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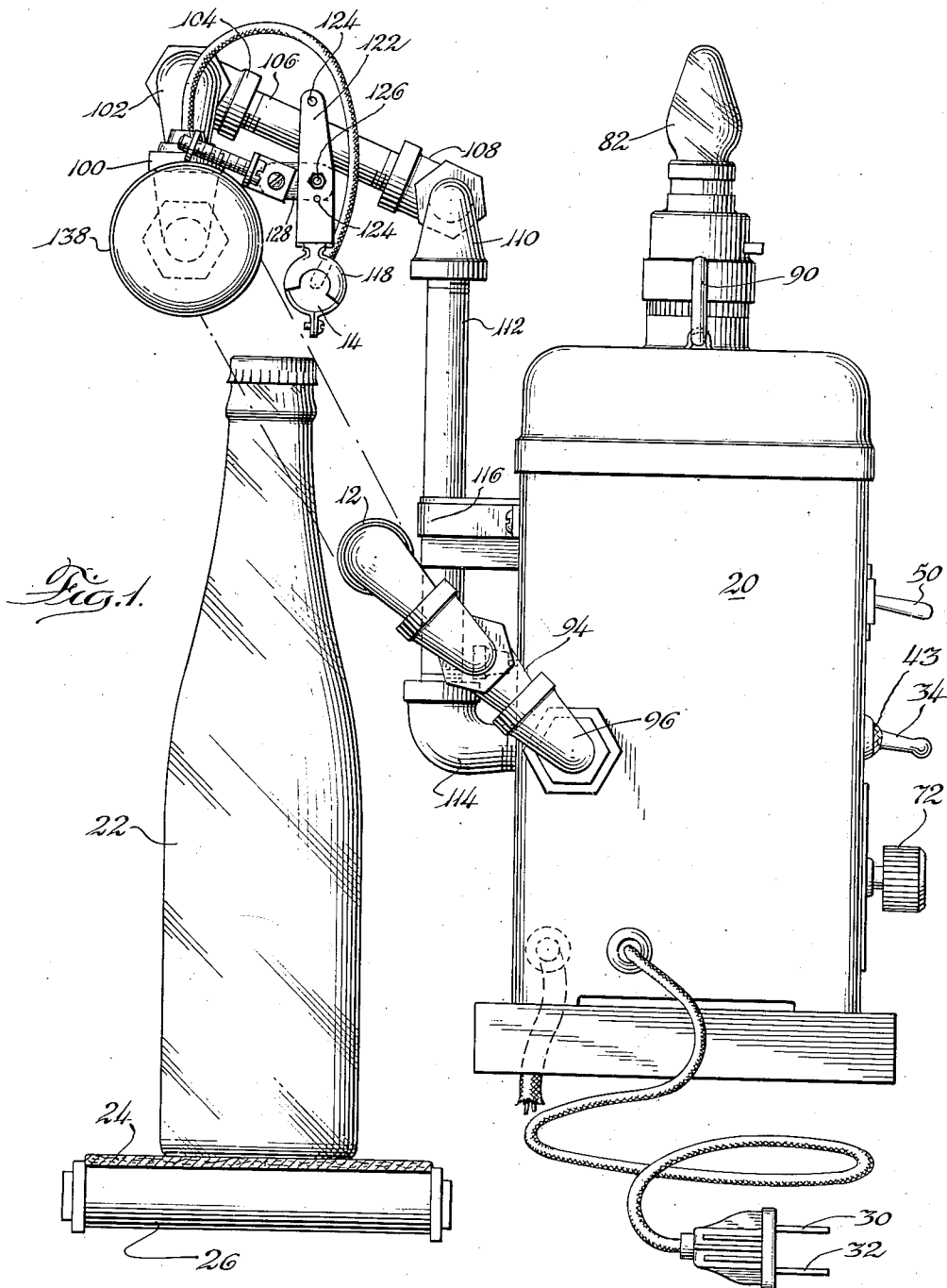
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APPARATUS FOR DETECTING UNCAPPED BOTTLES

