United States Patent

[11] 3,618,762

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[45] Patented **Nov. 9, 1971**

[54] **CONTAINER-INSPECTING MACHINE**
12 Claims, 24 Drawing Figs.

[52] **U.S. Cl.** ..... **209/80,** 33/172 E, 33/174 L
[51] **Int. Cl.** **B07c 5/02**
[50] **Field of Search** ..... 209/80, 88, 73; 198/127; 33/172 E, 174 L

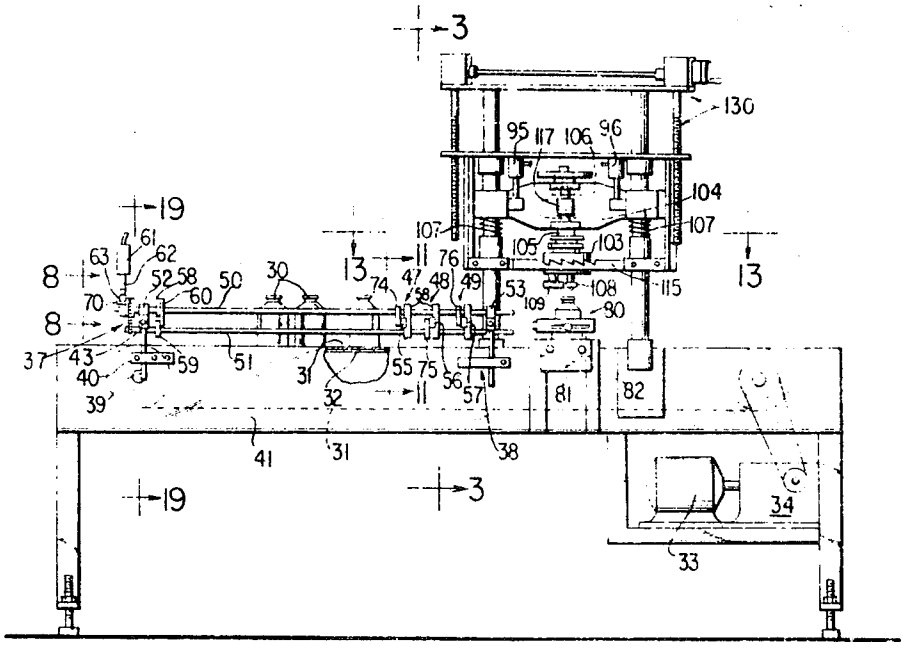
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Primary Examiner—Richard A. Schacher
Assistant Examiner—Gene A. Church
Attorney—Smythe & Moore

ABSTRACT: A machine and method for inspecting and sorting containers, such as glass bottles, that are acceptable from those not acceptable because of defects in the lip or shortness of the containers. A rotating test head has feelers thereon which are other than 180° apart and which can move relative to each other in a direction of the axis of the containers to actuate differential transformer means. The rotating testing head is employed to actuate a control circuit for ejecting a container if it is too short or if the lip does not fall within predetermined limits.



