United States Patent [19]

Yasuhiro et al.

[11] **3,879,987**

[45] **Apr. 29, 1975**

[54] **DEVICE FOR EXAMINING INNER PRESSURE RESISTANCE OF GLASS BOTTLE**

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[73] Assignee: **Yamamura Glass Kabushiki Kaisha,** Hyogo, Japan

[22] Filed: **Sept. 24, 1973**

[21] Appl. No.: **399,804**

[30] **Foreign Application Priority Data**

Dec. 29, 1972 Japan 48-3166

[52] **U.S. Cl.** **73/37;** 73/41; 141/165; 141/312

[51] **Int. Cl.** **G01n 3/10**

[58] **Field of Search** 73/37, 40, 41, 45, 45.1, 73/45.2, 45.4, 49.8; 141/312, 165, 287; 215/358

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Primary Examiner—S. Clement Swisher
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

A device for examining breaking resistance of a glass bottle by applying inner pressure thereto. The device includes endless conveying means for repeatedly transferring pressure fluid ejection head groups at equal spaces to a bottle examination zone provided on the path along which bottle to be examined are conveyed and conveyors for transferring the bottles synchronizing with the movement of the pressure fluid ejection head groups in the examination zone, each pressure ejection head including a vertically movable nozzle connected to a pressurizing fluid source and a packing capable of rapidly resiliently deforming and bulging out at one end of the nozzle. When the nozzle is inserted into the bottle, the bottle mouth is sealed by the packing which resiliently bulges outwardly, and a valve for a pressurizing fluid passageway is opened to fill the bottle with pressure fluid.

8 Claims, 13 Drawing Figures

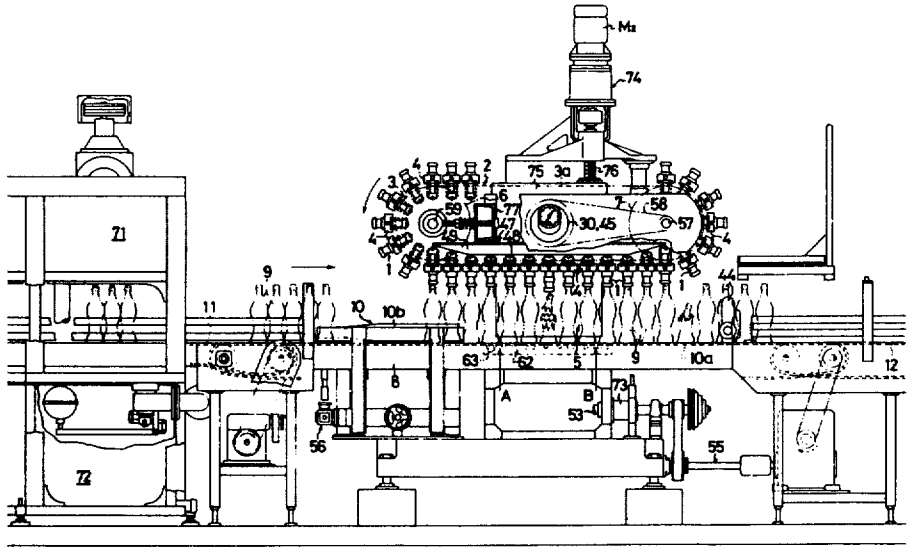
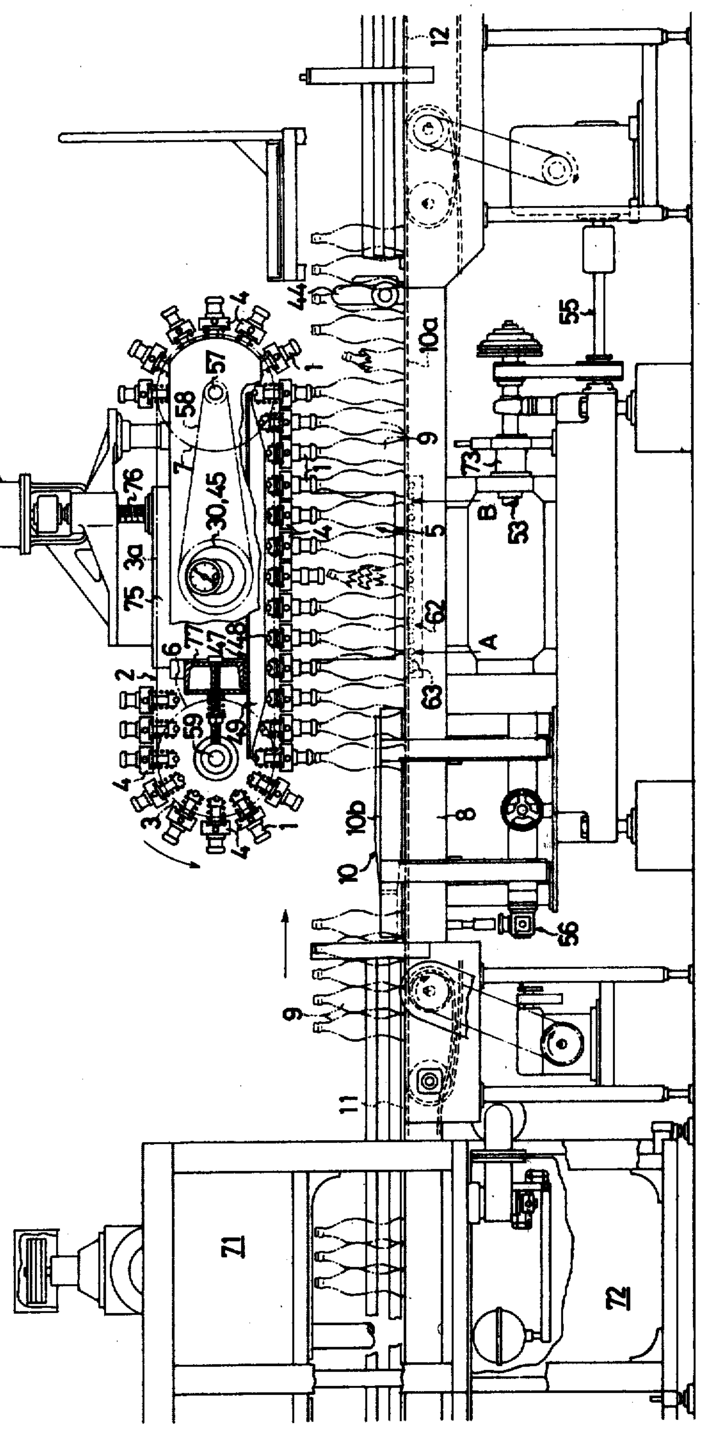