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2 Sheets-Sheet 1



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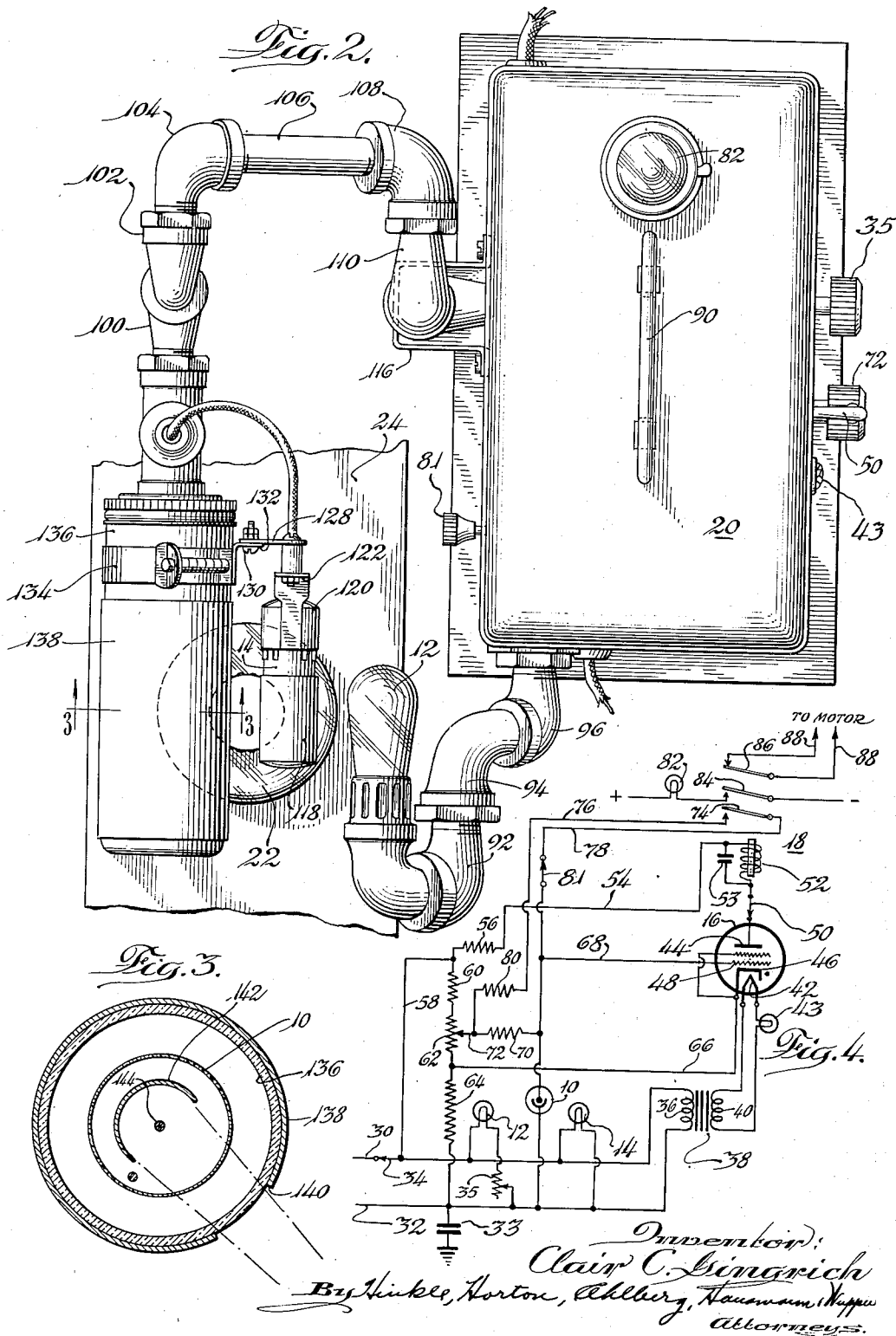
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UNITED STATES PATENT OFFICE

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APPARATUS FOR DETECTING UNCAPPED BOTTLES

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4 Claims. (Cl. 250—220)

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The present invention relates to electronic control apparatus and has for its primary object the provision of a new and improved electronic bottle capping observer or detector, i. e., an apparatus for detecting uncapped bottles.