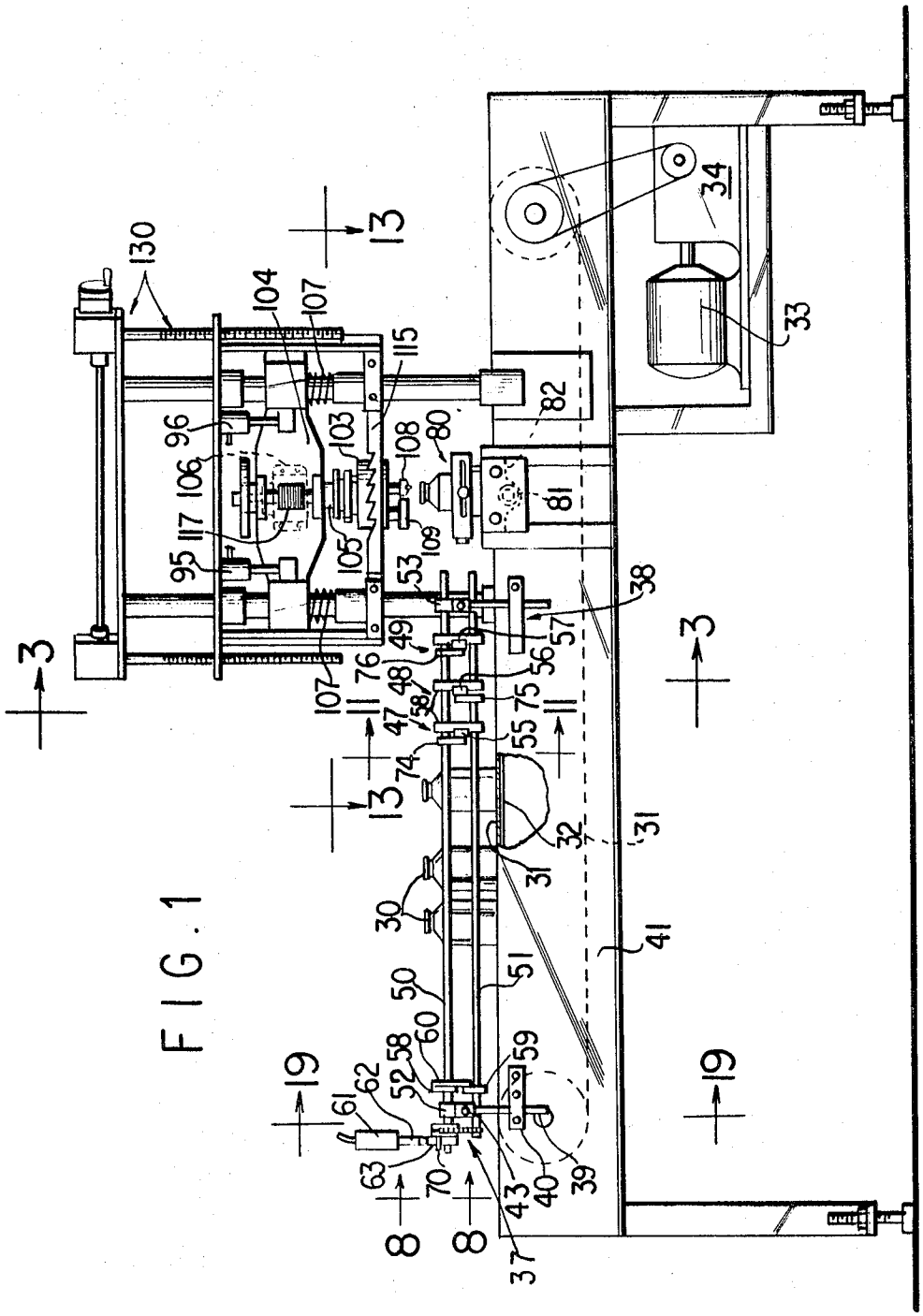


FIG. 1

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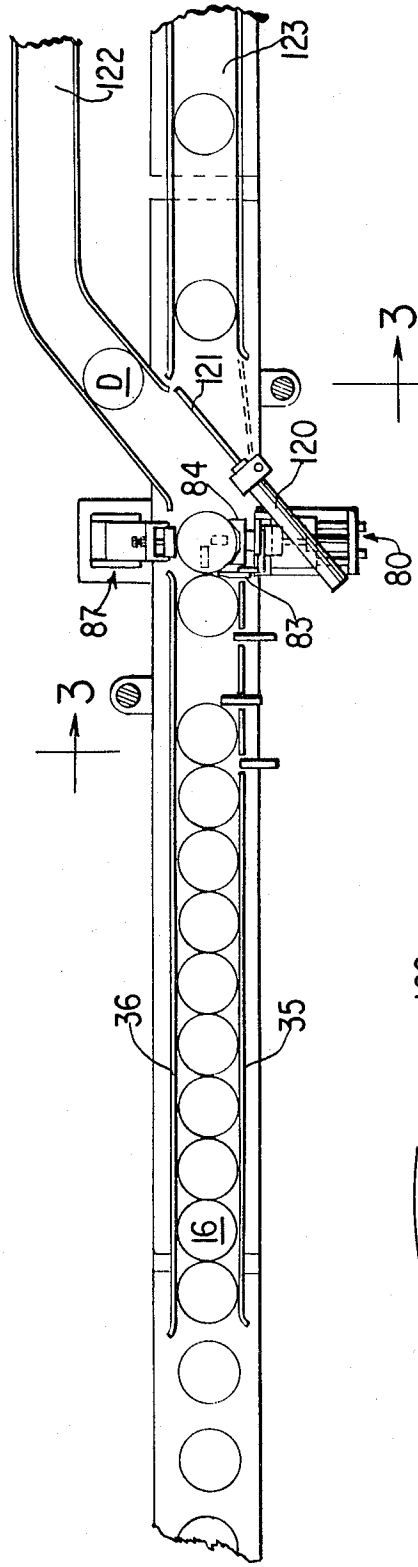


FIG. 2

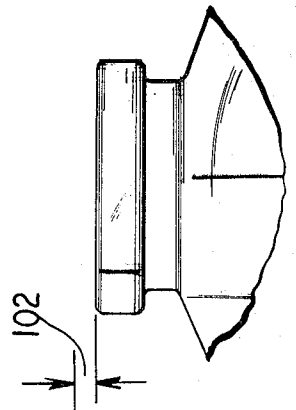


FIG. 6

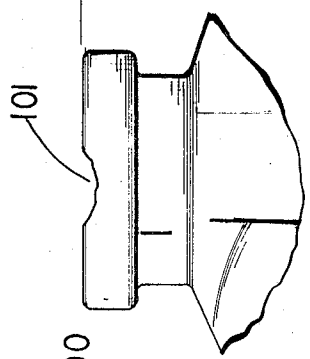


FIG. 5

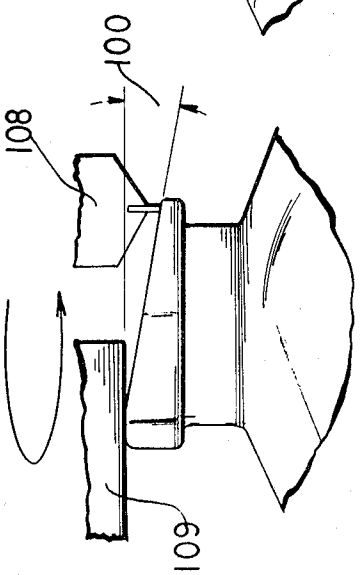
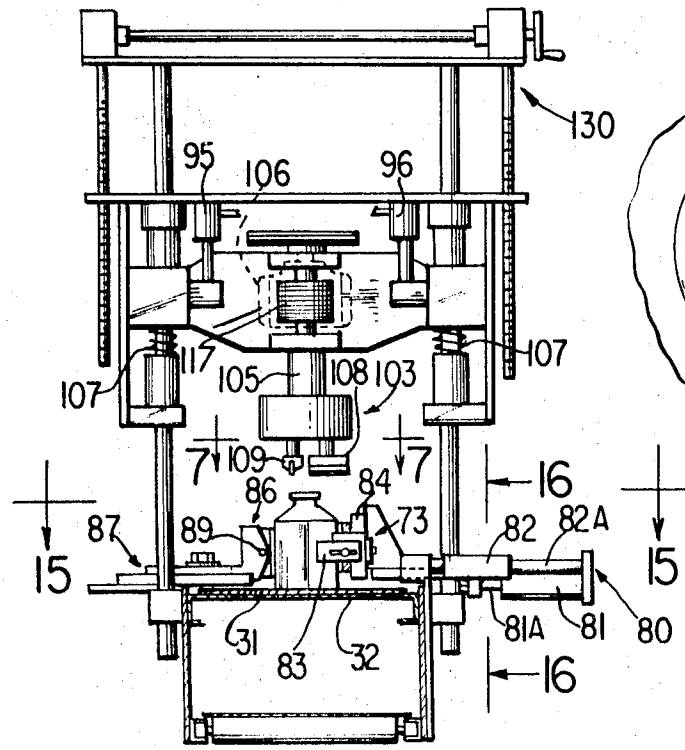


