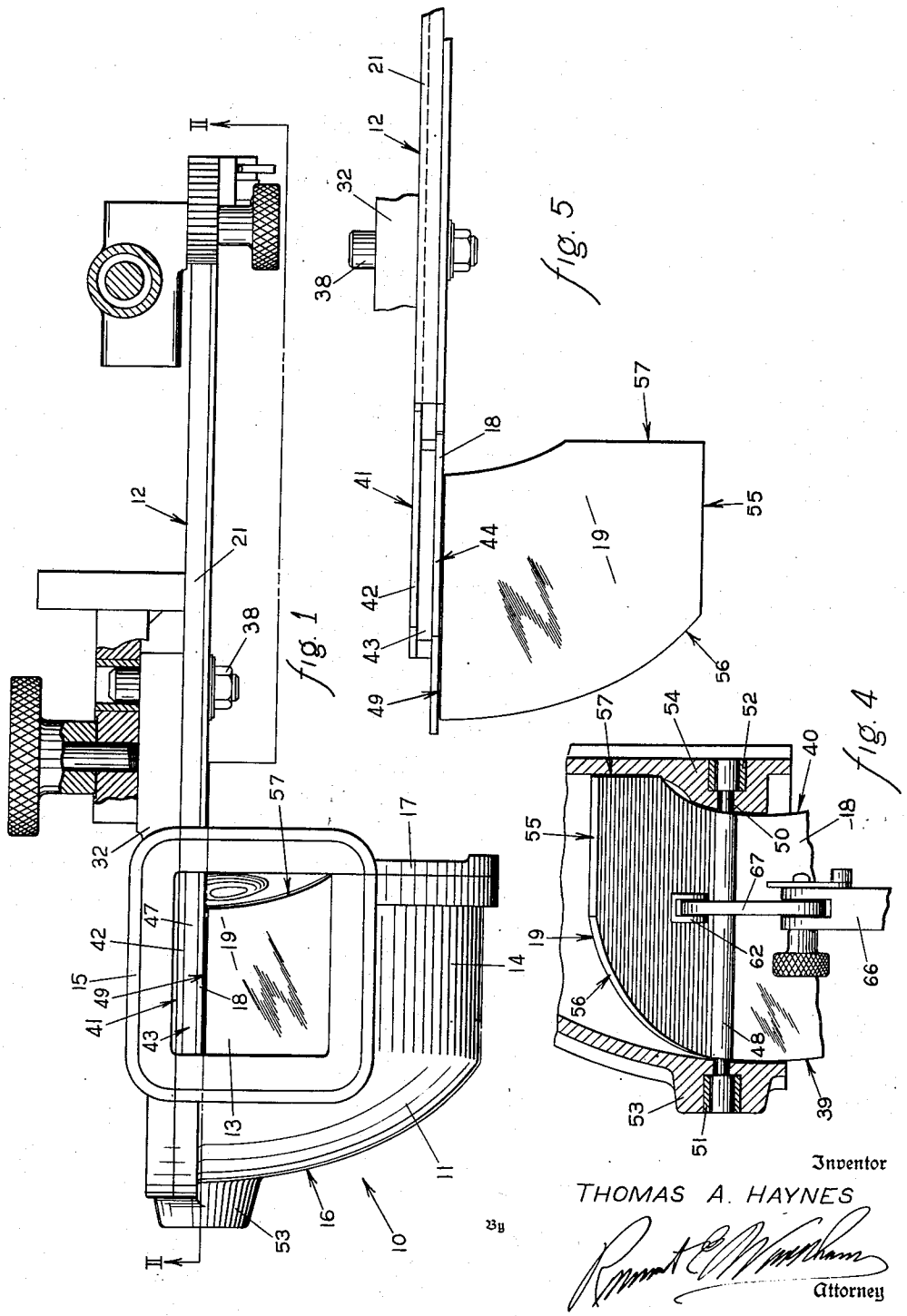
April 27, 1954 T. A. HAYNES 2,676,741

HOPPER AND DISPENSING DEVICE FOR BOTTLE STOPPERS

Filed March 10, 1950

3 Sheets-Sheet 1



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HOPPER AND DISPENSING DEVICE FOR BOTTLE STOPPERS

Filed March 10, 1950 3 Sheets-Sheet 2

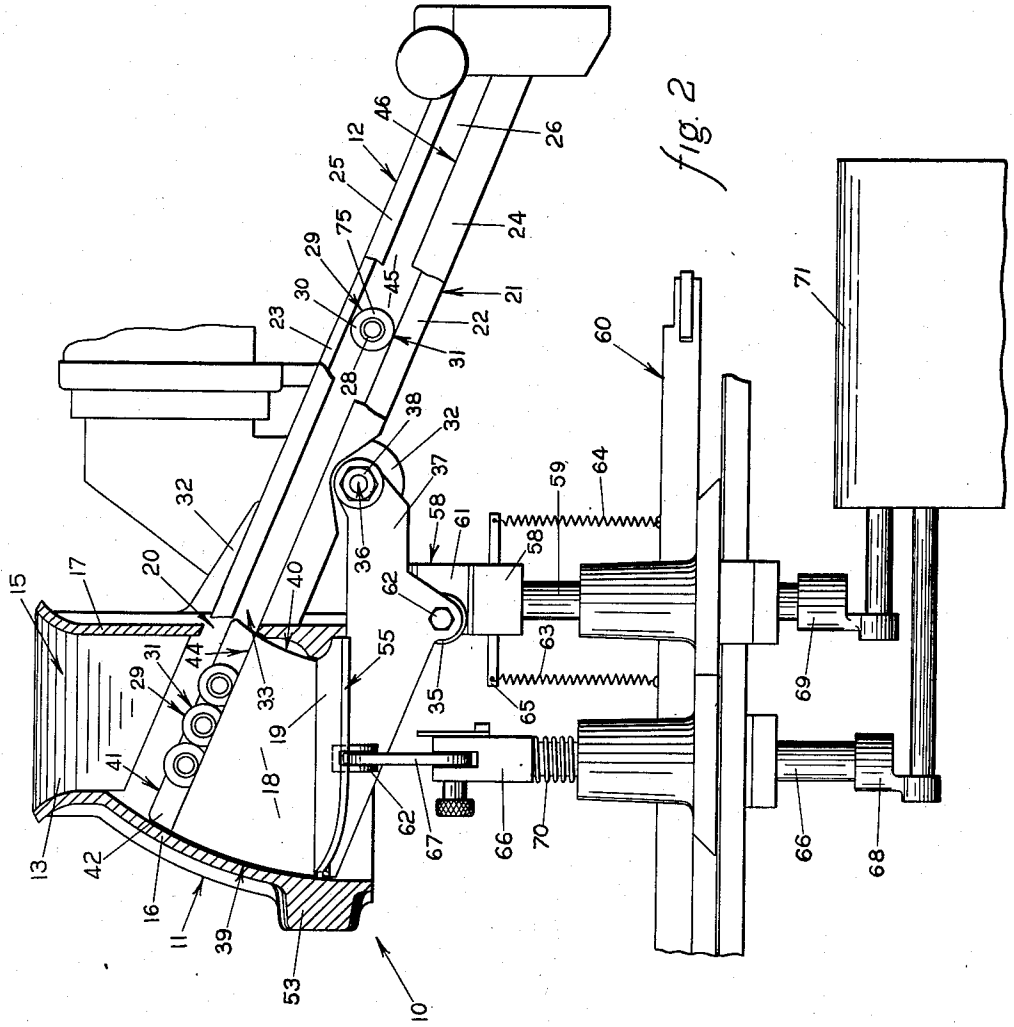

fig. 2

Inventor
THOMAS A. HAYNES

By

Attorney

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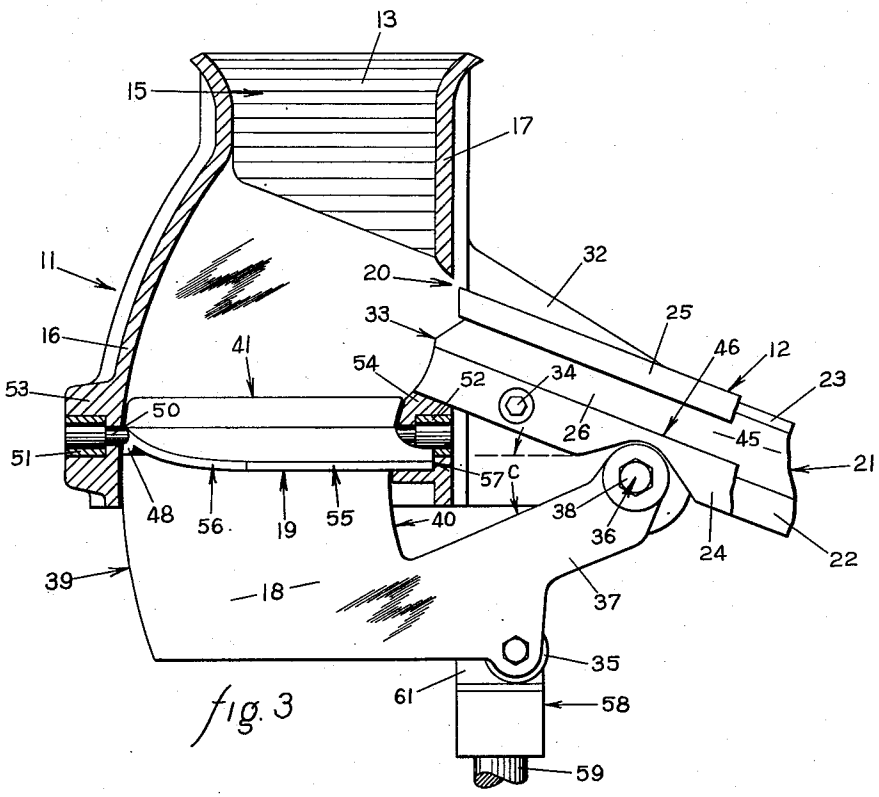

fig. 3

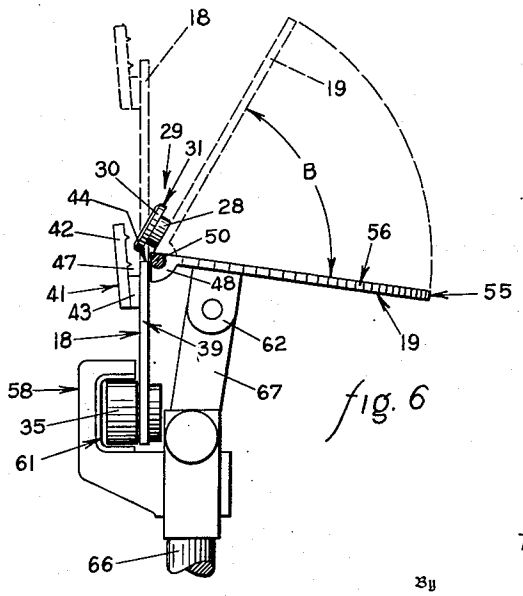

fig. 6

Inventor

THOMAS A. HAYNES

By

Attorney

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HOPPER AND DISPENSING DEVICE FOR BOTTLE STOPPERS

Thomas A. Haynes, Wyandotte, Mich., assignor to The Upjohn Company, Kalamazoo, Mich., a corporation of Michigan

Application March 10, 1950, Serial No. 149,005

3 Claims. (Cl. 226—88.1)

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This invention relates in general to a stopper feed device and more specifically to a type thereof for presenting resilient bottle stoppers having flat, circular tops and cylindrical shanks of reduced diameter to an inclined, sidewardly opening chute.

In industries, such as the pharmaceutical industry, which employ automatic equipment for inserting resilient stoppers into bottles, a satisfactory means of automatically presenting said stoppers to said stoppering equipment in a sanitary manner, which will allow for mass production methods and yet which will insure the requisite high standards of careful sealing particularly demanded in medical products, has long been desired.

