APPARATUS FOR PACKAGING WAFER TABLETS

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This invention relates to apparatus for packaging wafer tablets and, more particularly, to apparatus for packaging wafer size tablets directly as they are discharged from a high speed tablet compression machine.

Tablet compression machines of various types are well known in the art. Such machines compress powders into tablet form at high rates of speed. Heretofore the tablets discharged from a wafer tablet compression machine were received in bulk in containers and transported from the compression machine to a packaging machine. This procedure involved considerable time and cost in handling and, in addition, in the case of hygroscopic materials, allowed undesirable time for moisture absorption.

It is an object of the invention to provide apparatus for stacking wafer size tablets at the high rates of speed at which the tablets are received from a tablet compression machine.

It is a further object of the invention to provide apparatus which is capable of receiving wafer size tablets directly from a tablet compression machine and, with a minimum of handling and exposure to the air, position the tablets for admission into a bottle or other suitable container.

These and other objects of the invention will become apparent from the following description when read in conjunction with the accompanying drawings, in which:

Figure 1 is an elevation of the entire apparatus;

Figures 2 and 3 are perspective showings of the portion of the apparatus for receiving the wafers from the tablet compression machine and for depositing the wafers upon a conveyor belt;

Figure 4 is a plan view of the apparatus involved at the discharge end of the conveyor belt shown in Figures 2 and 3;

Figure 5 is a transverse section of the conveyor belt taken on the plane 5—5 of Figure 4;

Figure 6 is a transverse section of the conveyor belt taken on the plane 6—6 of Figure 4;

Figure 7 is a transverse section of the conveyor belt taken on the plane 7—7 of Figure 4;

Figure 8 is a plan view showing the apparatus for collecting the stacked tablets at the discharge end of the conveyor belt;

Figure 9 is an elevation of the apparatus shown in Figure 8;

Figure 10 is a rear view showing a portion of the apparatus shown in Figure 9;

Figure 11 is an elevation showing an end view of the left end of a portion of the apparatus shown in Figure 9; and

Figure 12 is a longitudinal section taken on the plane 12—12 in Figure 4.

In Figure 1 there is indicated generally at 2 a conventional tablet compression machine. This type of machine is well known to the art and is typical of the apparatus shown in the patent to Westin & Donaghy No. 2,043,086.

The tablet compression machine includes a rotating bed 4 and a rotating head 6. The rotating head mounts a plurality of punches 8 and the rotating bed 4 is provided with a plurality of dies 10. Means is provided for supplying the powder to be compressed into tablets to the dies 10 and for actuating the punches 8 to drive the plunger into the dies 10 compressing the powder therein to form a tablet or wafer. There is also provided beneath the rotating bed 4 suitable plungers for raising the formed tablets out of the dies 10 and, as the beds 4 rotates, the tablets, such as the tablet 12, which have been raised out of the dies 10, engage a deflector plate 14 and are deflected outwardly and pass down a chute 16 assuming positions as they slide down the chute as indicated by the tablets 18, 20 and 22 on the chute 16. The tablet compression machine is driven by a suitable motor through a shaft 21 which has affixed to its outer end a fly wheel 23.

As indicated above, the apparatus thus far described, with the exception of the chute 16, is perfectly conventional.

In accordance with the present invention, the chute 16 is provided with a twist in order that at its lower end the near edge 24 of the chute 16, as shown in Figure 3, is raised above the far edge 26 of the chute 16. The side walls 28 of the chute terminate adjacent to its lower end and, extending beyond the termination of the side walls, the end of the chute is turned upwardly at 29 in the form of an edge or lift 30. An upstanding plate 32 is positioned across a conveyor belt 34 and is adjacent to one edge of the upwardly turned portion 29 of the lower end of the chute 16. The chute is positioned so that its side walls 28 terminate adjacent to the edge of the conveyor belt 34 and the upwardly turned portion 29 extends partially across the belt 34.

The twist of the chute causes the tablets to slide toward the far side of the chute as shown by the position of the tablet 22 in Figure 2. The deflector plate 32 is positioned diagonally across the conveyor belt 34, a vertical plane through the lower or upper edge of plate 32 forming an angle of 45° with the center line of the belt, in order that tablets, such as tablets 18, 20 and 22, passing down the chute 18 strike the deflector plate 32 and rebound therefrom sliding across the extending portion 29 of the chute and upwardly over the lift 30 as indicated by the tablet 36 in Figures 2 and 3. The tablets are thus projected and fly through the air in a path indicated by the position of the tablet 38 in Figure 2 and fall partially overlapping the preceding tablet as shown by the tablet 40 in Figure 2. Preferably the plate 32 is made of spring steel for resilience.

