Feb. 16, 1954 H. C. WINKEL 2,669,376

GRID PASTING MACHINE

Filed July 8, 1949 5 Sheets-Sheet 1

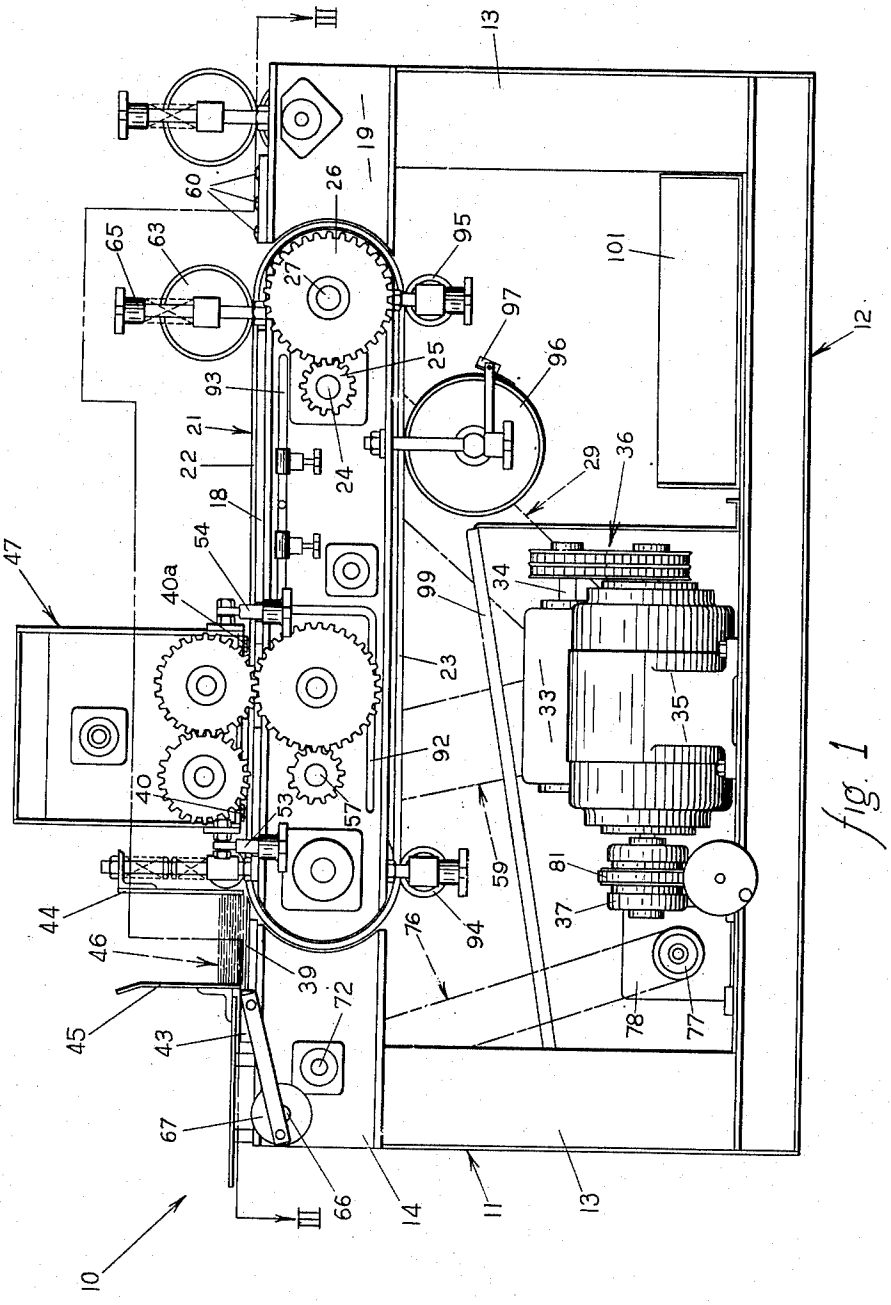


fig. 1

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GRID PASTING MACHINE

Filed July 8, 1949 5 Sheets-Sheet 2

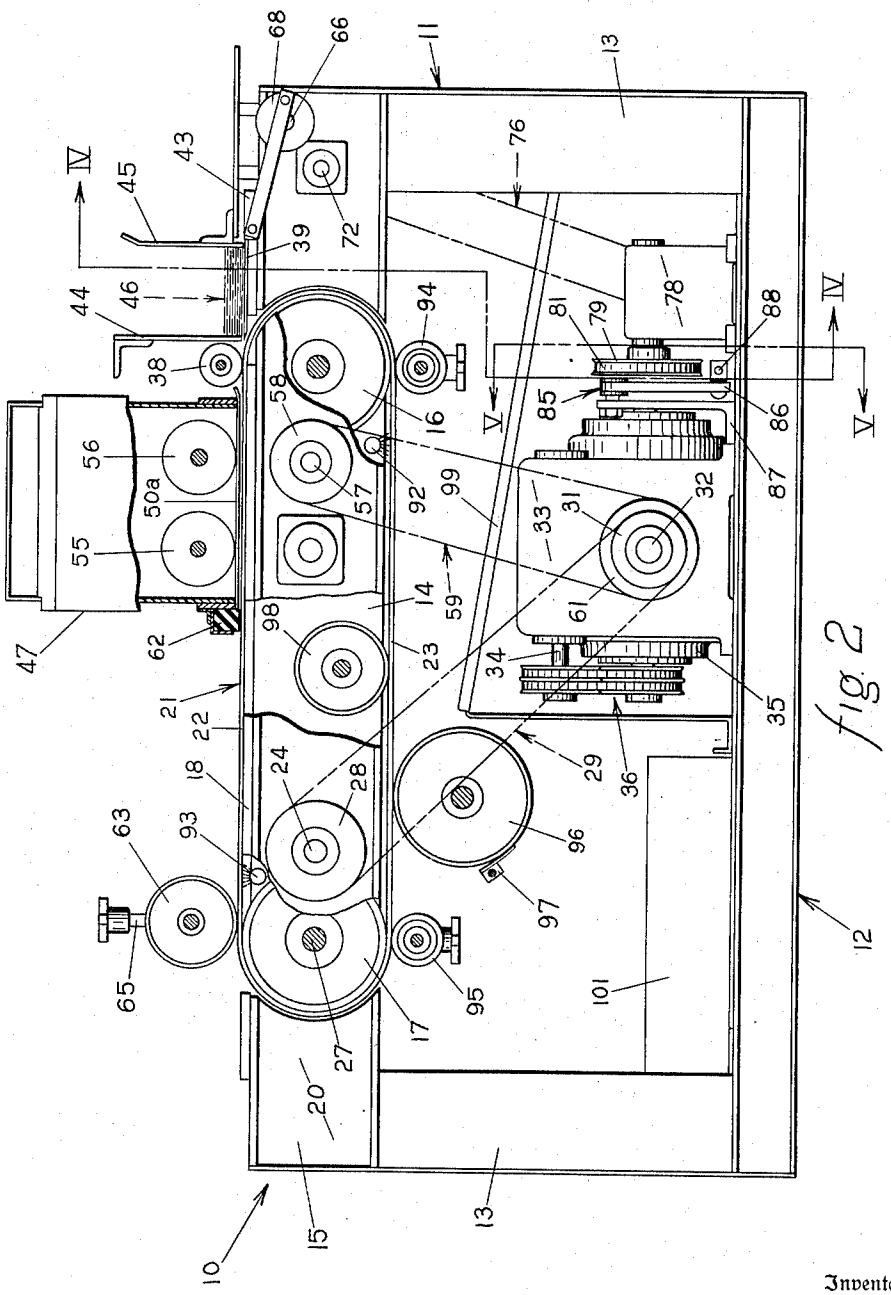


fig. 2

