United States Patent

Madalo et al.

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[54] ULTRAVIOLET LIGHT LABEL MONITORING SYSTEM

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[52] **U.S. Cl.** **209/111.7**

[51] **Int. Cl.** **B07c 5/342**

[58] **Field of Search** 209/74, 111.5, 111.7

[56] **References Cited**

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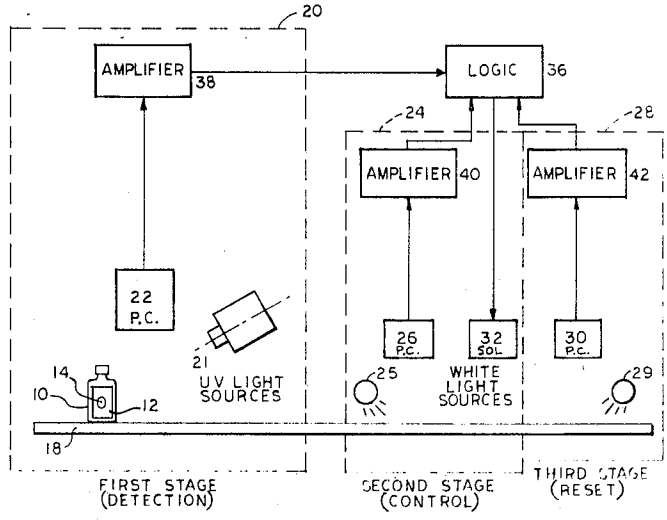
[57] **ABSTRACT**

A three-stage ultraviolet light label detection unit is provided for monitoring articles to detect and separate articles having luminescent, i.e., fluorescent or phosphorescent, imprints located thereon. The first detection stage uses ultraviolet light to sense the presence of luminescent imprints; the second control stage uses white light sensing to control the movement of articles passing thereby; the third reset stage also uses white light sensing to reset the control stage. Each stage acts through a logic circuit adapted to provide the desired detection and separation of luminescent from non-luminescent articles.

