSTRACT: Pasted battery plates are dried by suspending them from conveyor means by which they are moved through a rotatable cylinder having vanes projecting from the interior thereof and which create in the cylinder a dust cloud of dry powder, the plates being moved through the cloud so that dust settles evenly on the surfaces of the plates.

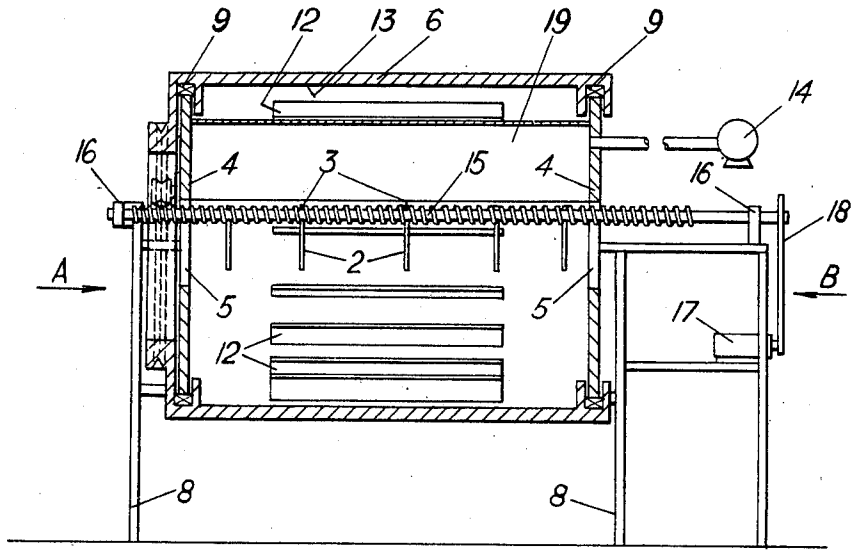

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Fig. 1.

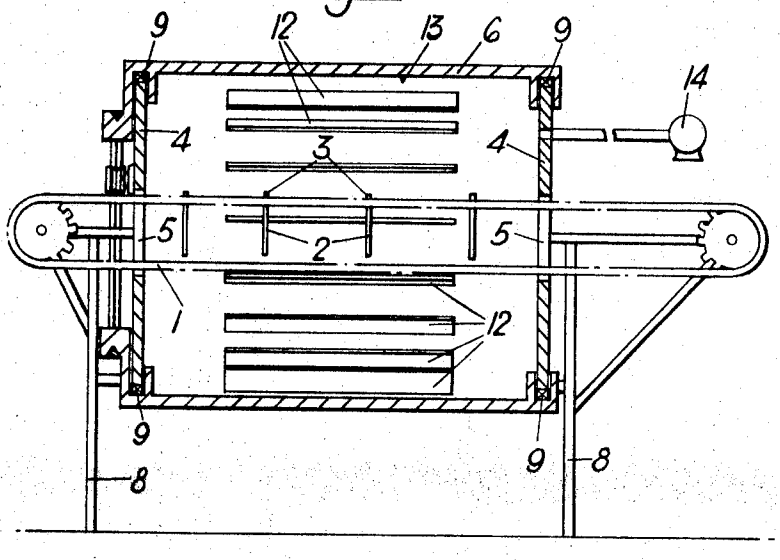

Fig. 2.