The uniformity of the tablets formed by the tablet compressing machine and the uniformity of speed and course of travel of the tablets passing down the chute 16 is such that the successive tablets rebanding over the lip 30 of the lower end of the chute will land successively in substantially identical positions and will, therefore, align themselves in the manner indicated by the procession of tablets positioned on the belt in Figure 2 and generally indicated by the numeral 41. The degree of overlap by these tablets will be dependent upon both the rate of feed of tablets from the compression machine and the rate of travel of the belt 34. The desired relation between these speeds is such that the tablets will stack themselves in overlapping relation as indicated in Figure 2 to such a degree that the overlapping tablets will remain relatively stationary in their positions with respect to each other as they are carried along by the movement of the conveyor belt 34.

In other words, the tablets are stacked only sufficiently to provide a firm overlapping relation and not to the extent at which each tablet will tend to slide or roll off of the preceding tablet.

The conveyor belt 34 is driven by a driving and mounting pulley 42, shown at the left end of the belt as viewed in the figures, the pulley 42 being driven from the shaft 21 through a belt take-off 44, a reduction gear assembly 46, a
2,747,352

3

shaft 48 and a bevelled gear assembly 50. Thus the speed of the conveyor belt 34 will always be proportionate to the speed of the tablet compression machine and thus the rate of travel of the conveyor belt 34 will be such that the tablets arriving at the conveyor belt 34 from the compression machine will fall on the conveyor belt in the desired overlapping relation once this proportionate speed has been established.

The pulley 42 and the conveyor belt 34 are supported by a platform or table structure having a top 52 and provided with suitable supporting members one of which is shown at 54. The pulley 42 is supported by the platform 52 and a similar pulley 56 supporting the right hand end of the belt 34, as shown in Figure 1, is similarly supported by the platform 52.

Referring to Figures 4 and 8, the right hand end of the conveyor belt is provided with parallel members 58 of triangular section positioned one above each edge of the belt. The height of the strips increases as the strips extend toward the right hand or discharge end of the conveyor as indicated in the successive sections as shown in Figures 5, 6 and 7. As the tablets are carried along by the conveyor, the forward edge of each tablet at its outermost portions engages the strips 58 which act to raise the forward edge of the tablet while permitting the rearward edge of the tablet to remain in contact with the belt 34 to be driven forward thereby. In this manner the tablets shown in Figure 6, which are in a lying down position when they are first deposited upon the conveyor belt from the chute 16 are raised upwardly by the triangular strips 58 and assume a substantially vertical position by the time they reach the right hand or discharge end of the conveyor belt 34 as shown in Figure 12. The vertically positioned tablets arriving at the discharge end of the conveyor belt are lifted upwardly from the belt by the triangular members 58 and are pressed forwardly by the succeeding tablets which are being carried forwardly on the conveyor belt and rotating through the annular member 62. The triangular members 58 join together in the region 59 supporting the tablet in the region beyond the conveyor belt forming the base portion of the annular member 62 through which the tablets pass. Extending backwardly from the top of the annular member 62 is a tongue member 60 which extends above the tablets and prevents the tablets from riding upwardly out of position and guides the top of the tablets into the annular member 62.

A wire loop 66 is provided with offset legs 68 which are pivotally mounted in bracket members 70. The bracket members 70 are affixed to the platform 52. The wire member 66 is positioned centrally over the tablets emerging through the annular member 62 and is formed so that its right hand end, as viewed in Figures 8 and 12, is lower than its left hand end. Accordingly, the first or leading tablet of a group of tablets being forced through the annular member 62 will engage its upper edge upon the wire 66 and will be thereby prevented from falling over forwardly as shown in Figure 12.

An upstanding stop member 72 is adjutably mounted by means of a screw 74 passing through a slot 76 in a horizontally extending portion 78 of the stop member. When a stack of tablets has passed through the annular member 62 and the leading tablet engages the stop member 72, the stack of tablets can obviously move no further. Apparatus is provided which will be hereinafter described in order to move the stack of tablets positioned between the stop member 72 and the stop member 72 horizontally or upwardly as viewed in Figure 8, to permit the bottling of the removed stack and to provide an open space between the annular member 62 and the stop member 72 for the accumulation of the next succeeding stack of tablets.

During the time intervals during which a stack of tablets is being removed, the succeeding tablets being carried by the belt in a generally horizontal position, as the group 41 in Figure 2, are being positioned vertically ahead of the annular member 62 as shown in Figure 12.