FIG. 4

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FIG. 3



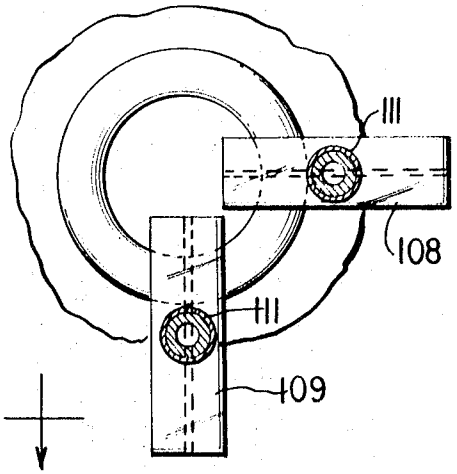
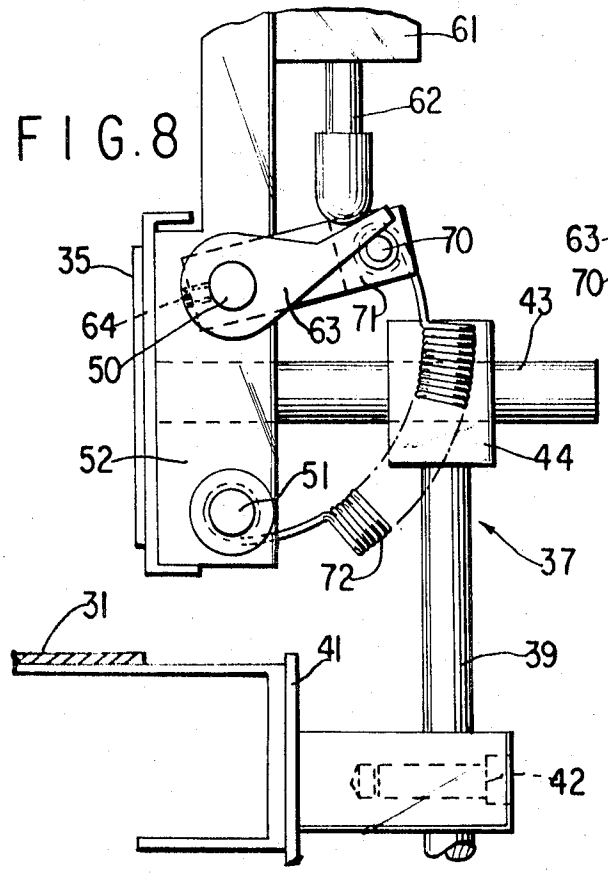


