

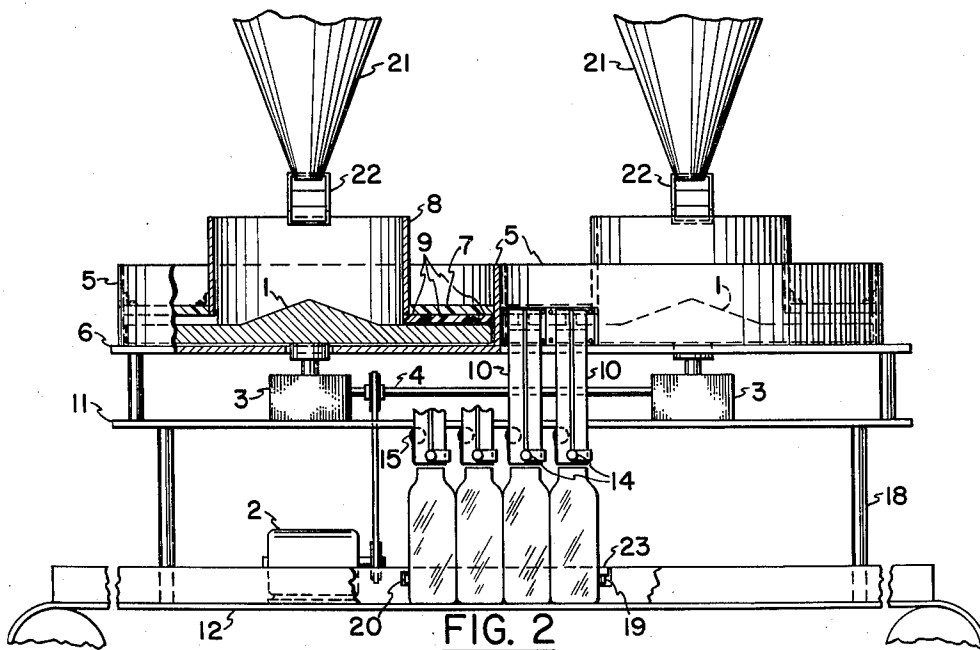
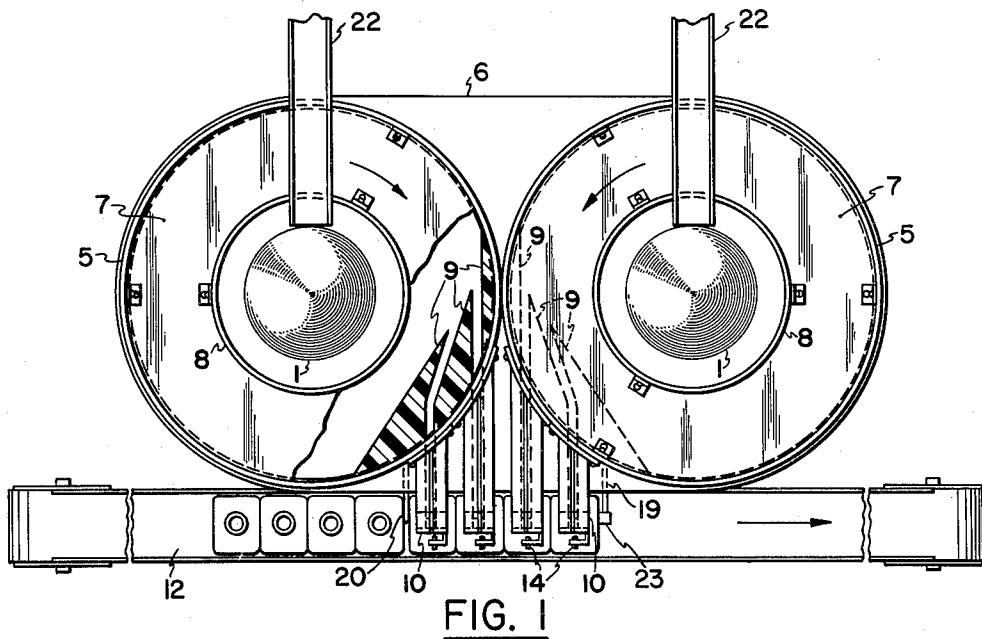
Jan. 30, 1962

