March 4, 1958 J. W. BATCHELDER 2,825,191

PACKAGING FEED AND COUNTING APPARATUS

Filed July 20, 1953 6 Sheets-Sheet 1

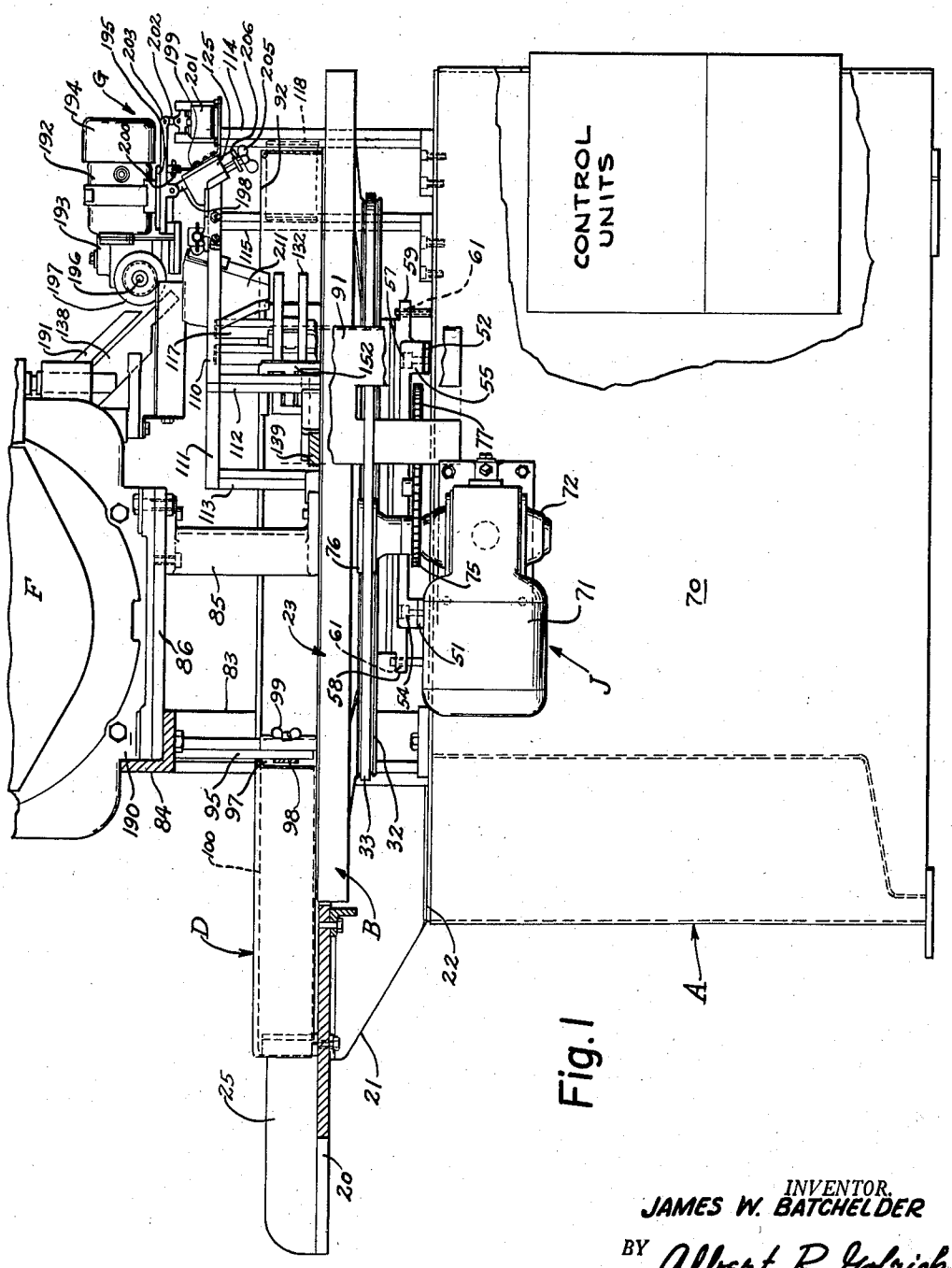


Fig. 1

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PACKAGING FEED AND COUNTING APPARATUS

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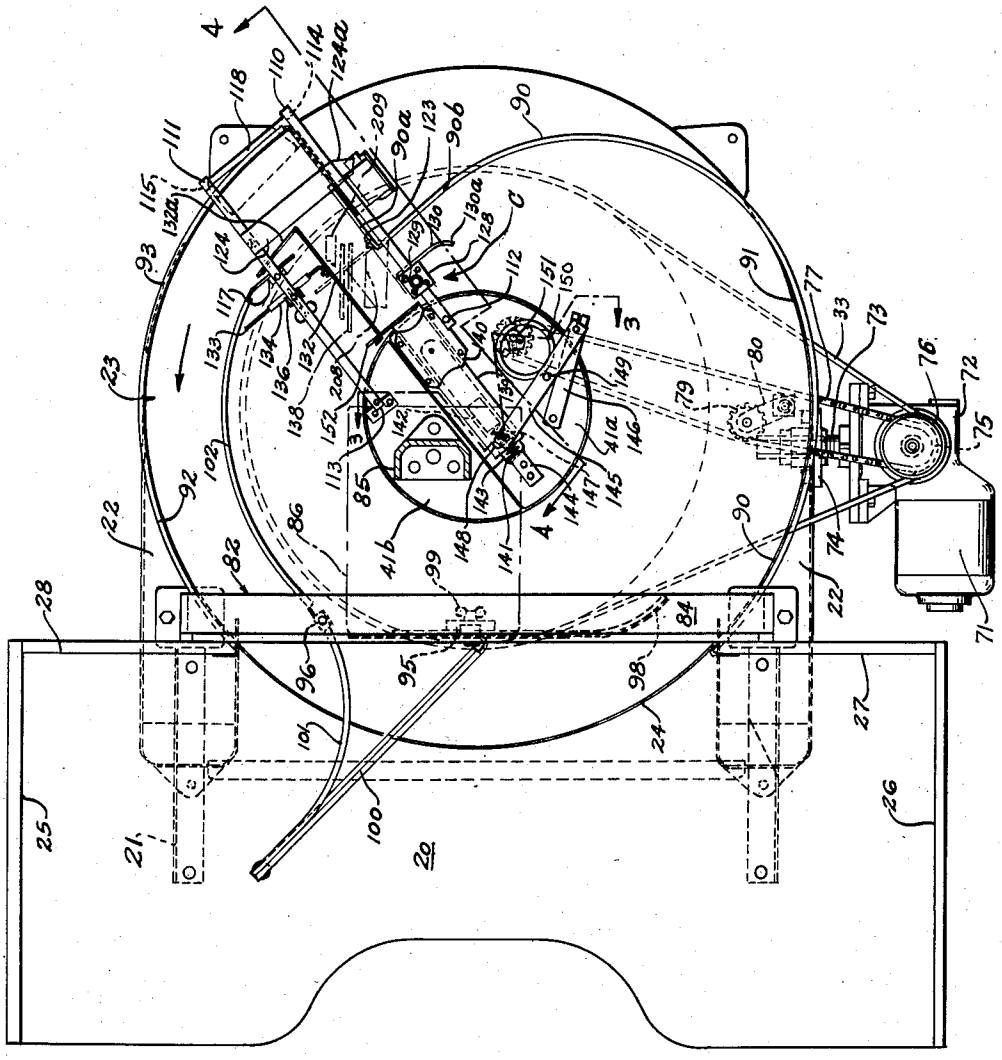


Fig. 2

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PACKAGING FEED AND COUNTING APPARATUS

