

Dec. 8, 1959

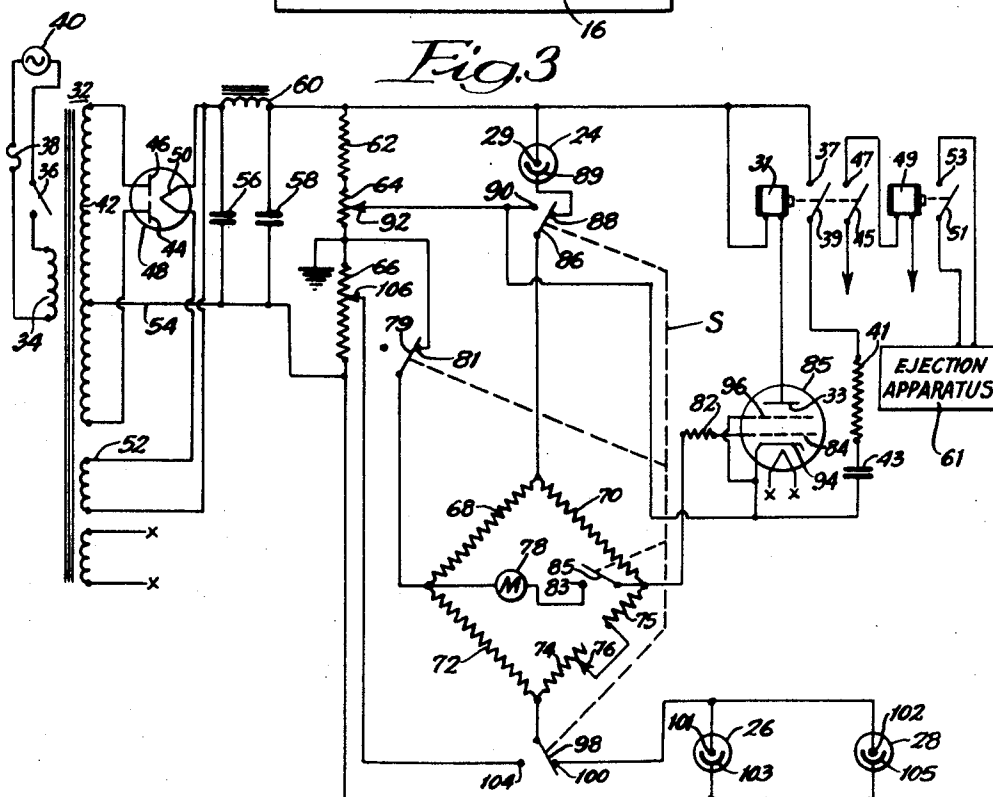
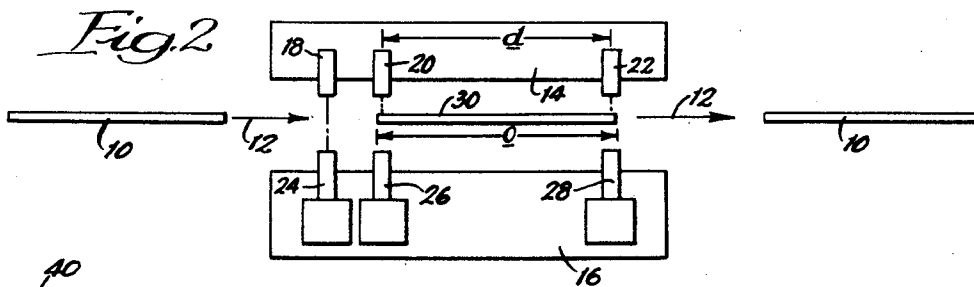
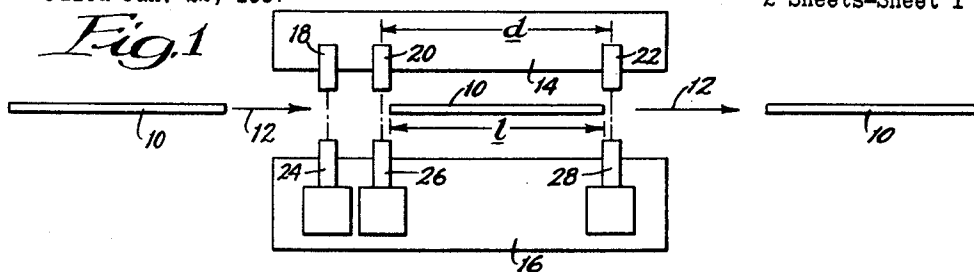
W. H. STONE ET AL

