United States Patent

Wallington

[15] **3,656,616**

[45] **Apr. 18, 1972**

[54] ARTICLE INSPECTION AND REJECT SYSTEM

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[73] Assignee: **Owens-Illinois, Inc.**

[22] Filed: **June 8, 1970**

[21] Appl. No.: **44,313**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 24,173, Mar. 31, 1970.

[52] **U.S. Cl.** **209/74,** 209/90

[51] **Int. Cl.** **B07c 5/00**

[58] **Field of Search** ..... 209/74, 74 M, 90; 198/38

[56] **References Cited**

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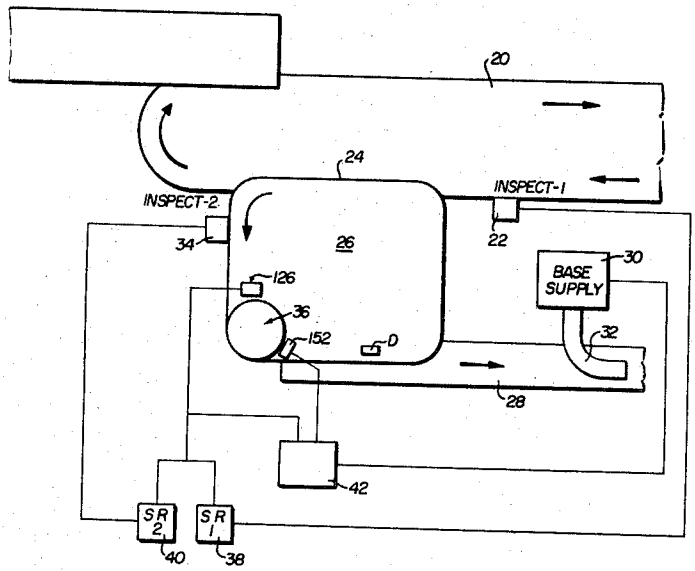
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[57] **ABSTRACT**

A system for inspecting articles on a continuously moving production line and ejecting flawed articles from the production line. One or more inspection stations are located at selected points along the production line to inspect articles passing through the inspection stations for specific types of flaws. Upon the detection of a flawed article, a reject signal is generated and stored in a shift register which transmits the reject signal to a reject mechanism in synchronism with the movement of the flawed container along the production line to cause the reject mechanism to eject the flawed container when the container reaches the reject station. The reject mechanism is so arranged that it is set and reset while out of registry with the production line so that the time required to set and reset the mechanism is independent of line speed. The system is also provided with a control which can set the reject mechanism to eject all containers moving along the line.

24 Claims, 9 Drawing Figures



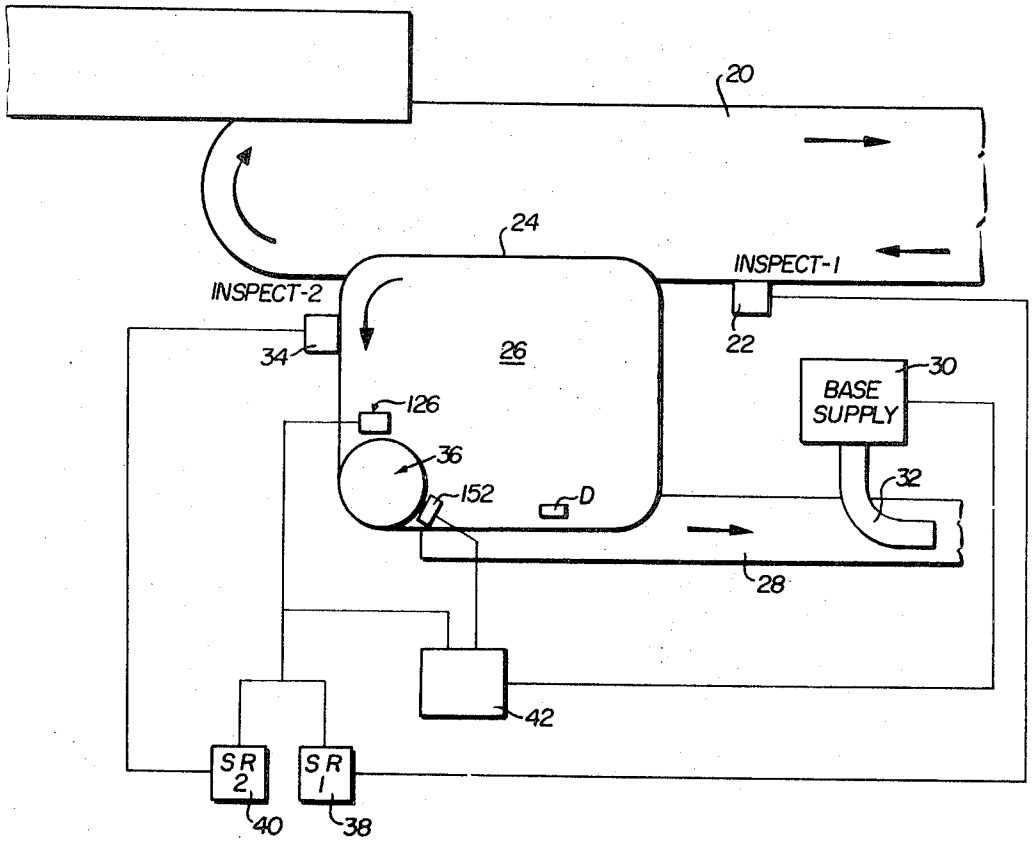


FIG. 1

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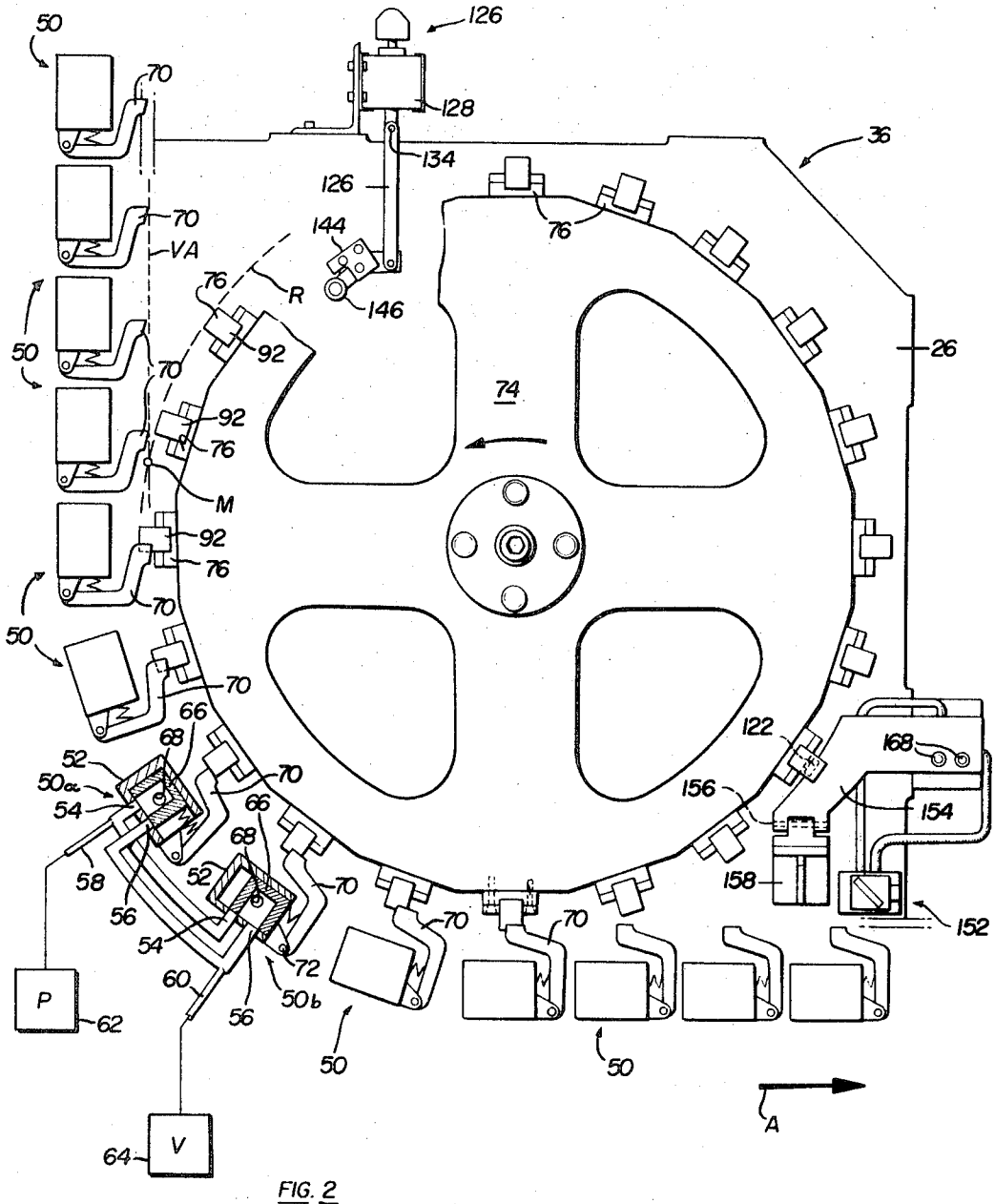