Fig.1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5
9
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10b
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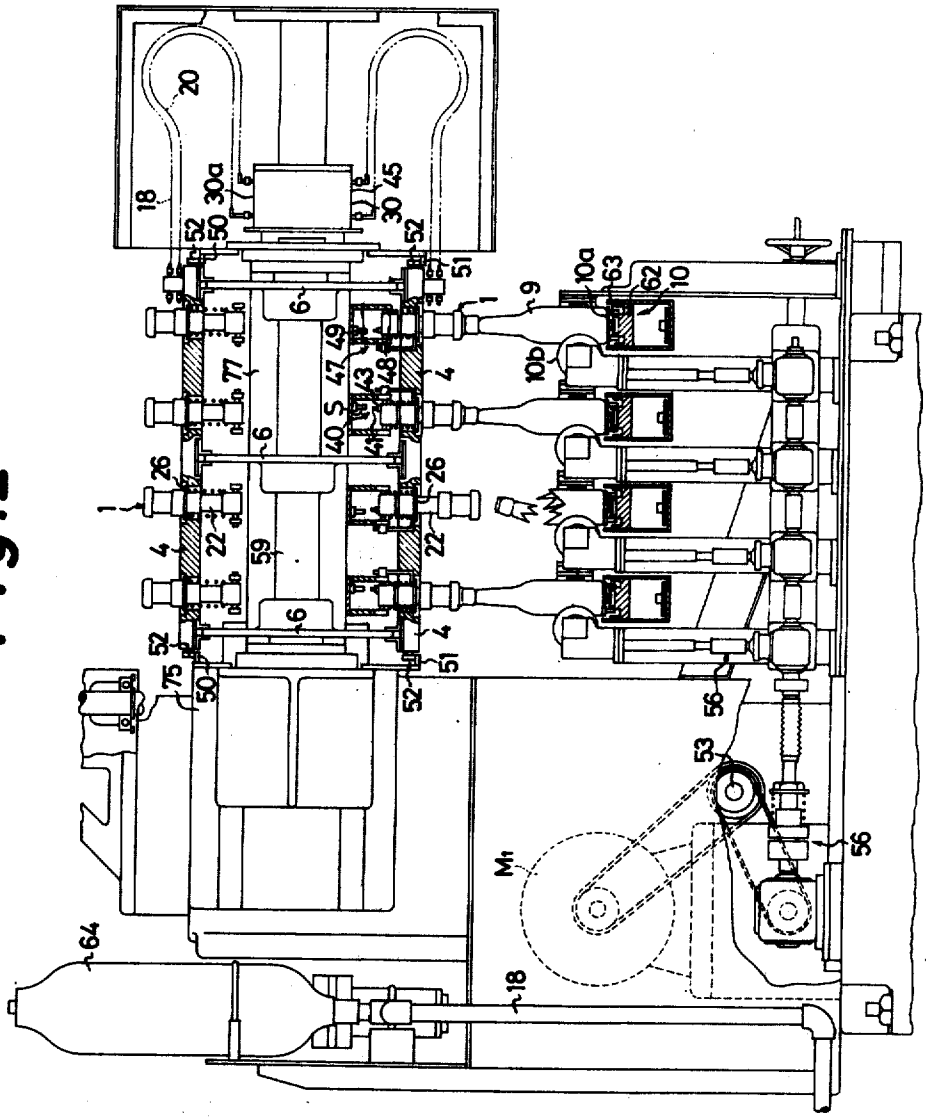
11
12
44
55
56
73
B
53
62
A
63
Z1
Z2

Fig.2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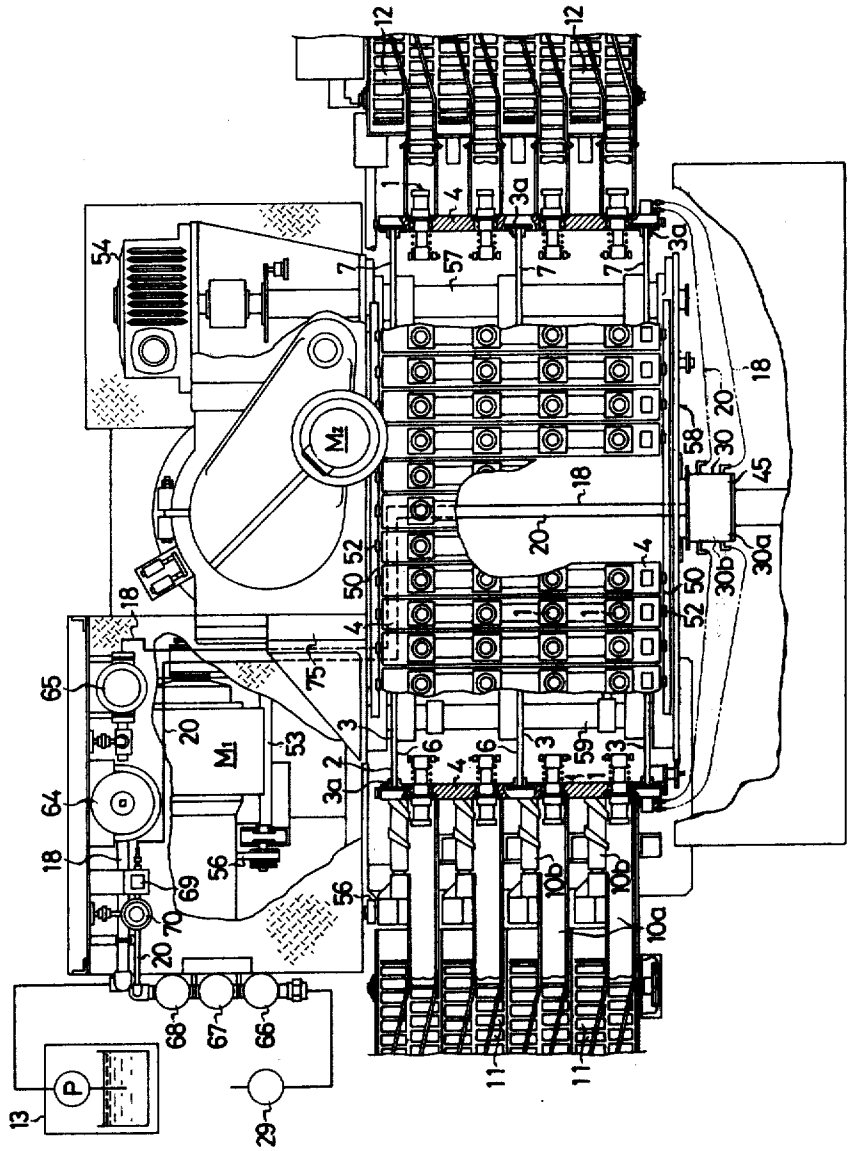
26
22
59
75
64
M1
53
56

Fig.3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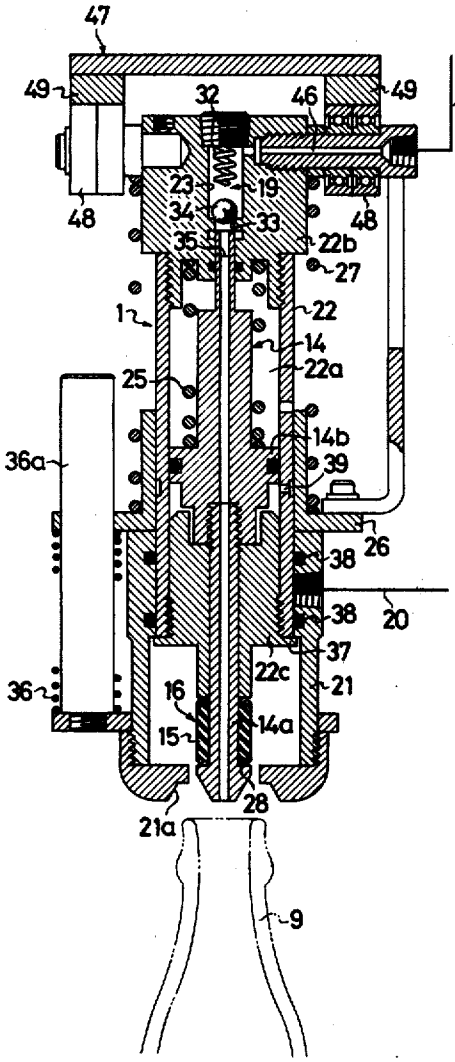
P
13
29