2,916,633

PHOTOELECTRIC ARTICLE DETECTOR

Filed Jan. 22, 1957

2 Sheets-Sheet 1



INVENTORS:

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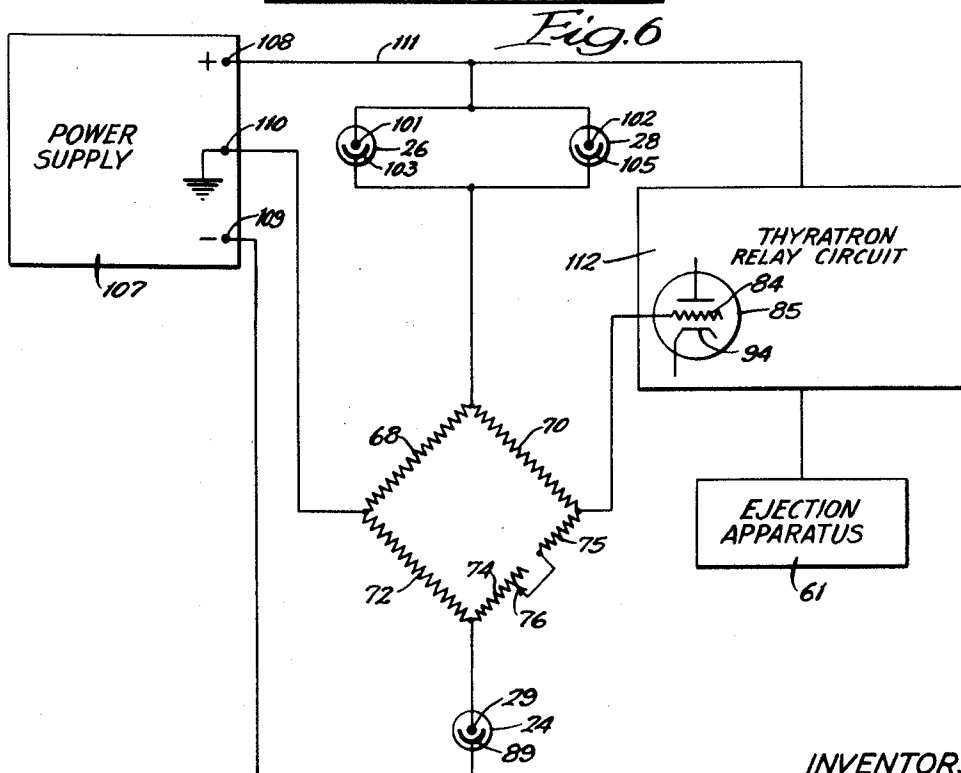
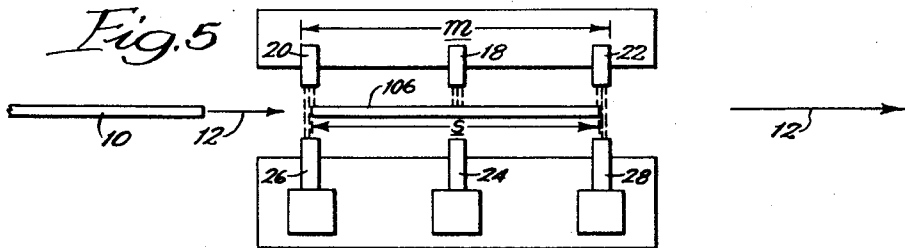
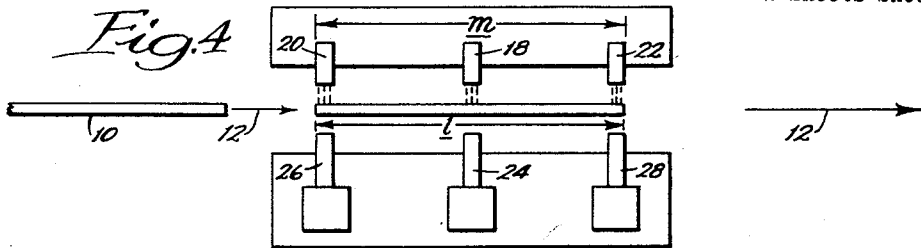
W. H. STONE ET AL