FIG. 2

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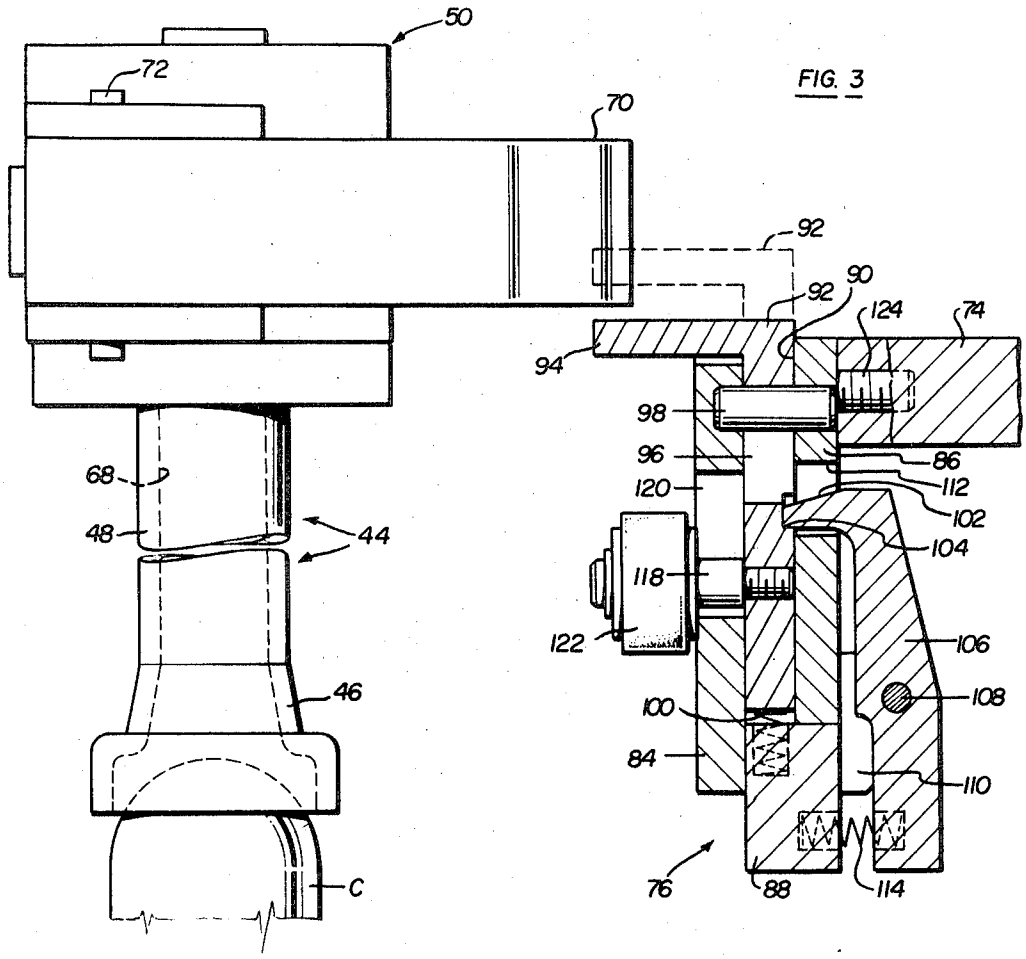


FIG. 3

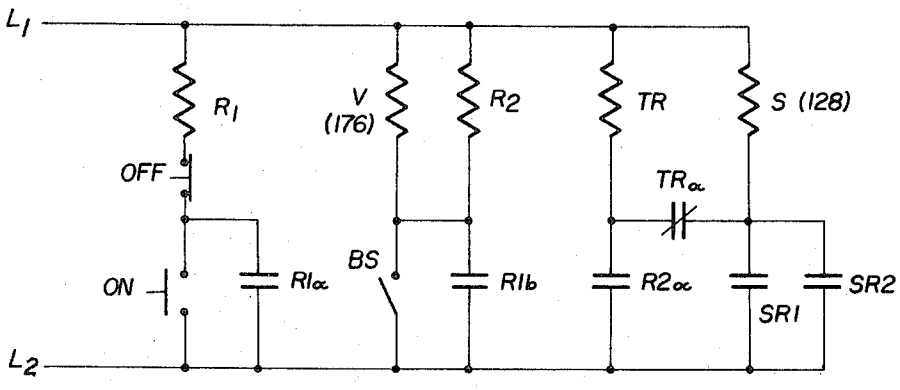
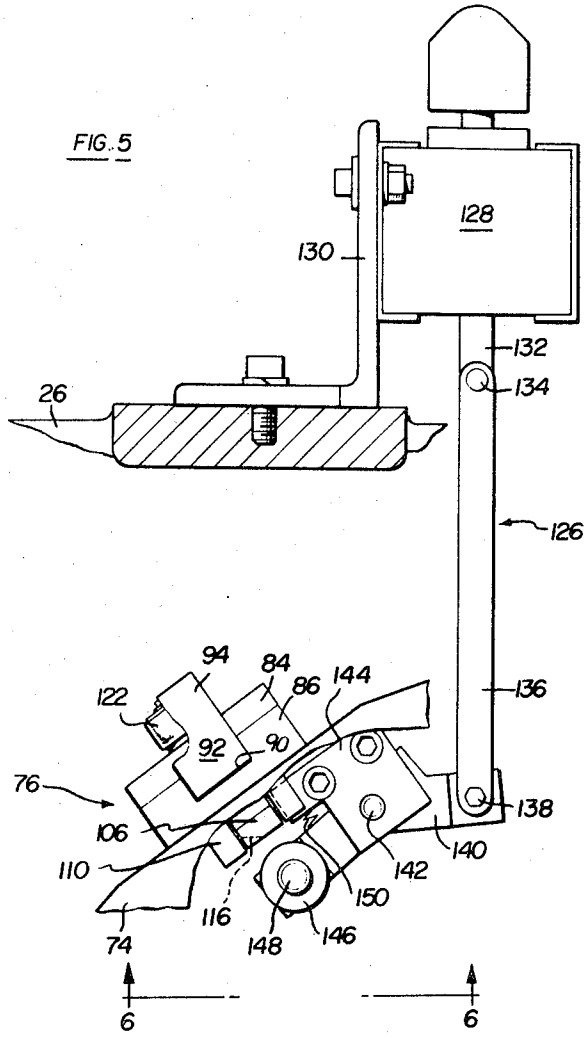