A further object of the present invention is the provision of new and improved apparatus for detecting uncapped bottles which is both simple and rugged in construction, and which is easily adjustable for various operating conditions.

A further object of the present invention is to provide a new and improved apparatus for detecting uncapped bottles including a single light-sensitive device, preferably a photo tube, and a pair of light sources so arranged relative to the photo tube and to bottles passing a detecting station that light from the first tube, which normally strikes the photo tube, is intercepted by a bottle passing the station and so that light from the second source, which normally does not strike the photo tube, is reflected to the photo tube by a properly capped bottle but is not so reflected by an uncapped bottle.

A still further object of the present invention is the provision of a new and improved apparatus of the character set forth in the preceding paragraph, including also an electron tube, preferably a gaseous discharge tube, the conductivity of which is controlled by the photo tube and which, in turn, controls suitable apparatus such as a warning signal or a conveyor drive moving bottles past the detecting station.

Another object of the present invention is to provide a new and improved apparatus for detecting uncapped bottles wherein a normally non-conductive gaseous discharge tube is rendered conductive in response to the passage of an uncapped bottle and the tube is thereafter maintained conductive or "locked in" until the apparatus is again conditioned for operation by an operator.

Other objects and advantages of the present invention will become apparent from the ensuing description of an embodiment thereof, in the course of which reference is had to the accompanying drawings, in which:

Fig. 1 is an elevational view of an embodiment of the present invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is an enlarged vertical cross sectional view taken along the line 3—3 of Fig. 2; and

Fig. 4 is a diagrammatic representation of the apparatus and its associated circuits.

Referring now to the drawings, it may be noted that the apparatus for detecting uncapped bot-

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ties includes only a relatively few parts. Among the main components are a light-sensitive device 10, first and second light sources 12 and 14, an electron tube control device 16, and electromagnetic means 18 controlled by the tube and capable of exerting certain control functions which will be referred to hereinafter. The tube and electromagnetic means, as well as other parts, are preferably mounted within a cabinet 20 from which the light sources and photo tube may be adjustably supported.

The apparatus of the present invention is so constructed and arranged that it may be readily applied both to new and existing equipment. It can also be applied readily to bottle filling apparatus wherein the bottles are continuously moved past a filling and capping station and such an application has been illustrated. In apparatus of this type the bottles 22 are moved by well known apparatus which may include a conveyor belt 24 movably supported upon a series of rollers 26 of which but one has been illustrated in Fig. 1 and driven by a motor (not shown).

In the usual bottle filling and capping machine, which is not provided with any apparatus for detecting uncapped bottles, the contents of the bottle are likely to be spilled, with a resulting delay in the operation. This difficulty is avoided by the present apparatus which detects an uncapped bottle and which may be utilized to give an audible signal that a bottle has not been capped, or to stop the apparatus until the uncapped bottle is removed and the apparatus again manually restarted.

In accordance with one of the main features of the present invention, only a minimum of operating elements are required. For instance, only a single photo tube 10 and two light sources are required. One of the light sources, the first light source 12, is located somewhat below the top of the bottle and in such relation to the tube that a passing bottle intercepts the normal passage of light from the light source to the photo tube. The second light source is located above the bottle in such relation to bottles passing the detecting station and the photo tube that a properly capped bottle reflects light from the light source to the photo tube. As a result, the amount of light reaching the photo tube is substantially unchanged when properly capped bottles pass the station but a considerable change occurs when an uncapped bottle is at the station.

The change in light reaching the photo tube in response to an uncapped bottle is utilized to change the conductive condition of the electron

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tube 16. The photo tube is normally in a certain operative condition—it is preferably arranged to maintain the tube 16 (preferably a gaseous discharge tube of the 2050 Thyratron type) nonconductive as long as it is supplied with light directly from the first light source or by reflection from the second light source. Thus, as long as properly capped bottles pass the detecting station, no change occurs in the control apparatus. However, when an uncapped bottle passes the station, no light reaches the photo tube and this absence of light results in the tube 16 being rendered conductive and operating the electro-magnetic means 18, and the latter is utilized to perform certain functions which will now be described in connection with Fig. 4.