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PHOTOELECTRIC ARTICLE DETECTOR

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2 Sheets-Sheet 2



INVENTORS:

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1

2,916,633

PHOTOELECTRIC ARTICLE DETECTOR

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Application January 22, 1957, Serial No. 635,156

9 Claims. (Cl. 250—223)

This invention relates to photoelectric article detection devices and more particularly to improvements in such devices for detecting articles having a dimension which does not correspond to a predetermined value.

This invention is particularly applicable to the detection of books, magazines and the like which are defective in the respect that their length either exceeds or is less than a desired predetermined amount. Although the invention is particularly described in connection with such defective articles it will be apparent that the described device is equally applicable to many other types of articles and that defective books and magazines are selected only as an example of the types of objects with which the apparatus can be used.

In the production of magazines, the final binding step conventionally involves a stapling of the stacked magazine contents and a subsequent gluing of the cover thereto. Obviously, the contents vary with the type of magazine from relatively simple arrangements to relatively complex ones which may include a plurality of signatures, i.e., a stack of several double pages folded along a center line, gate folds, and inserts. Gathering machines normally are utilized for assembling the various portions of the contents for each magazine as a uniform assembly and placing it upon its long edge in a conveyor track for transport to a stapling machine.

Manifestly a costly problem arises when the magazine contents are not properly aligned prior to stapling. If a misaligned magazine is stapled and covered before its contents are detected as being out of register, it is necessary to remove and destroy the cover, remove the staples, properly align the magazine contents and reintroduce the magazine for binding. Thus, it will be appreciated that if a defective magazine could be detected before stapling and the magazine removed from the binding process, great savings would be effected in both time and money.

Accordingly, it is a general object of this invention to provide an improved device for detecting articles of size exceeding or less than a predetermined amount.

It is another object of this invention to provide an improved detection device particularly adapted to detect defective books, magazines and the like, the contents of which are misaligned or out of register.

It is still another object of this invention to provide an electronic detection device which is adapted to respond quickly to the presence of defective articles transported thereby.

It is a further object of this invention to provide such a detection device which operates without physically contacting the articles transported thereby and therefore enables the article processing system to attain a relatively high speed of operation.

It is still another object of this invention to provide an improved defective article detection device characterized by its flexibility, simplicity, and its economy of manufacture and operation.

In accordance with a specific illustrative embodiment of the invention the improved article detection device

2

comprises a plurality of light sensitive devices, such as photoelectric cells, a plurality of light sources, advantageously equal in number to the photoelectric cells, an ejection control circuit and an electronic circuit responsive to the operation of the photoelectric cells for actuating the ejection control circuit.

In one preferable embodiment of the invention, which is adapted to detect over length articles, the photoelectric cells are spaced along the path of travel of the magazines to be scanned. It is a feature of this embodiment that on one side of the conveyor transporting the magazines there is disposed a pair of closely spaced photoelectric cells, and at a remote distance therefrom, which advantageously is slightly greater than the length of a properly aligned magazine, there is placed a third photoelectric cell. On the other side of the conveyor, there is disposed a plurality of light sources, one for each photoelectric cell, spaced in a manner similar to the cells so as to be in alignment therewith.

An ejection apparatus adapted to remove defective magazines from the conveyor advantageously is associated with the detection device so as to be actuated thereby in response to the detection of a misaligned magazine. It is another feature of this invention that the control circuit for the ejection apparatus comprises a normally nonconducting gaseous discharge device adapted when triggered to actuate the ejection apparatus and immediately thereafter return to its nonconducting state for further ejection operations. The discharge device is held in its nonconducting condition by a cut-off bias applied to its control grid from a bridge arrangement connected to the photoelectric cells.

In accordance with an important feature of this embodiment of the invention the cut-off bias from the bridge is removed only when the two photoelectric cells spaced from each other a distance slightly greater than a properly aligned magazine are both blocked from their respective light sources by the passage of a defective magazine thereby. The blocking of any single photoelectric cell or any other combination thereof will not remove the cut-off bias from the discharge device to actuate the ejection apparatus.