FIG. 9

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FIG. 5



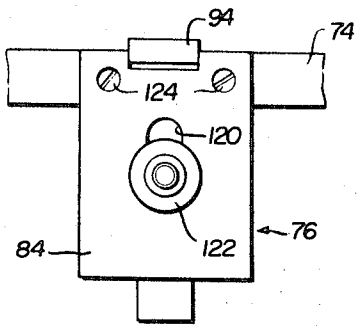


FIG. 4

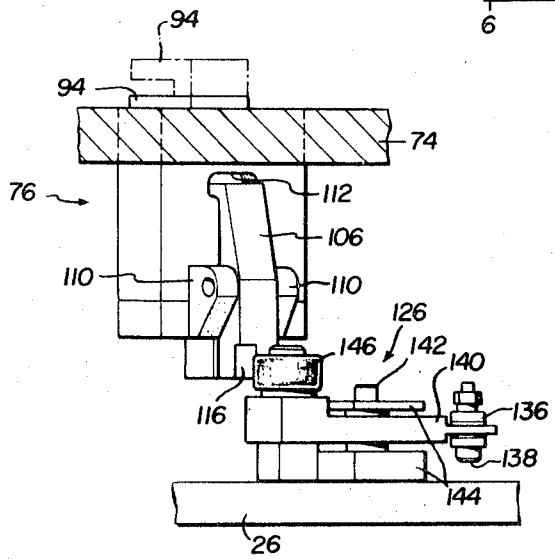


FIG. 6

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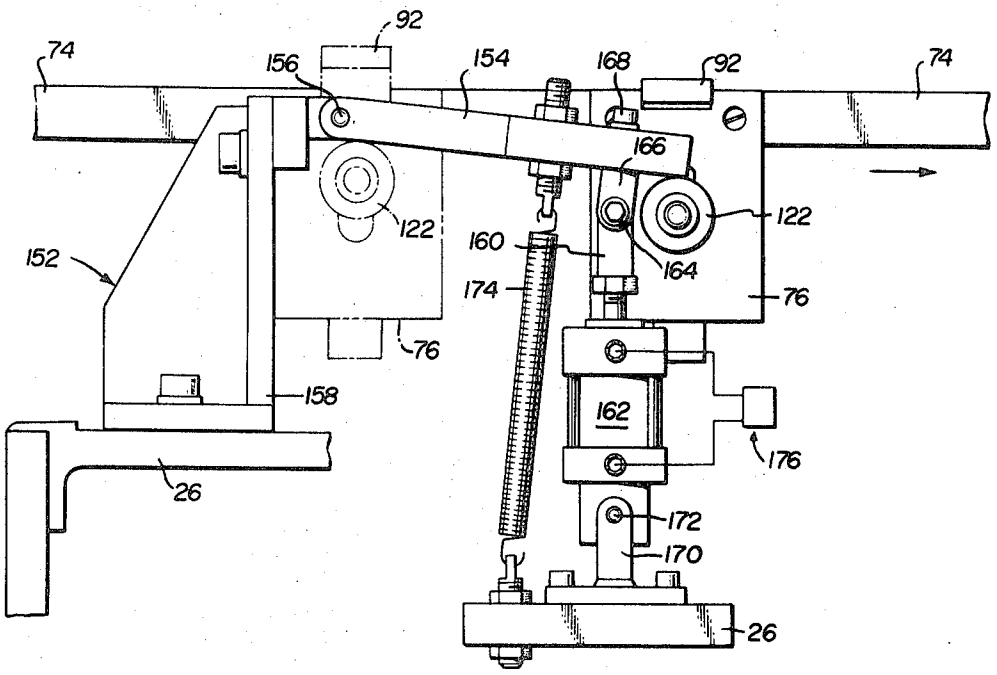


FIG. 7

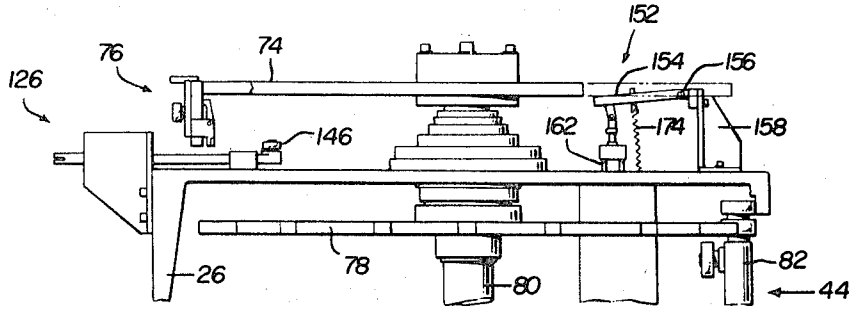


FIG. 8

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ARTICLE INSPECTION AND REJECT SYSTEM

This application is a continuation-in-part of the copending application of myself and John D. Banyas, Ser. No. 24,173 filed Mar. 31, 1970.

BACKGROUND OF THE INVENTION

The system of the present invention, while obviously having utility in many types of production lines, was specifically designed for use in the glass container production line which forms the subject matter of a commonly owned copending application of Richard A. Heaton, Ser. No. 24,721, filed Apr. 1, 1970.

In this particular production line, the glass container portion of the composite container which forms the subject matter of U.S. Pat. No. 3,372,826 successively passes from a forming machine in which the container blank is formed, to a transfer machine, upon which the container is sprayed with a first coating, to a burn-off machine, which burns off the moil portion of the container blank and forms the container mouth or finish, to a heat-treat machine, which then passes the container to a second transfer machine, upon which a second coating is applied to the container, and finally to an assembly machine upon which the plastic base element is mounted on the base of the glass container. Each of the successive machines employs a different type of container gripping or supporting mechanism which is designed in accordance with the particular operation to be performed on the container as it passes through the individual machine. As in every production line, it is desired to inspect the containers for flaws of various types as the containers move through the line. Because of the different manners in which the container is held or supported at various points along the line, it is not always possible to inspect and immediately reject a flawed container, because at the time a particular inspection is performed the container may be supported by a chuck or support from which ejection of the container is difficult or inconvenient.

In the production line disclosed in the aforementioned application, Ser. No. 24,721, for example, the second transfer machine is by far the most convenient point in the line to eject a container, because in this machine the container is held in an inverted position from its bottom by a vacuum chuck which has a valve operable to shift the chuck supply from vacuum to air to positively eject the container downwardly from the chuck. In the heat-treat machine, and in the final assembly machine, on the other hand, the container is supported within a pocket from which it can be removed only by lifting the container upwardly out of the pocket or by turning the pocket upside down. At the relatively high line speeds — up to 600 containers per minute past any given point — it is impractical from an engineering standpoint to attempt to selectively eject containers from either of these two latter machines.

While it would, at first glance, appear to be desirable to eject a container from the line as soon as a flaw was detected, in actual practice it may often be preferable to retain the flawed container in the line, and even perform subsequent operations upon it even though the container must ultimately be ejected, in order to maintain a more even work load on certain portions of the processing equipment. For example, in the production line of the aforementioned application, Ser. No. 24,721, in order to maintain a steady state operation of the heat-treat machine, it is preferable to maintain a fairly constant rate of flow of containers through the machine. Hence, should a reject mechanism located upstream of the heat-treat machine start to eject a substantial number of containers, adjustment or cycling of the heat-treat machine to compensate for the uneven flow of containers through it would be required.

The present invention is therefore specifically designed to permit location of the reject station at a point in the line where it is convenient to eject the article and to enable a single reject station to be operated by one or more inspection stations which may be located at substantial distances upstream of the line from the reject station.

SUMMARY OF THE INVENTION

The reject mechanism of the present invention takes the form of a plurality of individual reject devices mounted for movement in uniformly spaced succession along an endless path, one portion of which is in registry with the path of movement of the articles and a second, preferably major, portion of which is out of registry with the path of movement of the articles. Each reject device is constructed with an actuating member normally maintained in an inactive position and shiftable to an active position in response to the receipt of a reject signal. The actuating mechanism is designed in accordance with the structure of a release mechanism on the article support or conveying structure to engage or trip the article release mechanism as the reject device and article move along the portions of their respective paths which are in registry with each other. Resetting of the actuating element to its inactive position and setting of the actuating element into its active position are accomplished while the reject device is traversing that portion of its endless path which is out of registry with the article path. The reject devices are driven in synchronism with the movement of articles along the production line so that each reject mechanism is aligned with an article release mechanism throughout that portion of their respective paths which are in registry with each other.

Reject signals generated by an inspection device are fed into an electronic shift register which functions to store the signal until the container responsible for the generation of the reject signal approaches the reject station. At the appropriate time, the shift register triggers an actuating element setting device to shift the actuating element of a reject device to its active position at a time when that reject device and the flawed container are at locations on their respective paths equidistant and upstream from the point at which the respective paths merge with each other.