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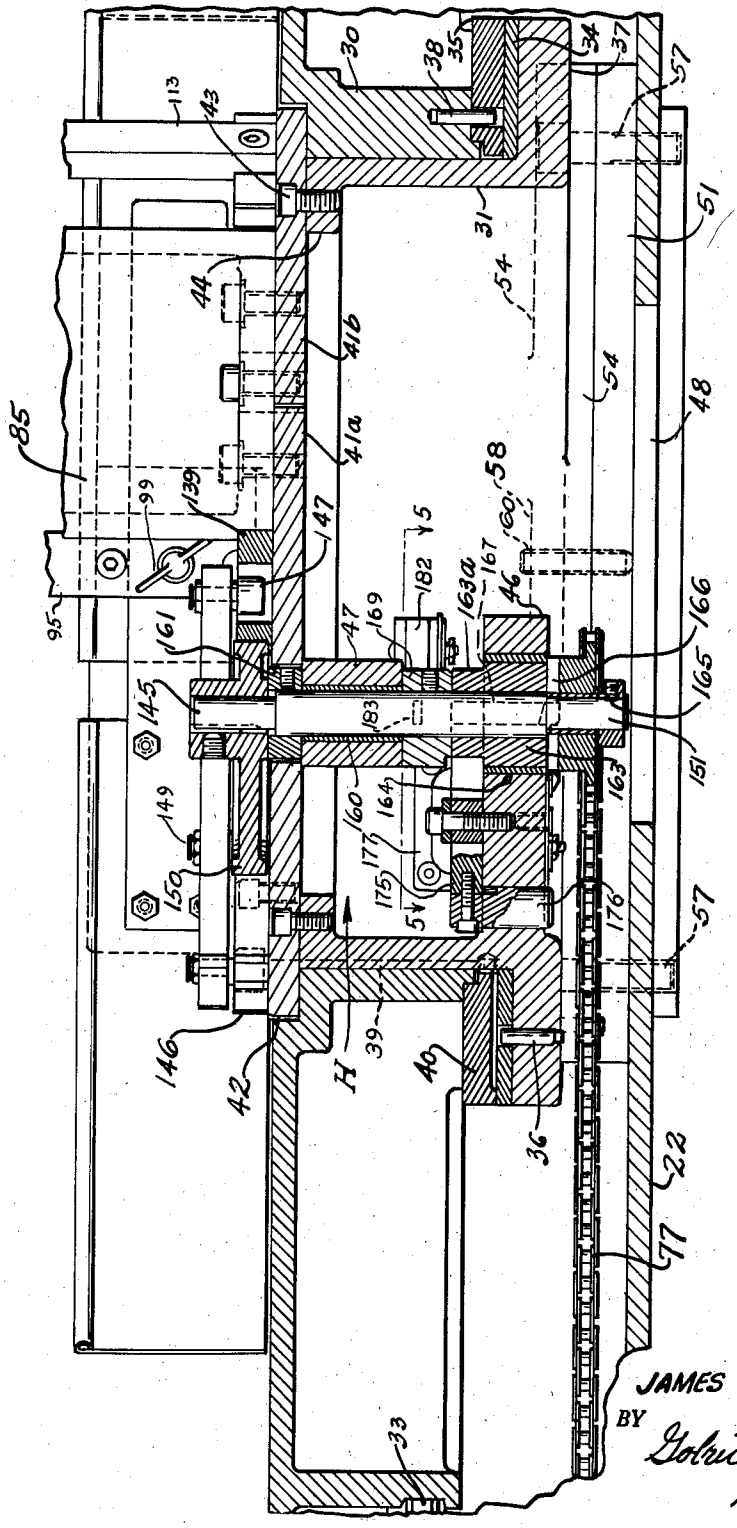


Fig. 3

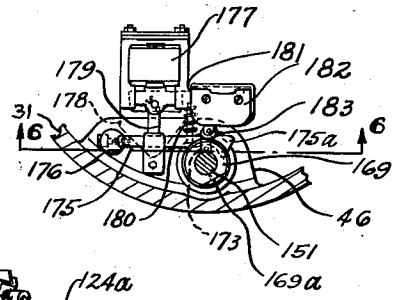
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March 4, 1958 J. W. BATCHELDER 2,825,191

PACKAGING FEED AND COUNTING APPARATUS

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Fig. 5



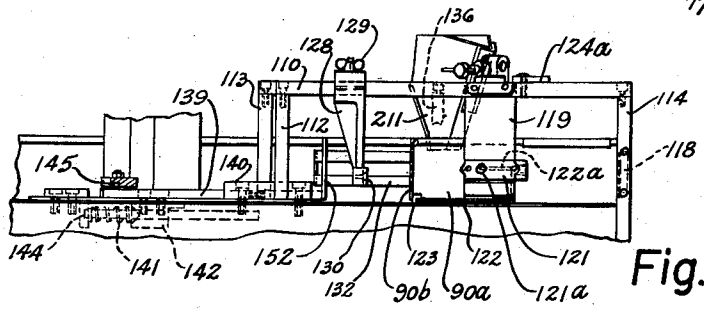


Fig. 4

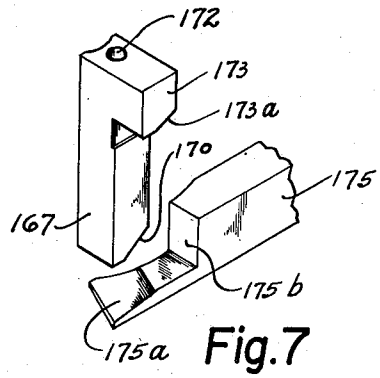


Fig. 7

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PACKAGING FEED AND COUNTING APPARATUS

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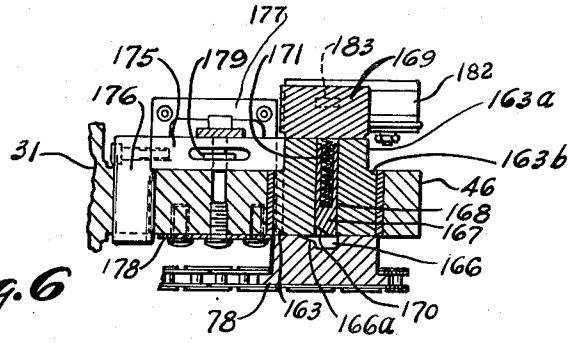


Fig. 6

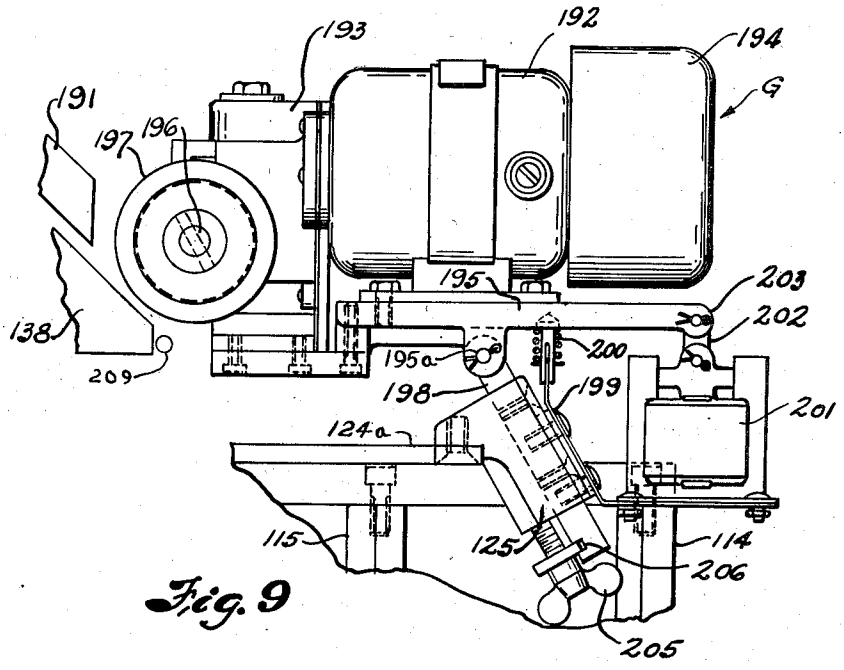


Fig. 9

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PACKAGING FEED AND COUNTING APPARATUS