In accordance with a second preferable embodiment of the invention, which is adapted to detect short length articles, the three photoelectric cells are uniformly spaced along the path of travel of the articles to be scanned. It is a feature of this embodiment that on one side of the conveyor transporting the articles, the three photoelectric cells are spaced such that the end cells are separated by a distance approximately equal to the length of a standard size article, and on the other side of the conveyor, the three light sources are spaced in a similar manner so as to be in alignment with the photoelectric cells.

The ejection apparatus and the control circuit therefor in the second embodiment are the same as that used in the above described over length embodiment. It is an important feature of the short length embodiment that the cut-off bias on the discharge device of the control circuit is removed only when light energy from the light sources is received by the two end photoelectric cells and is not received by the middle photoelectric cell. Under these conditions, which corresponds to the passage of an article of less than the predetermined length past the photoelectric cells, and only under these conditions, does the discharge device fire to operate ejection apparatus. The blocking of either end photoelectric cell alone or in combination with each other or with the middle photoelectric cell will not remove the cut-off bias from the discharge device.

Further features of this invention include the provision of disabling the ejection control circuit to permit adjust-

3

ment of the bias control bridge arrangement and the provision of means for selectively adjusting the spacing between the photoelectric cells to permit detection of defective magazines of various predetermined sizes.

The above and other features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of this invention, however, its advantages and specific objects attained by its use, reference is had to the accompanying drawing and descriptive material in which is shown and described an illustrative embodiment of the invention.

In the drawing:

Figure 1 is a simplified plan view of the photoelectric cell arrangement of the over length embodiment of the invention together with articles of proper size;

Figure 2 is a simplified plan view of the photoelectric cell arrangement of the over length embodiment of the invention together with a defective article of excessive length;

Figure 3 is a schematic diagram of the electrical control circuits in accordance with the over length embodiment of the invention;

Figure 4 is a simplified plan view of the photoelectric cell arrangement of the short length embodiment of the invention together with articles of proper size;

Figure 5 is a simplified plan view of the photoelectric cell arrangement of the short length embodiment of the invention together with the defective article of sub-standard size;

Figure 6 is a simplified schematic diagram of the electrical control circuits in accordance with the short length embodiment of the invention.

Referring now to the drawing, Figures 1 and 2 depict diagrammatically the manner in which the spaced photoelectric cells and the similarly spaced light sources cooperate with a plurality of articles transported in serial fashion thereby to detect those ones of the articles of a predetermined length or greater. Thus, in Figure 1, articles 10 are transported in the direction indicated by arrows 12 by any suitable conveyor means (not shown) through the channel defined by platforms 14 and 16. Three light sources 18, 20 and 22 are disposed in predetermined spaced relation on platform 14 and three photoelectric cells 24, 26 and 28 are disposed in similarly spaced relation on platform 16 so as to be in light receiving alignment with the light sources.

It will be understood by those skilled in the art that light sources 18, 20 and 22 may take the form of individual electric light bulbs, or, alternatively, may be derived from one elongated light bulb having a suitably apertured mask associated therewith. It further will be understood that light energy from sources 18, 20 and 22 may be suitably focused upon the light receiving photoelectric cells 24, 26 and 28, respectively, such as by lenses and the like. As will be better understood from the following explanation, the operational characteristics of the detection device will be dependent in part upon the width of the light beam from each light source and this width may be adjusted to a desired value by any means known in the art therefor.

In a preferred embodiment of the invention photoelectric cell 24 functions as a timing and action tube and photoelectric cells 26 and 28 as the defective article detection tube. Photoelectric cells 26 and 28 are spaced from each other a distance equal to d , where d is the minimum length of the defective articles to be detected. Thus, it will be seen in Figure 1 of the drawing that when articles 10 of length l smaller than d are transported past the detection device one or the other of photoelectric cells 26 and 28 will always be in a light receiving condition. It will be appreciated, of course, that the spacing between successive ones of articles 10 will be chosen so as to not interfere with this operational condition.