Fig.4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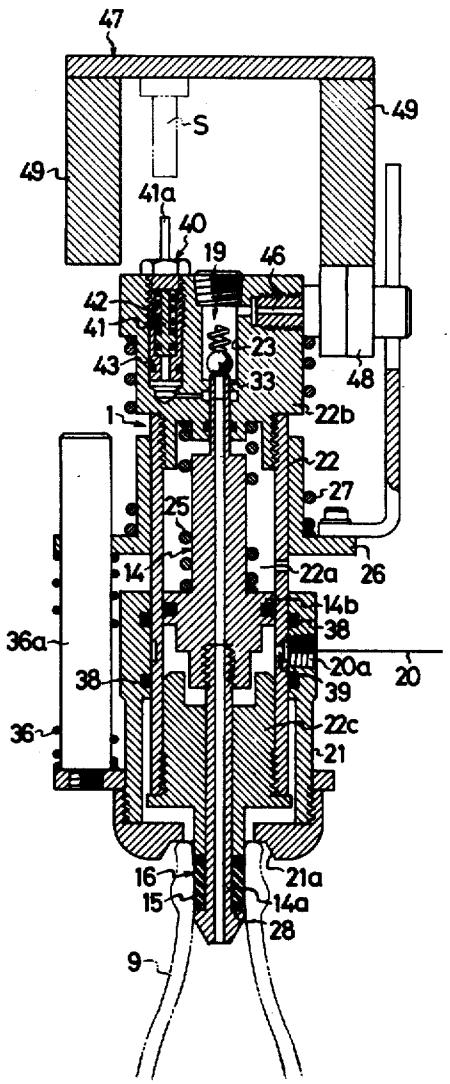
16
21
15
14a
28
21a
9

Fig.5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14a
28
9

Fig.6

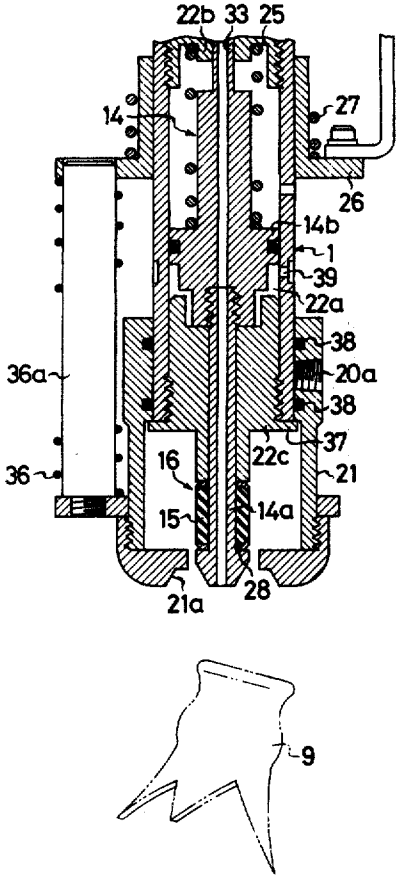
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Fig.7

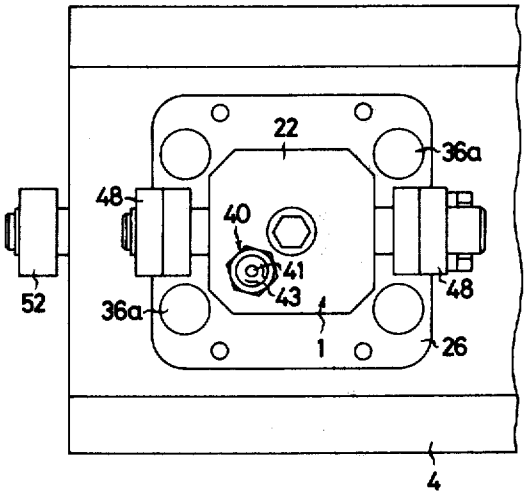
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Fig.8

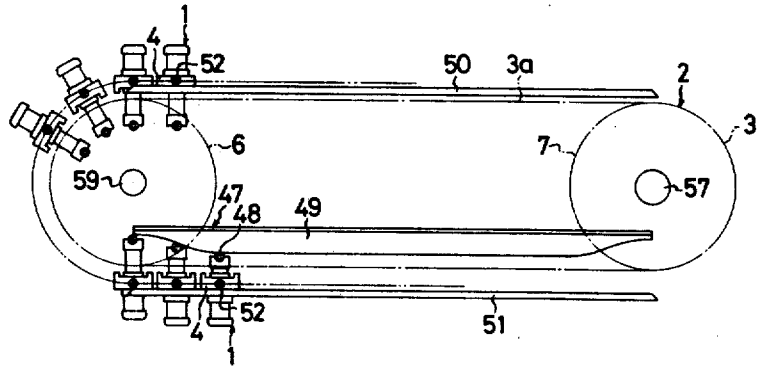
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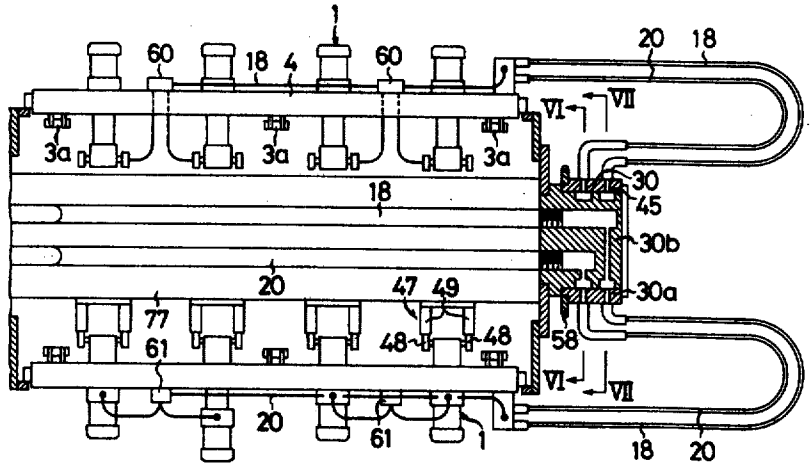
Fig.9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VI
VII
20
61
1
18
20

Fig. 10

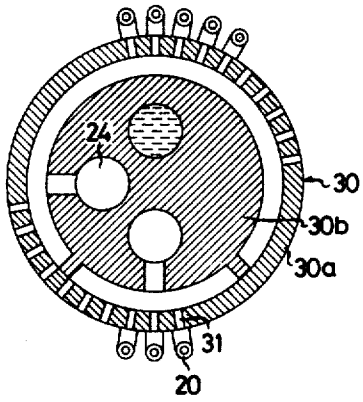
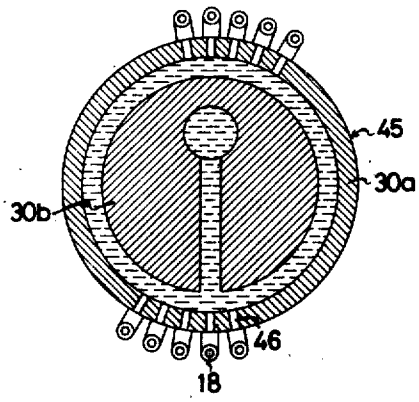