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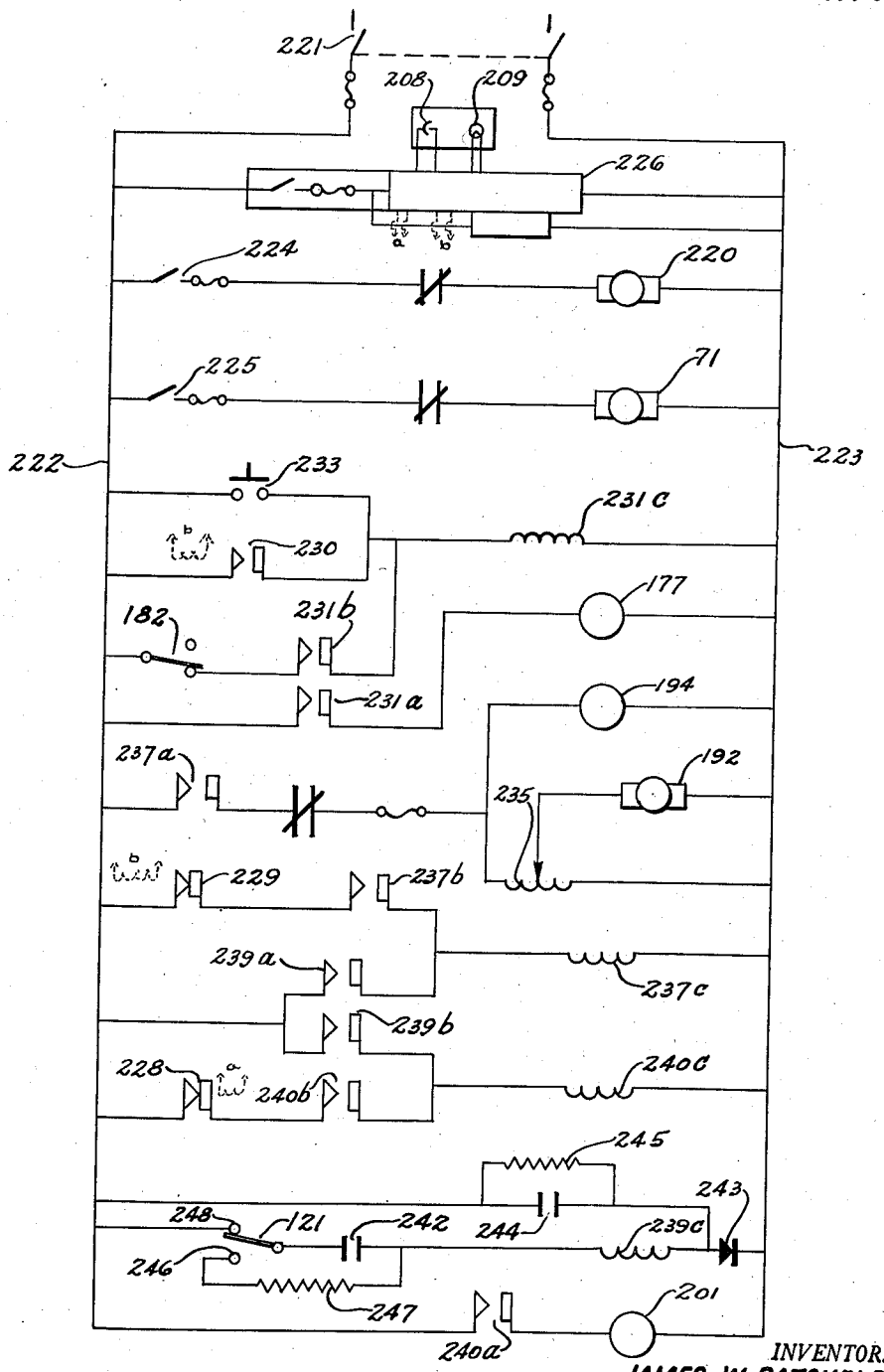


Fig.8

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Patented Mar. 4, 1958

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PACKAGING FEED AND COUNTING APPARATUS

James W. Batchelder, Ascutney, Vt.

Application July 20, 1953, Serial No. 369,161

13 Claims. (Cl. 53—62)

The present invention relates to a package filling apparatus or more particularly to an apparatus for counting and filling screws, nuts, rivets and other items usually count packed into packages of a stated number of units. The invention will be described and discussed in terms of screws to be packaged in boxes, although the invention may readily be adapted for handling certain other containers such as cans, and objects to be packaged other than screws.

Apart from bulk packaging of screws, or envelope packaging of a small number of assembling screws often enclosed with other goods, the majority of screw packaging for distribution or retail sales involves packaging in boxes containing a stated count anywhere say from 25 to 1,000, often in gross or multiple gross quantities. Obtaining the desired count by exact individual enumeration by packaging workers is of course almost entirely uneconomic. Hence screws are usually weighed in batches or loads intended to have the requisite count. However, due to the possible errors in weighing and at times weight variations of the individual units it is generally necessary to supply a slight overweight to insure against short count in each lot, which of course may lead to complaints from the purchasers. Such procedure, of course, requires the manufacture of screws beyond the total number required by a purchaser's order, and to loss of the excess screws so packaged. Further, there are the even greater disadvantages inasmuch as the weighing procedure is itself quite time consuming and the handling of the weighed lots at times difficult.

By the apparatus of the present invention there is provided screw feeding means adapted to receive screws in bulk and deliver them in controlled flow to a box filling station of the apparatus. There is also provided a rotary type table for conveying empty boxes from an operator's table to a box filling station and from the filling station to a discharge point in an orderly fashion. The apparatus provides an electronic screw counting device including a count totalizer which is adapted to be set at an exact desired count for sending a signal to a flow stopping device to shut off the flow at the desired count. The totalizer is also adapted to be set at a count point approaching the final set count to send a signal to the flow stopping device which causes the latter to initiate a trickle flow near the end of each count to facilitate obtaining the exact final count. A box escapement mechanism is provided on the rotary table for delivering empty boxes to the box filling station and for expelling filled boxes therefrom when the final count to each is obtained. The apparatus is substantially entirely automatic, requiring operator attention only for charging the screw feeding device with screws in bulk, for supplying the rotary table with empty boxes and for removal of filled boxes discharged from the apparatus.

Hence, a principal object of the present invention is to provide an apparatus in which screws may be delivered to packages in exact count. Another principal object is the provision of an apparatus including means for conveying boxes to and orienting them in a box filling station to receive a counted amount of screws delivered thereto and for removing filled boxes from the filling station to a discharge point automatically. Other objects and advantages of the invention will appear from the following description and the drawings, wherein—

Fig. 1 is a side elevation of the apparatus with certain parts shown in fragmentary form and others broken away for the sake of clarity;

Fig. 2 is a plan view of the rotary table type box feeding machine, the screw feeding machine and flow control mechanism being removed for the sake of clarity;

Fig. 3 is a fragmentary section taken substantially along the staggered line 3—3 in Fig. 2 through the supporting pivot post of the rotary table, with certain parts broken away;

Fig. 4 is a fragmentary view taken as indicated by the lines 4—4 in Fig. 2 to show in side elevation certain elements of a box escapement mechanism associated with the rotary table, with the screw counting and flow control mechanisms omitted;

Fig. 5 is a fragmentary plan view of a single revolution clutch mechanism for the box escapement taken along the line 5—5 in Fig. 3;

Fig. 6 is a vertical partial section taken along the line 6—6 in Fig. 5;

Fig. 7 is a perspective view of the clutch key and clutch latch bar shown separated from other clutch elements;

Fig. 8 is a control circuit diagram; and

Fig. 9 is a detailed view of a flow control regulating mechanism.

The general organization of the apparatus of this invention may best be seen in Figs. 1 and 2 as comprising a supporting base or pedestal A; a rotary table type packaging or box feeding mechanism B including a box escapement and positioning mechanism C for locating boxes individually and successively at a box filling station; an operator's table D for receiving empty boxes being loaded to the box feeding mechanism and filled boxes discharged therefrom; and mechanism for delivering the screws to be packed at the filling station on the table in controlled, counted flow including a screw feeding machine F of the track discharge type and screw counting and flow control mechanism G.