4

Figure 2 illustrates the operation of the detection device when an article 30 having a length o greater than spacing d between photoelectric cells 26 and 28 is transported through the channel defined by platforms 14 and 16. In this event, it can be seen that when article 30 is in the position shown in Figure 2, the light beams from sources 20 and 22 is blocked by article 30 and neither of the photoelectric cells 26 or 28 is in a light receiving condition. Thus, it is clear that the only time that photoelectric cells 26 and 28 are jointly blocked is when article 30 of length o equal to or in excess of predetermined spacing d between photoelectric cells 26 and 28, is transported thereby.

Figure 3 shows an electronic control circuit adapted to respond only to the jointly blocked condition of photoelectric cells 26 and 28 for actuating an article ejection apparatus. The control circuit comprises a rectifier having a power transformer 32, the primary winding 34 of which is connected through a switch 36 and a suitable fuse 38 to a source of A.C. voltage 40. One secondary winding 42 of transformer 32 is connected at one end thereof to an anode 44 and at the other end thereof to an anode 46 of a dual rectifier tube 48. The cathode heater winding 50 of tube 48 is energized from transformer secondary winding 52. A filter network is connected between cathode heater winding 50 and a return lead 54 connected to a center tap on transformer secondary winding 42. The filter network comprises condensers 56 and 58 connected across the rectifier output and an inductance 60 connected in series with the output and between the condensers in π network fashion. The D.C. output voltage from the rectifier network is applied across a voltage divider load comprising resistor 62, potentiometer resistance 64 and potentiometer resistance 66. The junction of potentiometer resistances 64 and 66 advantageously is connected to ground.

The action of the detection circuit is based upon a balanced Wheatstone bridge arrangement and the effect of photoelectric cells 26 and 28 being blocked by an article 30 of length o to bring about an unbalance of the Wheatstone bridge. The bridge includes fixed resistance arms 68, 70 and 72 and variable resistance arm 74. A sliding contact 76 is provided with the latter to enable this resistance to be selectively varied as desired. The bridge has a balancing meter 78 connected in series with a switch 80 connected between the junctions of resistance arms 68 and 72 and resistance arms 70 and 74. One terminal of meter 78 is connected through armature contact 79 and contact 81 of switch S to ground. Armature contact 85 of switch S is connected through a current limiting resistor 82 to the control grid 84 of thyratron tube 85.

The junction of resistance arms 68 and 70 of the Wheatstone bridge is connected to armature contact 86 of switch S. Contact 86 is adapted to be connected either to the anode 89 of photoelectric cell 24 through contact 88 or to wiper 92 of potentiometer 64 through contact 90. Wiper 92 also is connected to cathode 94 and screen grid 96 of thyratron 85.

The junction between resistance arms 72 and 74 of the Wheatstone bridge is connected to armature contact 98 of switch S which may be connected either to cathodes 101 and 102 of photoelectric cells 26 and 28, respectively, through contact 100 or to wiper 106 of potentiometer 66 through contact 104. Anodes 103 and 105 of photoelectric cells 26 and 28, respectively, are connected to return lead 54 of the rectifier.

Cathode 29 of photoelectric cell 24 is connected to the rectifier output at inductance 60 and to one winding of relay 31. The other winding of relay 31 is connected to anode 33 of thyratron 85. Contact 37 of relay 31 is connected to the rectifier output at inductance 60 and armature contact 39 of relay 31 is connected through a resistance 41 in series with a condenser 43 to cathode 94 of thyratron 85. Armature contact 45 of relay 31 is

5

connected to one terminal of a source of power (not shown) and the other contact 47 is connected through the windings of relay 49 to the other terminal of the source of power.

Armature contact 51 and contact 53 of relay 49 are connected to an ejection apparatus which advantageously may be of the type disclosed in a copending application for Letters Patent by Sidney H. Dengel, Serial No. 623,004, filed November 19, 1956. It will be understood, however, by those skilled in the art that any other type of utilization device, the operation of which is to be controlled by the photoelectric cells of the detecting device, may readily be connected across contacts 51 and 53 of relay 49.

In the operation of the invention the bridge is initially balanced by placing switch S in the balance position—the switch being in the operative position as shown in Figure 3 of the drawing. Thus, the various ganged contacts of switch S are connected as follows: contact 86 is connected to contact 90, contact 98 is connected to contact 104, contact 85 is connected to contact 83, and contacts 79 and 81 are opened.