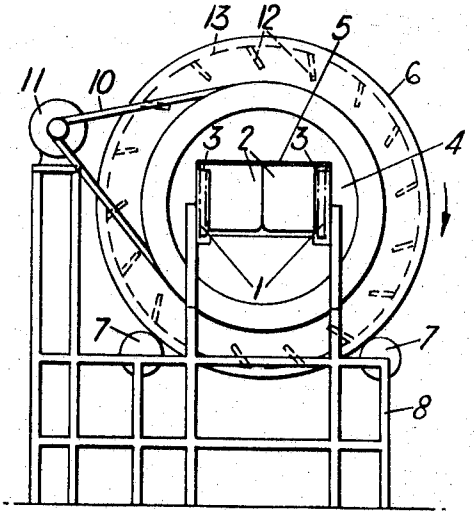

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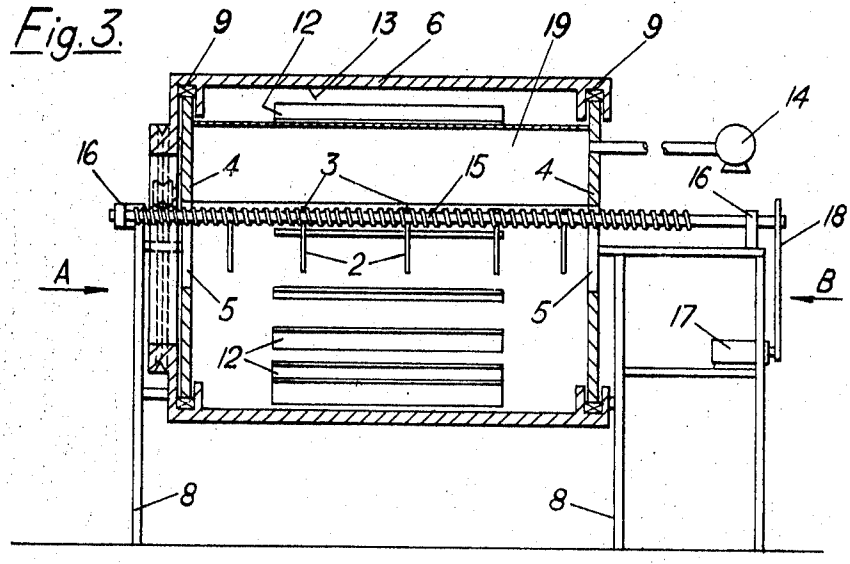
Fig. 3.



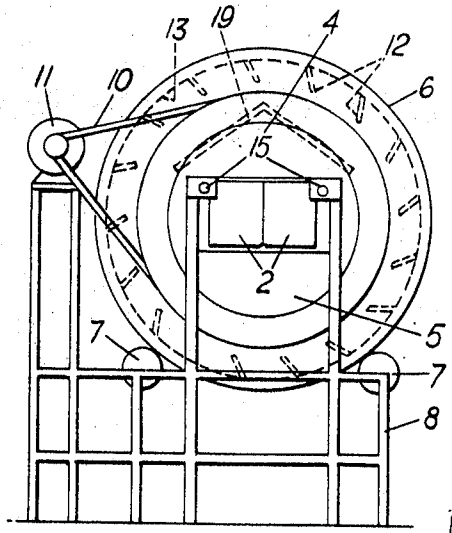
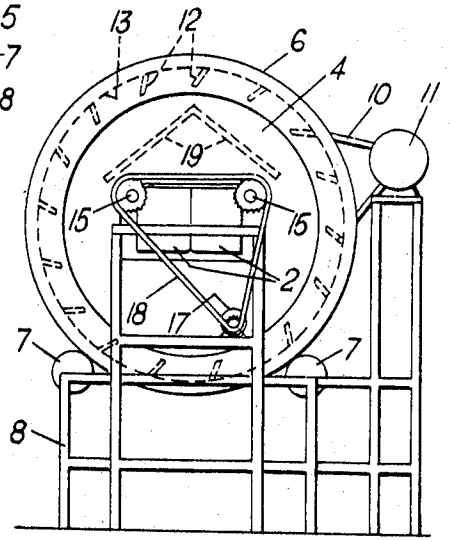


Fig. 4.

Fig. 5.



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DRYING PASTED BATTERY PLATES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the production of pasted battery plates and in particular to the drying of the plates.

Before full drying of pasted battery plates is effected it is usual for the plates to be subjected to some handling and transportation during which it is desirable that the damp surfaces of one plate do not come into contact with those of another plate. To this end the plates are sometimes suspended by their lugs in slotted baskets which ensure that the plates are separated one from another, for example by about one-half of an inch, and the baskets are loaded on trolleys. This procedure, however, requires the use of a considerable amount of equipment, i.e. baskets and trolleys, which in turn require a considerable amount of space. Further, the loading of the plates into the baskets requires more time than would be needed if the plates could be loaded directly into the trolleys.