FIG. 7

FIG. 8



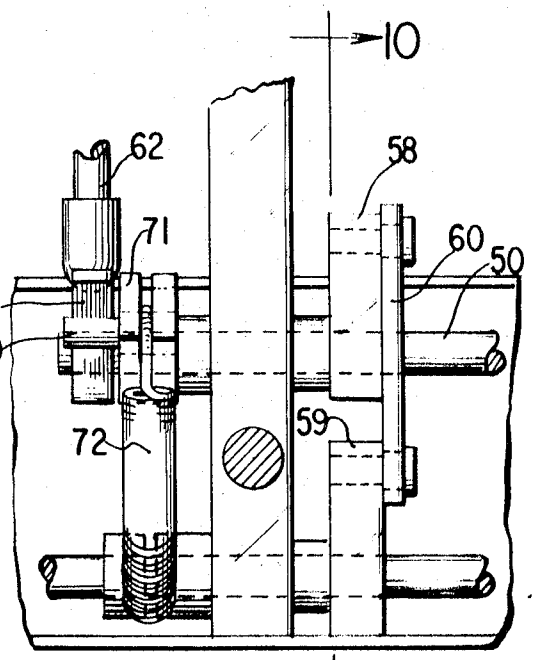


FIG. 9

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FIG. 10

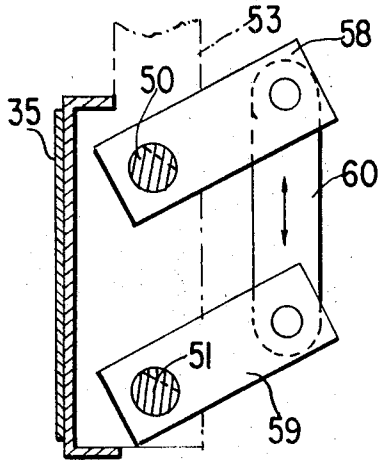


FIG. 11

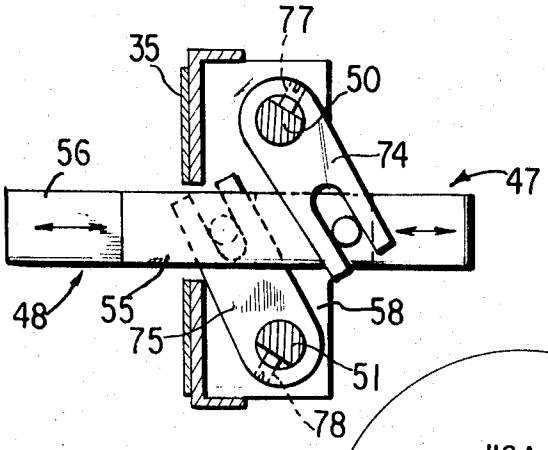


FIG. 13

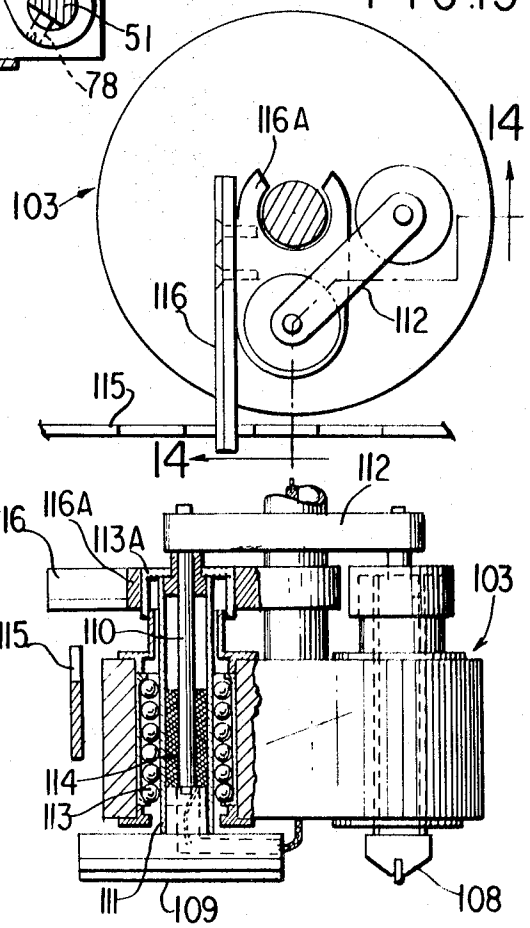


FIG. 14

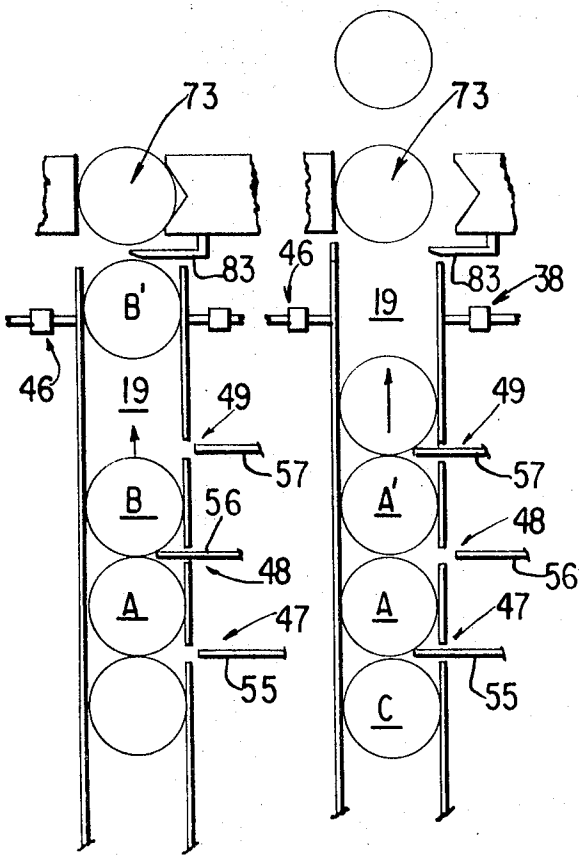


FIG. 12A

FIG. 12B

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FIG. 15