When switch S is in this condition, it will be seen that all three photoelectric cells are disconnected from the Wheatstone bridge circuit. Potentials of one polarity are applied from wiper 106 of potentiometer 66 to the junction of resistance arms 72 and 74 and potentials of the other polarity are applied from wiper 92 of potentiometer 64 to the junction of resistance arms 68 and 70. These potentials advantageously are opposite and equal to each other. Wiper 76 in resistance arm 74 then is adjusted to balance the bridge as indicated by a null reading on meter 78. The bridge then is balanced and switch S is placed in its operative condition wherein contacts 79 and 81 are connected, contacts 86 and 88 are connected, contacts 98 and 100 are connected, and contacts 83 and 85 are opened. In this condition if a light beam is received by all three photoelectric cells 24, 26 and 28 from their respective light sources the bridge will remain balanced and the potential at the junction of resistance arms 70 and 74 is applied as a negative bias to control grid 84 of thyatron 85 to maintain the thyatron in a cut-off condition. The blocking of any single one of photoelectric cells 24, 26 and 28 by articles 10 passing thereby or the blocking of photoelectric cell 24 together with photoelectric cell 26 or together with photoelectric cell 28 does not remove cut-off bias from thyatron 85.

However, if photoelectric cells 26 and 28 are simultaneously blocked by the passage of an article 30 thereby no negative bias is provided at the junction of resistance arms 70 and 74 and the positive potential at this point provided by the conduction of photoelectric cell 24 causes thyatron 85 to be triggered into conduction. When the thyatron fires, relay 31 in its anode circuit is energized to close contacts 37 and 39, and contacts 47 and 45. The closing of the last named contacts causes relay 49 to be energized to thereby close contacts 51 and 53 and actuate ejection apparatus 61 to remove articles 30 from the conveyor.

It is well known that when a thyatron fires its control grid becomes ineffective to control conduction therein. Therefore an R.C. circuit comprising resistance 41 and condenser 43 is provided between anode circuit and cathode 94 of the thyatron to reset the thyatron after a predetermined conducting period. Contacts 37 and 39 close upon the conduction of the thyatron as a result of the energization of relay 31. Condenser 43 then charges through resistance 41 to the output potential of the rectifier, in a time period determined by the time constant of the R.C. circuit. When cathode 94 of thyatron 85 reaches the same potential as anode 33 of the thyatron, conduction in the tube will be terminated and the tube will be reset in preparation for the next ejection operation. The time period for the cut-off of the thyatron after it begins to conduct may be varied by changing the time

6

constant of the R.C. circuit, that is, by changing the values of either condenser 43 or resistance 41, to accommodate the speed at which the articles are conveyed past the photoelectric cells.

From the above explanation it will be appreciated that only when the photoelectric cells 26 and 28 are blocked simultaneously is the thyatron triggered into conduction. For all other combinations of the conducting or blocked states of the three photoelectric cells the thyatron will remain in its cut-off condition. This operation is tabulated as follows:

Combinations	Photo-electric cell 28	Photo-electric cell 26	Photo-electric cell 24	Ejector operation
1-----	x	x	x	No.
2-----	x	—	—	No.
3-----	x	x	—	No.
4-----	—	x	x	No.
5-----	x	—	x	No.
6-----	x	—	—	No.
7-----	—	x	—	No.
8-----	—	—	x	Yes.

where "x" indicates a photoelectric cell receiving light and "—" indicates a blocked photoelectric cell.

Figures 4 and 5 of the drawing depict the manner in which the uniformly spaced photoelectric cells 26, 24 and 28, and the similarly spaced light sources 20, 18, and 22, cooperate with the articles conveyed thereby to detect the article having less than a standard predetermined length. Thus, in Figure 4, articles 10 of standard length l are transported in the direction indicated by arrows 12 between the photoelectric cells and their associated light sources.

Photoelectric cells 26 and 28 are spaced from each other a distance m , where m is the minimum length of a standard article 10. In accordance with an aspect of this invention, this spacing m should be such that when a standard length article 10 is positioned adjacent light sources 20, 18, and 22, no light energy impinges upon any of the photoelectric cells 26, 24, and 28, respectively. Photoelectric cell 24 is positioned intermediate cells 26 and 28. Although the position of cell 24 between cells 26 and 28 is not critical, advantageously cell 24 is placed at the mid-point between the end cells to provide uniform spacing of the three cells.