2. Description of the Prior Art

One proposal for overcoming these disadvantages consists of surface drying the battery plates in a flash-drying oven forming part of the pasting machine but it is found that this fairly rapid drying operation tends to produce cracks in the surface of the paste. One way in which it it has been proposed to reduce this tendency is to spray the surfaces of the plates with sulfuric acid before the plates enter the flash-drying oven. Thus a pasting machine may have an acid spray equipment and a long flash-drying oven combined with the pasting equipment. This method of surface drying of the plates is unsatisfactory for a number of reasons, for example:

a. The combined length of the flash-drying oven and the acid spraying equipment is about four times the length of the pasting equipment and thus results in a pasting machine the length of which is much greater than it needs to be.
b. The flash-drying oven is expensive to operate because of the large amount of heat energy required, and expensive equipment is required to control the temperature within the oven because overheating, which may occur when only a relatively few plates are in the oven, will be harmful to the plates.
c. Special equipment is needed to spray the acid on the plates and any parts of the machinery close to the acid spray equipment or to the sprayed plates must be made from acid resistant material such as stainless steel. Any parts which are not made from acid resistant material will rapidly corrode and will need frequent replacement.

It is a main object of the present invention to provide a method of and apparatus for surface drying pasted plates which will eliminate the need for flash-drying ovens and acid spray equipment thereby obtaining economy by saving floor space, capital expenditure, and heat energy required, and in machine maintenance.

SUMMARY

According to one aspect of the invention there is provided the method of drying a pasted battery plate which consists of surface drying the plate by applying a dry powder to the damp surfaces of the pasted plate to permit handling and stacking thereof in surface contact with other similarly surface dried plates prior to complete drying of the plates. The powder may be lead powder such as lead oxide.

The surface drying may be effected by suspending the plate from a conveyor and moving the plate by the conveyor through a chamber having a powder-laden atmosphere. The chamber may be provided with a recirculating flow of powder-laden air.

The invention also contemplates apparatus for drying pasted battery plates comprising a chamber including end plates each provided with an opening for the passage therethrough of battery plates suspended from conveyor means operable to move the plates into, through, and out of the chamber, and powder-tossing means operable to create in the chamber a powder-laden atmosphere through which battery plates are moved by the conveyor means so that powder is applied to the damp surfaces of the battery plates.

The chamber may comprise a rotatable cylinder and the powder-tossing means consist of vanes extending into the cylinder from the interior wall of the cylinder, and the leading face of each vane considered in the direction of rotation of the cylinder may form an acute angle with the interior wall of the cylinder.

The end walls may be stationary and the cylinder by rotatable relative thereto, and the cylinder may be supported for rotation by rollers extending lengthwise thereof.

If desired, means may be operable to create a slight negative air pressure in the chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal section through apparatus according to the invention.

FIG. 2 is an end elevation of FIG. 1,

FIG. 3 is a view, similar to FIG. 1, of an alternative form of the apparatus,

FIG. 4 is an end view looking in the direction of arrow A, FIG. 3,

FIG. 5 is an end view looking in the direction of arrow B, FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A battery plate is pasted in the usual manner on a conventional plate pasting machine and the damp surfaces of the plate then have a powder applied thereto. Lead powders will usually be used for surface drying the plate and it has been found that when the damp surfaces of a plate are dusted with lead oxide the powder adheres adequately to the plate. Thus use of lead oxide powder has the advantage that during the formation process which electrochemically converts the lead oxide paste to the active material, that is lead dioxide (positive) and sponge lead (negative), the powder becomes part of the active mass of the plate. However, for the purposes of the invention any powder may be used which is not harmful to the performance of the plate when in service and one other form of powder which has been found to be satisfactory is finely divided silica.

Plates so surface dried can immediately be stacked in surface contact with each other without adhesion between the plates. Following the surface drying thereof the plates are transported to a stove in which they are dried for a period of from one to three days under humid conditions to oxidize the major portion of the free lead in the paste and to ensure that the dried paste is crack free.

In one embodiment of the invention it is proposed that surface drying of the plates be effected by suspending the plates from a conveyor as they leave the pasting equipment and then moving the plates by the conveyor through a chamber having a powder, for example lead oxide, laden atmosphere. The chamber may have a recirculating flow of powder-laden air. By moving the plates through this atmosphere both sides of the plates will be covered with the powder.