When the activated actuating mechanism and the release mechanism of the chuck reach the merged portion of their respective paths, the actuating element trips the release mechanism to cause ejection of the article from the production line. The actuating element and release mechanism travel over that portion of their paths in registry with each other together and then diverge as the actuating mechanism enters that portion of its path out of registry with the path of movement of the articles. Shortly after the point of divergence of the paths, the actuating element passes a reset device which restores the actuating element to its normally assumed inactive position.

The employment of an electronic shift register, or other suitable signal delay device, enables the inspection station to be located at the most convenient possible location upstream of the reject station, because by suitable selection or adjustment of the shift register, the appropriate delay in transmission of the signal to the reject mechanism can be achieved. By the use of a suitable control system a single reject mechanism may be triggered by a signal from any one or more of the various inspection stations. This enables the reject device to be located at a point in the line where the article is carried or chucked in a fashion such that it can be easily ejected. Because the actuating elements are set and reset while they are traveling along a portion of their path out of registry with the path of movement of articles, the speed of movement of articles along the production line is not a critical factor in the time required to set and reset the individual actuating elements.

In certain instances it may be desirable to condition the reject mechanism to reject all containers from the line. Specific examples of situations in which this might be desirable are during the initial start-up of the production line until steady-state operating temperatures are reached at all points along the line or, in the case of the composite container in the particular production line of the aforementioned application, Ser. No. 24,721, if the supply of plastic bases to the assembly means is interrupted. Rejected containers are ejected into a cullet chute and returned to the glass furnace and thus recycled through the machine.

Other features and advantages will become apparent by reference to the following specification and to the drawings.

IN THE DRAWINGS

FIG. 1 is a schematic plan view of a portion of a container production line employing the present invention;

FIG. 2 is a detail plan view, with certain parts broken away, omitted or shown in section, of a reject station embodying the present invention;

FIG. 3 is a detail view, partially in section, again with certain parts broken away or omitted, showing structural details of a reject device and its positional relationship to a container chuck control device;

FIG. 4 is a front elevational view of an individual reject device;

FIG. 5 is a top plan view, with certain parts broken away or shown in section, of a latch mechanism;

FIG. 6 is a detail view, partially in section, taken approximately on line 6—6 of FIG. 5;

FIG. 7 is a detail side elevational view of a latch reset mechanism;

FIG. 8 is a detail side elevational view of the reject assembly; and

FIG. 9 is a schematic diagram of one form of electric control circuit.

GENERAL DESCRIPTION

Referring first to FIG. 1, there is shown a schematic diagram of the final portion of the container production line which forms the subject matter of the commonly owned copending application of Richard A. Heaton, Ser. No. 24,721, filed Apr. 1, 1970. This line is set up to produce a composite glass-plastic container of the type shown in U.S. Pat. No. 3,372,826 which consists of a bulb-shaped glass container seated in a cup-shaped plastic base element.

Schematically illustrated at **20** is a portion of an endless heat-treat conveyor in which the glass containers are supported in inverted positions in pocket-type carriers and conveyed past various heating and cooling stations to heat treat the container and to subsequently cool it. As the containers move from right to left on the lower run of conveyor **20** as viewed in FIG. **1**, the containers pass a first inspection station **22** at which the container bottom is inspected for possible defects in configuration and wall thickness by conventional inspection techniques. After passing beyond the first inspection station **22**, the containers on conveyor **20** pass into underlying alignment with a pick-up run **24** of a so-called second transfer machine **20** designated generally **26**. Transfer machine **26** forms the subject matter of a commonly owned copending application of John D. Banyas and Frederick L. Wallington, Ser. No. 24,173, filed Mar. 31, 1970.

As explained in greater detail in the Banyas et al. application, the transfer machine **26** includes a series of vacuum chucks linked together into an endless chain and driven in movement in a counter-clockwise direction around the generally rectangular path schematically indicated in FIG. **1**. The chucks have, at their lower ends, a downwardly opening vacuum head which is applied to the container bottom and supplied with vacuum to grip the container. The chucks can be raised or lowered relative to the frame of machine **26** to lift gripped containers upwardly clear of the pockets on conveyor **20** and to lower the containers into container receiving pockets of an assembly machine **28** which forms the subject matter of another commonly owned copending application of James D. Mallory and Frederick L. Wallington, Ser. No. 883,515, filed Dec. 9, 1969.

As explained in greater detail in the aforementioned Banyas et al application, the vacuum chucks of transfer machine **26** each include a control valve which can be selectively positioned to connect the container-gripping head of the chuck either to a source of vacuum to grip the container or alternatively to a source of air under pressure to eject or discharge a container from the chuck. This arrangement provides a positive and quick acting capability of ejecting a container from the production line, making it far more convenient and practical to eject containers from the line during their passage through machine **26** than would be the case in either of the pocket conveyors employed in heat-treat machine **20** or assembly machine **28**. Further, machine **26** is the final machine through which the glass container passes prior to its assembly with its plastic base element, which is accomplished in machine **28**. In machine **28**, as explained in detail in the aforementioned copending Mallory et al. application, plastic base elements are fed from a base supply **30** through a chute **32** and captured by the containers as the inverted containers are conveyed past the discharge end of chute **32**.

Returning to machine **26**, as the containers are conveyed through this machine, they pass a second inspection station **34** where a final inspection of the container side wall and finish is performed, by conventional techniques. Each of inspection stations **22** and **34** are operable, in a conventional manner, to generate a reject signal in the form of an electrical pulse which is subsequently employed to actuate a reject mechanism designated generally **36** to eject the flawed container from machine **26** as the flawed container passes the reject mechanism.

Because both of inspection stations **22** and **34** are physically located a substantial distance upstream of reject mechanism **36**, the transmission of the reject signal from inspection stations **22** and **34** to reject mechanism **36** is delayed by suitable electrical control circuitry, such as electronic shift registers **38** and **40**, respectively connected to inspection stations **22** and **34**. Electronic shift registers suitable for this purpose are well-known, see for example, U.S. Pat. No. 3,478,323. In brief, the shift register includes a "clock" or pulse circuit which is synchronized with the line speed of movement of containers through machines **20** and **26**. The register functions to store a received signal for a selected number of pulses and to then transmit the signal.

In the disclosed system the containers during their passage through the production line move continuously and at a uniform spacing at all times, and thus the function of the shift registers is to store the reject signal received from the inspection station for the period of time required for the container responsible for the generation of the reject signal to travel from the inspection station to reject station **36**.

In the example shown in FIG. **1**, only two inspection stations have been indicated, however, it is believed apparent that additional inspection stations may be employed at portions of the production line upstream from the portion shown and that such additional inspection stations may also be operatively connected by shift registers or other suitable time delay devices to control reject mechanism **36**.

The characteristics of assembly machine **28** are such that it is undesirable to transfer glass containers from machine **26** to assembly machine **28** unless it is certain that a base will be available from chute **32** to be assembled upon the container. Thus, in addition to controlling reject mechanism **36** from inspection stations **22** and **34**, a base supply detector **42** is connected as schematically illustrated in FIG. **1** to actuate the reject mechanism in the event the base supply become depleted, or in the event supply chute **32** should become jammed. Because the production line is intended to operate at speeds in the neighborhood of 600 containers per minute, the base supply detector **42** is operable, in a manner to be described below, to set reject mechanism **36** in a permanent reject condition which will cause rejection of all containers reaching reject mechanism **36** until the base supply has been restored.

REJECT MECHANISM

In the specific example shown in the drawings and to be described below, the reject mechanism employed does not act directly upon the glass container itself, but instead is employed to selectively actuate a control mechanism on the container support device which in turn causes ejection of the container from the support device.

As stated briefly in general terms above, the transfer machine **26** of the Banyas et al. application, Ser. No. 24,173 employs a vacuum chuck having a control valve which can be selectively positioned to connect the container engaging head of the chuck either to vacuum or to a source of air under pressure. The valve and chuck of the Banyas et al. application, Ser. No. 24,173 are diagrammatically shown in FIGS. **2** and **3**.