Fig. 11



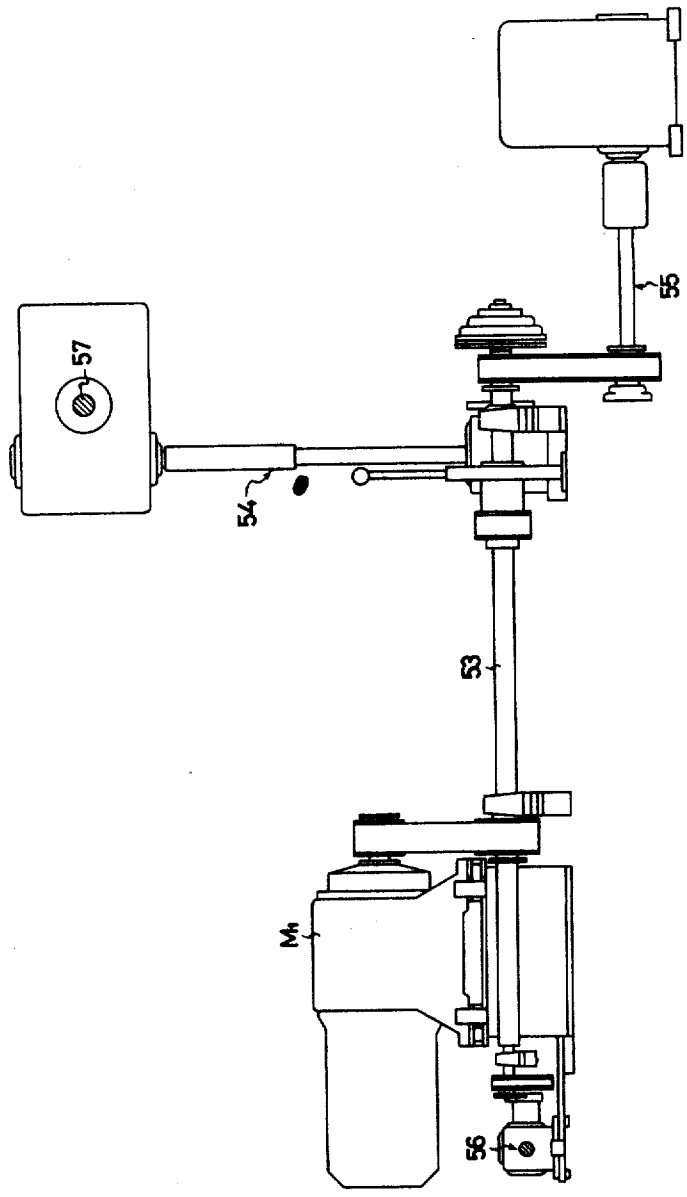
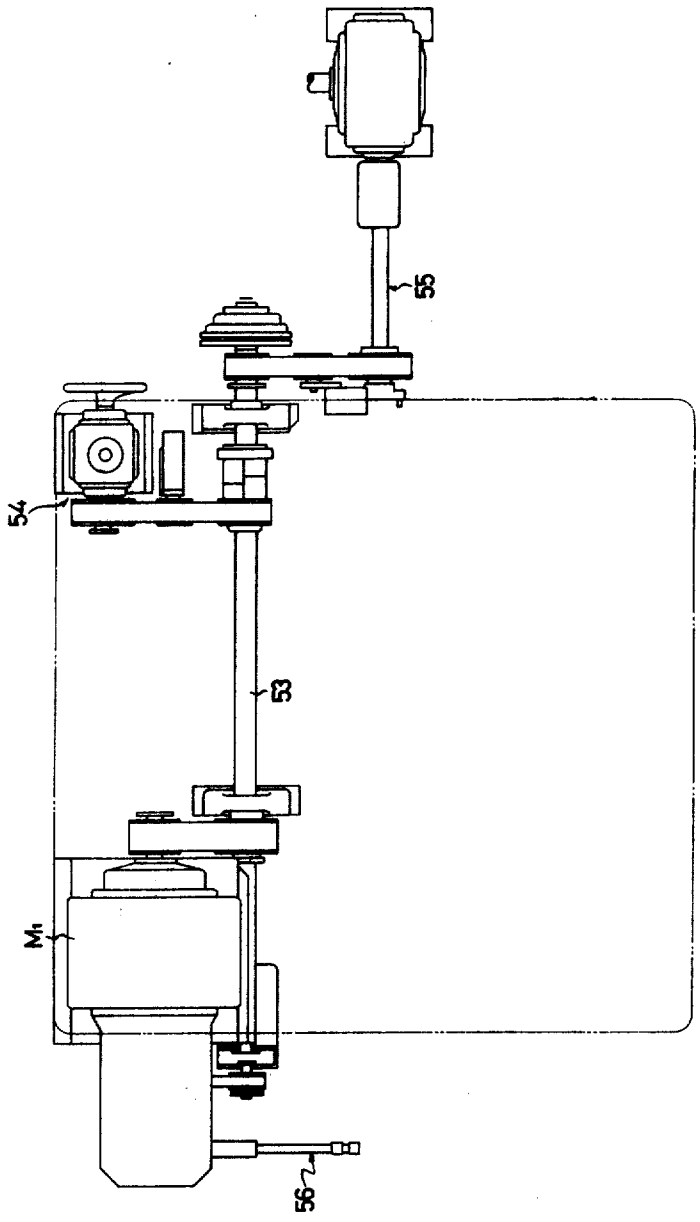


Fig. 12

Fig. 13



DEVICE FOR EXAMINING INNER PRESSURE RESISTANCE OF GLASS BOTTLE

BACKGROUND OF THE INVENTION

A filler simulator for reducing the number of cases where glass bottles are broken when being filled with liquid on a filling machine is well known. But since this device is operated under the range of low air pressure not exceeding the stress limit of a bottle and within the range of a pressure of vertical load, the device cannot function as a compression testing machine.

Glass bottles for pressurized beverages such as carbonated beverages, beer or the like are liable to break and are often dangerous to a person when the bottles have even very small flaws or undergo changes by effects of years or sudden changes in environmental temperature.

In order to avoid the danger of the kind described, it is only necessary to pour pressure fluid into a bottle and make a so-called hydraulic test as a means of examining the pressure resistance of the bottle, but in the prior art hydraulic test method a packing was provided on the fluid injection head to seal the mouth of the bottle, and the bottle mouth was vertically pressed and sealed, and hence the bottle was subjected to vertical load.

This load is an outer force having nothing to do with the inner pressure the bottle receives from the content fluid, and accordingly the method has the disadvantage that the correct results of the inner pressure examination are not obtained.

SUMMARY OF THE INVENTION

This invention relates to a device for examining the inner pressure resistance of a glass bottle and more particularly to a device for examining the inner pressure resistance of a bottle for a pressurized liquid such as carbonated beverages, beer, and the like.

A primary object of this invention is to provide a device for exactly examining the inner pressure resistance of a glass bottle by filling the bottle with fluid pressure under the same conditions as those under which the bottle is broken by a mere increase in its inner pressure in the described resistance examination of a bottle.

Another object of this invention is to provide a device capable of automatically making the pressure resistance examination of a glass bottle.

Still another object of this invention is to provide a device capable of efficiently and within a short time examining a large number of glass bottles to be filled with liquid.