S. E. HARRIS ET AL
PACKAGE FILLING APPARATUS

3,018,595

Filed March 25, 1959

4 Sheets-Sheet 1



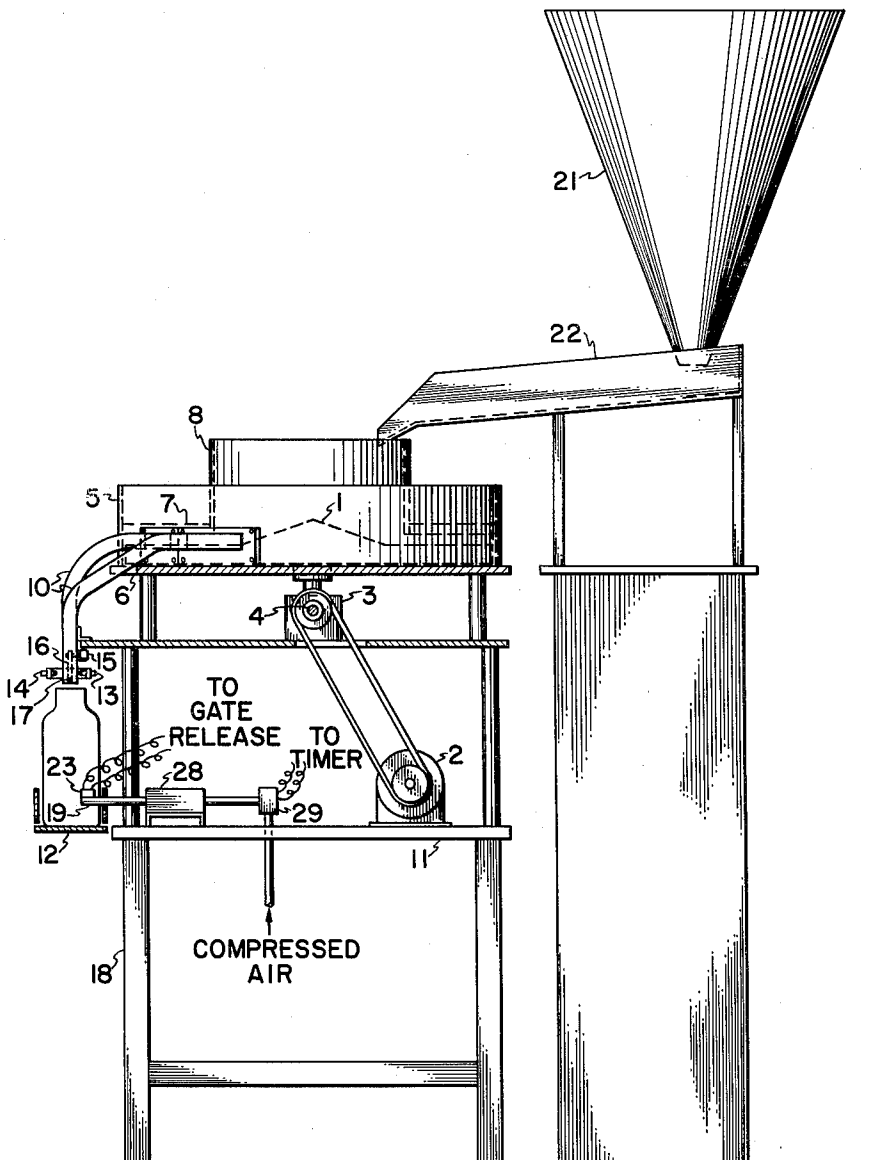
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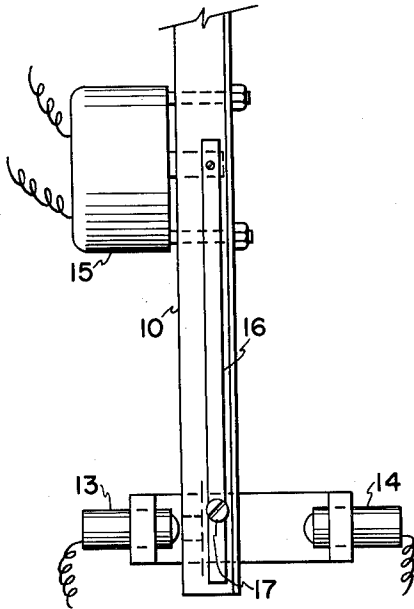