Rotary table

The operator's table D at one side of the apparatus comprises an extended plate 20 mounted by brackets 21 to the top plate 22 of the pedestal A to provide a horizontal box handling surface level with the surface of the circular rotary box conveyor table 23 of the box feeding mechanism B. The inward side of the horizontal plate 20 is arcuately recessed at 24 to conform with and receive the traveling edge of the circular or annular rotating conveyor table 23, and lateral curb members 25, 26 and inner edge curb members 27, 28 terminating at recess 24 partially enclose the working surface of table D.

The rotary table 23, which in its counter-clockwise rotation provides an annular box conveying surface for transporting boxes from the table D to the box positioning mechanism C and back to the table D, has on its under side a cylindrical hub structure 30 journalled about a hollow table pivot post 31 supported by the top plate 22 of the pedestal, while a cylindrical flange 32 concentric with the hub forms a pulley for the driving V-belt 33. Suitable thrust bearing means, for supporting the weight of the rotary table 23, is provided by flat rings 34 and 35 secured respectively by pins 36 to the outwardly extending bottom flange 37 on the pivot post and by pins 38 to the end of the table hub. Longitudinal grooves 39 in the pivot post extending down to the bearing rings and

radial grooves 40 extending radially into the bearing face of the upper ring 35 may be provided for lubrication.

A flat circular pivot post cap plate 41, extending radially into the circular recess 42 about the hub opening of the rotary table, is secured to the upper end of the pivot post by bolts 43 threaded into the inwardly extending flange 44 thereof. For convenience in assembly and maintenance the cap plate 41 is split into two segments 41*a*, 41*b*. Within and adjacent the bottom end of the pivot post there is provided an integral inwardly extending plate 46, and likewise near the upper end, a lug 47 for supporting a clutch structure H hereinafter described for the operation of the box escapement mechanism. For access to the under side of the pivot post the pedestal top plate 22 is apertured at 48.

To facilitate changing of the endless V-belt, the rotary table pivot post 31 is supported at opposite sides by a pair of parallel spacer bars 51, 52 resting on pedestal top plate 22, which bars normally support the entire weight of the pivot post and other structures bearing thereon. Across the bottom of the pivot post there is provided on opposite sides corresponding foot formations 54, 55 laterally projecting beyond flange 37 to bear on the spacer bars and the pivot post 31 is normally secured to the upper member 22 of the pedestal by bolts or machine screws 57 passed through the projecting ends of these feet, the spacer bars and the top plate of the pedestal. However, at a position corresponding to the mid-length of each of these feet 54 and 55, flange 37 is provided with outwardly extending lugs 58 and 59 threaded to receive vertical socket head set screws 60 and 61 spaced from the feet. Thus upon removal of the securing screws 57, and turning say the set screw 60 down to bear upon the top plate 22 of the pedestal and so take up the weight of the pivot post, the spacer bar 51 may be slid out from beneath the pivot post. By similar manipulation the other spacer bar may be removed after replacement of the first.

Thus when change of the endless V-belt 33 is necessary, the belt may be passed under the set screw at one side of the pivot post, the set screw turned down to take up the weight of the pivot post and annexed structures, the spacer bar removed to permit advancing the belt into the space under and between the spacer bars. The spacer bar may then be replaced and the set screw released. The second spacer bar may be removed at the opposite side in a similar manner, the V-belt then advanced into the space between the second spacer bar and its set screw, so that after replacement of the second spacer bar and release of its set screw, the new belt is then located about the pivot post for final connection.

At one side of the apparatus on the lateral plate member 70 of the pedestal, there is mounted a box feeding mechanism power assembly J comprising an electric motor 71 and speed reduction unit 72 adjustably mounted by means of a slide member 73 extending from the base of the power unit into a supporting slideway member 74 secured to the pedestal. On the vertically extending shaft of the reduction unit 72 there are keyed a chain sprocket 75 and a V-belt driving pulley 76 which drive respectively the rotary table 23 through V-belt 33, and the escapement mechanism C through the spocket chain 77 on the sprocket wheel 78 of the clutch mechanism H. An idler sprocket wheel 79 is carried on an arm 80 pivotally pinned to the top plate 22 of the apparatus pedestal for adjustment in taking up slack in chain 77 after the tension of V-belt 33 is adjusted by setting the position of power assembly J relative to slideway member 74.

An inverted U-shaped yoke member 82, the vertical legs 83 of which are fixed to and supported by the top plate 22 of the pedestal A, provides a horizontal beam 84 spanning the portion of the rotary table 23 let into the operator's table D. With vertical post 85 secured to pivot cap plate 41*b*, beam 84 provides support for the base plate 86 mounting screw feeder F above the table, and also serves to support box guiding vanes. One guide vane 90 extends from table D arcuately about one side of the rotary table 23 curving inwardly to the escapement mechanism C, being supported at one end by curb member 27 of the operator's table, laterally by a curved plate 91 secured to and extending upwardly from the pedestal and at the inner end by the escapement structure C.

A second guide vane 92 extends around the edge of the rotary table 23 from the outer end of the escapement mechanism C back to the operator's table, being supported at one end by structural members of the escapement, laterally by a plate 93 extending upward from the pedestal, and at the other end by the inner curb member 28 of the operator's table. A pair of posts 95, 96 extending downwardly from the beam portion 84 of the yoke member 82 toward the table, support a horizontal slideway 97 wherein the vane member 98 is slidably adjustably secured by wing nut 99. The curved end portion of 98, being spaced from vane 90, provides a box entrance to the rotary table adapted to direct the boxes into proximity to vane 90. The ends of a straight guide member 100, which extends obliquely outwardly onto the operator's table are secured to post 95 and to the table plate 20, while a curved vane 101 extends outwardly between and is secured to the second vertical post 96 and guide 100 to deflect to one side of table D boxes discharging from the rotary table in the channel formed by vane 102 secured to post 96 and the escapement mechanism structure in spaced relation to the discharge guide vane 92 at the periphery of the table.

Box escapement

The box escapement or positioning mechanism C may best be seen in Figs. 2 and 4, and in Fig. 3 for the clutch mechanism H thereof. A parallel pair of bars 110 and 111, supported at inner ends by posts 112 and 113, secured to the pivot cap plates 41*a* and 41*b*, and at their outer ends by bracket posts 114 and 115 extending upwardly outside the periphery of the rotary table from the top plate 22 of the pedestal, form a bridge mounting other components above and at one side of the rotary table. Thus, ends of the spaced inner and outer box discharge guide vanes 102 and 92 are secured respectively to the post 117 depending from bar 111 and to the horizontal spacing strut 118 between bracket posts 114—115, while plate 119 dependent from bar 110 provides an attachment for the radially outwardly bent inner end 90*a* of the arcuate box guide vane 90. A micro-switch 121 bracketed to the outside face of plate 119 has its actuating button 121*a* bearing upon the upper arm 122*a* of a U-shaped switch trigger 122 pivotally secured along its yoke portion to plate 119 with its free end 123 projecting through an aperture in vane end 90*a*. Outwardly of the position of plate 119, a plate 124 secured atop and transversely to bars 110 and 111 provides a support projection at 124*a* for the slide block 125 of the screw flow control mechanism mounting hereinafter described.

A bracket post 128 depending downwardly from the bar 110, whereon its upper end is adjustably slideably mounted and set by wing nut 129, carries a finger or guide strip 130 disposed generally parallel to the straight end portion 90*b* of the guide 90 to form a box orienting entrance of the escapement, while the free finger end 130*a* curves away from the guide 90 to funnel boxes carried by the rotary table into the escapement entrance. Opposite and at right angles to this entrance, a box stop 132, extending parallel to the end portion 90*a* of guide vane 90, is adjustably mounted for movement toward and away from the escapement entrance by a laterally extending bar or arm 133 slideably mounted in a horizontal slideway 134 carried on the post 136 dependent from bar 111.