5 Claims, 3 Drawing Figures



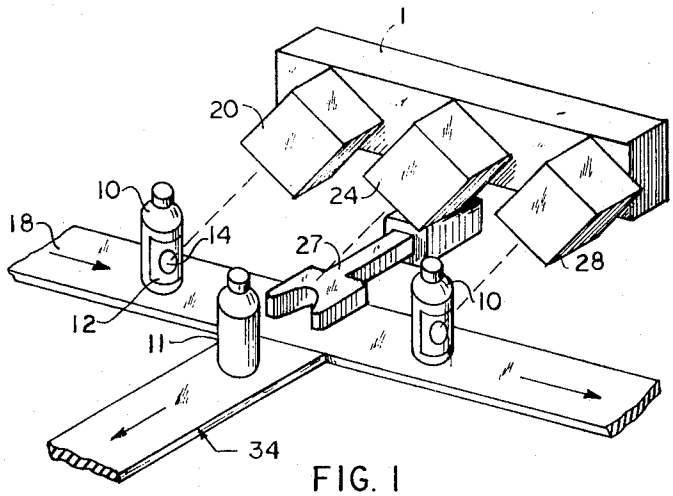


FIG. 1

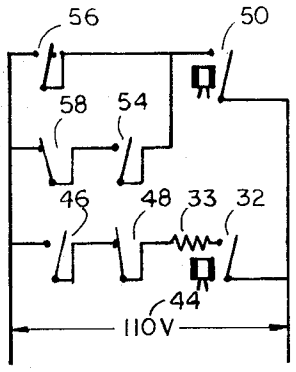


FIG. 3

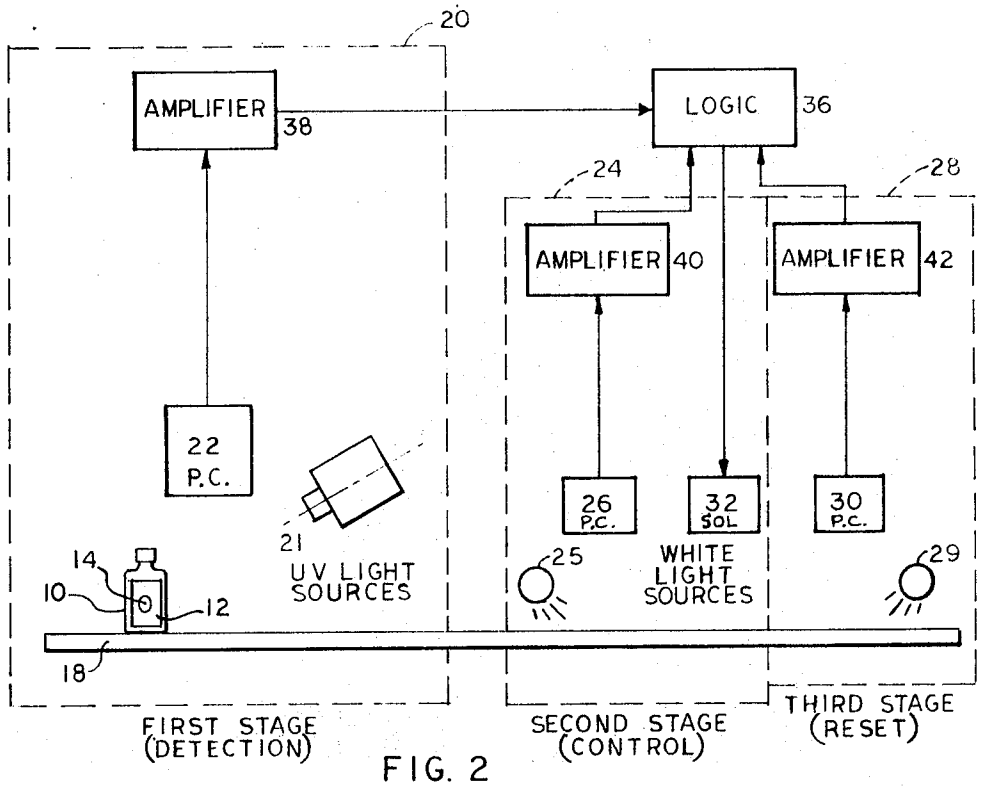


FIG. 2

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ULTRAVIOLET LIGHT LABEL MONITORING SYSTEM

SUMMARY OF THE INVENTION

Our label monitoring system can most readily be described as a three-stage system. EAch stage performs a systematic function cooperating with the other two stages. The first is a detection stage; the second, a control stage; and, the third, a reset stage. The detection stage has a source of ultraviolet light arranged to illuminate an article passing by it. The article may be bottle, box, carton, or other container normally having a label on it.

The label contains a luminescent mark or imprint, so that, when the article bearing the label passes into the ultraviolet light zone and is illuminated, the luminescent material, if present, will fluoresce or phosphoresce, emitting radiation, usually of visible light. The emitted light activates a photocell included in the detection stage which in turn energizes a logic circuit electrically connected to the control stage.

The control stage is normally set to reject all articles passing through it, using a source of white light and a photocell detector to determine the presence of the articles. However, if the photocell in the detection stage senses luminescent material, the control stage is directed by the logic circuit not to reject the article, and so it is permitted to pass.

The reset stage includes another source of white light and another photocell to detect passing articles. This stage resets the control stage to its normal operating, i.e., automatic reject, state when the reset stage photocell is activated.

The monitoring system thus provides a three-stage detection and separation unit, controlled by the presence or absence of luminescent material on a label, for detecting and separating articles.

For a better understanding of the features and advantages of the present invention, the detailed description should be read in conjunction with the following figures.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view generally showing the arrangement of the articles and sequence of operation of the monitoring stages.

FIG. **2** is a block diagram of the label monitoring system showing the three stages.

FIG. **3** is a schematic diagram showing a form of logic circuit that may be used.

DETAILED DESCRIPTION

STRUCTURE

This invention discloses a label monitoring system using a plurality of sequentially arranged stages, each stage performing a specific function in the detection and separation of labelled from non-labelled articles. Each label contains a luminescent material capable of activating a photocell when the luminescent material is exposed to ultraviolet light. The first stage inspects passing articles to detect the presence of luminescent imprints. The second stage, having a white light detector, controls the path of an article passing thereby. (It is normally set to reject the article unless a signal is received from the first stage). The third stage, also sensitive to white light, resets the control stage to its normal reject state.