No device is known to me to have been conceived for automatically feeding a plurality of resilient stoppers into an inclined, gravity fed chute having a sidewardly opening slot, through which the stopper shanks extend. The importance of the sidewardly opening chute will become evident by reference to my co-pending application Serial No. 149,004, filed March 10, 1950 and entitled "Mechanism for Metering, Positioning and Inserting a Stopper With Respect to a Bottle," which application fully discloses a combination metering device, transfer mechanism, and stopper inserting ram, for association with the lower end of said inclined chute.

It will be recognized that resilient, such as rubber, stoppers have certain characteristics which create unique problems of handling, feeding and alignment prior to the actual insertion operation, due primarily to the highly frictional and flexible nature of rubber. The usual types of stopper feeding devices now employed, such as those with the rotating hoppers or those having agitators of the screw or pedal type, obviously are not adaptable for precisely aligning and feeding rubber stoppers into a sidewardly opening chute.

Accordingly this invention has for its primary object the provision of a stopper feed device with which a plurality of resilient stoppers may be automatically fed into an inclined, sidewardly opening chute, down which said stoppers travel by force of gravity.

A further object of this invention is the provision of means, as aforesaid, by which resilient stoppers may be properly aligned with, and continuously supplied to, said chute.

Another object of this invention is the provision of means, as aforesaid, by which a large quantity of resilient stoppers may be fed in a completely sanitary manner to said sidewardly opening chute.

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Another object of this invention is the provision of means, as aforesaid, by which rubber stoppers may be handled for feeding purposes, which means is adaptable to mass production methods.

Other objects and purposes of my invention will be apparent to those familiar with equipment of this type upon examination of the accompanying drawings and by reading the following specification.

In effecting the objects and purposes above outlined, I have provided a hopper into which a plurality of resilient stoppers may be placed, said hopper being securable to, and communicable with the upper end of a sidewardly opening, inclined chute. Vertical and horizontal agitation plates are pivotally and reciprocably mounted upon, and housed within, said hopper. The actuation of said plates is coordinated so that the horizontal plate relinquishes its load of stoppers to the upper edge of the vertical plate when the latter plate is in its lowered position. The vertical plate is then raised whereupon its load of properly aligned stoppers is automatically emptied into the feed chute and the vertical agitation plate is then lowered for another load of stoppers.

For illustrations of a preferred embodiment of the stopper feed device to which this invention relates, reference is made to the drawings in which:

Figure 1 is a top plan view of my invention including a sidewardly opening chute associated therewith.

Figure 2 is a sectional view taken substantially along the line II—II of Figure 1 with the vertical agitation plate in the raised position.

Figure 3 is a sectional view taken substantially along the line II—II of Figure 1 with the vertical and horizontal agitation plates in a lowered position, and showing a fragment of said chute.

Figure 4 is a fragmentary sectional view taken substantially along the line II—II of Figure 1 with the horizontal agitation plate in a partially raised position.

Figure 5 is a top view of the vertical and horizontal agitation plates and a fragment of the feed chute.

Figure 6 is an end elevation view of the vertical and horizontal agitation plates in their lowered positions and broken line showings of the plates in their raised positions.

For the purposes of convenience in description

and reference to the drawings, the terms "upper" or "upwardly" and "lower" or "downwardly" as used herein shall have reference to the feed device and parts thereof when positioned, as shown in Figures 2, 3 and 6, in their normal manner of use. The terms "left" or "leftwardly" and "right" or "rightwardly" may be used with reference to the device, or parts thereof, as appearing in Figures 1 and 2.

The terms "rear" or "rearwardly" may be used with reference to parts of the feed device positioned toward the top of the sheet in Figure 1, whereas the terms "front" or "forwardly" may be used with reference to those parts positioned toward the bottom of the sheet in Figure 1.