Referring first to FIG. **3**, a vacuum actuated chuck designated generally **44** includes a container engaging head **46** which is supported at the lower end of an elongate vertically extending hollow spindle **48**. At the upper end of each spindle, a control valve **50** is mounted and includes a housing **52** (FIG. **2**) formed with a pressure inlet port **54** and a vacuum inlet port **56**, these ports being connected by conduits **58** and **60** respectively to pressure and vacuum sources **62** and **64** schematically indicated in FIG. **2**. Within the housing **52**, each valve is provided with a valve piston **66** which is shown at one end limit of movement in valve **50***a* of FIG. **2** and at its opposite end limit of movement at valve **50***b* of FIG. **2**. Valve **50***a* is shown with its piston positioned to connect pressure port **54** of the valve to its outlet port **68**, port **68** being directly connected to the hollow interior of spindle **48** and to the container engaging head **46**. Valve **50***b* of FIG. **2** shows piston **66** at its opposite end limit of movement, in which vacuum port **56** is connected to outlet port **68**. Piston **66** is normally maintained at the position shown at valve **50***b* in FIG. **2** — i.e. to supply vacuum to the chuck head — but can be shifted to the position shown in valve **50***a* of FIG. **2** upon the depression of a valve actuator **70** which is pivotally mounted upon housing **52** as by pivot **72**. Complete details of valve **50** are disclosed in the aforementioned Banyas et al. application, Ser. No. 24,173.

It is believed apparent that when the interior of head **46** is supplied with vacuum from source **64**, it will grip and maintain a container C in seated position in the mouth of the head as shown in FIG. **3**. When valve **50** is shifted to connect the interior of head **46** to pressure source **62**, the supply of pressure to the interior of head **46** positively expels and ejects the container from head **46**.

As indicated in FIG. **2**, the vacuum chucks are linked together into an endless chain in a uniformly spaced relationship such that the valves **50** of the individual chucks are spaced as indicated in FIG. **2**, the chucks and their associated valves being driven, in a manner described in more detail in the aforementioned Banyas et al. application, Ser. No. 24,173, in continuous movement in the direction of the arrow A of FIG. **2**.

Referring now particularly to FIG. **2**, reject mechanism **36** includes a wheel **74** which is mounted for rotation in the frame of machine **26** at one corner of the endless path of movement of the chucks on machine **26**. Wheel **74** carries a plurality of individual reject devices **76** mounted at uniformly spaced positions about the periphery of the wheel, the spacing between adjacent reject devices **76** corresponding to the spacing between adjacent chuck operating valves **50**.

Referring briefly to FIG. **8**, wheel **74** is driven in operatively aligned synchronized movement with the movement of chucks **44** by means of a sprocket **78** fixedly coupled to a shaft **80** upon which wheel **74** is mounted. Sprocket **78**, shaft **80**, and wheel **74** are driven in rotation by a support wheel assembly **82** which forms a part of the means which links the individual chucks **44** to each other, thus assuring a positively maintained accurate alignment between the individual reject devices **76** on wheel **74** and the valve assemblies **50** carried by each of the chucks. Referring now to FIG. **2**, it is seen that the alignment is such that each reject device **76** is operatively aligned with the valve actuator **70** of a chuck during concurrent movement of the actuators and reject devices between the 9 o 'clock and 6 o'clock positions of wheel **74** as viewed in FIG. **2**.

Structural details of reject devices **76** are best seen in FIGS. **3** through **6**. Referring particularly to FIG. **3**, each device **76** includes a housing made up of a front plate **84**, a rear plate **86** and a bottom plate **88**, the three plates being fixedly secured to each other as by bolts, not shown. As best seen in FIG. **5**, rear plate **86** is formed with a centrally located vertically extending slot **90** within which is slidably received an actuator member **92** having a forwardly projecting actuating lug **94** formed at its upper end.

As best seen in FIG. **3**, actuating member **92** is formed with a centrally located vertically extending slot **96** through which a guidepin **98** mounted in front plate **84** and back plate **86** passes to assist in guiding member **92** in vertical sliding movement within slot **90**. Actuating member **92** is resiliently biased upwardly by a compression spring **100** seated between the lower end of member **92** and bottom plate **88**. Actuating member **92** is normally maintained in its lowermost position shown in FIG. **3** by the engagement between a latch tooth **102** and a notch **104** cut into the rearward surface of member **92**. Latch tooth **102** is formed on a latch member **106** which is mounted as by a pivot pin **108** between a pair of spaced ears **110** integrally formed on the rearward side of bottom plate **88**. Tooth **102** passes freely through an opening **112** through back plate **86** and is resiliently biased to the position shown in FIG. **3** by a compression spring **114** engaged between the lower end of latch member **106** and bottom plate **88**. As best seen in FIG. **6**, the lower corner of latch member **106** is cut away to form an inclined ramp **116** employed in a manner to be described below to disengage latch tooth **102** from notch **104** (FIG. **3**).

On the front side of actuating member **92**, a stub shaft **118** projects forwardly through a slot **120** cut in front plate **84** to support a reset roller **122** for free rotation about shaft **118** in front of front plate **84**.

The assembled reject device **76** is fixedly secured to the periphery of wheel **74** as by bolts **124** (FIGS. **3** and **4**), the wheel periphery being flattened into a uniform polygonal shape, as seen in FIG. **3**, to angularly align the individual devices **76** in a symmetrical arrangement about the axis of wheel **74**.

As indicated in FIG. **3**, when the actuating member **92** of the reject device is in its normally maintained lower position shown in full line in FIG. **3**, its actuating lug **94** is located to pass freely beneath the actuating lever **70** of an aligned valve **50**. Upon disengagement of latch tooth **102** from notch **104** in actuating member **92**, the actuating member is free to move upwardly under the biasing action of spring **100** to the broken line position indicated in FIG. **3**, in which position lug **94** is operable to engage and depress actuating lever **70** of an aligned valve **50**, to cause the valve to eject the container from its associated chuck. The releasing of the latch tooth **102** of selected reject devices to permit the actuating member to move to the upper broken line or operative position shown in FIG. **3** is accomplished by a latch releasing mechanism designated generally **126**, best shown in FIGS. **2**, **5** and **6**.

Mechanism **126** includes a conventional solenoid **128** mounted upon a bracket **130** fixedly secured to the frame of machine **26**. The armature **132** of solenoid **128** is connected by a pivot pin **134** to one end of a link **136** whose opposite end is connected, by a pivot pin **138**, to one arm of a bell crank **140**. Bell crank **140** is pivotally supported upon the frame of machine **26** by a pivot pin **142** mounted in a suitably constructed bracket **144** fixedly secured to the frame of machine **26**. The opposite end of bell crank **140** carries an actuating roller **146** mounted for free rotation about pin **148** fixed to the bell crank. A compression spring **150** (FIG. **5**) engaged between bell crank **140** and bracket **144** resiliently biases the bell crank inducing rotation thereof in a counter-clockwise direction about its fixed pivot **142** as viewed in FIG. **5**. In FIG. **5**, bell crank **140**, link **136** and armature **132** of the solenoid are shown in the position which they assume when the coil of solenoid **128** is de-energized. When the solenoid coil is energized, armature **132** is pulled downwardly from the FIG. **5** position, thus pivoting bell crank **140** in a clockwise direction about its fixed pivot **142** to move actuating roller **146** into the path of movement of the lower end of latch member **106**. As best seen in FIG. **6**, actuating roller **106** is supported at an elevation such that when it is moved into the path of movement of latch members **106**, it will engage the ramp **116** on the

lower end of the latch member to force the lower end of the latch member inwardly as rotation of wheel **74** carries the latch member past roller **146**. Inward movement of the lower end of latch member **146** pivots its upper end and latch tooth **102** out of latching engagement with actuating member **92** to permit member **92** to be forced upwardly by spring **100** (FIG. **3**) into its operative position indicated in broken line in FIGS. **3** and **6**.

Referring now to FIG. **2**, it is seen that latch actuator mechanism **126** is mounted on the frame of machine **26** at a point in the circular path of movement of reject devices **76** which is somewhat upstream from the point at which the path of movement of reject devices **76** merges with the path of movement of valve actuators **70** on chucks **44**. The path of movement of the actuating members of the individual reject devices **76** is a circular path indicated in dotted line at R in FIG. **2**, while the path of movement of the operative portion of valve actuating members **70** is indicated at VA. The two paths merge at a merging point M slightly above the 9 o'clock position of wheel **74** as viewed in FIG. **2**, and it is at point M that the actuating member **92** of a reject mechanism **76**, is in its elevated operative position, engages the valve actuating member **70** of the aligned chuck. As indicated in FIG. **2**, the path R actually extends across the path VA by a distance sufficient to accomplish the necessary depression of a valve actuating member **70**. If the actuating member **92** of the reject mechanism is in its normally latched inoperative position, the actuating member **92** passes freely beneath the valve actuating member **70**, as indicated in FIG. **3**. A reject mechanism actuating member **92** which is in its elevated operative position will depress and pivot the aligned valve actuating member **70** as indicated at valve **50***a* (8 o'clock position on FIG. **2**).