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GRID PASTING MACHINE

Filed July 8, 1949 5 Sheets-Sheet 3

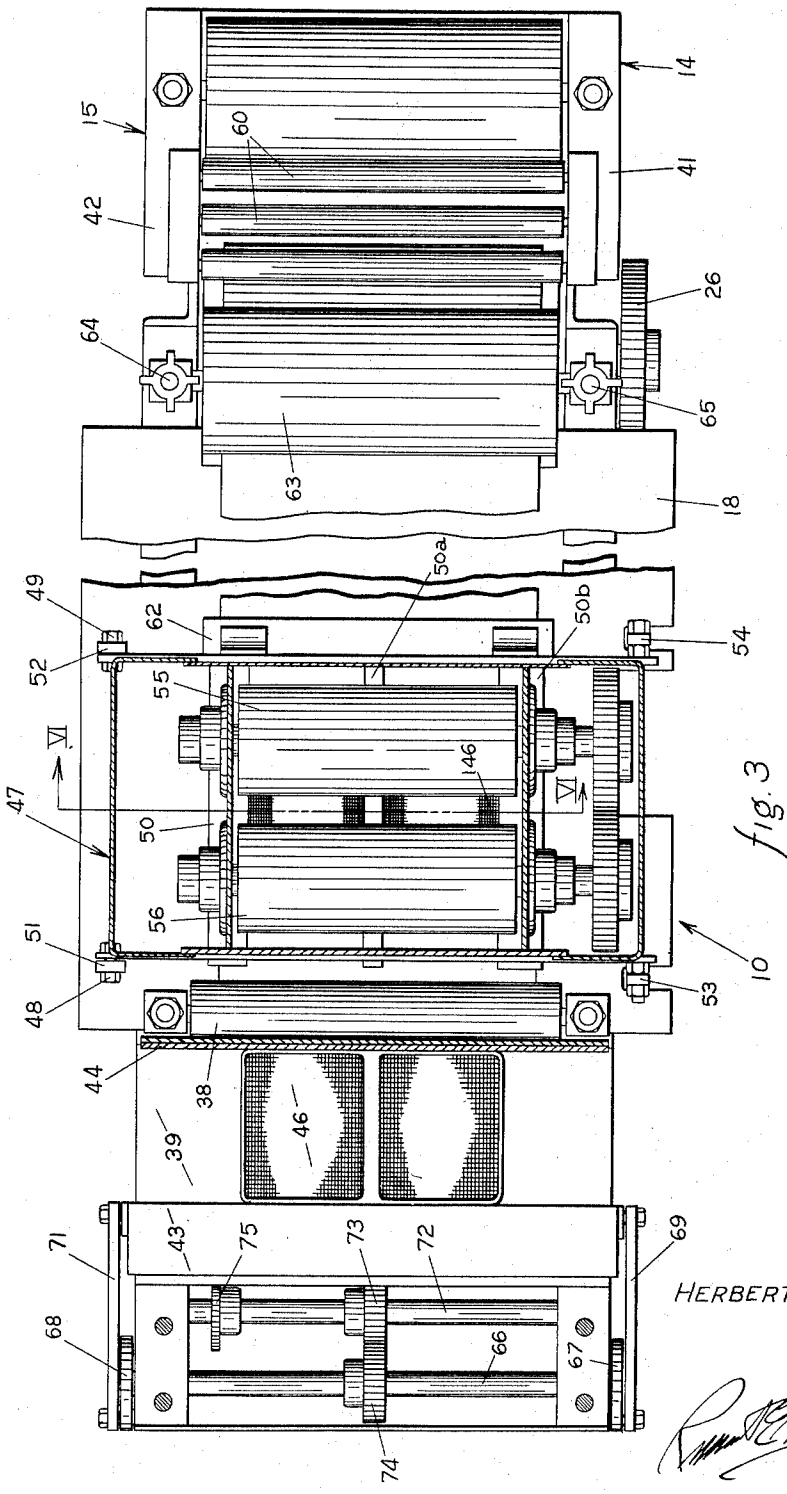


fig. 3

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GRID PASTING MACHINE

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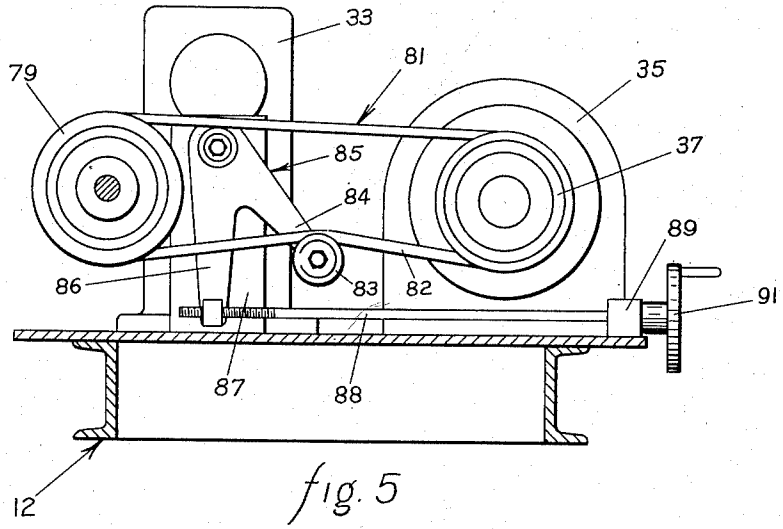