Construction

The feed device 10 (Figures 1 and 2) is comprised of a feed hopper 11, secured to the upper end of an included feed chute 12, and vertical and horizontal agitation plates 18 and 19, respectively, reciprocably housed within said hopper 11.

The feed hopper 11 (Figures 1, 2 and 3) has a front wall 14, a back wall 15, a left side wall 16 and a right sidewall 17 defining a chamber 13, which extends substantially vertically through the upper and lower ends of the hopper 11 and gradually increases in cross-sectional area from top to bottom.

The hopper is preferably, but not necessarily, constructed so that the back wall 15 and right wall 17 lie in vertical planes perpendicular to each other. The contours of the left wall 16 and front wall 14 will be described in detail hereinafter.

The right wall 17 (Figures 2 and 3) has a vertically elongated slot 20 intermediate the upper and lower ends thereof and adjacent to the back wall 15. The size and preferred position of the slot 20 will be described in more detail hereinafter.

The feed chute 12 (Figures 1, 2 and 3) is comprised of a channel shaped member 21 with lower and upper, forwardly extending, parallel flanges 22 and 23, respectively. A pair of coplanar, parallel guide strips 24 and 25 are secured by any conventional means, such as welding, to the free, or forward, edges of said flanges 22 and 23 so that the opposing edges thereof extend inwardly of the opposing faces of said flanges 22 and 23, thereby forming a shank slot 26 of slightly greater width than the shank diameter of the resilient stopper 29, but somewhat less than the diameter of the circular top 30 of the stopper 29. The upward extent of the lower guide strip 24 beyond said opposed, or upper, face of the lower flange 22 is preferably less than the difference between the radii of the circular top 30 and the cylindrical shank 28 of a stopper 29. This permits the weight of the stopper to be borne by the edge 31 of the top of said stopper as it moves down the chute 12.

The slot 20 in the right side wall 17 of the hopper 11 is formed so as to snugly receive the leftward end 33 of the chute 12, when said chute is tilted at an angle of about 70 degrees with the plane of the right side wall 17. The feed chute 12 is secured to the boss 32 which extends from, and is parallel with, the back wall 15 of the hopper 11 by any conventional means such as a bolt 34. Thus, the shank slot 26 in the chute 12 communicates with the hopper chamber 13.

A vertical agitation plate 18, having a rightwardly extending pivot arm 37 integral therewith, is pivotally mounted at a point 36 near the rightward end of said arm 37 upon the boss 32 by means such as the bolt 38, for pivotal movement in a plane parallel with and spaced forwardly from, said back wall 15 and co-planar with the plane of the guide strips 24 and 25. The upper edge 44 of the vertical plate 18 is designed so as to be aligned with the upper edge 46 of the lower guide strip 24 when the plate 18 is at the extreme upper end of its stroke arc C (Figure 3). A pivot roller 35 is rotatably supported about a horizontal axis upon the rear side of the arm 37 of the vertical agitation plate 18 intermediate the leftward and rightward ends thereof.

The leftward and rightward edges 39 and 40, respectively, of the vertical agitation plate 18 preferably define arcs of concentric circles whose centers lie at the pivot point 36. The inside surfaces of the sidewalls 16 and 17 are contoured so that they lie closely adjacent to the said arcs defined by the edges 39 and 40 as the vertical plate 18 swings through the vertical arc C (Figure 3).

An L-shaped angle member 41 (Figure 6) having a substantially vertical flange 42 and a forwardly extending substantially horizontal flange 43, is secured along the forward edge of said flange 43 to the back side of the vertical agitation plate 18 near to, and parallel with, the upper edge 44 thereof by any conventional means, such as by welding. The angle member, which is preferably the same length as the upper edge 44 of the plate 18 (Figures 3 and 6), cooperates with said plate 18 to provide a guide slot 47 between the vertical flange 42 and the vertical plate 18. The flange 43 is preferably spaced from the upper edge 44 of the vertical plate a distance equal to the distance between the upper edge of the lower guide strip 24 and upper face of the flange 22 of the channel member 21. The vertical flange 42 extends slightly above the upper edge 44 of the vertical plate 18 and is slanted upwardly and rearwardly toward the rear wall 15 at an angle of about 10 degrees to the plane of the vertical plate 18. The distance between the flange 42 and the opposing surface of the vertical plate 18 is substantially the same as the distance between the guide strip 24 and the opposing surface of the web 45 of the channel member 21 in the feed chute 12.