The control circuit is supplied with power from a suitable source, preferably as from the conventional 110-volt alternating current power supply line, through conductors 30 and 32. The former has interposed in it a power switch 34 which is closed when it is desired to place the apparatus in operation. Conductor 32 is connected to the cabinet 20 by a capacitor 33 (of about .1 mfd.). It is intended that conductor 30 be connected to the "hot side" of the power line, so that use of the capacitor "floats" the cabinet and prevents blowing of a fuse in the case of incorrect connection.

When the switch is closed, the light sources 12 and 14 are energized, the former through an adjustable resistor 35 which is provided for a purpose to be described in greater detail hereinafter. At the same time, the primary winding 36 of a filament transformer 38 is energized. The secondary winding 40 of this transformer is connected directly to the cathode heater 42 of the tube 16. A pilot light 43 is disposed in the heater circuit to indicate the operative condition of the heater.

The control tube 16 has associated with it the usual anode 44, cathode 46, and control grid 48. The anode is connected to the power supply line 30 through an anode circuit switch 50, a relay winding 52 forming part of the electromagnetic means 18 and shunted by capacitor 53, conductor 54, a current limiting resistor 46, and conductor 58. The grid and cathode are connected to a potentiometer including the series connected resistors 60, 62, and 64. The cathode is connected by conductor 66 to the junction of resistors 62 and 64 and the grid is connected to resistor 62 by conductor 68, resistor 70, and the adjustable potentiometer contact 72. The contact 72 is adjustable to vary the normal bias applied to the grid and thus to control the sensitivity of the apparatus.

The electromagnetic means 18 may be utilized to perform various functions and in accordance with another of the features of the present invention, it is utilized to "lock in" the control in response to the presence of an uncapped bottle to give a continuous indication or to keep the conveyor stopped until an attendant does something. The "lock in" is effected by a switch blade 74 operable to connect the grid 48 of tube 16 to a source of potential such that the tube is maintained conductive irrespective of the light supplied to the photo tube. The circuit closed by switch 74 includes the conductors 76 and 78 and a resistor 80 and it connects the grid to the movable potentiometer contact 72 thereby to make it sufficiently positive to maintain the tube conductive even though the detected uncapped bottle passes the detecting station or is removed.

In some installations and modes of operation it is desirable, as hereinafter pointed out, to render the "lock-in feature" ineffective. This is accomplished by the opening of a locking switch 81 in circuit with conductor 78.

In order to place the apparatus into operation after the bottle has been removed, it is necessary to open the anode switch 50, thereby to deenergize the winding 52 of the electromagnetic means and to permit the switch blade 74 to be returned to its normal position by suitable biasing means, such as a spring (not shown).

When the relay 52 operates in response to the presence of an uncapped bottle, it also energizes a signal light 82 by the closure of a second switch blade 84. At the same time, a third switch blade 86 opens a control circuit including the conductors 88 to deenergize the conveyor driving motor.

Before describing the operation of the apparatus as a whole, the mechanical construction of the device will be described. It should be understood that the physical construction may take various forms, although it is desirable, as will be pointed out hereinafter, that certain parts be adjustable in order to enable the apparatus to be used under various operating conditions.

The cabinet 20 is preferably utilized to house various of the component parts and also to support the light sources and photo tube. The various switches and adjustments are arranged to be accessible from the exterior of the cabinet, and as noted from Figs. 1 and 2, the switches 34, 50 and 81, the light and sensitivity controls 35 and 72, and pilot light 43 are all mounted upon the cabinet. The signal light 82 is preferably supported at the top of the cabinet adjacent a carrying handle 90. The locking switch 81 is mounted at the rear of the cabinet.

The light sources and photo tube are adjustably mounted relative to the detecting station. The first light source 12 is adjustably mounted to one side of the cabinet for movement to desired elevations, and also transversely relative to the conveyor belt and bottles moved by the latter. The mounting means preferably includes a plurality of relatively movable elbow-like fittings 92, 94 and 96, which also serve as a liquid-tight conduit for the conductors leading to the light source. The photo tube and second light source are similarly mounted at another side of the cabinet. The photo tube, from which the light source 14 is movably supported, is secured to the end of a fitting 100. The fitting 100 is secured by fittings 102 and 104 to a short conduit 106 secured in turn to the coupled fittings 108 and 110, the latter of which is secured to the upper end of a vertical conduit 112 secured by a fitting 114 to the cabinet. A supporting bracket 116 is utilized to maintain the conduit 112 in its desired vertical position.

The light source 14 is preferably provided with an apertured shield 118 which is movable angularly about the light. The light is secured to a mounting 120 by means of which it is adjustably secured to the photo tube. The mounting 120 has secured to it an upstanding arm 122 having a series of spaced-apart openings 124 whereby it can be secured as by a bolt 126 to a link 128 adapted to be secured by a screw bolt 130 in angularly adjusted position to a lug 132 integral with a clamp 134 encircling a photo tube housing 136, which is preferably made of glass and which is surrounded at its outer end by a light shield 138. The shield 138 wards out extraneous light and allows only the controlling light to act upon the photo tube, the controlling light entering through

the aperture 140, see Fig. 3. The photo tube 10 is so mounted within the envelope 136 that its cathode 142 faces the opening 140 while the anode 144 is located between the cathode and the aperture.

While a particularly adjustable arrangement of the light sources and photo tube has been illustrated and described, other arrangements can be used. For instance, these three elements can be constructed as a unit which is adjustable as a whole relative to the top of a capped bottle and which unit is independent of the cabinet. An arrangement of this character enables the cabinet with its controls to be located at some distance from the light and photo tube unit, thereby to give the apparatus greater flexibility.

Arrangements other than those illustrated and described can also be utilized to ward off extraneous light. For example, a lens system can be used in connection with the photo tube and the two light sources and photo tube may be more or less enclosed by light impervious material.

To place the apparatus in operation, the switch 34 is closed to energize the light sources and controls. Assuming that no bottle is at the detecting station, light from the first source 12 strikes the photo tube with the result that the latter is in a more conductive condition, thereby to make the grid 48 sufficiently negative to maintain the tube 16 nonconductive. The winding 52 is thus deenergized and the switch blades 74, 84 and 86 are all in their indicated positions. Under these conditions the conveyor driving motor operates to move the belt and to move bottles past the detecting station.

As long as properly capped bottles pass the detecting station no change occurs in the control. This results from the fact that when no bottle is at the station, light from the first light source 12 strikes the photo tube so that the grid 48 of tube 16 is maintained sufficiently negative to prevent the tube from becoming conductive. When a properly capped bottle passes the detecting station, light from the first source is prevented from reaching the photo tube by the bottle, but light from the second light source 14 is reflected to the photo tube and the latter maintains the tube in its nonconductive condition.

When an uncapped bottle passes the detecting station no light reaches the photo tube because the bottle intercepts light from the first source and there is no cap on the bottle to reflect light to the photo tube from the second source. As a result, the photo tube becomes less conductive and effectively constitutes a higher resistance and the grid 48 of the tube is made more positive and to an extent sufficient to render the tube 16 conductive. The winding 52 is thus energized by current flowing through it and through the tube during alternate half cycles and the winding is prevented from being deenergized by the capacitor 53 connected in shunt therewith.

When the relay winding is energized, the switch blades 74, 84, and 86 are operated. The switch 74 serves to connect the grid 48 to a point of more positive potential, thereby to maintain the tube conductive even though light should reach the photo tube 10. The relay is "locked in" in this manner until the relay switch 50 is opened. The closure of the switch 84 energizes the signal 82 which is illustrated as being a visual signal but which could be an audible signal as well. The motor is deenergized by the opening of the switch 86, thereby to prevent further movement of the

conveyor. The motor is thus deenergized until the anode switch is opened temporarily to deenergize the winding 52.

The sensitivity of the apparatus is controlled by adjustment of the potentiometer contact 72. The spread between the minimum and maximum sensitivity obtainable by adjustment of contact 72 is widened by use of the adjustable resistor 35 in series with the first light source. This resistor may be adjusted so that the potentiometer adjustment is at a mid point to offset minimum and maximum extraneous light which might impinge upon the photo tube and also to overcome the effect of slight drops in supply line voltage. Ordinarily, the photo tube receives more light from the first light source than from the second because the latter is reflected light. With the resistor the light sources can be made of more even intensity in so far as the photo tube is concerned.

The "lock-in" feature is not required in certain cases. For instance, in the event the control circuit 88 is part of a motor "stop" circuit, associated with a motor having a separate "start" circuit, then the "lock-in" feature is neither necessary nor desired. In this case it is also preferable to have the capacitor 53 of a value such as to delay the reclosing of the switch 86 for a time interval.

The "lock-in" feature is, however, desired in the event the switch 86 controls directly the motor circuit. It is also desired when a continuous signal is wanted, especially an audible signal.

The "lock-in" circuit is also desirable when the bottles pass the detecting station at a rate so high that the motor stopping means would not operate in the time taken by a bottle to pass the station.

While but a single embodiment of the present invention has been described in detail, it should be understood that the details thereof are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A control for detecting uncapped bottles passing a detecting station including a first light source, a light sensitive device so located relative to said source and a capped or uncapped bottle passing said station that the bottle itself intercepts the normal passage of light from said source to said device, a second light source so located relative to said device and a capped bottle passing said station that light from said source is reflected by the bottle cap to said device, a normally nonconductive grid controlled gas tube, means including grid biasing means connecting said light sensitive device to said gas tube for rendering said tube conductive when an uncapped bottle passes said station and no reflected light reaches said device, a relay in the output circuit of said gas tube adapted to be operated from one position to another when said tube is rendered conductive, and means operable by said relay for supplying said gas tube with a constant bias sufficient to maintain said tube conductive until said output circuit is broken.

2. A control for detecting uncapped bottles passing a detecting station including a first light source, a photo tube so located relative to said source and a capped or uncapped bottle passing the detecting station that the bottle intercepts light normally passing from said source to said tube, a second light source so located relative to

said tube and a capped bottle passing the detecting station that the cap of the capped bottle reflects light from said second light source to said tube, an electron tube controlled by said photo tube, means connecting said electron tube to said photo tube so that its conductive condition changes when an uncapped bottle reaches the station, and means including switch means controlling the bias of said tube for maintaining said tube in its said changed conductive position.

3. A control for detecting uncapped bottles passing a detecting station including a first light source, a photo tube so located relative to said source and a capped or uncapped bottle passing the detecting station that the bottle intercepts light normally passing from said source to said tube, a second light source so located relative to said tube and a capped bottle passing the detecting station that the cap of the capped bottle reflects light from said second light source to said tube, the reflected light being the same as the light from the first light source, a gas discharge tube having a grid, anode and cathode, means including electrical connections from said photo tube to said grid for maintaining said tube non-conductive when light from either of said sources reaches said tube whereby said tube is maintained nonconductive during the time that no bottle is at said station or when a capped bottle passes it but is rendered conductive when an uncapped bottle passes the station, electromagnetic control means in the anode-cathode circuit of said gas discharge tube adapted to be operated when the tube is rendered conductive, control means operable by said electromagnetic means for maintaining said tube conductive and said electromagnetic means operative once the tube has been rendered conductive, and means

for selectively rendering the last said mentioned means effective or ineffective.

4. A control for detecting uncapped bottles passing a detecting station including a first light source, a light sensitive device so located relative to said source and a capped or uncapped bottle passing said station that the bottle intercepts the normal passage of light from said source to said device, a second light source so located relative to said device and a capped bottle passing said station that light from said source is reflected by the bottle cap to said device, a grid controlled electron tube having its conductivity controlled by said photo tube, means including manually adjustable means for supplying and varying the bias supplied to the grid of said tube, and means for adjusting the relative intensities of said two light sources.

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