The preferred form of our invention is shown in FIGS. **1**, **2**, and **3**. FIGS. **1** and **2** show the structural layout, and FIG. **3** shows the logic circuitry.

Turning first to FIGS. **1** and **2**, our system includes means for conveying an article, the three stages mentioned above, the logic control circuitry, and article rejection means.

For purposes of illustration, we have shown bottles **10** having labels **12** on them. Also shown is one bottle **11** without a label. The bottles are carried on a conveyor belt **18** which is shown moving to the right in the figures.

Each label should have a mark **14** of fluorescent material on it. It is this mark **14** which is detected in our system, thereby detecting the presence or absence of a label.

Positioned adjacent to belt **18** and preferably to one side of it, are detection, control and reset stages, in that order, identified by numerals **20**, **24** and **28**, respectively.

The first (detection) stage **20** includes source of ultraviolet light **21** and photocell detector **22**. The second (control) stage **24** includes a source of visible light **25** and a photocell detector **26**; and also includes a rejector **27**. The third (reset) stage includes a source of visible light **29** and photocell detector **30**.

The rejector **27** in the second stage may be of any desired type. A reject plunger, actuated by a solenoid **32**, adjacent belt **18** and positioned to push bottles transversely off belt **18**, is satisfactory. When actuated, the plunger pushes the bottle **10** onto a reject station **34**, as shown by the arrows in FIG. **1**.

The three stages and rejector are interconnected through logic circuit **36** and, if necessary, amplifiers **38**, **40** and **42**. That is, the output of first stage photocell **22** passes through amplifier **38** to logic circuit **36**; and that of the third stage photocell **30**, through amplifier **42**, to logic circuit **36**. The output from logic circuit **36** goes to solenoid **32** to control the reject plunger.

In our preferred form, logic circuit **36** is adapted to reject every bottle passing through control stage **24**, unless it receives a signal from detection stage **20** indicating that luminescent material is present. Normally, logic circuit **36** actuates solenoid **32** each time a bottle **10** is detected in the second stage. Thus, the system is "fail-safe". If, however, a signal is received from detection stage **20**, indicating the presence of luminescent material, control stage **24** is deactivated, preventing rejection. When that bottle passes photocell **30** of the third stage, logic circuit **36** then reactivates, i.e., resets, control stage **24**.

It should be realized that other types of logic programs could be used, if desired, in our three-stage system. For example, the second stage could be set to "reject" when a signal is received indicating the presence of marking on the label. In such a case, the reset stage **28** would be positioned over the reject station **34**.

A form of logic circuit which may be used is shown in FIG. **3**. In essence, this circuit is designed to have solenoid **32** actuated each time a bottle reaches the second stage, thus rejecting the bottle. This actuation is accomplished by having the second stage photocell **26** close the circuit to solenoid **32** each time it detects the presence of a bottle. If, however, a luminescent label on the bottle has been previously detected by photocell **22** at the first stage, solenoid **32** is deactivated and cannot reject.

The circuit itself includes solenoid coil **32** and resistor **33** in series with normally-open relay **46** controlled by second-stage photocell **26** and normally-closed relay **48** controlled by first stage photocell **22**. The coil and two relays are across a power supply **44**, so solenoid **32** will operate when relays **46** and **48** are closed.

Closure of normally-open relay **46** occurs when its photocell **26** detects a bottle. Thus, every bottle entering the second stage is rejected unless solenoid **32** is deactivated.

Deactivation occurs by short-circuiting solenoid **32**. Relay coil **50**, having normally-open contacts **54**, is in series across the power supply with normally-open relay contacts **56** controlled by first-stage photocell **22**. Thus, when a bottle with a luminescent label is detected by photocell **22**, the circuit of contacts **56** and coil **50** is closed, shorting out solenoid **32** (since they are in parallel with it across the power supply.)

Energization of coil **50** also closes its associated relay contacts **54**. Contacts **54** are in series with coil **50** and normally-closed relay contacts **58** controlled by third stage photocell **30**. This series circuit is in parallel with that of coil **50** and contacts **56**, so solenoid **32** remains short-circuited even after the bottle leaves the first stage and contacts **56** again open.

Thus it can be seen that solenoid **32** will be deactivated, and so not reject a bottle entering the second stage, if a signal is received from the first stage.

Under these latter circumstances, however, the logic circuit must be reset to "reject" before the next bottle reaches the

second stage. This happens because the then "passed" bottle moves to the third stage and is detected by photocell **30**. This opens relay contact **58** and deenergizes coil **50**. Solenoid **32** is thereby "reset" since it is no longer shorted out. The cycle may then be repeated.

In summary, solenoid **32** rejects every bottle passing under photocell **26** unless prevented. It is prevented whenever photocell **22** detects a luminescent sample and so, through contact **56** and coil **50** shorts out and deactivates solenoid **32**. Solenoid **32** will thereafter remain deactivated until a bottle, not rejected goes under photocell **30**.

OPERATION

The operation of our label monitoring system is as follows:

Normally, as bottle **10** proceeds along the conveyor belt **18**, the second stage photocell **26** will detect its presence, closing relay **46**. This action closes the circuit to the reject solenoid **32**, actuating the reject plunger **27** to push the bottle **10** off the belt **18** onto the reject station **34**. Thus, the logic circuit is programmed to reject every bottle **10** unless prevented in some manner.

The prevention occurs through actuation of photocell **22** in the first stage **20** whenever the presence of luminescent material is detected on the bottle **10**. Such actuation of the photocell **22** closes the normally-open relay **56** thereby short-circuiting the reject solenoid **32**, de-activating it.

Further, the activation of the relay coil **50** closes normally-open contacts **54**. This action of the relay coil **50** holds the circuit through the relay coil **50** closed even after the bottle **10** passes the photocell detector **22** opening relay **56**. Thus, the action of the relay coil **50** prevents the rejection of a bottle **10** until it is deactivated.

Deactivation occurs when an accepted bottle **10** is detected by photocell **30**. When such detection occurs the normally-closed relay **58** is opened, deactivating the relay coil **50** and returning the circuit to its original setting as described above and as shown in FIG. **3**.

It should be understood that the various arrangements of the stages or modification in the construction thereof may be made by one skilled in the art without departing from the spirit or scope of the invention as set forth in the specification and claims.

We claim:

1. Apparatus for sorting articles in accordance with the presence or absence of luminescent material thereon, said apparatus including a detection stage, a control stage, and a reset stage, a detector in each said stage, said detection stage detector being adapted to detect radiations from activated luminescent material, a logic circuit interconnecting said detectors to receive information therefrom, a conveyor to carry said articles sequentially through said stages, a rejector in said control stage controlled by said logic circuit, said logic circuit activating and deactivating said rejector in accordance with whether or not said detection stage detector finds luminescent material present on said articles as they pass through said detection stage.

2. Apparatus as set forth in claim **1**, in which said logic circuit is adapted to actuate said rejector each time one of said articles passes through said control stage unless said detection stage detector has found luminescent material present on said article when it passed through said detection stage.

3. Apparatus as set forth in claim **2**, in which said logic circuit is reset to cause said rejector to thereafter reject each time one of said articles is detected by said reset stage detector.

4. Apparatus for sorting articles including a detection stage including a detector therein sensitive to radiations from activated luminescent material, a following control stage including a visible light detector and a rejector therein, and a following reset stage including a visible light detector, said detectors and said rejector being interconnected through a logic circuit, said logic circuit being programmed to actuate said rejector to reject each said article as it passes through said control stage and is detected by said control stage detector unless said detection stage detector has found luminescent material on said article, said reset stage detector resetting said logic circuit to again cause rejection of articles as soon as a non-rejected article leaves said control stage and is detected by said reset stage detector.

5. Apparatus for sorting articles as set forth in claim **4**, in which said logic circuit controls said rejector by deactivating same each time said detection stage detector finds the presence of said luminescent material and by reactivating same every time said reset stage detector detects the presence of one of said articles.

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