The leftward end 33 of the feed chute 12, positioned within said slot 20, is contoured so that the leftward ends of the channel member 21 and the guide strip 24 are adjacent to, aligned with, and spaced slightly from the L-shaped angle member 41 and the rightward edge 40 of the vertical agitation plate 18 when said plate is at the upper end of its vertical pivot arc C.

A horizontal agitation plate 19 (Figures 3, 4 and 5) having a boss 48 along one straight edge, near the rear edge 49, thereof, is pivotally supported within the lower end of the chamber 13 upon a shaft 50 which extends longitudinally through the boss 48. The said boss is disposed adjacent to, and parallel with, the vertical agitation plate 18, and the ends of the shaft 50 extending from the boss 48 are rotatably supported within conventional bearings 51 and 52 supported within the bearing housings 53 and 54 in the hopper sidewalls 16 and 17, respectively.

The inside surface of the front wall 14 of the hopper 11 is contoured so that it defines the arc of a cylinder adjacent to and concentric

with an arc defined by the forward edge 55 of the horizontal plate 19 as it moves through its pivotal arc B (Figures 3, 4 and 6), about the axis of the shaft 50. Similarly the inside surface of the left side wall 16 is contoured to lie adjacent to the path of the leftward edge 56 of said horizontal plate 19. The rightward edge 57 of the horizontal plate 19 is contoured to remain closely adjacent to the inside surface of the right side wall 17 during the pivotal movement of said horizontal plate 19. The spacing between the edges 55, 56, 57, and the corresponding walls 14, 16 and 17 of the hopper 11 are sufficiently close to positively prevent the escape of a stopper, supported upon said plate 19, through the lower end of the chamber 13 during the pivotal movement of the horizontal plate 19. A pivot fork 62 is secured to the lower face of the horizontal plate 19 intermediate the edges thereof for purposes hereinafter discussed in detail.

A head 58 (Figures 2 and 3), having a horizontal, sidewardly opening groove 61 engaging the roller 35 on the vertical plate arm 37, is mounted upon the upper end of a push rod 59 which is vertically reciprocably mounted upon a support bed 60. The push rod 59 is vertically reciprocated, thereby vertically pivoting the vertical agitation plate 18 about the pivot point 36, by any conventional actuating means 71 (Figure 2) connected to the lower end 69 of the push rod 59.

A resilient means including a horizontal bar 65 secured to the head 58 and a pair of coiled springs 63 and 64, extending between the respective ends of the bar 65 and the support bed 60, may be provided for urging the head 58 toward the support bed 60.

An actuating rod 66 (Figures 2 and 6) which is parallel to the push rod 59 and spaced therefrom, is vertically reciprocably mounted upon the support bed 60. A link bar 67 extends between, and is pivotally secured at its lower and upper ends, respectively, to the upper end of the rod 66 and the pivot fork 62 on the horizontal agitation plate 19, for translating the vertical movement of the rod 66 into vertically pivotal movement of the horizontal agitation plate 19. Resilient means, such as the coiled spring 70, is sleeved upon a portion of the rod 66, of reduced diameter, and is supported upon the support bed 60 for cushioning the downward movement of the rod 66.

The actuating rod 66 may be vertically reciprocated, thereby pivoting the horizontal plate 19 about the shaft 50, by said actuating means 71, of any conventional type, connected to the lower end 68 of the rod 66.

The actuating means 71 (Figure 2) may be provided with an integral timing mechanism, of any conventional type, whereby the relative reciprocation of the rods 59 and 66, hence the reciprocation of the vertical plate 18 and horizontal plate 19, may be selectively coordinated as desired or required.

Operation

In operation, a quantity of resilient stoppers 29 is placed in the hopper 11, either manually or automatically, through the opening in the top thereof. The vertical agitation plate 18 and the horizontal agitation plate 19 are both preferably in their lowered position (Figures 3 and 6) when the hopper 11 is initially loaded and the feeding operation is started. The hopper is advantageously not loaded above a horizontal plane through the lowest point on the upper edge 44 of the vertical plate 18 when said plate is in the raised position (Figure 2). This prevents interference of the stopper load with the movement of the stoppers down the inclined, upper edge 44 of the vertical plate 18 when said plate is in the raised position.

The operation of the agitation plates 18 and 19 is commenced with the upward movement of the actuating rod 66 by the actuating means 71, which causes the horizontal plate 19 to pivot upwardly about the shaft 50 through the pivot arc B. The stoppers 29 are thereby dumped upon the upper edge of the vertical agitation plate 18 which is in its lowered position (Figure 6). As the stoppers 29 tumble onto the vertical plate 18 some of them are deposited with the rims 31 of their circular tops 30 in the guide slot 47 along the upper edge 44 of the vertical agitation plate 18 and with their shanks 28 extending forwardly over the top edge 44 of the vertical plate 18.

The horizontal plate 19 is then returned to its lowered position while at the same time the vertical plate is pivoted upwardly about the pivot point 36, by actuating means 71 operating through the push rod 59. This coordination in the movement of said plates 18 and 19 forces the upper edge 44 of the vertical plate 18, and the guide slot 47 adjacent thereto, to move through a concentration of stoppers piled by the horizontal plate 19 thereabove against the rear wall 15. Thus the stoppers are provided with a maximum opportunity to become properly seated, as described above, within the guide slot 47.

When the vertical plate 18 reaches its top position the horizontal plate is again in its lowered position, thereby permitting the stopper load to fall away from the vertical plate 18 and to avoid interference with the stoppers in the guide slot 47. When the vertical plate is at the upper limit of its swing, its upper edge 44 is aligned with, and forms an extension of, the upper edge 46 of the lower guide strip 24 of the feed chute 12 thereby permitting the stoppers to roll rightwardly (Figure 2) through the slot 20 in the right side wall 17 and into the upper end 33 of the feed chute 12.

The vertical plate 18 remains in the raised position for a sufficient period of time to permit the stoppers supported thereon to roll into the chute 12, and is then pivoted downwardly to its lowered position by the push rod 59 and the actuating means 71. The springs 63 and 64 maintain a positive engagement between the roller 35 and the groove 61.

The operations of the push rod 59 and the actuating rod 66 are preferably coordinated by the actuating means 71 so that as the vertical plate 18 reaches its lowered position, the horizontal plate 19 begins its upward swing, thereby initiating another cycle of operation of the feed device 10, such as that just described.

Although the above mentioned drawings and description apply to a 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 device for automatically presenting resilient stoppers having flat circular tops and cylindrical shanks of reduced diameter in a predetermined attitude, the combination compris-

ing: a substantially rectangular stationary hopper having a pair of vertical, adjoining sidewalls perpendicular to each other and a pair of curved, adjoining sidewalls opposite said vertical sidewalls, one of said vertical walls having an opening therethrough intermediate its upper and lower ends and adjacent to the other vertical sidewall; an inclined chute snugly received at its upper end into said opening in said one vertical sidewall, said chute having a sidewardly opening, substantially U-shaped cross-section, the lower side of said chute having an upwardly opening, lengthwise chute groove therein; a vertical agitation plate pivotally supported outside of the hopper for vertical movement within said hopper in a plane parallel with and adjacent to said other vertical wall, said vertical plate having a straight upper edge; an angle bar having a first flange secured along the free edge thereof to said vertical plate near the upper edge thereof and parallel therewith, and having an upwardly extending second flange spaced from said vertical plate and parallel therewith, said flanges and said plate defining a plate groove alignable with said chute groove; a horizontal agitation plate disposed within the lower end of said hopper and having a straight, horizontal edge adjacent to said vertical plate and below said opening; means pivotally supporting said horizontal plate upon said hopper for movement about said horizontal edge thereof, and reciprocable means for pivoting said horizontal plate between a substantially horizontal position and a position above, and at an angle to, said horizontal position, the edges of said horizontal plate being adjacent to the walls of said hopper throughout such movement; actuation means reciprocating said vertical agitation plate between a position wherein said plate groove is adjacent to, and parallel with, the horizontal edge of said horizontal plate, and a position wherein said plate groove is alignable with said chute groove; and means associated with both said reciprocable means and said actuation means for coordinating the movements thereof, whereby, in one operating cycle, said horizontal plate reaches its maximum upper position before said vertical plate reaches its maximum upper position.