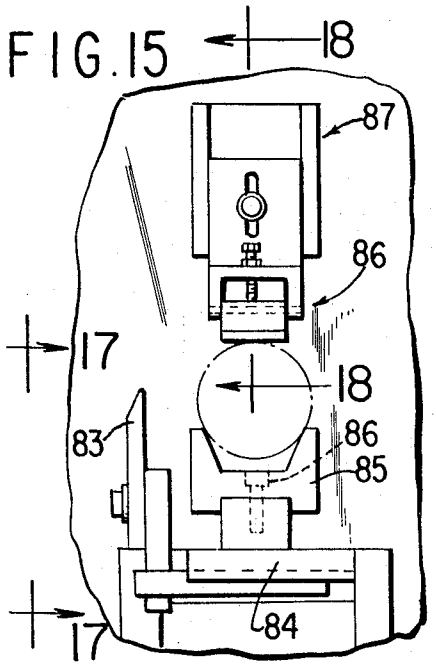


FIG. 18

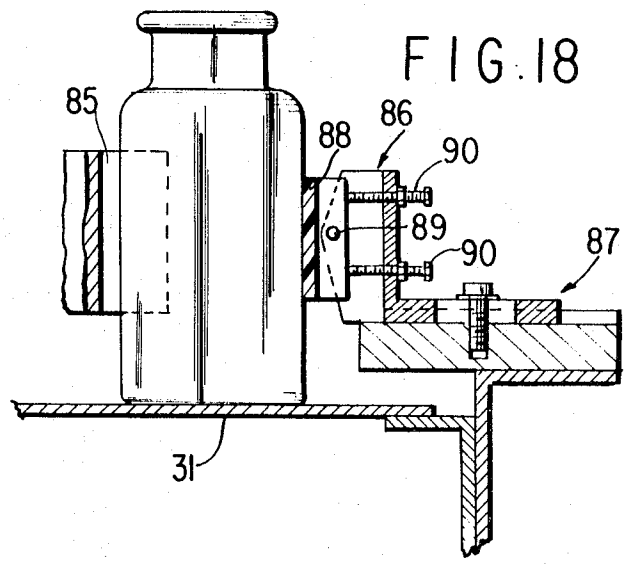


FIG. 19

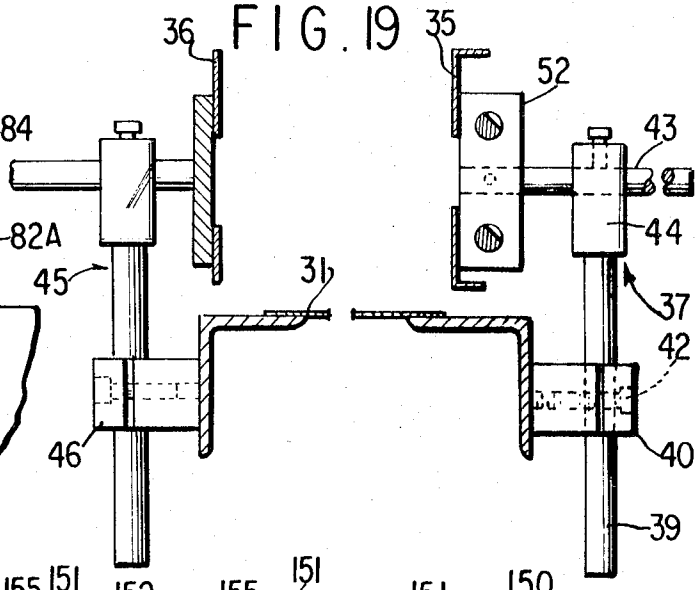


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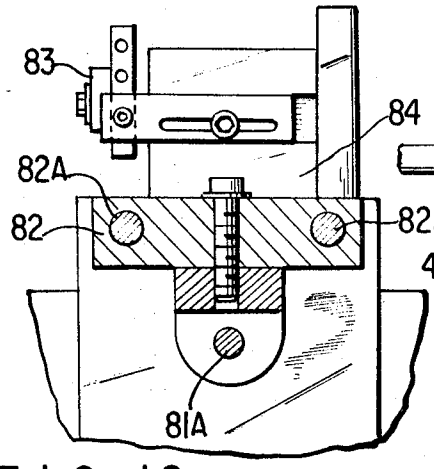


FIG. 17

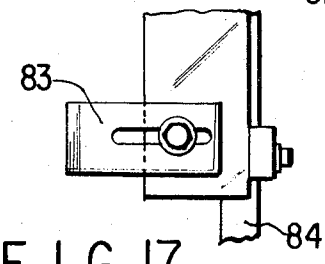


FIG. 21

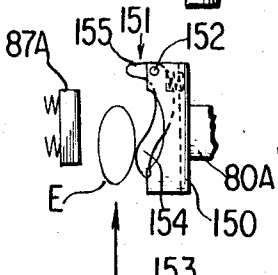


FIG. 22

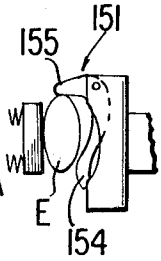
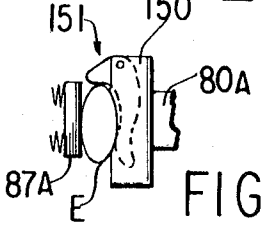


FIG. 23



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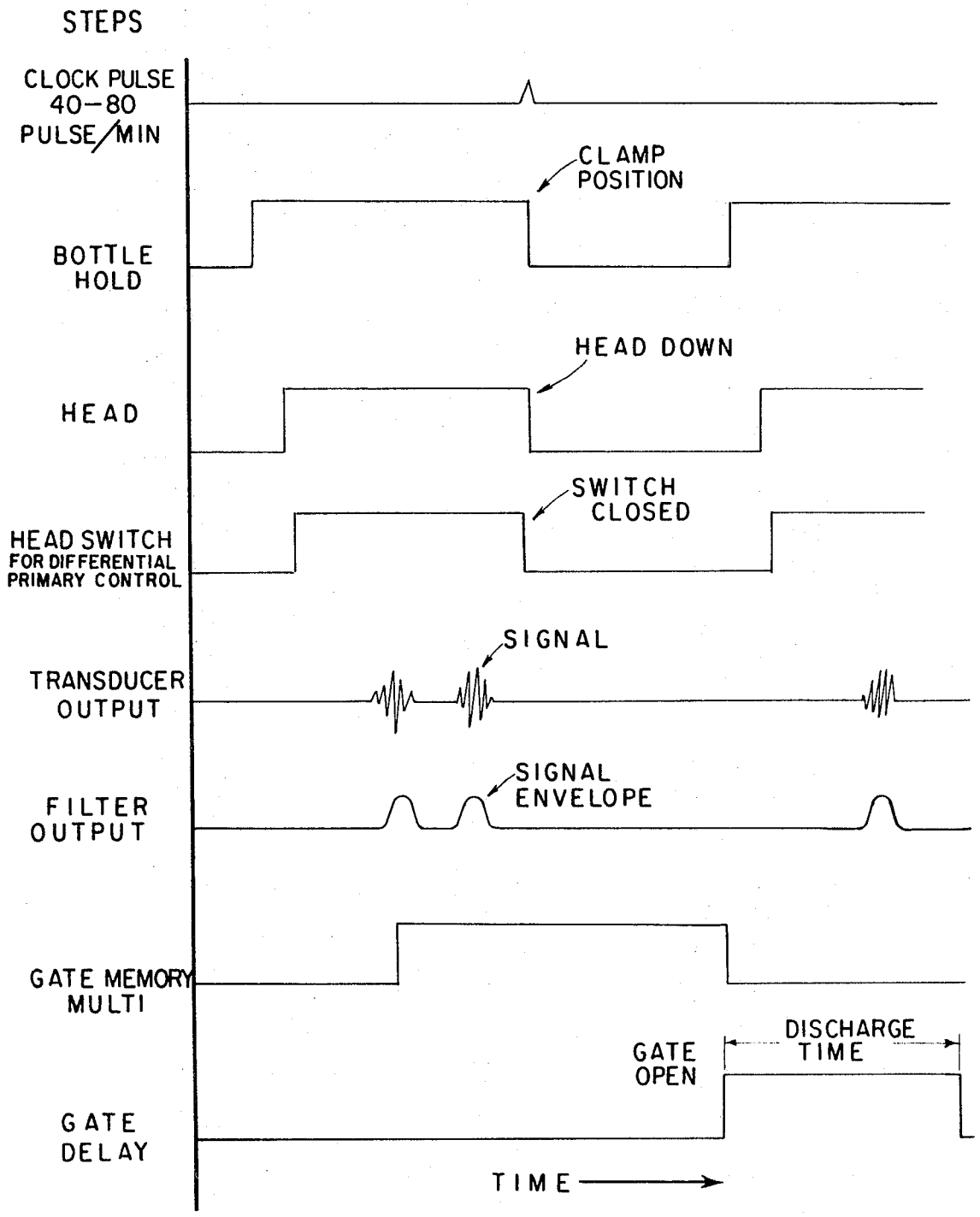


FIG. 20

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CONTAINER-INSPECTING MACHINE

This invention relates to container-inspecting machines and particularly to a machine for determining the acceptability thereof.

In the production of containers, such as glass bottles, considerable difficulty has been encountered in providing a testing or inspection system which will eliminate bottles having defective lips and bottles that are too short and yet hot reject any bottles which are actually acceptable. A machine of the type concerned must be adjustable to accommodate various size containers and must be relatively fast in its operation.

One of the objects of the invention is to provide a machine which will inspect and classify bottles without unnecessarily rejecting useable bottles.

Another of the objects of the invention is to provide a feeding means for an inspecting machine which will accommodate various size containers.

In one aspect of the invention, the containers to be inspected are moved past adjustable gates for controlling movement thereof to an inspection point. A pusher clamps the bottle or container under a test head and the rotating test head is lowered onto the top of the container. Feelers on the test head are located other than 180° apart and are connected in such a manner as to provide a reject signal if the lip is defective or outside of acceptable limits. If a reject signal is produced, a gate will be operated so that the container will move to a reject point. The test head also has means to detect a container that is too short.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings which are merely exemplary.

In the drawings:

FIG. 1 is an elevational view broken away in parts, showing a machine for carrying out the present invention;

FIG. 2 is an enlarged fragmentary and schematic view of the conveyor track and gate arrangement;

FIG. 3 is a sectional view looking in the direction of line 3—3 of FIG. 1, showing the testing head station;

FIGS. 4, 5 and 6 are side enlarged broken views of the neck of a bottle illustrating various defects that are detected by the present invention;

FIG. 7 is an enlarged fragmentary view of the test feelers of the machine taken along line 7—7 of FIG. 3;

FIG. 8 is an enlarged fragmentary view of the feed-gate-operating mechanism looking in the direction of line 8—8 of FIG. 1;

FIG. 9 is a side view of FIG. 8;

FIG. 10 is an enlarged view of the feed-gate-operating mechanism taken along the line 10—10 of FIG. 9;

FIG. 11 is a view looking in the direction of line 11—11 of FIG. 1;

FIGS. 12A and 12B are schematic views of the feed-gate-operating means showing the gating of bottles thereby;

FIG. 13 is a fragmentary top view of the feeler mechanism taken in the direction of line 13—13 of FIG. 1;

FIG. 14 is a side view partially in section generally along the line 14—14 of FIG. 3;

FIG. 15 is a sectional view along the line 15—15 of FIG. 3;

FIG. 16 is a vertical section along the line 16—16 of FIG. 3;

FIG. 17 is a fragmentary view looking in the direction 17—17 of FIG. 15;

FIG. 18 is a fragmentary vertical view looking along the line 18—18 of FIG. 15, showing a container in testing position;

FIG. 19 is a fragmentary sectional view along the line 19—19 of FIG. 1, showing details of the adjustable rail supports;

FIG. 20 is a time chart showing operation of the invention; and

FIG. 21, 22 and 23 are plan views of a modification of the pusher saddles showing three positions thereof.

Containers or bottles 30 (FIG. 1) are deposited automatically or manually on conveyor belt 31, the belt being supported on table 32 and being driven by electric motor 33 through a suitable adjustable gearbox 34.