The box stop 132 and the portion 90*a* of vane 90 thus provide a radially directed path—adjustable in width for

the accommodation of various size box runs—along which boxes may be moved, in a manner to be explained, from the escapement entrance to a position beyond the inwardly reflected stop end **132***a*, whence the boxes are carried on the perimeter of the rotating table into the box discharge channel leading back to the table D. The space between the vertical faces of **90***a* and **132** beyond the micro-switch trigger end **123** defines a box filling station beneath the screw feeder machine discharge track, the downward projection of which in Fig. 2 is partially outlined by dashed-dotted lines **138**, with the projected position of a photoelectric counting cell **208** and light source **209** similarly outlined.

A box pusher arm **139** is slidably mounted on the top face of the pivot post cap structure by a guide bridge **140** of inverted channel shape bolted to the plate **41***a* for longitudinal reciprocation radially of the rotating table in pushing a box, carried by the rotary table through the escapement entrance to stop against **132**, outwardly into the box filling station. The arm is urged outwardly by the force of a compression spring **141** interposed between the block **142** depending from the bottom of the pusher arm into the slot **143** in the plate **41***a* and the L-shaped bracket **144** depending into the end of the slot. A lever **145**, pivotally supported at one end by a support arm **146** bolted to the plate **41***a* and carrying at its other end a roller **147** projecting into the pusher bar slot **148**, carries near its mid point a cam following roller **149** bearing against the edge of a circular eccentric cam **150** secured to the upper end of the shaft **151** projecting upward through the plate **41***a* from the clutch mechanism H. Hence, as the eccentric cam in rotating through one revolution recedes from and advances toward the lever, the pusher bar slides outwardly under the force of the compression spring and is again cammed inwardly to retracted position.

On the working end of pusher arm **139** there is affixed a transverse vertical plate **152** for engaging a substantial lateral box area. Preferably the box stop **132** is slotted or formed of co-planar metal strips, with a laterally projecting portion of the plate **152** slotted, allowing mutual interprojection thereof at right angles to prevent snagging of a box corner therebetween.

The general arrangement of the clutch mechanism H, a single revolution clutch, is seen in Fig. 3 and in the details thereof appearing in Figs. 5 and 6. The clutch shaft **151** is journalled by a sleeve bearing **160** in the cast lug **47** on the pivot post wall and is vertically supported thereon by the collar **161** secured thereto within an aperture in the plate **41***a* beneath cam **150**, while the lower end of the shaft passes through and is pinned to a collar **163** journalled in bearing **164** in the support plate **46** projecting inwardly from the lower end of the pivot post. The lower end of the shaft **151**, projecting through the collar **163**, carries the continuously driven counter-clockwise rotating sprocket wheel **78** held thereon by an end collar **165**, the sprocket wheel hub face adjacent collar **163** being provided with a plurality of radial slots **166** for engagement by the end of a clutch key or pin **167**, longitudinally slideable in a keyway slot **168** cut in the collar **163** to drive the shaft as hereinafter described.

Between the reduced upper end **163***a* of collar **163** and the lug **47**, a switch cam collar **169** with a flat **169***a* thereon is secured to the shaft by a set scew. The leading edge **166***a* of each slot **166** in the hub of sprocket wheel **78** and corresponding edge **170** on the key end as shown are beveled to insure clutch engagement when the pin is free to move downwardly under the bias of compression spring **171** disposed in key bore **172** and bearing against the bottom of collar **169**. At the upper end of the key a laterally extending head **173** projects radially from the reduced collar portion **163***a* above the collar shoulder **163***b*, the under side of the projecting key head being beveled at **173***a* on the edge toward the direction of rotation. A clutch actuating arm **175** pivotally mounted at one end to plate **46** by a pivot pin **176** is shaped at its free end to provide a beveled edge **175***a* and inward thereof a shoulder **175***b* which respectively serve to lift the key out of engaged position by knifing inwardly under the beveled edge **173***a* of the key head and to engage the head **173** to stop the shaft after a single turn.

A solenoid **177** secured by a bracket plate **178** to the clutch support plate **46**, with its armature connected to the clutch actuating arm **175** by a pivot link member **179**, upon energization withdraws the clutch arm from beneath the key to permit engagement of the clutch. The compression spring **180** interposed between the bracket **181** and the clutch actuating arm biases the arm toward clutch disengaging position, so that upon de-energization of the solenoid the actuating arm is moved into position in readiness to wedge under the head **173** and lift the key from clutch engaged position as it completes a revolution. The solenoid release micro-switch **182** mounted on the solenoid, with a roller **183** on its actuating button bearing upon the cam collar **169**, is actuated shortly after the clutch engages by passage of the cam collar flat **169***a* to de-energize the solenoid and release clutch arm **175**. To this end, the cam flat **169***a* is angularly positioned relative to the clutch pin in a rotationally lagging position, so that when the shaft comes to a stop with the clutch pin against shoulder **175***b*, the micro-switch roller **183** bears on a cylindrical portion of collar **169** ahead of the flat.

As may be seen from Fig. 1, the screw feeding machine F is mounted above the rotary table upon a horizontal plate **86**. This screw feeding machine, shown in drawings only in fragmentary portion since its specific structure is per se no part of the present invention, may be any machine having a hopper adapted to receive a large bluk of the screws and having a track type outlet wherein the screws are aligned in soldiered, oriented fashion for individual successive discharge, and adapted for stoppage of the screw discharge by merely blocking screws on the track without stopping the entire machine. The machine may be, for example, such as that described in my co-pending application Serial No. 293,303, filed June 16, 1952, wherein an inclined vibratory track appears in various modifications adapted to handle diverse objects. Here in the drawings the screw feeder F is fragmentarily represented only by the base portion **190** and discharge track **138** comprising a pair of spaced members between which screws are discharged in soldiered manner with the heads supported on the top edges of the track members and the shanks suspended therebetween. Above the track **138** there is provided a holding bar **191** in adjustably spaced relation to the track for preventing the screws from riding over each other in their progress down the track. The holding member as here appears terminates a short distance above the end of the track, which is positioned directly above the box filling station, as indicated by the dash-dot lines in Fig. 2.

Flow control mechanism

The screw counting and flow control mechanism for regulating the discharge of screws from the track includes a variable speed electric track motor **192**, a speed reduction unit **193** and an electric brake **194** for the motor, supported as a unit upon a common base **195**. Adjacent and above the end of the screw feeding track **138**, the output shaft **196** of the speed reducer carries a rubber-tired screw feed control wheel **197** disposed with its plane of rotation in the plane of motion of the screws down the feed track. The base plate **195** of the assembly is pivoted at **195***a* to a slide member **198** adjustable in the slide block **125** carried by the transverse bar **124** on the escapement mechanism C, so that the assembly may be tilted about a horizontal pivot axis transverse to the plane of the track to swing the control

wheel 197 away form or against screws on the track. To normally urge the track motor assembly and control wheel toward the track, between a bracket plate 199 on the slide member 198 and the bottom of the motor assembly base plate 195 a helical compression spring 200 is operatively disposed. Also carried by the bracket plate 199 is a solenoid 201 having its armature connected through the pivot link 202 to the outer end 203 of the track motor assembly base plate 195. Thus by the bias of the compression spring the track assembly is normally urged to bring the control wheel to bear upon the heads of the screws passing over the end of the feed track to initiate a controlled trickle flow with the wheel slowly turning and to stop the screw flow when the control wheel is stationary, while the assembly may be drawn away from the feed track against the bias of the spring upon energization of the solenoid to permit free flow of screws.