2. In a device for automatically presenting resilient stoppers having flat circular tops and cylindrical shanks of reduced diameter in a predetermined attitude, the combination comprising: a substantially rectangular stationary hopper having a pair of vertical, adjoining sidewalls perpendicular to each other and a pair of curved, adjoining sidewalls opposite said vertical sidewalls, one of said vertical walls having an opening therethrough intermediate its upper and lower ends and adjacent to the other vertical sidewall; an inclined chute snugly and fixedly received at its upper end into said opening in said one vertical sidewall, said chute having a sidewardly opening, substantially U-shaped cross-section, the lower side of said chute having an upwardly opening, lengthwise groove therein; a vertical agitation plate within said hopper positioned parallel with and adjacent to said other vertical wall and having a straight upper edge, the lower edge of said plate extending through the bottom of said hopper; an arm supporting at its one end the lower edge of said plate and being pivoted at its other end about a point outside of said hopper and adjacent said chute; means defining at the upper edge of said plate an upwardly opening plate groove of cross section identical with the groove in the chute, the positioning of said plate groove and the point of pivotal mounting of said plate being such that said plate groove is alignable with said chute groove when said plate is in a raised position; a horizontal agitation plate disposed within the lower end of said hopper and having a straight, horizontal edge adjacent to said vertical plate and below said opening; means pivotally supporting said horizontal plate upon said hopper for movement about said horizontal edge thereof, and reciprocable means for pivoting said horizontal plate between a substantially horizontal position and a position above, and at an angle to, said horizontal position, the edges of said horizontal plate being adjacent to the walls of said hopper throughout such movement; actuation means reciprocating said vertical agitation plate between a position wherein said plate groove is adjacent to, and parallel with, the horizontal edge of said horizontal plate, and a position wherein said plate groove is alignable with said chute groove; and means associated with both said reciprocable means and said actuation means for coordinating the movements thereof, whereby, in one operating cycle, said horizontal plate reaches its maximum upper position before said vertical plate reaches its maximum upper position.

3. In a device for automatically orienting and conveying stoppers having flat circular tops and cylindrical shanks of reduced diameter, the combination comprising: a stationary hopper having a pair of vertical, adjoining sidewalls perpendicular to each other and a pair of curved, adjoining sidewalls opposite said vertical sidewalls, one of said vertical walls having an opening therethrough adjacent the other vertical sidewall; an inclined chute snugly received at its upper end into said opening in said one vertical wall, said chute having an upwardly opening, lengthwise groove therein; a vertical plate pivotally supported outside of the hopper for vertical movement within said hopper in a plane parallel with and adjacent to said other vertical wall; means defining an upwardly opening groove along the upper edge of said vertical plate, alignable with said chute groove; a horizontal plate disposed within the lower end of said hopper and having a straight horizontal edge adjacent to said vertical plate and below said opening; means pivotally supporting said horizontal plate upon said hopper for movement about said horizontal edge thereof, and reciprocable means for pivoting said horizontal plate between a substantially horizontal position and a position above, and at an angle to, said horizontal position, the edges of said horizontal plate being adjacent to the walls of said hopper throughout such movement; and actuation means reciprocating said vertical plate between a position wherein said plate groove is adjacent to, and parallel with, the horizontal edge of said horizontal plate, and a position wherein said plate groove is alignable with said chute groove.

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