According to this invention, groups of pressure fluid injection heads are successively and repeated fed at equal pitch in an examination zone having a certain distance over the travelling path of bottles to be examined, and a means of transporting the bottles is designed to transport bottles in synchronism with the pitch of movement of the groups of heads. According to the embodiment of the invention, the pressure fluid injection heads are horizontally moved by an endless moving means from the starting point of the examination zone to the final point thereof.

Each of the pressure fluid injection heads according to the invention is provided with a nozzle connected to an examination pressure fluid tank. The nozzle is fitted with an annular packing on the outer circumference of the portion which is inserted into the mouth of the bottle to be examined. The packing is squeezed on the outer circumference of the nozzle by forces axially opposing each other, so that the packing is radially and resiliently deformed to seal the mouth of the glass bottle.

The nozzle is also provided with a valve for a supply passageway from the examination pressure fluid tank. After the bottle mouth has been sealed with the packing, the fluid pressure is charged into the bottle until predetermined pressure is obtained.

Other features and advantages of the invention are apparent from a description of the embodiment of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a front view showing an embodiment of this invention with parts partially broken away for clearness;

FIG. **2** shows the principal part of the examination zone in section, the screw conveyor that transports glass bottles being shown in a nonsectional view;

FIG. **3** is mainly a plan view of the examination zone of FIG. **1**;

FIGS. **4** to **6** are sectional views showing the respective operational states of the pressure fluid injection heads with only one of plural elements shown and the others omitted for clearness;

FIG. **7** is a plan view of the head;

FIG. **8** is a front view showing the arrangement of the guide rails for the head;

FIG. **9** is a sectional view showing, in part, the state of connection of each each head to a distributing valve for feeding fluid to the head;

FIGS. **10** and **11** are the respective sectional views of distributing valves for feeding pressure air for upwardly moving the nozzle and pressure applying fluid as seen along line VI—VI and line VII—VII of FIG. **9**; and

FIGS. **12** and **13** are front and plan views showing, in part, the driving systems of the respective conveying means for the heads and bottles to be examined.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to a preferred embodiment of the invention in conjunction with the drawings, the numeral **1** designates examination head means which will later be described and which will hereinafter be called head means; **2** a conveying means comprising chain conveyors having a plurality of heads **1** at equal spaces, for example, endless chain conveyors **3**, **3**, and **3** disposed parallelly, the respective chains **3***a*, **3***a* and **3***a* of said chain conveyors having head holders mounted thereto, said holders **4** being mounted at a specified pitch in large numbers and each having several lines of head means **1** secured thereto, said means **1** being moved to an examination zone **5** one after another. The numerals **6** and **7** designate a pair of sprockets which are spanned with a chain **3***a* of the conveyor. The numeral **8** designates a frame of a conveying means for transporting the glass bottles **9** to be examined to an examination zone, said frame including a conveyor **10** for transporting the glass bottles **9** to be examined in the examination zone, a conveyor **11** for feeding the bottles **9** to said conveyor **10**, and a conveyor **12** for receiving the examined glass bottles **9** from said conveyor **10** and removing the same from the examination zone. The conveyor **10** com-

prises a conveyor **10***a* for transporting the glass bottles **9** and a screw conveyor **10***b* for correcting the arrangement of the bottles **9** at spaces adapted to the pitch in the direction of conveyance of said head means **1**, said bottles **9** being positioned by the side of conveying path on that side of the conveyor **10***a* from which the bottles **9** to be examined enter and on which the bottles **9** are pushed to be in succession placed in a manner of packed sardines.

The screw conveyor **10***b* corrects the spaces at which the bottles **9** to be examined are lined and synchronizes the spacing of the bottles **9** with the conveying means **2** of the head means **1** and feeds the bottles **9** in timed relation with the moving of the head means **1** which are conveyed. To this end, the conveyor **10***a* can maintain the state in which one head means **1** corresponds within the limits of the examination zone to one bottle **9** to be examined as long as the conveyor **10***a* is driven at the same speed as that at which the head means **1** are transferred by the convying means **2**. As shown, the conveying means **2** and conveyor **10***a* are disposed laterally so as to be in vertically parallel relation with each other to use a bottle conveying path provided between the means **2** and the conveyor **10** as the examination zone **5**. Also, in the embodiment illustrated, the examination heads **1** are plurally mounted to each holder **4** and conveying means are also disposed in plural rows correspondingly thereto, and the pressure resistance examination that will be described hereinafter is simultaneously made in each row.

The foregoing head means **1** include therein a vertically movable nozzle **14** (FIGS. **4** to **6**) connected to a pressure fluid source **13** (FIG. **3**) in the structure that will be described hereinafter. On the outer circumference of that portion of the lower end of the nozzle **14** which is inserted into the bottle **9** is mounted an annular packing **15**, and a packing squeezing means **16** for squeezing the annular packing **15** on the outer circumference of the nozzle **14** in the axial direction of the packing **15**, deforming the packing **15** and bulging the same circumferentially by the upward movement of the nozzle **14** is provided as will later be described. Furthermore, the head means **1** includes a nozzle upwardly moving means for upwardly moving the nozzle **14** by the actuation of fluid pressure while the head means is in the examination zone, a valve means **19** for opening a pressurizing fluid supply conduit **18** for application of pressure to the nozzle by the upward movement of the nozzle **14**, and a bottle guide **21** for opening a working air supply conduit **20** for upward movement of the nozzle by being pressed against the bottle **9** when the nozzle **14** is inserted into the glass bottle **9**.

The nozzle **14** is vertically movably provided within the cylinder **22***a* disposed in the head body **22** of the head means **1**, the upper end of the nozzle **14** being enabled to extend into a connection port **23** of the supply conduit **18** formed on the upper head **22***b* of the cylinder **22***a*, and the nozzle end **14***a* on the lower end being provided in the form of an insertion part which projects below a lower sleeve **22***c* of the cylinder **22***a* and which is adapted to be inserted into the mouth of the bottle **9**, and being provided on the outer circumference thereof with the annular packing **15**. Also, the nozzle **14** is formed with a piston portion **14***b* in one part of the area within the cylinder portion **22***a*, and is moved upward within the head body **22** by the working of the fluid pressure imparted to the piston portion **14***b* by the supply of working fluid (to be later described) to the space between the piston portion **14***b* and the lower sleeve **22***c* of the cylinder **22***a*, so that the upper end of the nozzle **14** projects into said connection portion **23**. The numeral **25** designates a spring adapted to urge the nozzle downward. The head body **22** is supported vertically movably within the sleeve number of a seat **26** secured to said holder **44**, and is adapted to insert the nozzle **14** by being lowered from the seat **26** (to be later described) into that bottle **9** on the conveyor **10***a* to which the head body **22** corresponds. Furthermore, the head body **22** is urged to move upward by a spring **27** based on the holder **4**.

The packing squeezing means **16** is made up of said nozzle **14** in the form of a movable member, said member having a stepped portion **28** formed therein to receive said annular packing **15** from below, and said lower sleeve **22***c* of the cylinder portion **22***a* in the form of a fixed member, said fixed member being fitted over the outer circumference of the nozzle **14** and having the lower end thereof pressed against the upper end of the annular packing **15**. The upward movement of the nozzle **14** with respect to the head body **22** squeezes the annular packing **15** in the axial, i.e. vertical direction of the nozzle **14** between the stepped portion **28** and the lower end of the lower sleeve **22***c* and deforms the packing **15** circumferentially and expands the diameter of the packing **15** resiliently.

A nozzle raising member is designed to move the nozzle **14** upwardly by supplying the cylinder portion **22***a* with pressure air by means of a compressor **29** (FIG. **3**) through a distributing valve **30** (FIGS. **1**, **2**, **3**, **9** and **10**) from a pressure air supply conduit **20** through a port **20***a* and a port **39** formed in the cylinder portion **22***a*. The distributing valve **30** comprises a drum and a non-rotatable valve body in the drum **30***a*, said drum **30***a* having a plurality of connecting ports **31** leading to the air supply conduits **20** for upwardly moving the nozzle and rotating in conjunction with the movement of the head means **1**. A design concerning the position between the drum **30***a* and valve body **30***b* in the distributing valve **30** makes it possible to bring connecting ports **31** corresponding to a plurality of head means **1** positioned in the examination zone into communication with said compressor **29** through the valve body **30***b* while the head means **1** are being positioned in the examination zone, thereby making it possible for the nozzle upwardly moving means to carry out timely operation.

Valve means **19**, in the connecting port **23** formed in the upper head **22***b* of the cylinder portion **22***a*, includes a spring **32** and a ball **34** designed to normally close that hole **33** at the upper end of the nozzle **14** which opposes the connecting port **23** by a depression force of the spring **32**. Also, at the upper end of the nozzle **14**, the nozzle **14** is formed with a slit **35** for bringing the pressurizing fluid supply conduit **18** into communication with the nozzle hole of the nozzle through the connecting port **23** when the upper end of the nozzle **14** projects from the hole **33** into the connecting port **23** to thereby push up the ball **34**. Accordingly, the pressure fluid from the pressurizing fluid conduit **18** is brought by the upward movement of the nozzle **14** with respect to the head body **22** into communication with the nozzle **14** through the slit **35**.

A bottle mouth guide **21** that guides the mouth of the bottle **9** to be examined to the specified position with

respect to the nozzle 14 is normally urged to lie in the lowermost position by springs 36 vertically movably fitted over the outer circumference of the cylinder portion 22*a* of the head body 22 and disposed in four places in plan view. The numeral 36*a* designates a stud guide for spring 36, and 37 designates a stopper for regulating the lowermost position of the bottle mouth guide 21 with respect to the head body 22, the stopper being formed like a flange on the outer circumference of the lower head 22*c* of the cylinder portion 22*a*. The bottle mouth guide 21 connects the pressure air supply conduit 20 for the nozzle upwardly moving means to the position of the portion that maintains air tightness between the guide 21 and the outer circumference of the cylinder portion 22*a* by means of two O-rings 28 and 38 mounted on the inner circumference of the guide 21. And the thus connected working fluid conduit 20 is brought into communication with the pressure air inlet port 39 of the cylinder portion 22*a* only when the bottle mouth guide 21 itself is in its elevated position with respect to the head body 22 as shown in FIG. 5. But when the guide 21 is in its lowered position as shown in FIG. 6, the guide blocks the port 20*a* of the conduit 20 with the wall of the cylinder portion 22*a*, and the pressure air inlet port 39 is positioned above the upper end of the guide 21 to thereby place the port 39 open to the atmosphere. The nozzle 14 and the guide 21 are at their lower ends in substantially the same height as shown in FIG. 4 before they operate. When the nozzle 14 is inserted into the glass bottle 9 by the head body 22 being lowered with respect to the holder 4, the guide 21, while guiding the mouth of the bottle 9 by means of the lower end guide face 21*a*, has its guide face 21*a* pushed over the bottle 9 and is moved upward with respect to the head body 22, with the result that the port 20*a* of the pressure air supply conduit 20 is brought into communication with pressure air inlet port 39.

The numeral 40 designates a defect bottle defecting means, and the means 40 includes a sleeve 43 which, when the nozzle 14 is moved upwardly to thereby open the pressurizing fluid supply conduit 18, is subjected to pressurizing fluid pressure to the nozzle 14 through the slit 35 of the nozzle 14 and moves an actuator 41 upwardly against the action of a spring 42, the actuator projecting its upper end 41*a* from the upper surface of the head body 22. On the other hand, a final stage unit of the examination zone is provided with a sensing switch S, which does not operate when the upper end 41*a* of the actuator 41 passes in the specified state of projection but which operates when the end 41*a* projects to a lesser degree. The sensing switch S, when the upper end 41*a* of the actuator 41 projects to a lesser degree, electromagnetically operates and remotely operates a reject means made up, for example, of a blower 44 disposed alongside of a conveying line extending from the examination zone of the bottles 9 onward. Of course, this reject means is specifically set by a timer or the like to operate in timed relation with the time at which a defect bottle broken in the examination zone reaches the place of the reject means.

A distributing valve 45 common to the aforestated distributing valve 30 is disposed midway in the pressurizing fluid supply conduit 18, and the pressurizing fluid supply conduit 18 is connected from the valve 45 to a plurality of head means 1. The valve 45 uses the nonrotatable valve body 30*b* and the drum 30*a* of the aforestated valve 30 with the valve 30 and permits introduction of pressurizing fluid from the valve body 30*b*. On the other hand, the rotation of the drum 30*a* constantly supplies the pressurizing fluid to all the fluid supply conduits 18 connected to the connecting ports 46 (FIG. 11) to the head means 1.

The numeral 47 designates a guide means for advancing the head means 1 (lowering the head means 1 with respect to the holder 4 in the drawing) to the side of the bottles 9 to be examined while the means 1 is in the examination zone 5, and the guide means 47 comprises a bilateral pair of guide rollers 48 mounted on the head body 22 of the head means 1 on the conveying means 2 and guide rails 49 and 49 disposed in pairs with respect to each row of the head means 1 and in parallel with the conveying means 2 in such a manner that the guide rollers 48 and 48 of the examination head 1 in the examination zone may be rotated in contact with the guide rails 49 and 49. The guide rails 49 lower the head body 22 of head means 1 provided with a pair of rollers 48 with respect to the holder 4 through a pair of guide rollers 48 rolling respectively along the guide rails 49 in the examination zone 5 while the head 1 is in the examination zone 5, and insert the nozzle 14 into the bottle 9. The numerals 50 and 51 (FIGS. 2 and 8) designate guide rails for guiding the holder 4, the rails 50 and 51 being laid along the upper and lower chain paths except for the outer circumference of the sprocket wheels 6 and 7 of the chain conveyor 3 of the conveying means 2, and in the upper and lower paths, the upper and lower guide rails 50 and 51 each are designed to receive movably each holder 4 from below through guide rollers 52 provided on the side ends of the holder 4.

In FIGS. 2 and 3, the character M_1 designates a common drive motor for the conveying means 2, conveyor 10*a* and screw conveyor 10*b*, and the motor M_1 is related with transmission systems including a transmission system 54 (FIGS. 12 and 13) from a main shaft 53 driven by the motor M_1 to the conveying means 2, a transmission system 55 to the conveyor 10*a*, and a transmission system 56 to the screw conveyor 10*b*, and drives the conveying means 2 and the screw conveyor 10*b* or conveyor 10*a* in synchronized relation required therebetween. Also, the conveying means 2 is of the construction in which rotation is transmitted from the transmission system 54 to one sprocket 7 mounted shaft 57 of each chain conveyor 3 of the means 2 and rotation is imparted to a drum 30*a* in common use by the distributing valves 30 and 45 by another transmission system originating from the shaft 57 so as to synchronize the movement of the head means 1 with the rotation of the drum 30*a*. And the distributing valves 30 and 45 are positioned midway between the shaft 57 of each chain conveyor 3 and another shaft 59 having the other sprocket 6 mounted thereon, and the respective supply conduits 18 and 20 from the distributing valves 30 and 45 to examination heads 1 are radially extended from the connecting portions of the drum 30*a*, for example connected, as shown in FIG. 9, to a plurality of connectors 60 and 61 on the holder 4 on which the head means 1 are mounted, and are connected branchedly from the connectors 60 and 61 to each port of each head means 1 mounted on the holder 4. Also, a known flexible tube which has the flexibility to meet a change in connection distance consequent upon the movement by the conveyor means 2 but

which does not depend is used in the supply conduits **18** and **20** from the distributing valves **30** and **45** to the connectors **60** and **61** on the holder **4**.

The numeral **62** designates a guide for the conveyor **10***a*, the guide forming a guide face with a plurality of rotatable rollers **63** and making it possible for the conveyor **10***a* to transport the bottles **9** in the examination zone smoothly. The numerals **64** and **65** (FIG. 3) designate an accumulator and a reducing valve for establishing pressure to a desired pressure disposed in the pressurizing fluid supply conduit **18**, respectively. The numerals **66**, **67**, and **68** respectively designate a filter, a reducing valve, an oiler disposed in the pressure air supply conduit **20**, and the conduit **20** is further provided with a magnet valve **69** and a reducing valve **70** for establishing pressure to a desired pressure. The conduits **18** and **20** each are connected to the nonrotatable valve body **30***b* of the distributing valves **30** and **45** and then through each connection port of the drum **30***a* to the head means **1** as described previously.

The numeral **71** designates a water feed tank for beforehand keeping those bottles filled to the full with water which are transported by a conveyor **11** before they are transported to the examination zone **5**, the tank **71** being formed on the bottom with numerous small holes (not shown) and being adapted to discharge water in showers over a group of bottles **9** to thereby fill the bottles to the full. The numeral **72** designate a storage tank placed below the group of bottles **9** transported and adapted for storing water falling from the supply tank **71**, and **73** designates a clutch means mounted on the transmission system **54** from the main shaft **53** to the conveying means.

The numeral **74** designates a vertically moving means for raising the whole of the conveying means **2** together with the head means **1** mounted thereon from the state in FIG. **1** and restoring the same to its original position, and is adapted to be used for purposes other than examination, for example, for purposes of inspection, adjustment and other operation services. The means **74** comprises a screw shaft **76** threadedly fitted into a vertically movable member **75** that holds the conveying means **2** and a motor M_2 that drives the shaft **76**, and **77** designates a crossbar secured to the member **75** to which the guide rails **49** are secured and which supports the shafts **57** and **59** of the conveying means **2**.

Referring now to the operation of the embodiment illustrated, a line of bottles conveyed by the conveyor **11** are first filled with water falling in showers from the water feed tank **71**, and are then conveyed line by line to each conveyor unit **10***a*, and are spaced apart at the same pitch as the pitch of the head means **1** by screw conveyor **10***b* at the entrance to the conveyor **10***a*, and the screw conveyor **10***b* corrects the positions of the bottles **9** in such a manner in which the bottles may oppose one by one each of the head means being transported. The bottles **9** that passes the screw conveyor **10** are then conveyed by the conveyor **10***a* at the same speed and in the same direction as the examination heads **1** and guided one after another to the examination zone **5** while the relation of one bottle **9** to head means **1** is being maintained, and pass the zone **5**.

The head means **1** is caused by one member **49** of the guide means **47** to lower its head body **22** with respect to the holder **4** at the point of time at which the means **1** is entering the examination zone **5**, and, as shown in FIG. **5**. On the other hand, the bottle mouth guide **21** is not lowered but guides by its guide face **21***a* the bottle **9** to the specified position with respect to the nozzle **14** adapted to be inserted into the bottle **9**, thus preventing the failure of the nozzle **14** in insertion due to misregistering of the head means **1** with the bottle **9**. On the other hand, the bottle mouth guide **21** is brought into the same relation with that in which the guide **21** moves up and down with respect to the head body **22**, and brings the port **20***a* of the pressure air supply conduit **20** into communication with the working fluid inlet port **39** in the cylinder portion **22***a* of the head body at the point of time at which the nozzle **14** is sufficiently inserted.

Since the time at which the means **1** reached the examination zone **5**, the supply conduit **20** has been opened by the distributing valve **30** and working fluid is supplied to the cylinder portion **22***a* through the communication of the conduit **20** with the port **39** and the nozzle **14** is moved upwardly with respect to the head body **22**. The packing squeezing means **16** as previously stated clamps the annular packing **15** vertically by such upward movement of the nozzle **14** and bulges the outer diameter of the packing **15** outwardly, and seals the bottle mouth in the state in which the nozzle **14** is inserted into the bottle as shown in FIG. **5**, and as stated, a valve means **19** opens the pressurizing fluid supply conduit **18** to the nozzle **14**. Because of this, the bottle **9** is filled with pressurizing fluid pressure and loaded inside with pressure.

This operation is started, for example, at the time at which the bottle **9** is in the position A shown in FIG. **1**, and is thereafter maintained in the pressurized state for a certain period of time, for example until it reaches the position B shown in FIG. **1**, and hence the bottle is placed under the specified pressure for a certain period of time e.g. several seconds so as to judge the quality of the bottle **9** by whether the bottle is broken or not.

When the bottle **9** is broken in the examination zone **5**, the bottle mouth guide **21** is relieved of an obstacle constituted by the bottle **9** to the lowering of the guide **21** and is urged by springs **36** to lower around the head body **22** as shown in FIG. **6**. As such lowering of the guide **21** breaks communication between the pressure air supply conduit **20** and the working fluid inlet port **39** of the cylinder portion **22***a* and opens the port **39**, the nozzle **14** is urged by a spring **25** to lower with respect to the head body **22**. When the nozzle **14** is lowered, a valve means **19** closes the pressurizing fluid supply conduit **18** to thereby prevent the wasteful discharge of the pressurizing fluid and loss from the discharge. On the other hand, the packing squeezing means **16** releases clamping of the annular packing **15**. Even if the mouth portion of the broken bottle **8** is left attached to the nozzle **14**, the bottle mouth guide **21** is urged by the springs **36** to push aside the attached broken mouth portion and is lowered.

A defect bottle detecting means **40** functions in such a manner that, when the bottle **9** is broken, a pressurizing fluid passageway within the nozzle **14** below the valve means **19** is brought into communication with the atmosphere and an actuator **41** is lowered by a spring **42** and the upper end **41***a* of the actuator **41** is reduced in the degree of of projection, and accordingly when the head means **1** having the actuator **41** passes by the place where a sensing switch S is disposed, the switch S operates and a blower **44** as a reject means, when the broken bottle **9** comes to the position of the blower **44**,

operates and rejects the broken bottle from the conveying means 10*a*. Since in the invention the pressurizing fluid is water, fragments of the broken bottle are prevented from scattering by the tenacity of water and is brought into the state of being collected in a certain range, and accordingly there is no inconvenience in collecting the fragments.

When the bottle 9 is not broken, the bottle 9 passes by the sensing switch S with the pressure of the pressurizing fluid kept applied to the actuator 41 in the sleeve 43, and accordingly the switch S does not operate and consequently the reject means does not operate.

When the head means 1 has passed the position B of the examination zone, supply of pressure air through the supply conduit 20 to the cylinder portion 22*a* is stopped by the distributing valve 30, and also, the head body 22 is gradually moved upwardly by the guide means 47 with respect to the holder 4. If at this time the bottle 9 has not been broken but is in the state of the nozzle being inserted into the mouth of the bottle 9 as shown in FIG. 5, the bottle mouth guide 21 is prevented by the bottle 9 from lowering with respect to the head body 22, and the pressure air supply consuit 20 is in communication with the pressure air inlet port 39 of the cylinder portion 22*a* but fluid supply in the supply conduit 20 is stopped by the distributing valve 30 in prior to the upward movement of the head body 22. On the other hand, when the head body 22 is moved upwardly at the end of the guide means 47 as shown in FIG. 1, the pressure air inlet port 39 of the cylinder portion 22*a* is exposed from the upper end of the bottle mouth guide 21 and communicates with the atmosphere. Accordingly, the pressure to move the nozzle 14 upwardly with respect to the piston portion 14*b* is lost, and the nozzle 14 is lowered by a spring 25 with respect to the head body 22, and a valve means 19 closes the pressurizing fluid supply conduit 18, and the packing squeezing means 16 releases the clamping pressure of the annular packing 15, and the packing 15 is returned to its original state to remove the sealing of the bottle 9.

Accordingly, when the head body 22 of the head means 1 is moved upwardly with respect to the holder 4, the nozzle 14 is also moved upwardly therewith, but the bottle 9 does not follow such upward movement but the nozzle 14 is smoothly drawn out of the examined bottle 9 by the upward movement of the head body 22. When the head body 22 is moved up to a certain position, namely when the bottle mouth guide 21 reaches the position in which the guide 21 takes the lowermost position with respect to the head body 22, the bottle mouth guide 21 also follows the head body 22 and is brought into its preexamination state in FIG. 4. And the examined bottle 9 is fed by the conveyor 12 to the next processing step, and the head means 1 is cyclically transported by the conveying means 2 to the examination zone 5, the operation above being continuously repeated. Also, the pressure examination described above is simultaneously carried out in a plurality of rows.

Since in the invention the bottle is sealed by circumferentially outwardly expanding the annular packing on the circumference of the nozzle to be inserted into the bottle when the bottle is pressurized by fluid, there is no possibility of a great outer force irrelevant to pressure resistance examination being applied to the bottle as was the case with the conventional type packing which was pressed on the bottle from above, and hence a proper pressure resistance examination can be made under the conditions equal to those under which natural breakdown due to the content of the bottle occurs, with the result that reliability on the results of examination is greatly improved.

What is claimed is:

1. A device for examining the inner pressure resistance of a glass bottle, comprising, in combination:

a. a horizontal conveyor means (10*a*) for horizontally conveying a plurality of rows of glass bottles in succession at equal spaces;

b. an endless conveyor means (2) provided around it with a plurality of head holders (4) having a plurality of head assemblies (22) at right angles to the direction of movement of the endless conveyor means (2) at spaces equal to those of the bottles on the horizontal conveyor means (10*a*) and adapted to convey the head assemblies (22) horizontally in synchronism with the bottles in an examination zone;

c. head assemblies (22) vertically movably supported in the head holders (4);

d. guide rails (49) for lowering and conveying the head assemblies (22) in the examination zone;

e. a valve means (19) provided in the head assembly (22), operatively connected to a conduit for pressurized fluid;

f. a nozzle (14) supported in the head assembly (22) movably with respect to the valve means (19);

g. an annular packing (15) of a resilient material provided at the lower end of the nozzle (14);

h. a squeezing means (16, 28, 22*c*), provided at the lower end of the nozzle (14) and the lower portion of the head means respectively for resiliently deforming the annular packing (15) in a radial direction;

i. a pressure air supply conduit (20) for moving the nozzle (14) upward connected to the lower portion of the head assembly (22);

j. a valve means (30) for supplying pressure air to the conduit (20);

k. a valve means (45) for supplying pressurizing fluid to the nozzle (14);

l. whereby the annular packing (15) is resiliently deformed in a radial direction, the valve means (19) is opened, and pressurized fluid for examination from a conduit (18) connected to the valve means (19) is introduced into a bottle through the nozzle (14).

2. The device as set forth in claim 1, wherein the head assemblies (22) are vertically movably supported by seats (26) on the head holders (4) mounted at equal spaces to endless chains (3*a*) of the endless conveyor means (2), and springs means (27) are mounted on the seats (26) of the head holders (4) for urging to the guide rails (49) rollers (48) in contact with the guide rails (49) provided in parallel with the horizontal conveyor means (10*a*).

3. The device as set forth in claim 1, wherein the head assembly (22) comprises a cylinder portion (22*a*) composed of an upper head (22*b*) and a lower head (22*c*) having therebetween a piston (14*b*) of the nozzle (14) and the valve means (19) comprises a spring-loaded ball (34) in a connecting port (23) of the pressurizing fluid supply conduit (18) leading to the upper

head (22*b*) and a hole surrounding the upper end of the nozzle (14) and closed by the ball (34).

4. The device as set forth in claim 1, wherein the head assembly (22) further comprises a pressure air inlet port (39) for upward movement of the nozzle disposed between the piston (14*b*) of the nozzle (14) and the lower head (22*c*); a spring (25) for urging the nozzle (14) between the piston (14*b*) and the upper head (22*b*); and a pressure air port (20*a*) in a bottle mouth guide sleeve (21) slidably mounted on the outer circumference of the head assembly (22).

5. The device as set forth in claim 4, wherein the guide sleeve (21) is slidably mounted on the outer circumference of the head assembly (22) and urged downward by a spring (36), and includes a guide face (21*a*) for receiving a bottle mouth around the nozzle (14) and an upper edge for bringing the pressure air inlet port (39) of the head assembly (22) into communication with the atmosphere when a bottle is broken and the guide sleeve (21) is brought to the lowest position by the spring (36).

6. The device as set forth in claim 5, which, in order to receive pressurizing fluid from a water source, further comprises a fixed valve body (30*b*) mounted in the center of the endless conveyor means (2), a distributing valve rotating in synchronism with the conveyor means (2) around the valve body (30*b*) and the conduits (18) for connecting the distributing valve (45) with the valve means (19) of each head assembly (22).

7. The device as set forth in claim 5, which, in order to receive pressure air from a compressor, further comprises the fixed valve body (30*b*) mounted in the center of the endless conveyor means (2), a distributing valve (30) rotating in synchronism with the conveyor means around the valve body and the conduits (20) for connecting the distributing valve with the pressure air inlet port (39) of each head assembly (22).

8. The device as set forth in claim 5, which further comprises a spring-loaded indicator (41) provided within a sleeve (43) communicating with a slit (35) formed at the upper end of the nozzle (14) with the upper end (41*a*) projecting from the upper head (22*b*) of the head assembly, (22) and a sensing means (S) mounted fixedly on the terminal portion of the endless conveyor means (2) on the path for the upper end (41*a*) of the indicator (41), said sensing means (S) being electrically connected to a rejecting means for removing a broken bottle.

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