For adjustment of position of the track control wheel 197 relative to the track for varying sizes of screws, the track motor assembly may be adjusted by moving the slide member 198 in the slide block 125, as, for example, by a wing nut 205 threaded into the slide block with axis parallel to the slide and having a head flange 206 engaged in a slot in the slide member. Beneath the control wheel 197 a photoelectric cell 208 and light source 209 directed to the cell are mounted on opposite sides of the track so that screws discharged therefrom and dropping into a box in the box filling station below will interrupt the light beam to produce a counting signal for a count totalizer. The cell and light source may be mounted on the end of the track, the base plate of the track motor assembly or upon the structural members of the box escapement feeding mechanism C, depending upon the design features used in these several structures. If desired a chute or funnel structure 211 may be mounted below the feed track to guide the screws or other counted objects into a container located at the filling station.

Control circuitry

The driving unit J for continuously driving the rotary table and the clutch sprocket wheel 78 and the driving units 220 of the feeder machine F may be switched on and off by a master control switch 221 in the lines 222, 223 or by individual switches 224, 225 in conventional manner at the beginning and end of a working period or screw packaging run, as shown in Fig. 8 representing a control system hereinafter described integrating the operation of the box escapement mechanism C and of the screw flow control assembly G whereby automatic operation is provided.

An electronic or electromechanical counting and totalizing unit 226 is provided into which are fed the signals generated by screws interrupting the light beam to the photocell 208 in dropping to a box in a filling station. Such totalizer is adapted to be set at a desired final screw count per count cycle (i. e. per box) to develop a first output impulse or signal at a point in the count a selected number previous to the final count and a second signal or impulse at the selected final count. The first impulse through one relay in the unit opens the normally closed relay switch contacts 228, and the second or final count impulse, through a second relay, simultaneously opens the normally closed relay switch contacts 229 and closes the normally open relay switch contacts 230 for the purposes hereinafter described. Upon attaining the desired final or lot count for which the unit is preset, the totalizer automatically resets itself to zero for another lot of the same count, that is the unit is "self-clearing." Since the totalizer 226 of the control system and its components may be of conventional design and are not per se in their particular structure part of the invention here claimed, no wiring diagram or detailed description is given for that unit, but only the operating characteristics required therein.

Operation of the escapement mechanism is controlled through a clutch solenoid relay having the switch contacts 231*a* thereof in series with clutch solenoid 177 across lines 222, 223, and second switch contacts 231*b* for self holding in series with the normally open clutch micro-switch 182 and the relay coil 231*c* across the lines 222, 223. A normally open starting switch 233, as a push-button switch, and the normally open relay switch contacts 230 are connected in parallel between line 222 and a point between coil 231*c* and holding contacts 231*b*. Hence, if micro-switch 182 is of the normally open type and held closed by the cylindrical surface of cam collar 169, upon momentary closing of the starting switch 233, the relay coil 231*c* is energized to close the relay holding switch 231*b* and the solenoid switch 231*a*. Thus solenoid 177 is energized to permit engagement of the clutch H. The transit of the cam flat 169*a* past the switch roller 183, after the shaft starts to rotate, briefly opens and then closes the micro-switch 182, thereby de-energizing the relay coil 231*c* to cause opening of the solenoid switch 231*a* and the self-holding switch 231*b*, de-energizing the clutch solenoid 177 to release clutch arm 175. Hence upon completion of a single turn of the shaft 151, the clutch arm disengages the clutch. Such clutch cycle causes a single turn of cam 150 and a single stroke or reciprocation of pusher arm 139, thereby feeding a box into the filling station.

When switch 230 is closed by the final count impulse produced by totalizing unit 226 after the desired number of objects has passed into a box in the filling station, the same cycle of clutch control operations is repeated to actuate the escapement mechanism, automatically feeding an empty box into position at the filling station while expelling the previously filled box therefrom.

Controls for the motor 192, electric brake 194 and solenoid 201 include means energizing solenoid 201 on receipt of a signal from micro-switch 121 when actuated by complete passage of a box by its trigger arm 122, thereby to draw the screw flow control wheel 197 away from the tracks and to permit rapid screw flow; to simultaneously release the motor brake 194 and start the motor 192 before the wheel comes into track engagement; to cut off current flow to solenoid 201 on receipt of the aforementioned first impulse from the totalizer, so that under bias of spring 200 the slowly turning control wheel 197 is swung into contact with screw heads on the track to apply a restraining force hindering free flow thereby to initiate trickle flow beneath the wheel; and to cut off power to motor 192 and actuate motor brake 194 upon receipt of the said second totalizer output signal to stop the wheel rotation and hence the trickle flow at exact final count. Preferably there is provided a motor speed control means, such as the variable auto-transformer 235 whereby the speed of rotation of wheel 197 may be preset in accordance with a particular size of screw being fed, or for the time required for operations of the apparatus.

As here shown the electrically controlled brake 194 and motor 192 are effectively in parallel with each other for operation as a unit, so that as current is supplied to start the motor, the brake is electrically-solenoidally-disengaged, the brake being spring engaged when current to the motor, and therefore to the brake solenoid, is cut off.

In series across the lines 222, 223 with the brake-motor combination there is the normally open relay contact switch 237*a* closed by motor relay coil 237*c*, the motor relay including the relay self-holding switch 237*b* in series with the relay coil and with the normally closed switch 229, across lines 222, 223. Another normally open relay switch 239*a*—simultaneously closed with switch 239*b* by energization of relay coil 239*c* as will be explained—is connected from coil 237*c* to line 222, that is in parallel with the series switches 229 and 237*b*. Hence upon momentary closing of 239*a*, coil 237*c* is energized

to close relay holding switch 237*b* keeping the relay energized and closing 237*a* to start motor 192 and release brake 194. The opening of relay switch 229, occurring simultaneously with the closing of switch 230 to actuate the escapement upon final count signal as above explained, de-energizes coil 237*c* to release and open relay holding switch 237*b* and motor control switch 237*a*, thereby cutting off current to the motor 192 and brake 194 to stop wheel 197.

The solenoid 201, for drawing the control wheel unit away from the feed track, is connected in series with the normally open relay operated switch 240*a* across the lines 222, 223, while the relay coil 240*c* therefor is connected across the lines 222, 223 in series with the relay holding switch 240*b* (closed by the coil with main switch 240*a*) and the normally closed relay switch 228. The relay switch 239*b* is connected in parallel with the series switches 228 and 240*b* from the coil 240*c* to line 222, so that upon closing of 239*b* along with 239*a* by energization of coil 239*c*, the relay coil 240*e* is energized to close 240*a* and 240*b*, thereby keeping solenoid 201 energized and the control wheel 197 drawn away from the track to allow free flow, until 228 is opened upon the first output signal from the totalizer. With 228 opened 240*a* opens to de-energize the solenoid 201, permitting the wheel 197, now rotating, by the bias of the spring 200 to swing into engagement with objects on the track to initiate trickle flow.

The micro-switch 121 which serves as a box actuated trigger to start free flow of screws from the track to the filling station is a single pole double throw switch, the arm of which is connected through capacitor 242, relay coil 239*c* and selenium rectifier 243 to line 223.

A capacitor 244 and resistor 245 in parallel are connected from a point between coil 239*c* and rectifier 243 to 222, for ripple smoothing of the half-wave power rectifier circuit. One point 246 of switch 121 is connected by resistor 247 to capacitor 242, so that as a box first engages switch 121, the switch arm is thrown to contact 246 to discharge 242. When the box has passed the switch, and therefore is positioned in the filling station, the switch arm returns to normal contact with switch point 248 connected to line 222. Thereupon current flows through relay coil 239*c* until capacitor 242 is charged, the time being determined by the chosen values of the circuit elements involved. The current through coil 239*c* closes simultaneously the relay switches 239*a* and 239*b*, which of course open with the diminishing charging current. As previously explained, closing of 239*b* causes solenoid 201 to withdraw the control wheel 197 from the engaged position where it withholds flow on the feeder track, and the closing of 239*a* causes release of brake 194 and starting of motor 192.