fig. 5

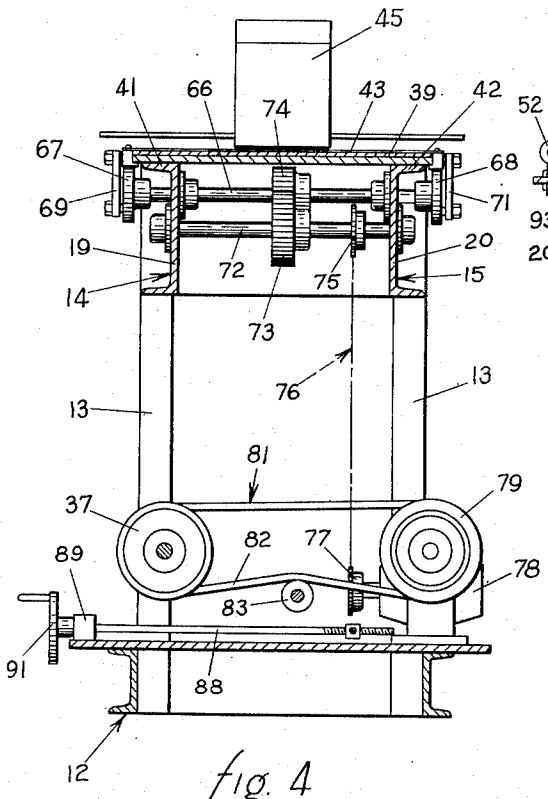


fig. 4

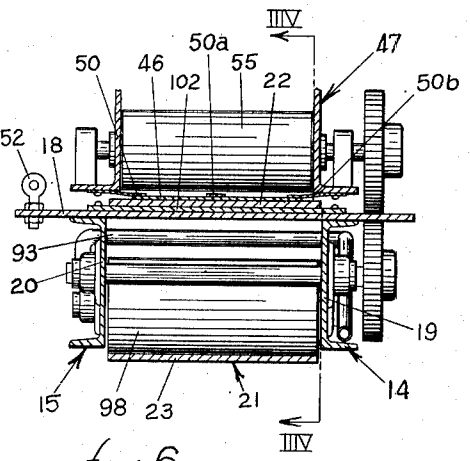


fig. 6

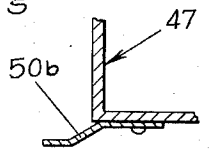


fig. 7

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GRID PASTING MACHINE

Filed July 8, 1949

5 Sheets-Sheet 5

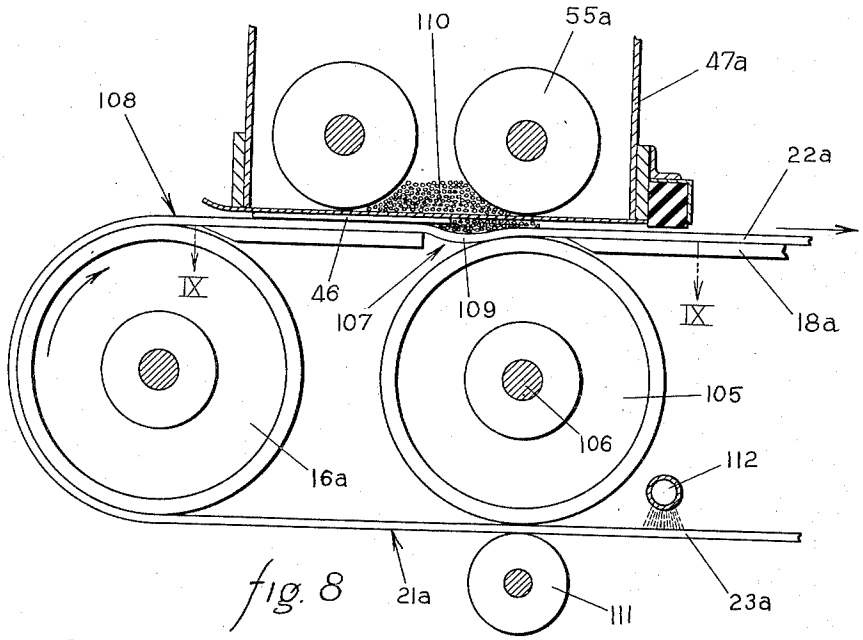


fig. 8

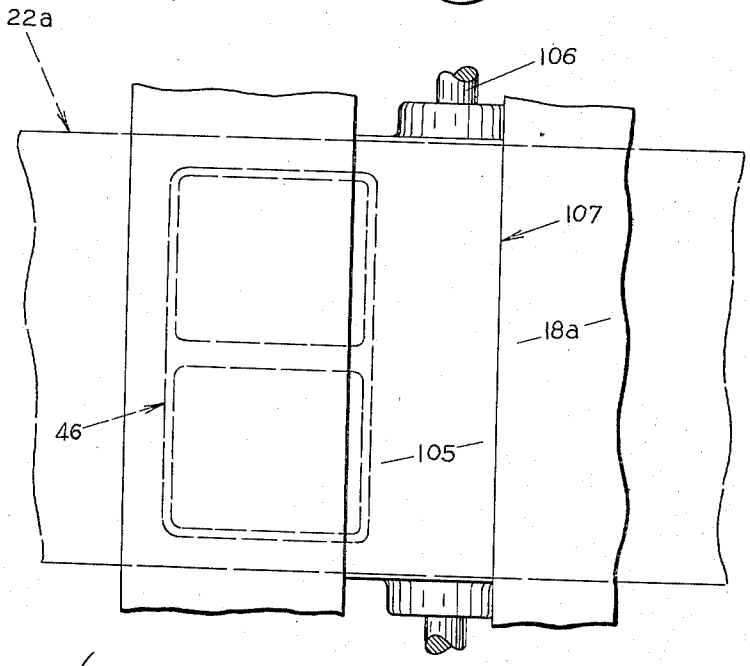


fig. 9

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Patented Feb. 16, 1954

2,669,376

UNITED STATES PATENT OFFICE

2,669,376

GRID PASTING MACHINE

Herbert C. Winkel, Watervliet, Mich.

Application July 8, 1949, Serial No. 103,634

12 Claims. (Cl. 226—39.6)

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This invention relates in general to an improved machine for applying a lead oxide paste to a plurality of cast lead battery grids, and more particularly to a type thereof having an endless conveyor belt upon which the grids are carried as the paste is being applied thereto, said improved machine being so designed and constructed as to reduce materially the waste of paste and the resulting damage to the belt normally incident to this type of machine.

In prior experience with belt-type grid pasting machines, wherein a woven, textile water-absorbent belt conveys freshly filled grids from a filling point to a point of discharge, it has been found that the belt must be kept at the proper degree of dampness, neither too wet nor too dry, in order to minimize the tendency of the paste to stick to the belt and thereby be pulled out of the grids. However, some excess paste will accumulate on the belt even under the most favorable conditions and eventually build up to a point where it materially inhibits the water absorption qualities of the belt. As this progresses, the paste in the grids will not only be pulled out of the grids by direct adherence of the paste to the belt, but also by coherence of the paste in the grids to the paste on the belt. Obviously, the increasing dryness of the belt, due to the displacement of water therefrom by the accumulating paste, contributes substantially to this, progressively accelerating the undesirable process.

Persons familiar with the manufacture and operation of grid pasting machines have, therefore, long recognized the need for means whereby the paste may be applied to the grids without wasting the paste, without having excessive amounts of paste deposited upon the conveyor belt and whereby substantially all of such small amounts of paste as do become deposited upon the belt can be easily removed during the operation of the machine. Thus the belt is kept clean and the finished grids thereby have a better appearance. Further, keeping the belt clean increases the life of the conveyor belt and, accordingly, the output volume of a given machine by reducing the frequency of replacements of the belt, hence reducing the time losses incident to removing the belt from the machine and replacing it with a new one. Therefore, it becomes desirable to provide means whereby the amount of paste accumulating upon the belt is reduced to a minimum and whereby such small amounts of paste as do become deposited upon the belt can be removed therefrom.

I have also discovered that a substantial

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amount of adherence of paste to the belt may be eliminated by the simple expedient of keeping the upper, grid-conveyiing reach of the conveyor belt in a single plane. Where such a conveyor belt passes at its discharge end around a belt drum in the conventional manner, and where the grid is permitted to pass from said belt directly onto a receiving means, a substantial amount of paste is often pulled out of the grid regardless of the precautions taken to maintain the belt clean and at the proper moisture content. By careful study of this situation, however, I have discovered that such paste removal results from a small arching of the belt, where the belt is relatively thick and stiff to provide ample moisture absorption, which arching occurs immediately ahead of its initial point of contact with the belt drum around which it is about to pass. Therefore, by preventing this arching, I have substantially decreased the amount of paste sticking to the belt without abandoning the advantages of ease of use and maintenance incident to a horizontal belt.