Containers placed on the belt 31 are moved toward a testing station between adjustable guide rails 35, 36 (FIGS. 1, 2, 19). Front guide rail 35 is adjustably supported on bracket 37 (FIGS, 1, 19) and bracket 38 (FIG. 1). Vertical rod 39 is slidably held in block 40 attached to frame 41 of the machine. The rod 39 can be adjusted vertically and then locked in position by screw or clamp 42. The location relative to the centerline of the conveyor can be adjusted by moving rod 43 relative to support 44. The right end (FIG. 1) of the front rail 35 is adjustably held in a similar manner by support 38.

The rear guide rail 36 is positioned and held by blocks 45 (FIG. 19) and 46 (FIG. 12A). Thus, it can be seen that the rails can be adjusted or set relative to each other so as to guide the bottle or container to be inspected regardless of size.

The front rail carries the gate mechanism for controlling movement of the bottle along the conveyor which includes gates indicated generally by 47, 48 and 49. The gate units are adjustably slidably carried on gate-operating shafts 50, 51 which are carried in journal blocks 52, 53. Rotation or oscillation of shafts 50, 51 as will be described will result in movement of the gates so as to control feed of containers to the inspecting station at proper intervals.

The fingers of gates 47, 48 and 49 are moved in and out relative to the center of the conveyor belt as will now be described. Each gate has a reciprocable bar or finger 55, 56, 57 (FIGS. 1, 11). The bar is movable in a slot in its gate block 58. Shafts 50, 51 have a flat portion therealong so that the operating gate arm assemblies can be adjusted thereon.

The operating arm assemblies for the shafts will now be described. Arms 58, 59 (FIG. 10) are connected by link 60. Fluid-operable motor 61 (FIG. 9), such as a pneumatic motor, has a plunger 62 which is engageable with arm 63, arm 63 being held in position on shaft 50 by setscrew 64. Upon actuation of motor 61 to move plunger 62 downwardly, arm 63 will be moved clockwise (FIG, 8) so as to rotate shaft 50. Arm 58 also will operate in the same direction to rotate shaft 51 (FIG. 10) through link 60 and arm 59. Arm 63 contacts pin 70 which is carried by arm 71. Spring 72 is connected at one end to pin 70 and is anchored at the other end to shaft 51. The spring can be one which maintains a constant force which resists compression, the action being a flexing action. The spring tends to hold and return the shafts relative to their initial positions with the gate fingers positioned as shown in FIG. 12A.

In the position illustrated in FIG. 12A, container A is held by gate 48 and B is moved toward testing station container positioner 73 by the conveyor or to position B'.

When motor 61 is actuated, shafts 50 and 51 will be rotated clockwise and will move the gate fingers to the positions shown in FIG. 12B. The manner of changing the finger position will be described hereafter.

As seen in FIGS. 1 and 11, arm 74 is in initial position because spring 72 tends to urge shaft 50 to its most counterclockwise location with arm 63 against plunger 62. The arm 75 of gate 48 is on the lower shaft 51 so that upon actuation of motor 61, rotation of the shaft 51 will move arm 75 clockwise and will withdraw or move finger 56 of gate 48 to the right (FIG. 11). Such will permit container A to travel to the position A' shown in FIG. 12B because gate 49 has been moved inwardly.

Arm 76 (FIG. 1) of gate 49 is mounted on the top shaft 50 so that it will move to the left as motor 61 is actuated, which will hold container A from moving further as illustrated in FIG. 12B. Gate 47 also will hold the next container C.

By loosening setscrews 77, 78 and a similar setscrew on gates 48 and 49, the gate assemblies can be slid along shafts 50, 51 as needed so that various size containers can be handled.

The inspecting station operation will now be described. It is necessary to bring the container under the rotating and reciprocable inspecting head. This is accomplished by the clamping assembly 80 (FIGS. 1, 3) which includes a fluid-operated motor 81 with plunger 81A (FIGS. 3, 16) for reciprocating the movable clamping plate 82 which is suitably

guided by rods 82A (FIGS. 1, 16) in its excursion toward and away from the testing head center.

The clamp may have an adjustable gate finger 83 (FIGS. 3, 15) thereon. Clamp saddle bracket 84 also is adjustably carried on plate 82 so that it can be raised, lowered or moved longitudinally relative to plate 82 in accordance with the size and shape of the container. Container saddle 85 is removably fastened by screw 86 to the bracket 84.

Stationary or rear saddle 86 is adjustably and removably fastened to the machine frame 87 (FIG. 18). In the form shown, saddle 88 is pivotally mounted at 89 to the bracket. Stops 90 are provided so that the saddle can be set at the proper angle to clamp the containers regardless of shape and taper. Gate finger 83 will prevent the next bottle from movement as can be seen in FIG. 12A. Retraction of the clamping head to the position shown in FIG. 12B will permit the next container to move into alignment with the clamp as it is moved.

As previously mentioned, bottles having a mouth with an angle thereacross within certain limits is acceptable provided the lip is smooth. If the angle is too great or the bottle is too short, it is not acceptable.

Referring to FIG. 4, if the angle 100 is within predetermined limits so that a cap can be properly sealed thereon, the bottle is acceptable. If there are dips 101 as seen in FIG. 5, then a cap will not seal. Also, if the bottle is shorter than a predetermined amount 102, it is not acceptable.

The testing head 103 is mounted on crosshead 104, head 103 having a rotatable shaft 105 which is rotatable by motor 106 (FIG. 13) driving said shaft. Fluid motors 95, 96 will move the testing head downwardly, and springs 107 will raise the head upon deenergization of fluid motors 95, 96.