Control functions

In summary, at the start of a box filling run with the turntable motor 71 and hopper feeder motors 222 running, closing starting switch 233 momentarily actuates the single cycle clutch mechanism to position a box at the filling station. The box, in tripping micro-switch 121, causes closing of relay switches 239*b* and 239*a* to tilt the control wheel 197 from the track to start free counted flow of screws, and to start the rotation of control 197. At the chosen number before desired final count, the totalizer first output or "warning" signal causes relay switch 228 to open thereby effecting release of the rotating control wheel to trickle flow position. At final count, the second output signal of the totalizer opens relay switch 229 thereby cutting off motor 192 and engaging brake 194 to stop flow at exact count; and also closes switch 230 to initiate the escapement single clutch mechanism for repetition of the cycle.

As long as boxes are present on the rotating table the above described composite cycle of operations continues until the last box is filled. When the second output signal of the totalizer corresponding to the final count for the last box actuates the clutch, a single stroke of the pusher arm follows, but since no box is thereby impelled into the filling station to trip the trigger arm 123 to actuate switch 121, switches 239*a*, *b* remain open, the control wheel 197 remains braked and in engaged position, and no flow of screws ensues to cause photocell signals. Hence no further output signals of the totalizer are developed to actuate either the flow control mechanism G or the clutch mechanism H, so that the operation thereof is automatically stopped. When a new supply of boxes is fed into the apparatus, the starting switch 223 in the circuit energizing the solenoid 177 must be closed to start the automatic feeding of the boxes. In the event that the supply of screws in the feeder machine is exhausted, since no photocell signals are fed to the totalizer, no output signals are developed, and the unfilled box remains in filling position until the hopper feeder is filled.

Over-all operation

In setting up the apparatus for a run handling particular screw and box sizes, the guide finger 130 is set relative to vane portion 90*b* to provide an entrance opening to the box escapement mechanism of proper size, and the box stop 132 is adjusted relative to 90*b* so that the trigger arm end 123 is tripped by passage of a box into the filling station. The position of screw flow control mechanism G is adjusted by wing nut 205 on the slide block to bring the control wheel 197 into proper spacing from track 138 for the size of screw or other object being packaged. The screw counting totalizer is of course set for the desired final count.

In operation of the apparatus, the hopper of feeder machine F is bulk loaded with screws as required, and the driving mechanism thereof is turned on along with the rotary table driving unit J for continuous operation during a work period or the duration of the packaging run with given screw or box sizes. Then empty boxes, loaded upon the operator's table open side up, are manually pushed indiscriminately as to orientation onto that portion of the rotary table projecting outwardly into the area of the table D, whence they are carried by the rotating table between the guide vanes 90—98, coming to bear against the inwardly curving guide vane 90 so that with continued advancing motion the boxes are directed by the vane 90 toward the entrance of the escapement mechanism, into which the first of the boxes, of course, passes to stop against the box-stop 132. The tendency of the remaining boxes is therefore to line up in serial position behind this first box.

The previously mentioned starting switch 223 is closed to initiate the operation of the escapement mechanism C and the counted screw flow control mechanism G with their automatic controls for carrying out the previously described operational cycles in repeated manner. As the filled boxes are successively expelled from the filling station onto the outer portion of the rotating table, they are carried back and directed onto the operator's table D by guide vanes 92, 102 and 100. Thus the only attention required of the operator when the apparatus is functioning is to supply empty boxes to the rotating table, remove the filled boxes from table D, and where the run of screws exceeds the hopper capacity of feeder machine F, to bulk load screws as required.

The advantages of the invention as above described and as shown in the drawings are of course susceptible to use in various ways. Thus the apparatus as a whole may be used with means for delivery of empty boxes to the entrance of the turntable and removal of filled box from the discharge outlet such as gravity feed chutes, moving belts or other conveyor means. Counting elements other than photocells and means for applying a force to objects on the track to initiate trickle flow and

to stop flow other than the control wheel, such as electromagnetic elements or transducers may be utilized.

Further, the trickle flow control may be applied for some terminal control operations at final count other than complete stoppage of flow on a feed track at exact count with ensuing change of boxes or other container at the filling station. Thus where it is desired to direct counted lots of objects from a feed track alternately along two paths, as by use of a switching gate, the use of the trickle flow, initiated by a warning count signal previous to exact final count of a given lot, provides an interval between the discharge of the last object of one counted lot, and the first of the next lot, during which the terminal control operation of switching the gate for another feeder discharge path may be carried out, say in response to a final lot count signal. Such operation may be carried out if desired without completely stopping the control wheel 197 (where such is used), since the control wheel is effectively withholding from free flow the first object of a subsequent lot during the time the object is passing under the wheel. Operation of this character may be found advantageous for example, where the object feeder machine supplies objects to two filling stations alternately.

I claim:

1. In a machine adapted for rapid stream discharge of objects in successive exactly counted lots, including a track means determining a path for serial discharge of the said objects: the combination with said track and means inducing rapid flow movement of objects along said track, of means for breaking up the discharge flow into successive counted lots, the last said means comprising flow regulating means mounted adjacent said track for applying force to objects thereon to reduce the rate of travel and to stop such flow; and control means for said flow regulating means including counting and totalizing means having an element thereof disposed downstream of said regulating means adjacent said path and responsive to passage of an object therealong, said counting and totalizing means being adapted at a count a predetermined number before final lot count to operate said regulating means to reduce the flow and at a predetermined final lot count to operate said regulating means to interrupt and stop said flow, and externally operated means for causing said flow regulating means to release objects on the track for free flow.

2. In a machine adapted for rapid stream discharge of objects in successive exactly counted lots, including a track means determining a path for serial discharge of the said objects: the combination with said track and means inducing rapid flow movement of objects along said track, of means for breaking up the discharge flow into successive counted lots, the last said means comprising flow regulating means mounted adjacent said track for applying force to objects thereon to reduce the rate to a trickle flow and to stop such flow; and control means for said flow regulating means including electric counting and totalizing means having a photoelectric cell and light source disposed downstream of said regulating means on opposite sides of said path, said counting and totalizing means being adapted at a count a predetermined number before final lot count to operate said regulating means to induce the said trickle flow and at a predetermined final lot count to operate said regulating means to stop said trickle flow, said counting and totalizing means being self clearing on attaining the predetermined final count, and externally triggered means for causing said flow regulating means to release objects on the track for free flow.

3. A machine adapted for rapid stream discharge of objects in exactly counted lots comprising track means determining a path for serial discharge of the said objects; means inducing rapid free flow movement of objects along the track; flow regulating means including a rotatable wheel mounted adjacent to and for movement toward said track to engage objects thereon, the track direction being in the plane of rotation of said wheel, driving means whereby said wheel may be rotated at a peripheral rate lower than the linear rate of free movement of objects on said track, brake means for said wheel, and wheel shifting means for moving said wheel toward and away from said track, whereby upon movement of the wheel toward said track into engagement with objects thereon with the wheel rotating the rate of flow is diminished to a trickle flow and upon braking of the wheel the flow is stopped; and control means for said flow regulating means including counting and totalizing means having a counting element thereof disposed adjacent said path on the discharge side of said wheel, said element being responsive to passage of an object, said counting and totalizing means being self clearing upon attaining a predetermined final lot count, means for actuating said wheel shifting means and for starting the driving means to bring the wheel into engagement and rotation upon attaining a count a predetermined number before a desired final lot count to initiate said trickle flow, means for actuating said brake means and for stopping said driving means at the desired predetermined final lot count to stop said trickle flow, and externally triggered means for actuating said wheel shifting means to move the wheel from engagement, thereby releasing the objects for free counted flow in a succeeding lot.