FIG. 4

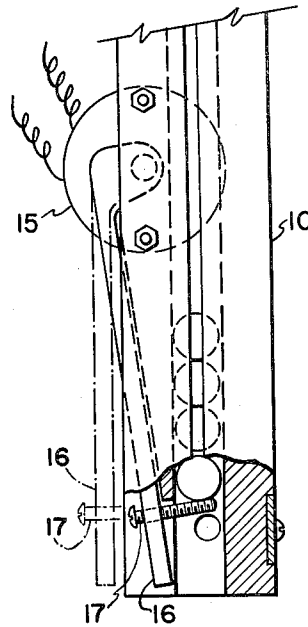


FIG. 5

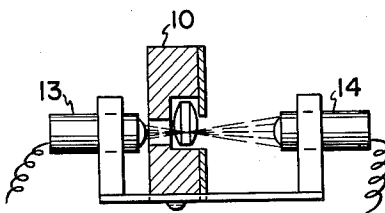


FIG. 6

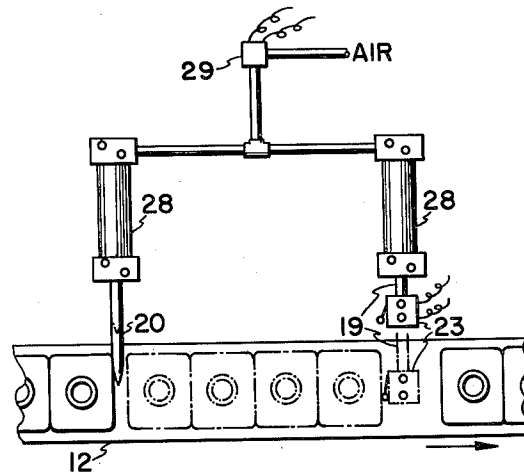


FIG. 7

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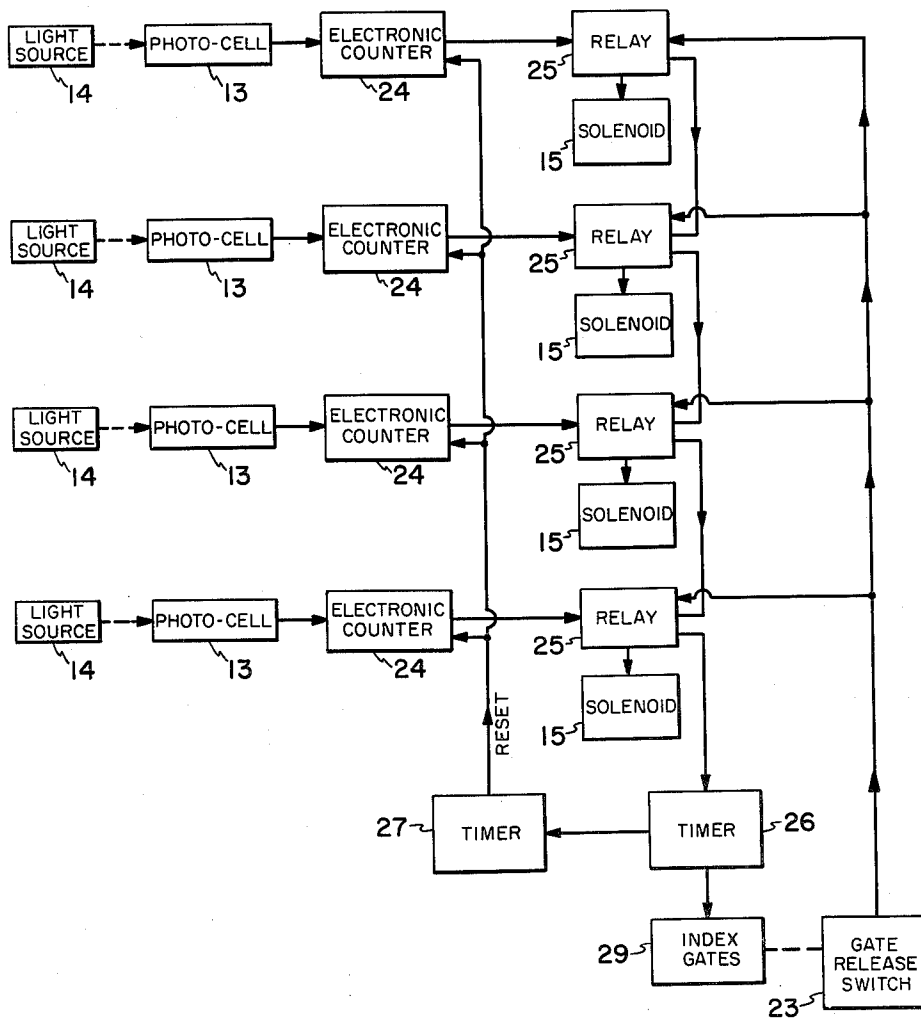


FIG. 8

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PACKAGE FILLING APPARATUS

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3 Claims. (Cl. 53—78)

This invention relates to an improved apparatus for filling containers with small, uniformly shaped solid objects. Primarily, the invention is directed to an apparatus for filling bottles and the like with an accurate count of medicinal tablets.

In the pharmaceutical industry, it is the conventional practice to supply medicinal tablets from the manufacturing level to the retailing level in containers containing multiple doses of the drug. Bottles of varying sizes containing, for example, 20, 25, 30, 50, 100, 200, 250, 500 or 1000 tablets, are frequently used. The sizes of tablets also vary within relatively broad limits depending on the type and dosage of the drug or drugs contained therein. It is important, especially from the economic standpoint, that the tablet packaging operations be rapid and accurate with a minimum of handling, breakage and attrition. The highest amount of automatic operation is usually desired. Accuracy of count, particularly at a high rate of operation, is also a primary goal.

In known devices, high speed operation results in sacrifice of accuracy due in large measure to the relatively slow response of the mechanisms employed. In other instances, high speed operation is sacrificed for the sake of accuracy and/or gentle handling to reduce breakage unless large and complex mechanisms are utilized. Frequently jamming of the delivery means slows or stops operations, or in other cases, results in incomplete filling of the container if the counting means is not responsive to such interruptions.

It is an object of this invention to provide an apparatus by means of which small objects such as tablets are accurately and rapidly packaged in a simple, automatic operation. It is also an object of the invention to provide an apparatus which is readily adjustable to different sizes of the objects to be packaged.

In its broad outlines, the apparatus of this invention comprises a disc rotating in a substantially horizontal plane. Tablets are fed onto the disc and the rotation carries the tablets to its periphery where they are diverted by stationary guides through one or more openings in a fence surrounding the disc into a delivery chute. The chute guides the tablets past a counting means into a waiting receptacle. The counting means consists of a photoelectric cell receiving light from a source projecting a beam across the chute transverse to the path of tablets falling therein. The impulse resulting from the interruption of the beam of light upon the photoelectric cell by the passage of each tablet through the chute is registered by a predetermined electronic counter of conventional type. When the predetermined number of tablets has passed the counting photoelectric cell, a signal is sent through an electrical circuit which operates to interpose an obstacle into the chute to prevent the passage of additional tablets. The containers, preferably resting on a continuously moving conveyor or belt, receive the tablets at the end of each chute. Automatically operated gates control the positioning and movement of the containers on the conveyor.

One or more chutes may be accommodated by a single rotating plate. It has been found, however, that in general, best results are obtained with not more than two chutes. It is possible, as described more particularly below with respect to the preferred embodiment, by utilizing two adjacent, counterrotating plates each with two

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delivery chutes, to fill four receptacles simultaneously in a rapid, automatic operation.

The counting and filling cycle is controlled by an electrical circuit adapted to the operation desired, referred to briefly above and more fully described below.

In the drawings which accompany this specification and illustrate the invention

FIGURE 1 is a top view of a preferred modification of the invention showing the rotating discs and associated assembly in detail.

FIGURE 2 is a front elevation of a preferred form of the apparatus.

FIGURE 3 is a side view of the apparatus shown in FIGURES 1 and 2.

FIGURES 4 to 6 are detailed views showing the light source and photocell and rotary solenoid, lever arm and stop pin arrangements.

FIGURE 7 shows the gate mechanisms.

FIGURE 8 is a block diagram of the electrical circuit controlling the automatic cycle of the apparatus.

A detailed description of the apparatus and its operation follows with particular reference to FIGURES 1 to 3. The apparatus shown in those figures is an especially preferred modification and is illustrative of the invention.

Each disc 1, rotated continuously by motor 2 through reducing gear 3 and shaft 4 is surrounded by fence 5, attached to support plate 6. Adjustable cover plate 7 in the form of an annular ring is attached to fence 5. Attached to cover plate 7 is inner fence 8 and guides 9 which extend as closely as possible but do not touch disc 1. Chutes 10 are removably attached to fence 5 in alignment with the guides 9. Further support is given to the chutes by removably attaching them to drive support plate 11. Chutes 10 are so constructed that they project over conveyor 12 with the projecting vertical portions in alignment. Attached to chutes 10 are photoelectric cell 13 and light source 14. Photocell 13 and light source 14 (shown also in FIGURES 4 and 6), which conveniently are combined in a single removable unit, are attached close to the lower end of chutes 10. The light from source 14 passes, by means of suitable openings in chute 10, across the path of tablets dropping through the chute and falls on the face of photocell 13.

Mounted also on chute 10 is rotary solenoid 15 to which is attached lever arm 16 and stop pin 17 (shown also in FIGURE 5). These elements constitute an assembly which is attached to the chute by nuts and bolts and may be readily removed as later described. In normal operation, stop pin 17 is held in a withdrawn position by means of a spring, but when actuated by solenoid 15, pin 17 enters the chute 10 through an opening in the side thereof to obstruct the passage of the tablets. The photocell and light source assembly is mounted so that stop pin 17 is above and as close as possible to the light beam passing across the chute without actually breaking it. The entire unit as described above is mounted on movable frame 18.

Attached also to frame 18 are index gates 19 and 20 (shown also in FIGURE 7). The gates are so mounted in relation to conveyor 12 as to extend transversely across the conveyor and to control the movements of the containers on the conveyor. Gates 19 and 20 are mounted on a slide so that the distance between them is adjustable to accommodate the number and size of bottles being filled in a given operation. Index gates 19 and 20 are extended and withdrawn by means of air cylinders 28 operated by solenoid valves 29 responsive to signals from timer 26. Gate release microswitch 23, whose function is described below, is mounted on gate 19.

Conveyor 12 is shown in FIGURES 1 to 3 as an auxiliary, independent unit. It preferably operates con-

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tinuously. In this instance, the package filling apparatus, mounted for example on casters, is moved into position beside the conveyor 12 so that chutes 10 project over it as shown in FIGURE 3. It is temporarily attached to the filling apparatus by clamps or bolts so as not to move out of position due to vibration during operation. Either frame 18 or conveyor 12 may be adjustable in height from the floor to adjust for differences in height of the containers used. It will be appreciated, however, that conveyor 12 may be made an integral part of the apparatus by mounting it appropriately on frame 18 and may be operated independently or by means of motor 2.

Hoppers 21 combined with vibratory feeders 22 illustrate the preferred means of continuously introducing tablets onto rotating discs 1.

In the operation of the apparatus described above, the tablets in supply hoppers 21 fall by gravity onto vibrators 22 which move the tablets forward and deliver them to the respective rotating disc 1 within inner fence 8. Rotation of the disc 1 moves the tablets in a single layer beneath cover plate 7 and into alignment along the periphery of disc 1. Stationary guides 9 lead the tablets through openings in fence 5 into the chutes 10. The tablets move freely through the chutes and into receptacles placed beneath each chute until passage is barred by the operation of removable stop pins 17.

The tablets are counted as they fall downwardly through the chute and interrupt the beam of light passing from light source 14 to photoelectric cell 13. When the predetermined number of tablets has passed photoelectric cell 13, solenoid 15 is energized through the electrical circuit described below, thereby advancing pin 17 by means of lever arm 16 into its chute and barring the passage of additional tablets. During the period when the tablets are not moving into and through the delivery chutes, the discs continue to rotate as the tablets thereon remain stationary.

When all of the bottles being filled have received the full count of tablets, gate 19 is withdrawn to allow the filled containers to be carried away by conveyor 12. Gate 20 is simultaneously closed at this stage to prevent the entry of empty bottles into the filling station. After the filled containers have been removed, a timing device opens gate 20 and closes gate 19 in order to permit empty containers to align themselves under the respective chutes. When the empty bottles are in proper position to receive tablets, microswitch 23, mounted on gate 19, is closed by the pressure of the oncoming bottles. Closing switch 23 results in the removal of stop pin 17 from each chute and initiates a new cycle.

The apparatus of this invention not only provides rapid operation and accurate counting, but it is also flexible in accommodating to tablets varying in diameter, thickness and shape. A changeover from operation with tablets of one type to tablets of another requires only removal and replacement of cover plate 7 and chutes 10 with parts adapted to the new type tablet and, if necessary, adjusting the spacing between gates 19 and 20. During the changeover, the photoelectric cell assemblies and stop pin-solenoid assemblies are removed and then remounted on the replacement chutes. Thus by providing a series of chutes of different sizes and cover plates with suitably spaced guides, the apparatus may be rapidly changed over to operation with any size tablet.

From cover plate 7, affixed to fence 5, are suspended the guides 9. These guides are so designed in size and spacing as to guide the tablets aligned along the periphery of disc 1 through fence 5 and into chutes 10. When two chutes per disc are used, guides 9 divert the outermost and next to outermost rows of tablets. The cover plate and guides may be constructed of plastic, metal or other workable rigid material. A transparent plastic has been found advantageous.

The chutes 10 may be constructed of any rigid material such as metal or plastic. They are shaped so as to

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smoothly guide the tablets from a substantially horizontal plane as they are moved through the fence 5 from disc 1 to a substantially vertical plane to fall by gravity into the waiting containers and have the general contours apparent from FIGURES 1 and 3. The cross section of a chute is generally rectangular and just large enough to permit free movement of the tablet size to which it is adapted. Openings are provided for passage of the light beam and entry of the stop pin. A small longitudinal opening may be provided for access to the interior of the chute.

In making change parts for containers of various capacities, heights and diameters, one convenient method, as shown in FIGURE 2, is to align the chutes at fixed distances apart and to make them long enough to reach the mouth of the bottle of appropriate size. Alternatively, the chutes may be only long enough to permit attachment of the photocell and its light source beneath the drive support plate, the remainder of the distance between the end of the chute and the opening of the bottle being covered by means of an adapter.

The photoelectric cell and its light source are mounted together in a unit which is attached in proper position on the delivery chute by means of bolts. The chutes are attached to fence 5 by means of screws and wing nuts and are also supported by bolts attached to drive support plate 11.

The electronic counters and relays are preferably mounted as a separate unit and not affixed to the packaging apparatus in order to avoid malfunction due to vibration.

Although FIGURES 1 to 3 show a preferred form of the apparatus utilizing two counterrotating plates, each feeding two delivery chutes, the package filling apparatus of this invention may also be designed for use with one plate serving either 1, 2 or more chutes. Such modifications are also within the scope of this invention.

It is also possible, if desired, to operate a machine designed to operate with four or more chutes as in FIGURES 1 to 3 with less than the full number possible. This may be accomplished by switches which bypass unneeded portions of the electrical circuits.

The complete cycle of operation is under automatic control by means of an electrical circuit shown in block diagram in FIGURE 8. Each chute 10 is fitted with its own solenoid and pin assembly and photocell and light assembly. Each photocell is electrically connected to its own counter 24. Each counter 24 operates its own multipole latching relay 25. As the tablets break the beam of light passing between light source 14 and photocell 13, the photocell transmits an impulse for each tablet to its corresponding predetermined electronic counter 24. When the predetermined number of tablets has been counted through any chute, the corresponding predetermined electronic counter 24 for that chute immediately acts to operate its latching relay 25 closing its normally open contacts. One pair of these contacts energizes rotary solenoid 15 causing stop pin 17 to block the chute sending the signal. This state is maintained for each chute until all have completed the predetermined count. A second pair of contacts in each of relays 25 are wired in series with each other. When all chutes have been blocked off by operation of relays 25, the series-wired contacts together close a circuit to initiate the action of electronic timer 26 of conventional type. Contacts within electronic timer 26 close, activating solenoid valve 29 and air cylinders 28 thereby opening gate 19 to release the full bottles and closing gate 20 so as to withhold the empty ones. Timer 26 is preset to keep the contacts closed for sufficient time to allow the filled bottles to be removed by the conveyor. At the end of this time, timer 26 opens the contacts controlling gates 19 and 20 and the gates reverse their respective positions, i.e. gate 20 opens and gate 19 closes. Empty bottles move towards the filling position at the same time as other contacts within timer 26 close to initiate a preset time in-

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terval in timer 27. During this interval contacts within timer 27 reset all four predetermined counters 24 to zero position. When empty bottles reach the filling position and are arrested in proper alignment by gate 19, micro-switch 23 mounted on gate 19 is closed by the pressure of the bottles against it and completes a circuit to the unlatching coil of relay 25. This operates rotary solenoids 15 to withdraw the stop pins from each chute and to initiate a new cycle.

The components in the electrical circuit are of conventional types which are available and which may be adapted to the circuit and sequence of operations as described. The predetermined electronic counters and timers are adjustable for variations in count and for varying intervals in the inter-cycle operations.

We claim:

1. A package filling apparatus which comprises in combination a supply means which delivers tablets to be packaged to a substantially horizontal rotatable disc surrounded by a vertical fence, guides to direct said tablets from the surface of said disc through openings in the fence into a substantially enclosed delivery chute removably attached to said fence and adapted to deliver tablets from the disc in a substantially vertical direction to containers for said tablets on a conveyor below said chute adapted to deliver and remove receptacles from beneath said chute, a stop means adapted to extend into said chute through an opening therein from a normally withdrawn position, a solenoid, an electrical circuit, a photoelectric means attached adjacent to said chute close below said stop means which counts the tablets passing through the chute and interrupting a beam of light directed at said photoelectric means, said stop means being actuated by said electrical circuit through said solenoid in response to the passage of a predetermined number of tablets past said photoelectric means and said electrical circuit also actuating means controlling the entry and removal of containers by the conveyor.

2. In a bottle filling apparatus the combination which comprises a supply hopper, two horizontal counterrotating discs in juxtaposition, a vertical fence surrounding each of said discs, a cover plate for each of said discs, guides suspended from said cover plates adapted to direct tablets from said discs through two openings in each of their respective fences into delivery chutes which delivery chutes are substantially enclosed and removably attached to each fence in alignment with said openings and project from said fence over a conveyor positioned beneath, said chutes being adapted to deliver tablets from said openings to bottles on said conveyor, a preset electronic counter, a photoelectric cell attached to each chute which counts the

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tablets passing through the chute and interrupting a light source directed at said cell through the chute and transmits impulses to said preset electronic counter, an electrical circuit, a solenoid, a stop means mounted on each chute in close proximity to said photoelectric cell maintained in a withdrawn position in normal operation and projecting into said chute through an opening therein so as to block passage through said chute when actuated by said solenoid to a closed position within the chute, automatic movable index gates extending transversely across said conveyor and controlling the flow of bottles under said chutes, said stop means being actuated by said electrical circuit through said solenoid in response to the passage of the count of tablets preset in said electronic counter past said photoelectric means and said electrical circuit also actuating said automatic movable index gates.

3. A bottle filling apparatus which comprises in combination a supply hopper, a motor, two horizontal counterrotating discs in juxtaposition and driven by means of said motor and, a vertical fence surrounding each of said discs, a cover plate for each of said discs, guides suspended from said cover plates adapted to direct tablets from said discs through openings in their respective fences into delivery chutes which delivery chutes are substantially enclosed and removably attached to each fence in alignment with said openings and project from said fence over a conveyor traversing a path beneath said chutes, said chutes being adapted to deliver tablets from said openings to bottles on said conveyor, a lever arm bearing a stop pin for each chute, said stop pin being adapted to extend into said chute through an opening therein from a normally withdrawn position, a solenoid, an electrical circuit, a light source projecting a light beam through each chute across the path of flow of the tablets and falling upon a photoelectric cell, automatic movable index gates extending transversely across said conveyor adapted to control the flow of bottles under said chutes, said lever arm and said stop pin being actuated by said electrical circuit through said solenoid in response to the passage of a predetermined number of tablets past said photoelectric means and said electrical circuit also actuating said automatic movable index gates.

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