In conventional machines of this general type, quantities of paste are sometimes deposited onto the belt in the spaces between successive grids. This causes a waste of paste and constitutes an additional source of paste contamination of the belt. However, in conventional machines it is not usually possible to adjust the grid feeding means with sufficient accuracy to hold the grids closely together on the conveyor belt and eliminate the undesirable spaces therebetween. Therefore, it is desirable to provide means by which the feeding of the grids may be so adjusted that they are closely adjacent to each other on the conveyor belt.

Accordingly, a primary object of my invention is the provision of an improved grid pasting machine having an operational efficiency and a continuous, useful operating life substantially greater than those automatic grid pasting machines presently in use.

A further object of my invention is the provision of an automatic grid pasting machine, as aforesaid, having an endless conveyor belt and means for positively preventing the deposit of excessive amounts of paste upon said belt during the grid pasting operations.

A further object of this invention is the provision of an improved automatic pasting machine, as aforesaid, having means whereby that portion of the belt conveying the pasted grids is maintained in a single plane, thereby diminishing the adherence of paste to the belt.

A further object of the invention is to provide means by which the successive grids may be fed to the conveyor belt so that they are substantially in contact with each other and thereby eliminate the spaces between them through which paste may become deposited directly onto the conveyor belt.

A further object of this invention is the provision of an improved automatic grid pasting machine, as aforesaid, provided with means for removing from the belt such small amounts of excess paste as may be deposited thereon.

A further object of this invention is the provision of an improved grid pasting machine having means permitting the application of paste to grids of a widely varying range of thicknesses, whereby the escape of paste from a paste hopper onto the grid conveying belt is positively prevented regardless of the thickness, within the said range, of the grids.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon referring to the accompanying drawings and upon reading the following specification.

In meeting those objects and purposes heretofore mentioned, as well as others incidental thereto and associated therewith, I have provided an improved, automatic battery grid pasting machine comprising a frame supporting a pair of horizontally spaced substantially parallel drums, around which is extended an endless conveyor belt, the upper reach of which is supported by a flat, metal plate disposed intermediate said drums. A paste hopper supported upon the said frame is positioned above the upper reach of the belt intermediate the ends thereof so that a battery grid can be conveyed upon the belt beneath the paste hopper for application of paste thereto.

A platform for the support of a plurality of unpasted grids is positioned adjacent to one end of the upper reach of the belt and substantially coplanar therewith. Means, reciprocably supported upon the grid platform, is provided for the purpose of advancing one of said plurality of grids at a time from the grid platform onto the upper reach of the belt. Means are provided for driving both the said reciprocable means and the said belt in predeterminable, coordinated movement. Means is also provided for preventing the upper reach of the belt from arching away from the lower reach thereof, as said upper reach approaches and contacts the drum at the discharge end of said conveyor belt. Further, means which are introduced between the two reaches of the belt, are provided for the purposes of depositing a cleaning liquid, such as water, upon the opposed, inner surfaces of both upper and lower reaches of the belt, both for the purpose of moistening the belt and for the purpose of removing excess paste from within the pores and upon the belts.

For illustrations of a preferred embodiment of my invention reference is made to the accompanying drawings in which:

Figure 1 is a front elevation view of my improved automatic grid pasting machine.

Figure 2 is a broken rear elevation view of my grid pasting machine.

Figure 3 is a broken sectional view taken along the line III—III of Figure 1.

Figure 4 is a sectional view taken along the line IV—IV of Figure 2.

Figure 5 is a sectional view taken along the line V—V of Figure 2.

Figure 6 is a sectional view substantially as taken along the line VI—VI of Figure 3.

Figure 7 is a fragmentary, enlarged view of a portion of Figure 6.

Figure 8 is a sectional view of an alternate structure of my invention substantially as taken along the line VIII—VIII of Figure 6.

Figure 9 is a sectional view taken along the line IX—IX of Figure 8 including a broken line showing of a grid and a fragment of the conveyor belt.

Construction

As shown in Figures 1, 2 and 4, the grid pasting machine 10 is comprised of a frame 11 having a base 12, a plurality, such as four, of upstanding legs 13 supported upon and secured at their lower ends to said base. A pair of spaced, parallel channel-shaped beams 14 and 15 are secured to and supported upon the upper ends of the legs 13 so that the webs 19 and 20 thereof are substantially parallel and the flanges thereof extend in opposite directions.

For the purpose of convenience in description the terms "leading" and "trailing" as used in this specification shall be understood to have reference to the leftward and rightward ends of the grid pasting machine 10, respectively, as appearing in Figures 1 and 3. The terms "upper" and "lower" shall be understood to refer to the device when positioned and/or operating in its normal manner of use.

A pair of parallel, horizontally spaced belt drums (Figure 2), hereinafter referred to as the leading drum 16 and trailing drum 17, are rotatably supported upon and between the webs 19 and 20 of the channel beams 14 and 15, respectively, near the leading and trailing ends thereof, respectively.

A belt support plate 18 is secured to and upon the upper flanges 41 and 42 of the channel beams 14 and 15, respectively, between the drums 16 and 17. The drums are preferably so mounted upon the beams 14 and 15 that they are tangent with the plane defined by the upper surface of the belt plate 18. An endless conveyor belt 21 which extends tightly around both the leading and trailing drums 16 and 17, respectively, has an upper reach 22, which is supported upon the belt plate 18, and a lower reach 23. The conveyor belt 21 is preferably, but is not necessarily, fabricated from a tightly woven, textile fabric in a conventional manner and, therefore, is reasonably stiff. Accordingly, the drums 17 and 18 must be sufficiently large in diameter to permit turning of the belt 21 therearound without subjecting the belt to undue bending strains.

It will be noted that the drums must further be of sufficiently large diameter that there will be no perceptible tendency for the outer surface of the belt to creep with respect to the inner surface of the belt as said belt moves around the drums. Such creeping produces an action which tends to damage the pasted grid.

A drum jack shaft 24 (Figures 1 and 2) is rotatably supported upon and between the webs 19 and 20 parallel with and adjacent to the trailing drum 17. A drum driving gear 25, which is secured to that end of the jack shaft 24 extending through the web 19, engages and drives the drum driven gear 26, which is secured to the trailing drum shaft 27, whereby the trailing drum 17 may be rotated.

A sprocket 28 (Figure 2), which is secured to that end of the drum jack shaft 24 extending through and beyond the web 20, is operably en-

gaged by a drum chain 29 which in turn engages the gear box driven sprocket 31. This driven sprocket 31 is mounted upon and secured to the driven sprocket shaft 32 of the drum gear box 33. The gear box 33 is preferably positioned upon the base 12 so that the driven sprocket 31 (Figure 2) is properly aligned with the jack shaft sprocket 28. The driving shaft 34 of the gear box 33 is driven by suitable constant speed means, such as the electric induction motor 35 (Figure 1), which is positioned adjacent to the gear box 33 of the base 12, by means of a conventional pulley and belt assembly 36. The electric motor 35 is preferably of the type having a shaft extension from both axial ends thereof, and a variable pitch pulley 37 of a conventional type is mounted on that shaft extension of the motor 35 remote from the pulley and belt assembly 36.

A pressure roll 38, which may be fabricated with a rubber covering, is vertically adjustably and resiliently mounted upon the belt plate 18 at the leading end thereof so that it is axially parallel with the leading drum 16 and vertically aligned therewith. The pressure roll 38 is resiliently pressed against and rotates with the conveyor belt 21 for the purpose of holding a grid thereagainst as it moves thereon.

A grid supporting platform 39 is supported upon the flanges 41 and 42 of the channel beams 14 and 15, respectively, adjacent to the leading end of the upper reach 22 of the conveyor belt 21 so that the upper surface of the grid supporting platform 39 is substantially coplanar with the upper surface of the upper reach 22. A grid feed bar 43, which is perpendicularly disposed with respect to the beams 14 and 15, is slidably supported upon the grid supporting platform 39 for reciprocable movement toward and away from the leading end of the belt upper reach 22.

A fixed, vertical, grid guide plate 44 is supported upon the belt plate 18 on that side of the pressure roll 38 adjacent to the grid supporting platform 39. An adjustable, vertical grid guide plate 45 is supported upon the upper flanges 41 and 42 between the fixed guide plate 44 and the leading ends of the beams 14 and 15 for movement toward and away from the fixed guide plate 44. The fixed guide plate 44 and the adjustable guide plate 45 are so disposed with respect to each other that a plurality of battery grids 46 can be placed in a pile between the plates 44 and 45 upon the grid platform 39. The lower edge of the fixed guide plate 44 is preferably spaced above the plane of the upper surface of the grid supporting platform 39 so that the grid feed bar 43 can advance one battery grid 46 at a time from the platform 39 onto the upper reach 22 of the conveyor belt 21 beneath the lower edge of the fixed guide plate 44.

A paste hopper 47 (Figure 3) is hingedly and vertically adjustably supported upon the belt plate adjacent to the pressure roll 38, and is spaced above the upper reach 22 of the conveyor belt 21 so that a battery grid 46 may be conveyed on said upper reach 22 beneath the paste hopper 47. The paste hopper 47 is hinged upon the belt plate 18 adjacent to the channel beam 15 by means of the hinge bolts 48 and 49 and the hinge posts 51 and 52, respectively. As shown in Figure 6 with respect to hinge post 52, both hinge posts are mounted upon the belt plate 18 for vertical adjustment with respect thereto. The opposite side of the hopper 47 is securable to the belt plate 18 by means of the toggle bolt clamps 53 and 54 adjacent to the channel beam 14. A pair of vertically adjustable hopper support bolts 40 and 40*a* (Figure 1) are threadedly secured to the top of the belt plate 18 for engaging and supporting that side of the hopper 47 to which the toggle bolts 53 and 54 are secured. Thus, the vertical position of the hopper 47 with respect to the belt 21 can be varied within limits by appropriate vertical adjustment of the hopper support bolts 40 and 40*a* and the hinge posts 51 and 52.

A pair of parallel, horizontally spaced mixing rolls 55 and 56 (Figure 2), which are preferably axially parallel with each other and with the pressure roll 38, are rotatably supported within the paste hopper 47. A hopper jack shaft 57, which is rotatably supported upon and between the webs 19 and 20, is substantially, axially parallel with said mixing rolls. The mixing rolls 55 and 56 are geared to each other, as well as to that end of the hopper jack shaft 57 extending through the web 19, by means of appropriate interengaging gears. A hopper sprocket 58, which is supported upon and rotatable with that end of the hopper jack shaft 57 extending through the web 20, is engaged by a hopper chain 59 which in turn engages and is driven by the driven sprocket 61. The sprocket 61 is mounted upon the driven sprocket shaft 32 of the gear box 33, adjacent to the gear box driven sprocket 31.

A plurality, here three, of flexible, paste control strips 50, 50*a* and 50*b* (Figures 2, 3, 6 and 7) which are parallel with each other as well as with the beams 14 and 15, are adjustably and removably secured to the bottom of the paste hopper 47 across the opening therethrough and adjacent to the upper reach 22 of the belt 21. These flexible strips guide the paste into the interstices in the grids and positively prevent contamination of the lands surrounding the interstices, as the grids pass beneath the hopper 47. The strips 50, 50*a*, and 50*b*, as shown in Figure 2 with respect to strip 50*a* and in Figure 7 with respect to the strip 50*b*, are shaped to permit a substantial range of vertical flexion. Thus, the strips can maintain control of the paste flow from the hopper onto grids of widely varying thicknesses without necessitating vertical adjustment of the hopper 47.

A squeegee bar 62 (Figure 2), which may be fabricated from sponge rubber and extends completely across the conveyor belt 21, is mounted upon the side of the paste hopper 47, near the bottom thereof, remote from the pressure roll 38. Said squeegee bar 62 is preferably positioned so that it sweeps the upper surface of the upper reach 22.

A belt flattening roll 63 (Figures 1 and 2) is rotatably and vertically adjustably supported upon the vertical support posts 64 and 65 above the trailing end of the upper reach 22 of the conveyor belt 21. Resilient means are provided on said support posts for urging said flattening roll downwardly against the belt 21. The axis of the flattening roll 63, which is preferably parallel with the axis of the trailing drum 17, is spaced from a vertical line through the axis of said trailing drum in a direction toward the leading edge of the upper reach 22 of the conveyor belt 21. Thus, the flattening roll 63 engages the upper reach 22 just before the upper reach contacts the trailing drum 17, thereby preventing arching of that portion of the upper reach away from the lower reach 23.

A feed bar actuating shaft 66 (Figures 2, 3 and 4) is rotatably supported upon and between the webs 19 and 20 adjacent to the leading ends thereof so that it is substantially axially parallel

with the leading drum 16, and so that it extends through both of the said webs. A pair of feed bar actuating disks 67 and 68 are secured to and rotatable with the extended ends of the feed bar actuating shaft 66. A pair of connecting rods 69 and 71 are pivotally secured at one end of each, respectively, to the feed bar actuating disks 67 and 68 near the perimeters thereof. The other ends of the connecting rods 69 and 71 are pivotally secured to the opposite lateral ends, respectively, of the grid feed bar 43. Thus, rotation of the actuating disks 67 and 68 is translated into reciprocable motion of the feed bar 43 along the grid support platform 39 by means of the connecting rods 69 and 71.

A feed bar jack shaft 72 (Figures 2, 3 and 4) is rotatably supported upon and between the leading ends of the webs 19 and 20 adjacent to, and preferably parallel with, the feed bar actuating shaft 66. A gear 73 mounted upon and rotatable with the feed bar jack shaft 72 engages a gear 74 mounted upon and rotatable with the feed bar actuating shaft 66 for the purpose of driving same.

A feed bar sprocket 75 (Figures 3 and 4), which is mounted upon and rotatable with the feed bar jack shaft 72, is engaged by a feed bar chain 76 which also engages the gear box sprocket 77 which is rotatably supported upon and by the feed bar gear box 78. The feed bar gear box 78 is mounted upon the platform base 12 near the drum gear box 33 and rotatably supports a gear box pulley 79 which is radially aligned with the variable pitch pulley 37 mounted on the motor 35. The sprocket 77 may be provided with any conventional slip clutch, not shown, for preventing damage to the grid feed bar 43 and associated mechanism in the event that a grid becomes jammed during advancement from the grid platform 39 onto the belt 21 or thereafter.

The gear box pulley 79 and variable pitch pulley 37 are mutually engaged by an appropriate pulley belt 81 (Figure 5). The lower reach 82 of the pulley belt 81 is rotatably engaged by an adjustment pulley 83 which is rotatably supported upon the free end of the pulley arm 84 of the pitch adjusting fork 85. That end of the pulley arm 84 remote from the adjustment pulley 83 is joined by, and preferably integral with, an adjustment arm 86 which is preferably, but not necessarily, disposed at an angle of approximately 35 degrees to the said pulley arm. The pitch adjusting fork 85 is pivotally supported at the junction of the pulley and adjustment arms upon a support bracket 87 (Figure 5), which is mounted upon and secured to the platform base 12 approximately between the gear box 33 and the gear box 78.

The pitch adjusting fork 85 is normally positioned so that the pulley and adjustment arms 84 and 86, respectively, are substantially below the pivot point of the pitch adjusting fork 85 upon the support bracket 87. The free end of the adjustment arm 86, remote from the said pivot point, is threadedly engaged by a substantially horizontal adjustment rod 88 which is preferably rotatably supported upon the platform base 12 by means of the rod support post 89. The adjustment pulley, hence the pulley arm 84, is preferably disposed between the adjustment arm 86 and the support post 89.

That end of the adjustment rod 88, remote from the end thereof engaged by the adjustment arm 86, is engaged by and secured to a crank 91 of any convenient, conventional type. Accordingly, rotation of the adjustment rod 88 by means of the crank 91 causes the pitch adjusting fork 85 to pivot upon the support bracket 87 toward or away from the rod support post 89. Such pivotal movement of the pitch adjusting fork 85 effects a generally upward or downward movement of the adjustment pulley 83 with respect to the platform base 12 and the lower reach 82 of the pulley belt 81 with which said pulley 83 is engageable. Such movement of the adjustment pulley 83 tends to change the effective length of the belt 81 which in turn results in a comparable change in the pitch diameter of the variable pitch pulley 37 within standard, conventional limitations.

Liquid conducting pipes 92 and 93 (Figures 2 and 6) are introduced into the space between the webs 19 and 20 and the upper and lower reaches of the conveyor belt 21 for the purpose of depositing a liquid, such as water, upon the inner, opposed surfaces of both reaches of the belt 21, intermediate the trailing drum 17 and the leading drum 16. The pipe 92 is preferably disposed parallel with and adjacent to both the lower reach 23 and the leading drum 16 for depositing said water upon the upper surface of said lower reach just before it passes around the drum 16. The pipe 93 is preferably disposed parallel with and adjacent to both the upper reach 22 and the trailing drum 17 for depositing said water upon the lower surface of said upper reach just before it passes around the drum 17. Thus, the water so deposited upon said upper and lower reaches is urged therethrough as said reaches pass around the drums 17 and 16, respectively. In this way, the water is urged through the belt from the side opposite that onto which the paste was originally applied and hence its cleaning action is very effective.

A pair of presser rolls 94 and 95 (Figures 1 and 2) are rotatably supported below and against the leading and trailing ends, respectively of the lower reach 23 of the conveyor belt 21. The presser rolls 94 is axially aligned with and disposed vertically below the leading drum 16 and the presser roll 95 is axially parallel with and disposed vertically below the trailing drum 17.

A belt tightening roll 96 is rotatably supported upon and below the beams 14 and 15 so that it is axially aligned with and near to the trailing drum 17 and engages the lower surface of the lower reach 23 of the conveyor belt 21 intermediate the leading and trailing ends thereof. The tightening roll 96 is vertically adjustable so that upward movement thereof causes the conveyor belt 21 to be stretched more tightly around the drums 16 and 17. A tightening roll wiper 97 is supported adjacent to the tightening roll 96 for sweeping the surface thereof as said tightening roll is rotated as a result of its contact with the lower reach 23 of the conveyor belt 21. Thus, any moisture and/or paste removed by said tightening roll 96 from the conveyor belt 21 is removed from the tightening roll 96 by the wiper 97. An idling roll 98 is rotatably supported upon and between the webs 19 and 20 approximately midway between the leading drum 16 and the trailing drum 17 for engaging the upper surface of the lower reach 23 of the conveyor belt 21. The idling roll 98 assists in controlling the movement of the lower reach 23 and assists the tightening roll 96 in effecting control of the tightness of the conveyor belt 21.

A drain trough 99 and drain pan 101 are provided within the frame 11 between the platform base 12 and the channel beams 14 and 15 for the

purpose of catching and collecting both moisture and excess paste removed from the conveyor belt 21 as said conveyor belt passes between the trailing drum 17 and the leading drum 16.

A belt shim 102 (Figure 6), which may be fabricated from metal plate, may be secured to the top of the belt plate 18 substantially throughout the length and width thereof for raising the level of the upper reach 22 of the belt 21 when it becomes desirable to paste grids of thickness less than the range of grid thickness to which the pasting machine is normally adaptable without changing the vertical adjustment of the hinge posts 51 and 52 and the hopper support bolts 49 and 40*a*.

Alternate structure

As shown in Figures 8 and 9, a pressure roll 105 is rotatably supported upon the shaft 106 between the upper and lower reaches 22*a* and 23*a*, respectively, of the endless conveyor belt so that it extends upwardly into the slot 107 in the belt plate 18*a* and is substantially tangent with the upper surface thereof.

The pressure roll 105, which is preferably equal in diameter to the leading drum 16*a*, is axially parallel with, and disposed directly below, the mixing roll 55*a* in the paste hopper 47*a*, which hopper may be substantially identical to the paste hopper 47.

The slot 107, which is at least as wide as the hopper 47*a*, extends toward the leading end 108 of the upper reach 22*a* from the upper surface of the pressure roll 105 a substantial distance, such as approximately three inches, thereby permitting a downward flexion 109 (Figure 8) of the upper reach 22*a* by the paste 110 between the leading edge of the slot 107 and the pressure roll 105.

The lower reach 23*a* passes between the pressure roll 105 and a presser roll 111, which is axially parallel with, and disposed directly below, the pressure roll 105.

A liquid conduit 112, which may be substantially identical to the pipe 92, is disposed adjacent to the lower reach 23*a* and the pressure roll 105 on the rightward, or trailing, side thereof, as appearing in Figure 8.

Operation

As shown in Figures 1, 2 and 5, energization of the motor 35 effects a constant speed actuation of the gear box 33 through the pulley and belt assembly 36 and an adjustable speed actuation of the gear box 78 through the pulley belt 81. The trailing, or driving drum 17 is rotated at a constant speed by the gear box 33 through the driven sprocket 31, the chain 29, the sprocket 28 and the jack shaft 24. Such rotation of the trailing drum 17 effects rotation of both the conveyor belt 21 and the leading drum 16.

Actuation of the gear box 33 also effects rotation of the mixing rolls 55 and 56 in the paste hopper 47 (Figure 2) through the sprocket 61, the chain 59, the sprocket 58 and the appropriate interengagement of gears associated with the mixing rolls 55 and 56 and the jack shaft 57.