4. A feeding machine adapted for rapid stream discharge of objects in exactly counted lots comprising track means determining a path for serial discharge of the said objects; means inducing rapid free flow movement of objects along the track; flow regulating means including a rotatable wheel mounted adjacent to and for movement toward said track to engage objects thereon, the track direction being in the plane of rotation of said wheel, driving means whereby said wheel may be rotated at a peripheral rate lower than the linear rate of free movement of objects on said track, electrically controlled brake means for said wheel and electrically controlled wheel shifting means for moving said wheel toward and away from said track, whereby upon movement of the wheel toward said track into engagement with objects thereon with the wheel rotating the free flow is diminished to a trickle flow and upon braking of the wheel the flow is stopped; and electric control means for said flow regulating means including counting and totalizing means having a photo-electric counting cell and light source on opposite sides of said path on the discharge side of said wheel, said counting and totalizing means being self-clearing upon attaining a predetermined final lot count and being adapted to produce an output signal for actuating said wheel shifting means and for starting the driving means to bring the wheel into engagement and rotation upon attaining a count a predetermined number before a desired final lot count to initiate a slow trickle flow and being adapted to produce an output signal for actuating said brake means and for stopping said driving means at the desired predetermined final lot count to stop said trickle flow, and exteriorly triggered means for actuating said wheel shifting means to move the wheel from engagement thereby releasing the objects for free counted flow in a succeeding lot.

5. In a feeding machine adapted for rapid stream discharge of objects, while permitting a terminal control operation at an exactly counted quantity thereof, including track means determining a path for serial discharge of said objects and means inducing rapid free flow of objects along said track: the combination with said track means of discharge flow regulating means comprising a rotatable resiliently rimmed wheel mounted adjacent to an for movement toward said track to engage objects thereon, the track direction adjacent said wheel being in the plane of rotation thereof, driving means whereby said wheel may be rotated at a selected peripheral rate lower than the linear rate of free movement of objects on said track, wheel shifting means for moving said wheel toward and

away from said track, and control means including a counting and totalizing means having a counting element thereof disposed adjacent said path on the discharge side of said wheel responsive to passage of an object, said control means being adapted for actuating said wheel shifting means and for starting the driving means to bring the wheel into rotating engagement with objects on the track upon attaining a count of a predetermined number before a desired final count to initiate diminished flow with the interval between discharge of successive objects determined by the time of contact with each object, whereby after discharge of the last object in the desired counted quantity an interval is provided for execution of a desired terminal control operation before discharge of subsequent objects.

6. In a feeding machine adapted for rapid stream discharge of objects, while permitting a terminal control operation at an exactly counted quantity thereof, including track means determining a path for serial discharge of said objects and means inducing rapid free flow of objects along said track: the combination with said track means of discharge flow regulating means comprising a rotatable resiliently rimmed wheel mounted adjacent to and for movement toward said track to engage objects thereon, the track direction adjacent said wheel being in the plane of rotation thereof, driving means whereby said wheel may be rotated at a selected peripheral rate lower than the linear rate of free movement of objects on said track, wheel shifting means for moving said wheel toward and away from said track, and control means including a counting and totalizing means having a counting element thereof disposed adjacent said path on the discharge side of said wheel responsive to passage of an object, said control means being adapted at a predetermined final count to initiate said terminal control operation and being adapted for actuating said wheel shifting means and for starting the driving means to bring the wheel into rotating engagement with objects on the track upon attaining a count of a predetermined number before a desired final count to initiate diminished flow with the interval between discharge of successive objects determined by the time of contact with each object, whereby after discharge of the last object in the desired counted quantity an interval is provided for execution of the desired terminal control operation before discharge of subsequent objects.

7. A machine adapted to rapid stream discharge of objects in exactly counted lots, comprising track means determining a path for serial discharge of the said objects; means inducing rapid free flow movement of objects along the track; flow regulating means including a rotatable wheel and a pivoting base mounting said wheel adjacent to and for movement toward said track to engage objects thereon, said wheel and base being normally biased toward the track, the track direction being in the plane of rotation of said wheel, driving means whereby said wheel may be rotated at a peripheral rate lower than the linear rate of free movement of objects on said track, electrically operated brake means for stopping and releasing said wheel, and wheel shifting means for moving said wheel toward and away from said track including solenoid means moving the base and wheel in the direction away from the track, whereby upon movement of the wheel toward said track into engagement with objects thereon with the wheel rotating the rate of flow is diminished and upon braking of the wheel the flow is stopped; and electric control means for said flow regulating means including counting and totalizing means having an electrically responsive counting element thereof disposed adjacent said path on the discharge side of said wheel, said counting and totalizing means being self-clearing after attaining a predetermined final lot count, said control means being adapted for actuating said wheel shifting means and for starting the driving means to bring the wheel into engagement and rotation upon attaining a count of a predetermined number before a desired final lot count to initiate a slow trickle flow and adapted for actuating said brake means and for stopping said driving means at the desired predetermined final lot count to stop said trickle flow, and externally triggered means for actuating said wheel shifting means to move the wheel from engagement thereby releasing the objects for free counted flow in a succeeding lot.

8. In a container filling apparatus, the combination with a mechanism for receiving containers, conveying them to and positioning them in a container filling station provided in the mechanism, said mechanism including an escapement mechanism adapted in a container escapement cycle to pass a container into said station and retain the container therein until a succeeding container is positioned at the filling station by a following escapement cycle, of a feeding mechanism adapted to receive in bulk objects to be packaged and adapted for rapid stream discharge of objects to said filling station while permitting a terminal control operation at an exactly counted quantity thereof; the said feeding mechanism including track means determining a path for serial discharge of said objects to a container in said filling station, means inducing rapid free flow of objects along said track, and discharge flow regulating means; said flow regulating means comprising a rotatable resiliently rimmed wheel mounted adjacent to and for movement toward said track to engage objects thereon, the track direction adjacent said wheel being in the plane of rotation thereof, driving means whereby said wheel may be rotated at a selected peripheral rate lower than the linear rate of free movement of objects on said track, wheel shifting means for moving said wheel toward and away from said track, means for halting discharge of objects along said path, and control means including a counting and totalizing means having a counting element thereof disposed adjacet said path on the discharge side of said wheel responsive to passage of an object, said control means being adapted for actuating aid wheel shifting means and for starting the driving means to bring the wheel into rotating engagement with objects on the track upon attaining a count of a predetermined number before a predetermined final count to initiate diminished flow with the interval between discharge of successive objects determined by the time of contact with each object, said control means being adapted at the final count to actuate said means for halting object discharge, whereby after discharge of the last object in the desired counted quantity an interval is provided for operation of said container escapement mechanism to position an unfilled container in said filling station before discharge of subsequent objects.

9. An apparatus as described in claim 8, wherein said control means is adapted to initiate an escapement cycle of said escapement means when final count has been reached.

10. An apparatus as described in claim 8 wherein said container escapement means is provided with trigger means operatively connected to said control means and tripped by a container passed into said filling station, said control means being adapted upon tripping of said trigger to actuate said wheel shifting means for moving said wheel away from said track.

11. An apparatus as described in claim 9 wherein said means for halting objects from discharge comprises brake means adapted to stop rotation of said wheel upon discharge of the object completing the predetermined final count.

12. An apparatus as described in claim 8 wherein said container escapement means is provided with trigger means operatively connected to said control means tripped by a container passed into said filling station, said control means being adapted upon tripping of said trigger to actuate said wheel shifting means for moving said wheel away from said track and to start rotation of said wheel.

13. In a machine adapted for rapid stream discharge of objects in exactly counted lots, a discharge control mechanism comprising: track means determining a path for serial discharge of the said objects; means inducing rapid free flow movement of objects along the track; flow regulating means including a rotatable wheel mounted adjacent to and for movement toward said track to engage objects thereon, the track direction being in the plane of rotation of said wheel, driving means whereby said wheel may be rotated at a peripheral rate lower than the linear rate of free movement of objects on said track, brake means for said wheel, and wheel shifting means for moving said wheel toward and away from said track, whereby upon movement of the wheel toward said track into engagement with objects thereon with the wheel rotating the rate of flow is diminished to a trickle flow and upon braking of the wheel the flow is stopped.

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U. S. DEPARTMENT OF COMMERCE

PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,825,191 March 4, 1958

James W. Batchelder

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 35, for "bluk" read -- bulk --; column 12, line 69, for "an for" read -- and for --; column 14, line 38, for "aid wheel" read -- said wheel --.

Signed and sealed this 6th day of May 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents