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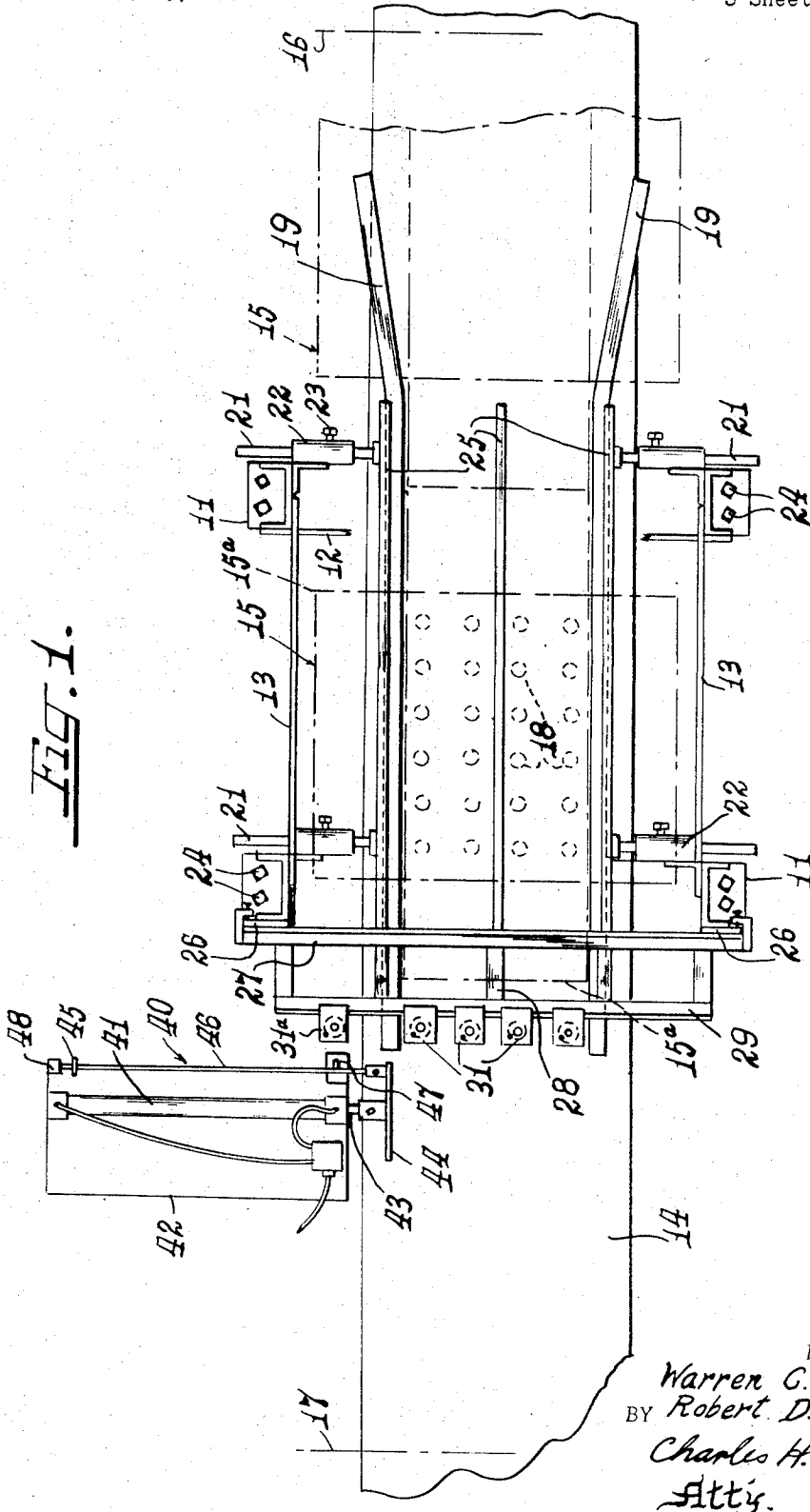
W. C. NESS ET AL

3,472,374

ARTICLE CONVEYING APPARATUS WITH REJECT SENSING MEANS

Filed Oct. 9, 1967

3 Sheets-Sheet 1



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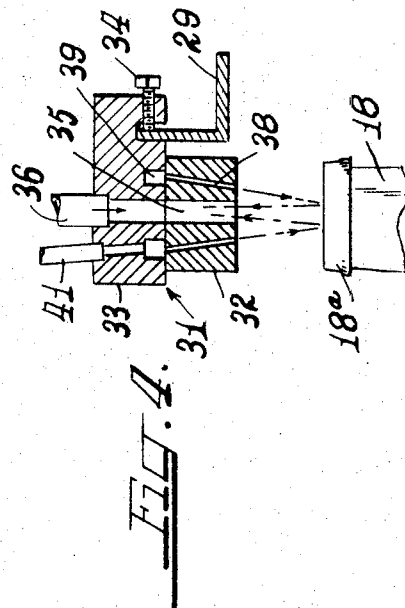
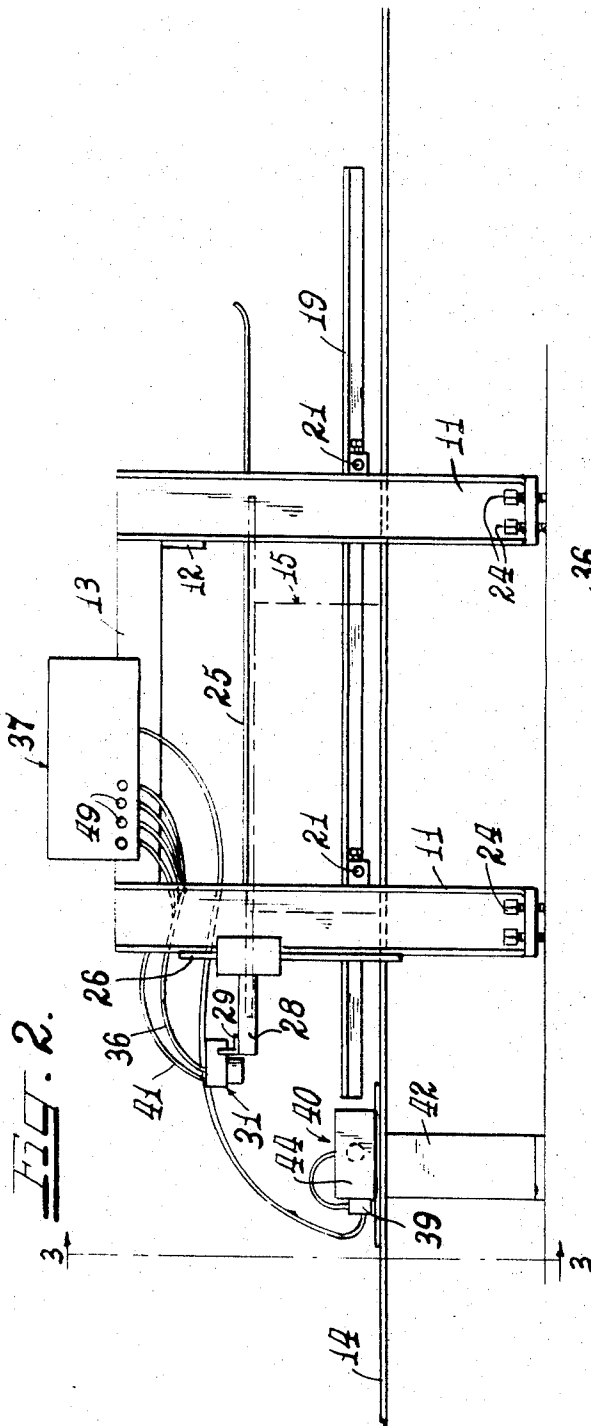
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ARTICLE CONVEYING APPARATUS WITH REJECT SENSING MEANS

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3 Sheets-Sheet 2



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ARTICLE CONVEYING APPARATUS WITH REJECT SENSING MEANS

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8 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for detecting the presence, in an open package, of misplaced, broken, missing or uncapped bottles and for actuating means to eject such a package from a conveyed stream of packages.

The invention relates to improvements in apparatus for checking the contents of open packages containing a multiplicity of items.

The apparatus is particularly designed to check the contents of a conveyed stream of packages or boxes containing a multiplicity of items such as, for example, an open case or package containing a multiplicity of capped bottles or other items. Such packages, containing capped bottles, on occasion will include a bottle that has not been capped, or perhaps a misplaced, missing or broken bottle. The apparatus is installed as part of a conveyor system operable for example to carry open cases of bottles from the packaging station to a package sealing station, and it includes detector means, in the form of reflective air sensing heads, beneath which the bottles and package pass. Should there be an uncapped bottle in the package or one that is mis-aligned, missing or broken, the respective sensing head or heads will be responsive to produce a signal and/or actuate means to push the package containing such defective bottle out of the line and off the conveyor. The sensing heads are mounted for adjustment so as to be positioned to be effective with different size bottles or bottles arranged in rows of various lateral spacing. Reflective air sensing heads of the type preferably used are shown, described and claimed in our copending application Ser. No. 673,788, filed Oct. 9, 1967. Generally these each comprise a body having a plurality of air jet passages disposed to eject high pressure streams of air downwardly onto the cap of a bottle or other item passing beneath it. The air streams are, upon striking the cap, deflected upwardly in a common stream and are entrained in a low-pressure air-passageway so as to retard the low pressure flow of air in such passageway and thereby generate a signal impulse in an associated control unit that responds, when the pulsation varies, to actuate means for ejecting the package from the conveyor. Such reflective air sensing heads are preferable to known types of electric control systems primarily because such systems function only when the bottle cap is comprised of magnetic metal.

It is, therefore, an object of the invention to provide apparatus of the character to which referred.

Another object is to provide apparatus embodying a multiplicity of reflective air sensing heads operable to detect defective items in a package of such items prior to sealing of the package and for ejecting the package containing the reject.

Another object is to provide apparatus of the character referred to which is not expensive or difficult to manufacture or to maintain in a serviceable condition, and one that is very efficient in use and entirely automatic in its operation.

The structure by means of which the above noted and other objects and advantages of the invention are attained will be described in the following specification, taken in

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conjunction with the accompanying drawings, showing a preferred illustrative embodiment of the invention, in which:

FIG. 1 is a plan view of the apparatus;

FIG. 2 is a side elevational view;

FIG. 3 is an end elevational view, as viewed along line 3—3 of FIG. 2;

FIG. 4 is a detail sectional view of a representative air sensing head; and,

FIG. 5 is a schematic view of the control system.

Referring to the exemplary disclosure of a preferred form of apparatus, as shown in the accompanying drawings, the apparatus comprises a rigid frame structure including spaced vertical standards 11 suitably tied together firmly by lateral and longitudinal trusses 12 and 13 respectively. The frame structure is adapted to straddle a driven conveyor 14 which carries open packages 15 of items from a filler station 16 to a closing and sealing station 17. The frame structure mounts novel means and mechanism, to be described hereinafter, for detecting when one or more of the items, such as bottles 18, packaged in the packages, are misplaced, broken, missing or uncapped. A package containing at least one such imperfectly placed, broken, missing or uncapped item is ejected from the conveyor before it reaches the sealing station, all as described presently.

The frame structure mounts a pair of guide rails 19, spaced above the plane of the conveyor, which function to maintain the packages in alignment on the conveyor. These guide rails preferably are adjustable toward and away from each other to adapt them to guiding packages of different widths. To this end each is carried on a mounting rod or bar 21 that is adjustable in brackets 22 carried by standards 11. Set-screws 23 serve to secure them in adjusted position. They may also be adjusted vertically relative to the plane of the conveyor upon adjustment of floor bearing screws 24 carried on the bottom ends of each of the standards 11. Also carried by the frame are horizontally extending straps 25 which overlie and hold the flaps 15a of the packages open and in a substantially horizontal plane.

The standards 11 adjacent to the discharge end of the conveyor are provided with vertical guides 26 along which is mounted, for vertical adjustment, an angle 27 that bridges the conveyor in a plane above the top plane of the packages. This angle 27 mounts firmly by means of straps or brackets 28, a transversely extending rail or angle 29 upon which are mounted, for slidable adjustment laterally, a plurality of reflective air sensing head assemblies 31. As best shown in FIG. 4, each of these assemblies, which are shown and claimed in our co-pending application aforesaid, comprises a sensing head 32 and a mounting bracket 33. The bracket is slidable on the rail 29 and may be secured in an adjusted position by set screw 34. The sensing head 32 has an axial passageway 35 therein which is in flow communication with a conduit 36 leading from a control box 37. The head also includes a plurality (three) of ports 38 that are inclined downwardly axially inwardly and their upper ends are in flow communication with an annular channel 39 connected by a conduit 41 to the control box 37. Preferably, the ports 38 are equidistantly spaced in any plane normal to the conduit 36.

In operation, insofar as the structure has been described, a sensing head assembly 31 is located to overlie the path of a row of containers (bottles) 18 in such manner that as the package advances beneath the sensing heads, the bottles in an aligned row are successively passed beneath a sensing head. The height of the head above the plane of the tops of the bottle caps is such that the streams of air issuing from ports 38 are reflected upwardly in one stream in alignment with the passageway 35. For purposes of illustration, there is shown a pack-

age containing four rows of six bottles each. The function of such sensing heads is substantially as follows:

There is maintained at all times a high pressure flow of air downwardly through ports 38. These air streams strike the cap 18a on a bottle 18 passing beneath it and are deflected upwardly into the axial passage 35. This passage has a down flowing stream of low pressure air flowing through it at all times. When this low pressure stream is impinged by the deflected high pressure streams, there is generated in the passageway 35 and through conduit 36 back into the control box, a back pressure that generates a pulse wave in the control box. Under normal conditions when all of the bottles in a lateral row are properly positioned and capped, the pulse wave from each sensing head occurs simultaneously or near simultaneously. The aggregate of these pulses create a secondary pulse wave within the control box, which secondary pulse in turn is properly registered within a fluidic counting circuit (not shown), but only during the presence of flap 15a beneath the sensing heads. Fluidic memory controls contained in the control box are employed to lengthen the initial pulse waves so as to create an absolute simultaneous signal in instances where lateral bottle alignment is imperfect. However, should one of the bottles in any lateral row be misplaced, missing or uncapped, the related sensing head will not generate a pulse wave. The resultant aggregate pulse wave delivered to counter means 42 in the control box is thus imperfect and said counter means registers this imperfection.

The package rejection and ejector means includes another sensing head assembly 31a which is located to one side of sensing heads 31 so as to overlie one of the side flaps 15a of the package. This head assembly functions in such manner that it senses the presence or absence of a package on the conveyor. When a package is passing beneath it there is a uniform back pressure pulse generated in the sensing head by reason of the high pressure air streams striking said flap and returning to the low pressure passage therein. However, as the flap 15a passes out from beneath sensing head 31a the pulse is interrupted and because this head is also connected with the control box, the absence of a pulse is registered therein. Should there have been no misplaced, broken or uncapped bottles in the package, the absence of a pulse received from the sensing head 31a has no affect and such package continues on toward the sealing station. However, should the absence of a pulse from any of the item sensing heads 31 be registered in the counter 42, the control box mechanism is conditioned, when pulse from sensing head 31a is interrupted, to actuate a valve 39 that controls operation of the ejector mechanism 40. At this time the package has advanced clear of the sensing heads 31 and is positioned in line with the ejector mechanism.

This mechanism 40, best shown in FIG. 1, includes the valve 39 and a piston-cylinder assembly 41, both mounted on an auxiliary frame or table 42. The piston rod 43 carries a pusher plate 44 disposed, when the assembly is actuated, to pass over the conveyor 14 and engage and push a package 15, in front of it, off the conveyor. Thus, when valve 39 is actuated, the piston rod 43 is thrust forward. When it reaches its maximum advance, a collar 45 carried by a follower rod 46 connected to plate 44 engages a control element 47 that the reverses the setting of valve 39 so as to return the piston rod and its pusher plate to its initial withdrawn position. When fully withdrawn, a control 48 cuts off the valve whereupon it is reset for repeat operation in response to actuation of the control box mechanism.

Although a package containing four rows of items has been illustrated it should be obvious that the apparatus is operable when less than four rows of items are contained in a package. In such event the non-required reflective air sensing heads are cut off from the control box by selective closing of valves 49 provided in the air

conduits from said heads. These valves are shown as contained on the control box but obviously may be located at any point of convenience in the conduits.

It should be evident also that this apparatus can be operated without automatic rejector means. In such event the interruption in the pulses received from the sensing heads 31 will actuate a visible or audible signal and an operator will then manually remove the imperfectly packaged item from the conveyor.

Although we have described a preferred embodiment of our invention, in considerable detail, it will be understood that the description thereof is intended to be illustrative, rather than restrictive.

We claim:

1. Apparatus for determining the presence of a cap on a bottle comprising, in combination, conveyor means for conveying the bottle, reflective air sensing means located above the bottle, said means including an air ejection system for directing a stream of air onto a cap passing therebeneath and a low air pressure system for receiving high pressure air reflected by the cap, and means operably connected with the low air pressure system for indicating the presence or absence of a cap on a bottle.

2. The apparatus recited in claim 1, in which the reflective air sensing means comprises a high and low air pressure system and a jet discharge for high pressure air and a return passage to admit reflected air into opposition with the low air pressure system.

3. The apparatus recited in claim 1, in which the low air pressure system is operably connected with means to eject an uncapped bottle from the conveyor means.

4. The apparatus recited in claim 1, in which the sensing means is comprised of a plurality of reflective air sensing heads.

5. The apparatus recited in claim 4, in which the reflective air sensing heads are vertically adjustable to facilitate accommodation of items of different height.

6. The apparatus recited in claim 4, in which the reflective air sensing heads are adjustable toward and away from one another.

7. The apparatus recited in claim 1, in which the apparatus is carried in a frame structure disposed to straddle the conveyor means.

8. Apparatus for determining the presence of caps on parallel rows of bottles comprising, in combination, conveyor means for conveying the bottles along said apparatus, a plurality of reflective air sensing means located one above each row of bottles, a control box connected to said sensing means, each of said sensing means including an air ejection system for directing a stream of air onto a cap passing therebeneath and a low pressure air system for receiving high pressure air reflected by the respective cap, said air sensing means operating in unison when a cap is present on each bottle to generate uniform pulse waves in the control box, and functioning when a cap is absent from a bottle to actuate means to register same.

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