Supported below the platform 52 by means of suspended bearing brackets 80 and 82 is a horizontally mounted shaft 84. Affixed to the right hand end of the shaft 84, as viewed in Figure 9, is a collar 86 which prevents the shaft from moving to the left through the bearings.

Affixed to the left hand end of the shaft 84 which extends to the left of the bearing bracket 80 is an arm 90 which is prevented from rotating with respect to the shaft 84 by means of a pin 92. Pivotally attached to the outer end of the arm 90 by means of a pin 97 and extending transversely of the arm is a cam 94.

Rotatably mounted on the shaft 84 adjacent to the arm 90 is the arm 98. Attached to the rearward portion of the arm 98, as viewed in Figures 1 and 9, and to the left hand end portion of the arm 88, as viewed in Figure 11, is a tension rod 96. A hinged foot treadle 98, which is conveniently mounted on the support column 54, is connected to the lower end of the tension rod 96 and is adapted to be actuated by an operator. Connected to the opposite end of the lever 88 from the connection of the tension rod 96 is the upper end of a spring 100 the lower end of which is connected to a pin 102 extending from the supporting leg 54.

An arm 104 is rigidly connected to the shaft 84 by means of a pin 106 and connected to the outer end of the arm 104 in the manner of arm 91, 98 and 90 with the arm 104 being connected to the pin 102 mounted on the supporting leg 54.

The spring 108, acting through the arm 104, tends to rotate the shaft 84 in a clockwise direction, as viewed in Figure 11, to the degree permitted by the stop member 110 which is mounted on the supporting leg 54 and is adapted to be engaged by the upper vertical portion of the annular member 112. An upstanding arm 112 is rigidly affixed to the shaft 84 by means of a pin 114. The upper end of the arm 112 passes through an opening 116 in the platform 52. Pivotedly connected to the upper end of the arm 112 is a horizontally extending arm 118 which is rigidly connected to a plate slider 120 mounted to slide under bracket member 121 which is affixed to the upper surface of the platform 52. A post 123 secured to platform 52 engages a slot 124 in plate 120. A shallow trough 75 holds the tablets from rolling out of position inadvertently when they pass member 62. Slider 120 rests on one side of trough 75, as shown in Figure 8.

Depression of the pedal 98 will pull the tension rod 96 downwardly moving the left hand end of the lever 88 downwardly, as viewed in Figure 11, and thereby moving the right hand end of the lever 88 upwardly. When the upper surface of the lever 88 engages the surface top of the cam 94, the cam 94 and its associated arm 90 will be moved upwardly rotating the shaft 84. As the shaft 84 is thus rotated in a counterclockwise direction, as viewed in Figure 11, the arm 112 will be moved similarly or upwardly, as viewed in Figure 8, moving the pivotally connected arm 118 and the slider 120 upwardly, as viewed in Figure 8. The moving slider 120 will move the stack of tablets which have accumulated in front of the adjustable stop 72 upwardly out of the trough 75 in Figure 8 into the position shown generally at 77 in Figure 8.

The cam 94 is provided with an extending portion 95 which, after the predetermined degree of upward motion of the cam as described above as a result of depression of the pedal 98 by an operator, is adapted to engage a stop member 124 which is mounted on the support post 54 above the cam member 94. When the extending portion 95 of the cam engages the stop 124, the cam is rotated in a clockwise direction, as viewed in Figure 8, around the pivot screw 87, on which the cam is pivotally mounted to the arm 90, until the cam surface 89 is thereby carried out of engagement with the upper surface of the lever 88. When this occurs, the spring 108 acting through the lever 104 is permitted to rotate the shaft 84 in a clockwise direc-
tion, as viewed in Figure 11, until the arm 104 has moved downwardly to a position where the lower surface of the arm 104 engages the upper surface of the stop 110. This degree of rotation of the shaft 84 is sufficient to withdraw the slider 120 back clear of the opening through the annular member 62, thus permitting a succeeding stack of tablets to accumulate in the space between the annular member 62 and the stop member 72.

After the trigger mechanism provided by the cam member 94 has acted and the slider 120 has been withdrawn as a result of cam release and the action of the spring 108, the operator will release pressure from the pedal 98 permitting the left hand end of the lever 88 to rise and the right hand end to be pressed downwardly by the spring 100. As the lever 88 is thus pulled downwardly below the can surface 89, the cam, as a result of the bulk provided by the outstanding portion 94, will rotate about the pivot point 87 to assume the position shown in Figure 9 at which position the stop pin 93 engages the side of the lever 90 and arrests the cam 94 with respect to the lever 90.

The tablet ejecting apparatus is thus repositioned in anticipation of the next ejection operation by the operator which will be controlled by a subsequent depression of the foot pedal 98.

A bell crank 126 is pivotally mounted by a pin 128. Bell crank 126 rides under bracket 127 at all times and thereby helps to guide slider 120. Leg 132 of the bell crank has a depending finger 133 which is urged against slider 120 by means of a spring 130 connected between leg 132 of the crank and a screw 134 mounted in slider 120. The leg 132A of the bell crank 136 is thereby permitted to be pressed inwardly by the advancing tablets passing through the annular member 62 when the slider 120 is in a forward position and as it is moved backwardly to the position in which it is shown in Figure 8 after having ejected a stack of tablets in order to prevent excessive pressure between the tablets and the slider 120.

A plate 136 is adjustably positioned on the slider 120 by means of screws 134 and is positioned so that its right hand end, as viewed in Figure 8, just clears the stop member 72 thus providing an adjustable width of the slider 120 which is adjusted to take care of variations in the thickness of tablets in accordance with the setting of the adjustable stop 72.

The rod 140 having a head portion 142 on one end thereof is slidably mounted in bearings 144 shown in Figure 10 and 146 shown in Figure 4 affixed to the upper surface of platform 52. Rigidly attached to the rod 140 is lever 148 by which an operator may slide the rod longitudinally through its bearing holes. A spring 150 is provided to draw the rod to the left as viewed in Figure 4 and to the right as viewed in Figure 10.

A latch member 152 is pivotally mounted on a pin 154 which is supported by the member 144. The latch member 152 is provided with a downwardly extending fork 156 which is engaged by the rear face of the head portion 142 of the rod 140. Thus, as the rod 140 is drawn to the position shown in Figure 8 by the action of its associated spring 150, the latch member 152 is rotated in a counterclockwise direction about the pin 154, as viewed in Figure 10. The latch member 152, in the position shown in Figure 10 with the downwardly extending fork 156, is biased against the head portion 142 by the action of a spring 158, one end of which is connected to a pin 160 extending upwardly from the latch member 152 and the other end of which is attached to a pin 162 mounted on the member 144.

The left hand end of the latch member 152, as viewed in Figure 10, is provided with a downwardly extending end portion 164. When the slider 120 moves a stack of tablets from the space between the annular member 62 and the stop member 72 to the space between the head portion 142 of the rod 140 and the downwardly extending end portion 164 of the latch 152, the downwardly extending portion 164 prevents the stack of tablets from falling over, and retains the stack of tablets in vertical alignment. When a stack of tablets is in this position, an operator will grasp the handle 148 and slide the rod 140 to the right, as viewed in Figures 4 and 8, to the left, as shown in Figure 10, and push the stack of tablets into a bottle 166 which he will have positioned in a cradle 168 in order to receive the stack of tablets. As the tablets are moved to the left, as viewed in Figure 10, the head 142 of the rod 140 will move to the left away from the downwardly extending fork 156 of the latch member 152, thereby permitting the spring 158 to raise the left hand end or the rod and downwardly extending portion 164 of the latch member 152, permitting the tablets to move to the left, as viewed in Figure 10, past the downwardly extending portion 164 and into the bottle 166.

Reviewing briefly the sequence of operations at the discharge end of the conveyor 34, the tablets which have been turned to an upright position by the triangular members 88 pass through the annular member 62 as a result of urging applied to them by succeeding tablets bearing against the conveyor 34, and are accumulated in vertical position between the annular member 62 and the stop member 72. This successive positioning of the tablets is shown in Figure 12. When a stack of tablets has been accumulated between the annular member 62 and the stop member 72, the operator will depress the pedal 98 moving the slider 120 upwardly, as viewed in Figure 8, moving the accumulated stack of tablets to a position such as is indicated by the tablet stack shown generally by the numeral 77 within the retaining edge 145 in Figure 8. The operation of the trigger mechanism provided by the cam member 94 will withdraw the slider 120 immediately upon the positioning of a stack of tablets against the retainer 145 and thus the new stack of tablets is permitted to accumulate between the annular member 62 and the upstanding stop 72. The operator will now grasp the lever 140 and move the rod 140 to the right, as viewed in Figure 8, driving the stack of tablets in front of the rod head 142 and into a bottle or other suitable container 166. As soon as the stack of tablets has been moved into the bottle 166, the rod 140 may be permitted to be moved to the left as a result of urging of spring 150, the bottle of tablets removed and an empty bottle positioned in its place. When the rod head 142 has returned to the position shown in Figures 8 and 10 and a new stack of tablets has accumulated, the operator will again depress the pedal 98 and move a succeeding stack of tablets into bottling position.

It will be evident during normal operation of the apparatus that there will be a continuous procession of tablets between the tablet compression machine and the annular member 62. Showing of this continuous procession of tablets is omitted from the drawings to permit clear showing of the various structural features of the apparatus.

The apparatus herein described provides means for stacking tablets automatically as the tablets are discharged from a tablet compression machine and for successively selecting groups of a predetermined number of tablets and delivering these tablets into a bottle or other suitable container. The apparatus accomplishes these ends with a minimum of handling and a minimum of time exposure of the tablets to the atmosphere. It will be evident that various modifications may be made in the embodiment of the invention disclosed herein. More particularly, one such modification may be, for example, to the form of the chute 16 and the relative position of the lower end thereof with respect to the devices 22, the essential requisite being that the tablets which are discharged in rapid succession from the tablet forming machine be projected so as to fall substantially horizontally and in overlapping relation upon the moving conveyor 34. Furthermore, various modifications may obviously be made to the physical details of the portion
of the invention shown in Figures 8 and 9 and associated with the discharge end of the conveyor. All of these various modifications may be made without departing from the scope of the invention as set forth in the following claims.

What is claimed is:

1. Apparatus for packaging wafer tablets comprising a conveyor, means including an inclined chute having an upturned lower end portion for receiving tablets and projecting the tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, and means for delivering a predetermined quantity of vertically positioned tablets into a container therefor.

2. Apparatus for packaging wafer tablets comprising a conveyor, means including an inclined chute having its base twisted adjacent to the lower end thereof and having an upturned lower end portion for receiving tablets and projecting the tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, and means for delivering a predetermined quantity of vertically positioned tablets into a container therefor.

3. Apparatus for packaging wafer tablets comprising a conveyor, means for depositing tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position upon the conveyor, means for receiving a predetermined quantity of vertically positioned tablets beyond the discharge end of the conveyor, and means for delivering the received predetermined quantity of tablets into a container therefor.

4. Apparatus for packaging wafer tablets comprising a conveyor, means for depositing tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, means for receiving vertically positioned tablets being driven from the end of the conveyor by succeeding tablets, means for ejecting successive groups of tablets from said receiving means, manually operated means for actuating said ejecting means to eject a group of tablets, and automatically operating means trigger actuated upon actuation of said ejecting means for returning said ejecting means to an inoperative position.

5. Apparatus for packaging wafer tablets comprising a conveyor, means for depositing tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, means for receiving vertically positioned tablets being driven from the end of the conveyor by succeeding tablets, means for ejecting successive groups of tablets transversely from said receiving means, for delivering each ejected group in the direction of its longitudinal axis into containing means therefor.

6. Apparatus for packaging wafer tablets comprising a conveyor, means for depositing tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substan-

tially vertical position beyond the discharge end of the conveyor, means positioned laterally of said vertically positioned tablets for receiving successive predetermined quantities of vertically positioned tablets, and means for delivering successive predetermined quantities of vertically positioned tablets to said receiving means and for delivering the received predetermined quantities of tablets into containers therefor positioned in longitudinal axial alignment therewith.

7. Apparatus for packaging wafer tablets comprising a conveyor, means for depositing tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, means for receiving a process of vertically positioned tablets being driven from the end of the conveyor by succeeding tablets, and means positioned to bear upon the upper portion of the first tablet of the procession of tablets as it is moved into said receiving means for retaining said first tablet in a vertical position as it is moved.

8. Apparatus for packaging wafer tablets comprising a conveyor, means for depositing tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, means for receiving vertically positioned tablets being driven from the end of the conveyor by succeeding tablets, means for displacing successive groups of tablets transversely from said receiving means, means for delivering each of said displaced groups of tablets into a container positioned longitudinally thereof, and means for supporting the tablets of each of the successively displaced groups of tablets in vertical positions during displacement thereof and prior to delivery thereof to their container.

9. Apparatus for packaging wafer tablets comprising moving conveyor means, an inclined means for receiving tablets having its base twisted adjacent to the lower end thereof and having an upturned lower end portion for projecting the tablets substantially horizontally and in overlapping relation upon said conveyor, means for moving the tablets from the substantially horizontal position on the conveyor to a substantially vertical position, and means for delivering groups of vertically positioned tablets into containers therefor.

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