FIGS. 1 and 2 diagrammatically illustrate one form of apparatus for carrying out the method described above. This apparatus comprises endless conveyor means consisting of parallel chains 1, FIG. 2, from which battery plates 2 having damp pasted surfaces can be suspended vertically by their lugs 3 for movement with the chains 1. A chamber surrounds the chains 1 for a part of the run thereof, see FIG. 1, and includes end plates 4 each provided with an opening 5 for the passage of the chains 1 and battery plates 2 therethrough. The chamber comprises a rotatable cylinder 6, the cylinder being supported for rotation by rollers 7, FIG. 2, which extend lengthwise of the cylinder and which are supported by a frame 8. The end plates

4 are stationary, being fixed to frame 8, and the cylinder 6 is rotatable relative to the end plates 4 on bearings 9, rotation being continuous from a belt 10 driven by a motor 11, FIG. 2.

The chamber has associated therewith powder-tossing means operable to create in the cylinder 6 a powder-laden atmosphere through which plates 2 are moved by the chains 1 so that powder is applied to the damp pasted surfaces of the plates. The powder-tossing means as shown in the drawings consist of vanes 12 which extend into the cylinder 6 from the interior wall 13 of the cylinder. Preferably, the vanes 12 are inclined away from the direction of rotation of the cylinder 6, that is, as shown in FIG. 2, the leading face of each vane forms an acute angle with the interior wall 13 of the cylinder 6.

In operation, continuous rotation of the cylinder 6 ensures that powder falling to the bottom of the cylinder is immediately picked up by the vanes 12 so that a continuous dust-laden atmosphere is maintained in the cylinder. As can be seen from FIG. 1, the vanes 12 do not extend to the ends of the cylinder 6 thus ensuring that the dust laden atmosphere is located at about the midportion of the cylinder and minimizing the chances of powder being discharged from the cylinder through the openings 5. As a further precaution, means, shown as a vacuum pump 14, FIG. 1, may be operable to create a slight negative air pressure in the cylinder.

The alternative embodiment of the apparatus illustrated in FIGS. 3 to 5 is similar to that of FIGS. 1 and 2 but differs therefrom in that the chains 1 are replaced by worm screws 15 supported by bearings 16 on the frame 8 for rotation about their longitudinal axes by a motor 17 and chain or belt 18, FIG. 5, and by the provision in the cylinder 6 of an inverted V-shaped baffle 19. The baffle 19 covers the conveyors 15 and ensures that dust does not fall directly on to the plates 2 but that a sufficient dust cloud is formed in the cylinder to produce a thin even coating on the plates 2.

The apparatus described with reference to FIGS. 1 and 2 is situated so as to follow the pasting machine, not shown, and the pasted plates 2 are transferred from the pasting machine to the chains 1 automatically so that the pasting and surface drying processes are continuous.

I claim:

1. Apparatus for drying pasted battery plates comprising:

a. unitary conveyor means disposed in side-by-side spaced relation to permit damp pasted battery plates to be suspended therefrom, therebetween, and in spaced relation lengthwise thereof;

b. a pair of stationary circular end plates spaced apart lengthwise of the conveyor means and provided with aligned openings through which the conveyor means extend and through which battery plates suspended from the conveyor means can pass;

c. a cylinder rotatable relative to the end plates on bearings arranged peripherally of the end plates; and

d. vanes extending into the cylinder from the interior wall of the cylinder and extending lengthwise of the cylinder in the central region thereof, said vanes being operable to create in the cylinder a powder-laden atmosphere through which battery plates are moved by the conveyor means so that powder is applied to the damp surfaces of the battery plates.

2. Apparatus according to claim 1, wherein the leading face of each vane, considered in the direction of rotation of the cylinder, forms an acute angle with the interior wall of the cylinder.

3. Apparatus according to claim 1, wherein the cylinder is supported for rotation by rollers extending lengthwise thereof.

4. Apparatus according to claim 1, including means operable to create a slight negative air pressure in the cylinder.

5. Apparatus according to claim 1, wherein the conveyor means comprises a pair of worm screws supported for rotation about the longitudinal axes thereof, and driving means operable to effect rotation of the worm screws.

6. Apparatus according to claim 5, including baffle means located in the chamber and arranged to cover the worm screws to prevent dust falling directly on to plates being moved by the worm screws through the chamber.

7. Apparatus according to claim 6, including means operable to create a slight negative air pressure in the chamber.

8. Apparatus according to claim 1, including baffle means located in the chamber and arranged to cover the conveyor means to prevent dust falling directly on to plates being moved by the conveyor means through the cylinder.