In synchronization with the rotation of the mixing rolls 55 and 56 and rotation of the conveyor belt 21, the feed bar gear box 78 effects reciprocable motion of the grid feed bar 43 from the sprocket 77, through the chain 76, the sprocket 75, the gears 73 and 74, the jack shaft 72, the actuating shaft 66, the actuating disks 67 and 68, and the connecting rods 69 and 71. The paste hopper 47 may be provided with a mixing paddle or other means, not shown, in any conventional manner, for keeping the paste within the said paste hopper in continuous agitation.

Accordingly, as the conveyor belt 21 moves around the drums 16 and 17 the grid feed bar 43 advances one grid 46 at a time from its position upon the grid supporting platform 39 onto the leading end of the upper reach 22 of the conveyor belt 21. The grid is conveyed by the belt 21 beneath both the lower edge of the fixed guide plate 44 and the pressure roll 38. The conveyor belt 21 then moves the battery grid 46 under the paste hopper 47 (Figure 3) where the mixing rolls 55 and 56 squeeze the paste into the interstices in the grid 46. As the pasted grid passes under the trailing end of the paste hopper 47, the squeegee bar 62 secured thereto wipes the excess paste from the upper surface of the grid. The conveyor belt 21 moves the pasted grid until it passes under the flattening roll 63 where it is thereafter released from the upper reach 22 onto any convenient, conventional means, such as the conveyor rolls 60.

With the flattening roll 63 preventing the arching of the conveyor belt immediately ahead of the trailing roll 17, and also assuring the clean and positive separation of the grid from the belt, there is substantially less paste pulled from the grid by and onto the belt than when such roll is not used. Its pressure should be only sufficient to prevent the said arching and thereby confining that portion of the upper reach of the belt 21 conveying pasted grids to a substantially unbroken plane up to the point that it actually commences to turn around the trailing roll 17.

The flexible paste control strips 50, 50*a* and 50*b* adjustably secured to the bottom of the hopper 47 control the application of the paste to the grid as it passes beneath the paste hopper 47. However, the spacing of one grid with respect to an adjacent grid as said grids are advanced from the grid platform 39 onto the conveyor belt 21 is controlled by the speed of reciprocation of the feed bar 43 with respect to the lineal speed of the conveyor belt 21. The lineal speed of the conveyor belt being constant, such spacing is varied by adjusting the speed of reciprocating of said feed bar 43. This is accomplished by adjustment of the vertical position of the adjustment pulley 83.

The spacing between the individual grids upon the conveyor belt 21 can thus be increased or decreased, respectively, by moving the pulley 83 upwardly or downwardly, which results in slowing down or speeding up the grid bar gear box 78. Thus, as shown in Figure 5, if it becomes desirable to reduce the spacing between the individual grid upon the conveyor belt 21, the crank 91 on the adjustment rod 88 is rotated in the appropriate direction so that the adjustment pulley 83 is lowered thereby increasing the pitch diameter of the variable pitch pulley 37 which in turn effects a speed-up of the feed gear box 78, thereby increasing the speed of reciprocation of the grid feed bar 43. The space between the individual grids is increased by rotating the crank 91 in the opposite direction.

Water deposited upon the upper reach 22 of the conveyor belt 21 by the pipe 93 is urged, at least partially, through the upper reach by the trailing drum 17. As the water is thus squeezed through the porous belt, excess paste imbedded in the pores of the belt or adhering to the surface thereof is urged therefrom by said water

and carried away therewith. The presser roll 95 removes the excess moisture from the conveyor belt 21 by pressing said conveyor belt against the trailing drum 17 as the said belt passes therebetween. Water may be deposited upon the lower reach 23 by the pipe 92 and is urged through the lower reach by the leading drum 16 thereby removing such paste as may be adhering to said belt after it passes between the trailing drum 17 and presser roll 95. The presser roll 94, by holding the conveyor belt 21 tightly against the leading roll 16, removes excess moisture from the lower reach and also improves the positiveness of the driving of said belt. As the said excess moisture and paste are removed, they may drop into the drain trough 99 and/or the drain pan 101.

It will be observed that the means, including the pitch adjusting fork 85 and its associated parts, whereby the spacing between individual grids on the conveyor belt 21 may be controlled, is so constructed that the change in spacing can be effected while the machine is in operation.

Since the length, hence the tightness of the conveyor belt 21 will vary both with use and with variation in moisture content, the tightening roll 96 is also mounted for adjustment while the belt 21 is moving.

The adjustable guide plate 45 can be moved toward and away from the fixed guide plate 44, within limitations, for adaptation to battery grids of various sizes. Likewise the paste control strips 50, 50*a* and 50*b* under the paste hopper 47 can also be either adjusted or replaced to meet the requirements for various sizes of grids.

The elevation of the hopper 47 with respect to the belt 21 may be altered either by insertion of the belt shim 102 between the belt plate 18 and the upper reach 22, substantially throughout the length thereof, or by adjustment of the hinge posts 51 and 52 and the hopper support bolts 40 and 40*a*.

In the alternate structure (Figures 8 and 9), the pressure roll 105 effects a positive filling of the interstices in that surface of the grid 46 bearing against the upper reach 22*a*. That portion 109 of the upper reach 22*a* passing over the slot 107, is flexed downwardly by the paste 110 within the hopper 47*a*, thereby permitting paste to pass through and to accumulate below the grid 46 (Figure 8) as said grid passes over the slot 107. As the upper reach 22*a* and the grid 46 thereon pass over the pressure roll 105, the said accumulation of paste is urged upwardly into the interstices in the lower side of the grid, thereby effecting a complete application of paste to the grid without bending the grid wires, which bending otherwise generally occurs.

The liquid conduit 112, in combination with the pressure roll 105 and the presser roll 111, effects a cleaning action on the lower reach 23*a* substantially identical to the cleaning action described above with respect to the pipe 92.

Although the above mentioned drawings and description apply to one particular, preferred embodiment of the invention, it is not my intention, implied or otherwise, to eliminate other variations or modifications which do not depart from the scope of the invention unless specifically stated to the contrary in the hereinafter appended claims.

I claim:

1. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: a flexible conveyor; a platform adjacent to one end of said conveyor; a reciprocable feed bar for advancing said grids, one at a time, from said platform onto said conveyor and power driven means effecting reciprocation of said bar; means effecting unidirectional movement of said conveyor; adjustable driving means including a variable pitch pulley, a fixed pitch pulley, a belt encircling said pulleys and manually controllable means for displacing a reach of said belt, associated with said driven means and controlling the speed of said reciprocation independently of the movement of said conveyor; a hopper and means supporting same above said conveyor; means resiliently resisting upward flexion of said conveyor, means positively resisting downward flexion of said conveyor along a line perpendicular thereto and beneath said hopper; means within said hopper for forcing paste into said grids; and means secured to the bottom of said hopper for controlling the application of paste to said grids.

2. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: an endless, porous belt having upper and lower courses; a platform adjacent to one end of said upper course and substantially co-planar therewith; a reciprocable feed bar for advancing said grids, one at a time, from said platform onto said upper course and power driven means effecting reciprocation of said bar; means effecting unidirectional movement of said upper course; adjustable driving means, including a variable pitch pulley, a fixed pitch pulley, a belt encircling said pulleys and manually controllable means for displacing a reach of said belt, associated with said driven means and controlling the speed of said reciprocation independently of the movement of said upper course; a hopper and means adjustably supporting same above said upper course near one end thereof; means resiliently resisting upward flexion of said upper course, means positively resisting downward flexion thereof along a line perpendicular thereto and beneath said hopper; rollers within said hopper, cooperable with said means resisting downward flexion of the upper course, for forcing paste into said grids; and means secured to the bottom of said hopper for controlling the application of paste to said grids.

3. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: a pair of parallel, horizontally spaced, rotatable drums and an endless, porous belt extending around said drums and having upper and lower reaches; a platform adjacent to one end of said upper reach and substantially co-planar therewith; a reciprocable feed bar for advancing said grids, one at a time, from said platform onto said upper course and power driven means effecting reciprocation of said bar; means effecting rotation of said drums; and adjustable driving means including a variable pitch pulley, a fixed pitch pulley, a belt encircling said pulleys and manually controllable means for displacing a reach of said belt, associated with said driven means and controlling the speed of said reciprocation independently of the rotation of said drums; a hopper and means adjustably supporting same above said upper course near one end thereof; means resiliently resisting upward flexion of said upper course near the other end thereof, means

resisting downward flexion of said upper course along a line perpendicular thereto and beneath said hopper; rollers within said hopper, cooperable with said means resisting downward flexion of the upper course, for forcing paste into said grids; and means secured to the bottom of said hopper for controlling the contact of said grids by said paste.

4. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: an endless, porous belt having upper and lower courses; a platform adjacent to one end of said upper course and substantially co-planar therewith; means effecting unidirectional movement of said upper course; means for advancing said grids, one at a time, from said platform onto said upper course, a hopper and means yieldably resisting upward flexion of said upper course near one end thereof, said last-named means including three spaced strips longitudinally arranged with respect to the direction of movement of said conveyor and positioned on the under side of said hopper, one thereof being located midway between the sides of said hopper and each of the other two thereof being affixed by their mutually remote longitudinal sides to said hopper and distorted along their respectively opposed edges for resiliently engaging the upper surface of the respective lateral edges of a battery grid resting on said upper course; and means supporting said conveyor below said hopper and so spaced from said hopper as to hold a battery grid on the surface thereof snugly against said three strips.

5. In a machine for automatically applying paste to a plurality of battery grids, the combination comprising: a conveyor including a pair of parallel, horizontally spaced, rotatable rollers and an endless porous belt extending around said rollers and having upper and lower reaches; a first of said rollers being adjacent the feeding end of said conveyor and a second of said rollers being adjacent the discharge end of said conveyor; a third roller adjacent said second roller, disposed with its axis parallel to the axis of said second roller and positioned to engage said conveyor adjacent its point of tangency with said second roller but spaced from said point toward said first roller a distance sufficient to prevent arching of said conveyor belt, said distance being less than the radius of said second roller; grid supply means adjacent said feeding end of said conveyor supplying battery grids thereto and paste supply means located between said grid supply means and said third roller for forcing paste into said grids.

6. The device described in claim 5 having also means for discharging a quantity of cleansing liquid against the under side of said conveyor belt, said cleansing fluid contacting said conveyor belt at a point spaced toward said first roller from said third roller a distance sufficient that said liquid substantially penetrates said belt prior to its point of tangency with said second roller.

7. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: a flexible conveyor, and a hopper disposed thereabove; a platform adjacent to one end of said conveyor; reciprocable means for advancing a grid from said platform onto said conveyor and driven means effecting such reciprocation; means effecting unidirectional movement of said conveyor; adjustable driving means, including a variable pitch pulley, a fixed pulley, a belt encircling said pulleys and manually controllabe means for displacing a reach of said belt, associated with said driven means and controlling the speed of said reciprocation independently of the movement of said conveyor; means resiliently resisting upward flexion of said conveyor, means positively resisting downward flexion thereof beneath said hopper; and means within said hopper for effecting controlled application of paste to said grids.

8. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: a pair of parallel, horizontally spaced, rotatable drums and an endless belt extending around said drums and having upper and lower reaches; a platform adjacent to one end of said upper reach and substantially co-planar therewith; feeding means for advancing said grids, one at a time, from said platform onto said upper course and power driven means effecting operation of said feeding means; means effecting rotation of said drums; and adjustable driving means including a variable pitch pulley, a fixed pitch pulley, a belt encircling said pulleys and manually controllable means for displacing a reach of said belt, associated with said driven means and controlling the speed of operation of said feeding means independently of the rotation of said drums; a hopper and means adjustably supporting same above said upper course near said one end thereof; means resisting downward flexion of said upper course along a line perpendicular thereto and beneath said hopper; rollers within said hopper, cooperable with said means resisting downward flexion of the upper course, for forcing paste into said grids; means secured to the bottom of said hopper for controlling the contact of said grids by said paste.

9. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: a conveyor comprising an endless belt having upper and lower courses; a platform adjacent to one end of said upper course and substantially co-planar therewith; means effecting unidirectional movement of said upper course; feeding means for advancing said grids, one at a time, from said platform onto said upper course and power driven means driving said feeding means; a hopper and means resisting upward flexion of said upper course near one end thereof, said last-named means including at least three spaced strips longitudinally arranged with respect to the direction of movement of said conveyor and positioned on the under side of said hopper, one thereof being located between the sides of said hopper and each of the other two thereof being affixed to said hopper for resiliently engaging the upper surface of the respective lateral edges of a battery grid resting on said upper course; means supporting said conveyor below said hopper and so spaced from said hopper as to hold a battery grid on the surface thereof snugly against said three strips; rollers within said hopper cooperable with said conveyor supporting means for forcing paste into said grids.

10. The device described in claim 9 having also: rollers at each end of said belt for supporting and driving same; means for discharging a quantity of cleaning fluid against the underside of said conveyor belt, said means being positioned so that said cleaning fluid will contact said con-

veyor belt at a point spaced toward said hopper from the discharge end of said conveyor a distance sufficient that said liquid will substantially penetrate said belt prior to its point of tangency with the roller supporting and driving said belt at said discharge end.

11. The combination defined in claim 9 including also: means for adjusting the speed of one of said feeding means and said conveyor, said speed adjustment being of such range that said conveyor and said feeding means can be correlated for feeding grids onto said conveyor in a substantially continuous end-to-end relationship with respect to each other.

12. In a self-cleansing machine for automatically applying paste to a plurality of battery grids, the combination comprising: a conveyor comprising an endless belt having upper and lower courses; a platform adjacent to one end of said upper course and substantially co-planar therewith; means effecting unidirectional movement of said upper course; feeding means for advancing said grids, one at a time, from said platform onto said upper course and power driven means driving said feeding means; a hopper and means for holding the grids snugly against the conveyor, including at least two elongated, spaced, strips longitudinally arranged with respect to the direction of movement of said conveyor and positioned on the underside of said hopper, each of said two strips being affixed to said hopper along one longitudinal edge of each thereof for resiliently and respectively engaging by the other longitudinal edge of each thereof the upper surface of respective lateral edges, and only said edges, of a battery grid resting on said upper course; means supporting said conveyor below said hopper and so spaced from said hopper as to hold a battery grid on the surface thereof snugly against said two strips; means within said hopper cooperable with said conveyor supporting means for forcing paste into said grids.

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