The feelers are located so as not to be 180° apart and preferably about 90° in angular relation so that they will sense the configuration of the bottle top or lip. As an example, they can be between about 60° and 120° apart.

Feeler 108 is slidably mounted in head 103, the upper end thereof being mounted on crossarm 112. Feeler 109 is connected to sleeve 111, sleeve 111 having differential transformer winding 114 mounted therein. Armature or slug 110 is connected to crossarm 112 so as to be moved by feeler 108. Sleeve 111 is slidable within ball bearings 113. A dust cover 113A can be connected to sleeve 111.

Difference in movement of the feelers relative to each other will cause signals to be set up in accordance therewith. If the top is square to the axis of the container as the head and feelers are rotated therewith, one type of signal or a null will result. If the lip is tipped, as in FIG. 4, a signal will be generated in accordance therewith. If the angle is too great, the circuits to which the transformer and circuit are connected can be chosen so as to eject the bottle being tested. In the event that there is a dip, as seen in FIG. 5, one feeler will move relative to the other to create an error signal which can be used to cause ejection of a bottle.

In order to detect bottles which are too short, notched bar 115 (FIGS. 1, 14) is provided. Extension 116 (FIG. 14) is carried by rotatable head 103 in such a manner that if the bottle is too short and if the head descends sufficiently far because thereof, an error signal will result. The extension could be connected to the crossarm 116A.

A suitable slipring arrangement 117 can be mounted on the rotatable head for carrying the signals from the transformer to the control circuits.

Motors and screws 130 can be provided to adjust the position of the crosshead 104.

If the bottle being inspected is within the set limits, no signal is provided to operate the ejection system. In this event, fluid-operated cylinder 120 is not activated so that gate rod 121 (FIG. 2) remains in place and the acceptable bottle D will be carried out on conveyor 122. If an unacceptable bottle signal is produced, gate rod 121 is drawn inwardly of cylinder 120 and the defective bottle will pass to defective bottle conveyor 123.

It should be evident that various types of control circuits and timing programs can be used. One example of a timing cycle is seen in FIG. 20. In the illustrated circuit and program, a clock pulse if furnished to the control circuit for operating the various fluid-actuating devices. Thus, when the feelers contact the lip, if the lip is flat and there are no dips, a null signal will be provided. This is true regardless of the height of the bottle unless it is too short. If too short, a signal will be set up also to cause ejection of the bottle.

If an elliptical or oval bottle is to be tested, it needs to be straightened as it is clamped so that the testing head will properly be positioned on the bottle mouth. One type of clamp is illustrated in FIGS. 21, 22 and 23. Clamping operator 80A has clamp 150 mounted thereon. Positioner arm 151 is pivotally mounted on pivot 152 in a slot (not shown) in the clamp or saddle body 150. The fixed clamp 87A is similar to that previously shown at 87. As the container E is moved on the conveyor in the direction shown by arrow 153 and clamp 150 is moved to the left, extension 154 will contact the side of the container. Further movement of clamp 80A as in FIG. 22 will result in arm 151 being rotated counterclockwise so that tongue 155 will touch the leading edge of the container and position and align it until it is properly located and clamped as in FIG. 23. Various shapes of clamps can be used in accordance with the bottle involved.

It should be apparent that variations can be made in the arrangement of parts and construction without departing from the spirit of the invention.

What is claimed is:

1. In a container inspection apparatus, the combination including inspection station container-positioning means, a rotatable inspection head having angularly spaced feelers thereon, means for moving a container relative to said inspection means so that said feelers will contact the lip of the container, one of said feelers having electric coil means and the other of said feelers having an armature means movable relative to said coil whereby movement of said feelers relative to each other provides a signal in accordance with the relative position of said feelers to each other so as to indicate the condition of said lip, said feelers providing a null signal when the lip is acceptable and an error signal when not acceptable.

2. An apparatus as in claim 1 wherein said feelers are elongated and are disposed in a radial direction relative to the axis of rotation of said head.

3. An apparatus as in claim 2 wherein there is a clamp means for holding a container under said head as it is lowered, so that said feelers rotate around the lip of the container.

4. An apparatus as in claim 1 wherein said means for moving said container includes a plurality of gate means to control movement of said containers toward said inspection station.

5. An apparatus as in claim 4 wherein said gate means are carried by oscillatable shaft means, said gate means being adjustable longitudinally of said shaft means so as to accommodate various sizes of containers.

6. An apparatus as in claim 5 wherein there is a clamp means which has adjustable clamps thereon for accommodating various size and shape containers.

7. An apparatus as in claim 5 wherein the gate means are supported on two shafts and are adjustably movable therealong according to the container size and wherein there are connections between said shafts so that said shaft will move the gates in and out so that containers can controllably move to the testing station.

8. An apparatus as in claim 1 wherein said rotatable head has arm means associated therewith to produce a signal if the container is shorter than a predetermined dimension.

9. An apparatus as in claim 1 wherein there is a clamp means operable as a container is located adjacent thereto to hold a container under said rotatable head, and means to lower said head toward the container so that said feelers will contact the lip thereof.

10. An apparatus as in claim 9 wherein the clamp means has cam means thereon for straightening the container position as it is moved into clamping position.

11. An apparatus as in claim 1 wherein there is means responsive to a signal to permit movement of a container in one path if it is not acceptable and another path is it is acceptable.

12. An apparatus as in claim 1 wherein there are adjustable guides along the path of the containers being moved toward the inspection station so as to accommodate various size containers.

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