Reject mechanism actuating members **92** which have been shifted to their operative position to cause ejection of a container are reset by a reset mechanism designated generally **152**. The structure of reset mechanism **152** is best seen in FIG. **7**.

Mechanism **152** includes a generally flat cam plate **154** supported at one end for movement about a horizontal axis upon a pivot pin **156** which is in turn supported from the frame of machine **26** as by a bracket **158**. The opposite end of cam plate **154** is supported upon the piston rod **160** of a fluid pressure actuated motor **162**, the cam plate being coupled to piston rod **160** by a pivot pin **164** received between a pair of ears **166** secured to cam plate **154** as by bolts **168**. Motor **162** is similarly supported from the frame of machine **26** by ears **170** fixedly secured to the frame and a pivot pin **172** passing between the ears and a mounting lug on motor **162**. A tension spring **174** coupled between the frame of machine **26** and cam plate **154** resiliently biases cam plate **154** to the inclined position best shown in FIG. **7**.

Referring briefly to FIG. **2**, it is seen that cam plate **154** overlies a portion of the path of movement of reset rollers **122** of the reject devices and, returning to FIG. **7**, is located at an elevation such that the reset roller of a reject device having its actuating member **92** in the elevated or operative position will engage the lower surface of cam plate **154** and be depressed downwardly to its lower limit of movement as the roller is carried underneath cam plate **154** from left to right as viewed in FIG. **7**. Referring to FIG. **3**, when the actuating roller is depressed by cam plate **154** to its lower limit of movement, the latch tooth **102** of the reject mechanism is automatically restored to latching engagement in notch **104** by spring **114**.

Pressure to operate motor **162** is supplied by a conventional four-way reversing valve controlled source schematically indicated at **176** (FIG. **7**), the valve of source **176** preferably being of the solenoid actuated, spring return type and connected in a fashion such that when the actuating solenoid is de-energized, motor **162** is in the retracted position shown in FIG. **7**. Upon energizing the solenoid of control valve **176**, piston rod **160** of motor **162** is extended upwardly from the position shown in FIG. **7** to a position in which cam plate **154** extends horizontally from its pivot point **156** and is thus ineffective to reset the reject mechanisms **76**.

OPERATION

Referring now particularly to FIGS. **1** through **3** and **9**, in normal operation of the production line, containers are fed in uniformly spaced succession along the lower run of heat-treat machine **20**, pass the first inspection station **22**, and are then transferred to transfer machine **26** as the heat-treat machine **20** conveys the containers into underlying relationship with pickup run **24** of machine **26**. The containers are gripped by vacuum chucks **44** of machine **26**, the control valves **50** of the respective chucks being normally positioned to supply vacuum to the chuck head **46** to hold the container in inverted position on head **46**.

The containers are carried by chucks **44** on machine **26** past a second inspection station at **34** (FIG. **1**) and then past the reject station **36** and deposited upon the pocket conveyor of assembly machine **28**. The releasing of the containers from machine **26** to the pocket conveyor of assembly machine **28** is accomplished by a stationary discharge cam D on machine **26** positioned to engage and depress the valve actuators **70** of the chucks as the actuators are carried past cam D. In assembly machine **28**, the containers are conveyed past the discharge end of a container base supply chute **32**, at which a cup-shaped plastic base element is assembled upon the spherical bottom of the container C. The bases are supplied to chute **32** from a base supply system schematically illustrated at **30** in FIG. **1**. Details of this assembly are set forth in the aforementioned copending application of Mallory et al., Ser. No. 883,515.

SELECTIVE REJECTION

Selective rejection of individual containers at reject station **36** is under the control of inspection stations **22** and **34**. At each of these stations, containers passing by the inspection station are inspected for specific flaws. Typically, at inspection station **22** the container bottom is inspected, because at this particular location the container is supported in a conveyor pocket which shields the container sides from the inspection device, but finds the container bottom projecting upwardly from the pocket, where it is exposed to the inspection device. At inspection station **34**, on the other hand, the container bottom is partially concealed within chuck head **46** (See FIG. **3**) while the side walls and finish of the container are completely exposed and hence at inspection station **34** the side wall and finish of the container may be inspected. The inspecting devices do not, per se, form any part of the present invention, and for the purposes of the present disclosure, the sole requirement of these two inspection devices is that they are operable to generate a reject signal in the form of an electric pulse upon the detection of a sub-standard or flawed container.

Each of inspection stations **22** and **34** is electrically connected to transmit a reject signal from the inspection device to a suitable time delay signal transmitter which delays transmission of the signal until the container responsible for generation of the signal is approaching reject station **36**. In the invention as herein disclosed, the necessary delay in transmission of the signal is accomplished by electronic shift registers **38** and **40** of the type disclosed in U.S. Pat. No. 3,478,323.

The shift registers **38** and **40** function to store the reject signal generated by their controlling inspection station **22** or **34** until the flawed container responsible for the reject signal has traveled from the inspection station to a point on its path of movement which is upstream from merging points M of FIG. **2** by a distance slightly greater than the distance along path R of FIG. **2** from merging point M to the location of latch release roller **146**. At this instant, the shift register closes a set of contacts SR1 or SR2 (FIG. **9**) to energize coil S of FIG. **9** which is the coil of solenoid **128** of latch release mechanism **126**. Energization of the solenoid shifts latch release roller into the path of the latch member of the reject mechanism **76** which is at this time just upstream from roller **146** to release the latch as the mechanism is carried past roller **146**. Releasing of the latch shifts the actuating member **92** of the reject

mechanism to its upper operative position. The synchronism between the rotation of reject wheel **74** which carries reject mechanisms **76** and the movement of the chucks will cause the extended actuating member **92** of the reject mechanism to engage the valve actuating member **70** on the chuck carrying the flawed container as the two actuating members arrive at the merging point M of FIG. **2**. Considering each chuck in FIG. **2** and each reject mechanism **76** to represent one "station", the reject mechanism is shifted, by latch release mechanism **126** to its operative container rejecting position at that point in time when the reject mechanism **76** and the chuck carrying the flawed container are both approximately three stations upstream from merger point M.

Thus, if inspection station **34** is located a distance of **33** chuck stations upstream from merger point M, shift register **40** is set to store a reject signal received from inspection **40 34** for the time required for the line to move forward a distance corresponding to 30 stations. Each shift register includes a "clock" or pulse circuit which is synchronized with the line speed of movement of containers so that the register automatically adjusts itself to variations in line speed.

Under normal operating conditions, the reject latch reset mechanism **152** is maintained with its cam plate in the inclined position of FIG. **7** so that the actuating elements **92** of the reject devices **76** are automatically maintained and set in their inoperative retracted position as they approach latch release mechanism **126** and thus actuation of latch release mechanism **126** is required to set or unlatch a reset mechanism to cause rejection of a container from the line.

A schematic diagram of one form of electric control circuit for the reject system is shown in FIG. **9**. In FIG. **9**, the coil of latch release solenoid **128** is indicated at S, while the solenoid of valve **176**, which controls motor **162** of the reset mechanism, is indicated at V. Contacts SR1 and SR2 in the circuit of FIG. **9** are respectively controlled by shift registers **38** and **40**. As indicated in FIG. **9**, solenoid V of control valve **176** is connected across electric supply lines L1 and L2 through normally opened contacts BS and R1*b*, and hence will not be energized unless one of these two latter contacts are closed. As explained above, valve **176** is spring-biased to a position such that piston rod **160** of motor **162** is maintained in the illustrated position of FIG. **7**. In these circumstances, the reset mechanism **152** is in its normal operating condition in which it automatically resets any reject mechanisms which have been activated to restore the mechanism to its inoperative position as the reject mechanisms **76** pass cam plate **154**.

Solenoid S of the latch release mechanism is likewise deenergized, being connected across supply lines L1 and L2 of FIG. **9** through the two normally open shift register controlled contacts SR1 and SR2. Closing of either or both of contacts SR1 and SR2 by operation of their respective shift registers will energize solenoid S of the latch release mechanism to its operative position.

CONTINUOUS REJECTION

Under some circumstances, it is desired to condition the reject system to reject all containers in a continuous reject operation. The two most common examples of such a situation are during initial startup of the production line or a depletion or failure of the base supply system.

When the production line is initially started up, a certain period of time is required for all portions of the line to reach a steady-state operating temperature or condition, and the majority of containers formed during this initial startup period will be of substandard quality in one respect or another.

In the case of a failure or malfunction in the base supply system, the containers are discharged from assembly machine **28** in a fashion such that the containers are supported by the base element during the discharge operation. Without a base element assembled upon it, the round bottomed container is unstable and will either fall off the discharge conveyor or create jams and handling problems in subsequent machines designed to handle only containers which are stably supported upon bases.

Thus, during initial startup or in the event of failure in the base supply system it is desired to continuously reject containers at reject station **36** until steady-state operation of the system has been achieved or until the base supply system malfunction has been corrected. Rejected containers are received by a cullet chute, not shown, and returned to the glass furnace.

Referring now to FIG. **9**, during initial startup of the machine, the control circuit may be conditioned to set the reject station for continuous reject by manual depression of the ON push button to complete a circuit across supply lines L1 and L2 through the manually closed ON button contacts, some normally closed OFF button contacts and a control relay R1. When relay R1 is energized, it closes normally opened contacts R1*a* which by-pass the ON button contacts and electrically lock in relay R1 so that the ON push button can be released after a momentary depression.

Energization of relay R1 also closes a second pair of normally open contacts R1*b* to energize the solenoid coil V of control valve **176** of reset mechanism motor **162**. Energization of solenoid coil V shifts valve **176** to cause motor **162** to stroke in a direction extending its piston rod **160**, thus swinging reset cam **154** upwardly to its inoperative horizontal position. When in the horizontal position, reset cam **154** is ineffective to restore activated reset mechanisms to their normal inoperative position, and thus actuating elements **92** of reset mechanisms **76** will stay in their extended operative positions once they are so set. Setting of the reset mechanisms in their extended operative position is accomplished by maintaining the solenoid coil S of latch release solenoid **128** energized for at least one complete revolution of reject wheel **74**.

This extended period of energization of solenoid coil S is accomplished by a timing relay TR in the circuit of FIG. **9**. A second control relay R2 is connected in parallel with the reset mechanism solenoid V and concurrently energized. Relay R2, when energized, closes normally open contacts R2*a* to thereby energize timing relay TR. Timing relay TR controls a pair of normally closed contacts TR*a* in a fashion such that the contacts TR*a* are opened after solenoid TR has been energized for a selected period of time, and maintained opened thereafter as long as relay TR is energized. Thus, as soon as contacts R2*a* are closed, solenoid S of the latch release mechanism is energized through contacts R2*a* and normally closed contacts TR*a*. After the predetermined time delay period of energization of relay TR has passed, contacts TR*a* open to de-energize solenoid S. The time period of delay in opening of contacts TR*a* is selected to allow sufficient time for reject wheel **74** to complete at least one revolution. During this time period, latch release roller **146** is maintained in its latch releasing position by virtue of the energization of solenoid S, and thus all of the reject mechanism **76** on wheel **74** will be unlatched and set in their elevated operative rejecting position. Solenoid V of reset mechanism **152** is continuously maintained in its energized position, thus rendering the reset mechanism ineffective to reset the reject mechanisms.

After the initial startup period has elapsed, the reject mechanism is restored to its normal selective reject operation under the control of inspection stations **22** and **34** by manual depression of the OFF button which opens the circuit to relay R1. De-energization of relay R1 opens contacts R1*a* and R1*b*, the latter contacts, when opened, de-energizing solenoid V and control relay R2. De-energization of control relay R2 in turn opens contacts R2*a*, thus de-energizing timing relay TR to permit its contacts TRa to assume their normal closed condition. Although the normal closed condition of contacts TR*a* connects timing relay TR in parallel with solenoid S, energization of solenoid S by operation of shift register contacts SR1 or SR2 has no effect on contacts TR*a*, because the time interval during which either of contracts SR1 or SR2 are closed by their respective shift registers is too short to cause activation of contacts TR*a*.

Continuous reject under control of a malfunction of the base supply system is accomplished by normally open contacts BS of the circuit of FIG. 9. Contacts BS may be under the control of a feeler gauge or the like to close automatically in the event of a depletion of the base supply system, for example. In the circuit of FIG. 9, closure of contacts BS will immediately energize reset mechanism solenoid V to disable the reset mechanism by elevating reset cam **154** to its horizontal inoperative position. Control relay R2 is energized concurrently with the reset control solenoid V, thus closing contacts R2*a* to activate the timing relay TR and solenoid S in the manner described above in connection with manual initiation of the continuous reject condition. In the base supply controlled continuous reject situation, solenoids V and control relay R2 remain energized as long as contacts BS are closed, contacts R1*b* being open since relay R1 is not energized. When the base supply has been restored, contacts BS return to their normal open position, thus de-energizing solenoid V to shift the reset mechanism back to its operative position thus resetting all of the reject latches and restoring control of solenoid S to the shift register controlled contacts SR1 and SR2.

SUMMARY

The reject system described above, while described in terms of a glass container production line, is generally adapted for use in production lines in which articles are conveyed in succession through several different machines where the manner in which the article is supported in a particular machine may make the performance of a particular inspection of the article or its ejection from the machine inconvenient. In the system described above, plural inspections may be performed at these locations along the line where it is most convenient to do so, with the articles being ejected from the line at a single location where ejection is most conveniently performed. In the glass container line environment, the ejected containers are returned as cullet to the glass furnace, and ejection of all flawed containers at a single location affords an obvious advantage in the cullet handling system. The system is capable of response to inspection stations located upstream of the line from the reject station and is also capable of response to system malfunctions at one or more locations downstream of the reject station.

By employing a plurality of reject devices moving along an endless path only a portion of which is in registry with the path of movement of the articles, the speed of movement of the reject device between its inoperative and reject positions is not critical in terms of line speed. The reject device may be shifted to its reject position and reset while it is out of registry with the path of movement of the articles. A relatively quick acting device, such as the solenoid-controlled actuating mechanism **126**, mounted at a stationary location is the only device whose rapidity of movement between an extended and withdrawn position need be related to line speed.

While one embodiment of the invention has been described in detail, it will be apparent to those skilled in the art that the disclosed embodiment may be modified. Therefore, the foregoing description is to be considered exemplary rather than limiting, and the true scope of the invention is that defined in the following claims.

I claim:

1. In combination with conveying means having article support means for conveying articles in succession along a first path, and article release means on each support means operable when actuated to eject the article supported thereon from said conveying means; an article inspecting and rejecting system comprising article inspecting means located adjacent said first path for inspecting articles passing thereby for flaws and for generating a reject signal upon the detection of a flawed article, a plurality of article reject means mounted for movement along an endless path which merges into registry with said first path at merging location downstream of said first path from said inspection means, drive means for driving said reject means in movement around said endless path synchronized with the movement of said article support means along said first path wherein each reject means moves into alignment with an article release means at said merging location, actuating means on each reject means normally maintained in an inactive position and moveable in response to the receipt of a reject signal to an active position wherein said actuating means is operable to actuate a release means aligned therewith at said merging location, and signal transmitting means for transmitting a reject signal from said inspection means to one of said reject means when the flawed article responsible for said signal and said one of said reject means are at locations on their respective paths equidistant and upstream from said merging location.

2. The invention defined in claim **1** wherein said endless path has a first portion in registry with said first path and a second portion out of registry with said first path, said signal transmitting means including reject signal responsive means mounted at a first location on said second portion of said endless path, means normally maintaining said responsive means in an inoperative position clear of the path of movement of said actuating means along said endless path, means responsive to the receipt of a reject signal for shifting said responsive means to an operative position wherein said responsive means shifts said actuating means to its active position as the actuating means is moved along said endless path past said first location.

3. The invention defined in claim **2** further comprising reset means mounted at a second location on said second portion of said endless path upstream from said first location for restoring actuating means to their inactive position as the actuating means are moved along said endless path past said second location.

4. The invention defined in claim **3** further comprising means operable to retract said reset means to a position wherein said reset means are ineffective to restore actuating means to their inactive position.

5. The invention defined in claim **3** further comprising control means operable to maintain said signal responsive means in its operative position for at least one complete cycle of movement of said reject means around said endless path and to simultaneously retract said reset means clear of the path of movement of said actuating means to thereby cause the rejection of all articles moving past said merging locations while said control means is in operation.

6. The invention defined in claim **1** wherein said drive means comprises a wheel mounted for rotation about its axis, said reject means being mounted at symmetrically spaced locations about the periphery of said wheel for movement along a circular path having a first portion in registry with said first path and a second portion out of registry with said first path, said actuating means comprising an actuating member mounted for movement axially of said wheel between its active and inactive positions, means biasing said actuating member toward its active position, releasable latch means normally latching said actuating member in its inactive position, and means in said signal transmitting means for releasing said releasable latch means.

7. The invention defined in claim **6** further comprising reset means on said second portion of said circular path for reengaging the released latch means.

8. The invention defined in claim **7** wherein said reset means comprises a roller mounted on said actuating member, and a stationary cam mounted in the path of movement of said roller and engageable therewith to shift the actuating member from its active to its inactive position as said roller is moved past said cam.

9. The invention defined in claim **8** further comprising means for retracting said cam to a position clear of the path of movement of said roller.

10. The invention defined in claim **1** wherein said articles are conveyed along said first path in uniformly spaced succession, said article inspecting means being located upstream of

said first path by a distance such that the number of containers on said first path between said inspecting means and said merging location exceeds the number of article reject means.

11. In a glass container production line wherein glass containers are continuously conveyed in uniformly spaced succession along a first path past a plurality of work stations to a discharge station; a container inspection and reject system comprising a reject means located on said first path upstream from said discharge station, drive means for driving said reject means in continuous movement along an endless second path having a first section registry with a container traversing a first section of said first path and a second section out of registry with said first path, said reject means being normally maintained in an inoperative position and being movable from said inoperative position to a container ejecting position, inspection means on said first path upstream from said reject means, said inspection means including means for inspecting containers passing thereby for a selected flaw and means for generating a reject signal upon the detection of a flawed container, reject signal transmitting means connected to said inspection means and synchronized with the speed of movement of said containers along said first path for delaying transmission of a reject signal until the container responsible for the generation of the signal arrives at a first location on said first path upstream from said first section of said first path, reject signal responsive means on said reject means connected to said signal transmitting means and responsive to the receipt of a reject signal therefrom for moving said reject means to its container rejecting position to cause ejection of the flawed container from said first path while said flawed container is traversing said first section of said first path, and reset means for restoring said reject means to its inoperative position while said reject means is traversing said second section of said second path.

12. The invention defined in claim 11 wherein said reject means comprises a plurality of reject devices mounted for movement about said second path in uniformly spaced succession corresponding to the spacing of glass containers on said first path, and reject signal receiving means at an actuating location on said second portion of said endless second path operable upon the receipt of a reject signal to shift a reject device to its container rejecting position as the reject device moves past said actuating location on said second path.

13. The invention defined in claim 12 wherein said first and said actuating locations on the respective paths are located upstream from said first sections of said paths by substantially equal distances greater than the spacing between adjacent containers.

14. The invention defined in claim 12 wherein said inspection means is located upstream of said first path from said first section thereof by a distance such that the number of containers on said first path between said inspection means and said first section exceeds the number of said reject devices.

15. The invention defined in claim 11 further comprising control means for conditioning said reject means to continuously reject all containers reaching said first section of said first path.

16. In combination with conveying means having uniformly spaced article support means for conveying articles in succession along a first path, and article release means on each support means operable when actuated to eject the article from said support means; a plurality of article reject devices mounted for movement in uniformly spaced succession along an endless path having a first portion in registry with said first path and a second portion out of registry with said first path, the spacing between said reject devices corresponding to the spacing between said article support means, drive means for driving said reject devices along said endless path in movement synchronized with the movement of said article support devices along said first path wherein each reject device is maintained in operative alignment with the article release means on an article support means as the reject device traverses said first portion of its endless path, an actuating member on each reject device normally maintained in an inoperative position and shiftable to an operative position wherein said member is operable to actuate an article release means operatively aligned therewith as the reject device traverses said first portion of said endless path, and actuator means at a first location on said second portion of said endless path selectively movable between a first position clear of the path of movement of said devices and a second position wherein said actuator means is operable to shift the actuating member of a reject device to its operative position as the reject device moves past said first location.

17. The invention defined in claim 16 further comprising reset means at a second location on said second portion of said endless path upstream from said first location operable to shift the actuating member of a reject device to its inoperative position as the reject device moves past said second location.

18. The invention defined in claim 17 further comprising control means for rendering said reset means inoperable and for maintaining said actuator means in said second position for a period of time at least as great as that required for a given reject device to completely traverse said endless path to thereby locate and maintain all of said actuating members in their respective operative positions.

19. The invention defined in claim 16 further comprising a wheel mounted for rotation about its axis, means mounting said reject devices on the periphery of said wheel for movement therewith whereby said endless path is circular, said drive means comprising a sprocket secured to said wheel for rotation therewith, and means on said conveying means movable with said article support means engageable with said sprocket to drive said sprocket in rotation.

20. In combination with conveying means having uniformly spaced article support means for conveying articles in succession along a first path, and article release means on each support means operable when actuated to eject the article from said support means; a wheel mounted for rotation about its axis adjacent said path with a first portion of the periphery of said wheel tangential to said first path and a second portion out of registry with said first path, a plurality of article reject devices mounted at uniformly spaced positions on the periphery of said wheel, the spacing between said reject devices on said wheel corresponding to the spacing between said article support means, drive means on said conveying means for driving said wheel in rotation to move said reject devices along a circular path in movement synchronized with the movement of said article support devices along said first path wherein each reject device is maintained in operative alignment with the article release means on an article support means as the reject device traverses said first portion of its circular path, an actuating member on each reject device movable between a retracted inoperative position and an extended operative position wherein said member is operable to actuate an article release means operatively aligned therewith as the reject device traverses said first portion of its circular path, spring means on each reject device biasing the actuating member to its operative position, releasable latch means on each reject device operable when latched to retain said actuating member in its inoperative position against the biasing action of said spring means, actuator means at a first location on said second portion of said circular path selectively movable between a first position clear of the path of movement of said devices and a second position wherein said actuator means is operable to release the latch means of a reject device as the reject device moves past said first location, and reset means at a second location on said second portion of said circular path for resetting a released latch means to its latched condition as the reject device moves past said second location.

21. In combination with conveying means having article support means for conveying articles in succession along a defined path, and article release means on each support means operable when actuated to discharge the article supported thereon from said conveying means; an article inspecting and rejecting system comprising article inspecting means located

adjacent said path for inspecting articles passing thereby for flaws and for generating a reject signal upon the detection of a flawed article; article reject means operable for selectively operating certain of said article release means to discharge articles at an article discharge location spaced downstream of said path from said inspection means, the reject means and article release means cyclically moving into alignment at said discharge location, actuating means on said reject means normally maintained in an inactive position and movable in response to the receipt of a reject signal to an active position wherein said actuating means is operable to actuate a release means aligned therewith at said discharge location, and signal transmitting means for transmitting a reject signal from said inspection means to said reject means before the flawed article responsible for said signal moves into alignment with said reject means at the article discharge location.

22. The combination of claim 21, wherein the signal transmitting means comprises shift register means connected to the article inspection means and the reject means whereby a reject signal generated by said inspection means is transmitted in step with movement of the flawed article to said downstream article discharge location to operate said reject means and discharge the flawed article from the article release means at said location.

23. The combination of claim 22, wherein the article inspecting means comprises plural inspection devices mounted at spaced points adjacent said path.

24. The combination of claim 23, wherein the shift register means comprises individual shift register devices connected between each said inspection device and said reject means.

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