Figure 5 illustrates the operation of the short length embodiment of the detection device when a defective article 106 having a length s , shorter than the standard length l , is conveyed past the photoelectric cells. In this event, it can be seen that when short length article 106 is in the position shown in Figure 5, the light beams from sources 20 and 22 activate their respective photoelectric cells, 26 and 28, which the light beam from source 18 is blocked by article 106 and therefore cannot activate its photoelectric cell 24. Thus, it is clear that the only time that cells 26 and 28 are activated, and cell 24 is blocked, is when an article 106 of length s , less than the spacing m between photoelectric cells 26 and 28, is transported thereby.

Figure 6 shows an electronic control circuit adapted to respond only to the jointly activated conditions of cells 26 and 28, and the blocked condition of cell 24, for actuating an article ejection apparatus 61. The control circuit has been shown in simplified form to facilitate the explanation of its operation and it will be readily understood that the power supply 107, the thyatron relay circuit 112, and the ejection apparatus 61 may be the same as that shown and described heretofore in connection with the over length embodiment of the invention. It will further be understood that balancing switch means S together with a balancing meter M may be incorporated in the circuit of Figure 6 to enable the control circuit to be properly balanced prior to its operation.

The short length control circuit differs from the over length control circuit primarily in that photoelectric cell

24 is connected between the bridge and the negative side of the power supply and photoelectric cells 26 and 28 are connected between the bridge and the positive side of the power supply. This circuit arrangement together with the physical placement of photoelectric cell 24 between photoelectric cells 26 and 28 changes the over length article detector to a short length article detector.

Thus, photoelectric cells 26 and 28 are placed in parallel with their respective anodes 101 and 102 connected to positive terminal 108 of power supply 107. The cathodes 103 and 105 of cells 26 and 28 respectively are connected to the junction of resistance arms 68 and 70 in the bridge. Photoelectric cell 24 has its cathode connected to the negative terminal 109 of power supply 107 and its anodes connected to the junction of bridge resistance arms 72 and 74.

The junction of bridge resistance arms 68 and 72 is connected to ground and the junction of bridge resistance arms 70 and 75 is connected to the control grid 84 of the thyatron discharge device 85 in the thyatron relay circuit 112.

In the operation of the short length embodiment the thyatron 85 is normally biased to its cut-off condition by the potential applied between its control grid 84 and its cathode 94. Only when both of the photoelectric cells 26 and 28 are receiving light from their respective light sources 20 and 22, and photoelectric cell 24 is blocked by the short length article 106 from its light source 18, will the potential at the junction of bridge resistance arms 70 and 75 be sufficiently positive to overcome the cut-off bias on thyatron 85 to fire the thyatron and actuate the ejection apparatus 61. For all other combinations of the conducting and blocked states of the three photoelectric cells, the thyatron will remain in its cut-off condition. This operation is tabulated as follows:

Combinations	Photo-electric cell 28	Photo-electric cell 26	Photo-electric cell 24	Ejector operation
1-----	x	x	x	No.
2-----	—	—	—	No.
3-----	x	x	—	Yes.
4-----	—	x	x	No.
5-----	x	—	x	No.
6-----	x	—	—	No.
7-----	—	x	—	No.
8-----	—	—	x	No.

where "x" indicates a photoelectric cell receiving light and "—" indicates a blocked photoelectric cell.

In one illustrative embodiment of detecting device constructed in accordance with the above description the various components had the following values:

Component	Value
Inductance 60 -----	15 henries.
Condensers 56, 58 -----	10 microfarads each.
Condenser 43 -----	0.5 microfarad.
Photoelectric cells 24, 26, 28 --	919 photo tubes.
Tube 48 -----	5Y3GT.
Tube 85 -----	502A thyatron.
Resistor 62 -----	10,000 ohms.
Potentiometer 64 -----	2,000 ohms.
Potentiometer 66 -----	12,000 ohms.
Resistances 68, 70 and 72 ----	8.2 megohms each.
Resistance 75 -----	6.8 megohms.
Potentiometer 74 -----	2.5 megohms.
Resistance 82 -----	1 megohm.
Resistance 41 -----	27,000 ohms.

It will be understood by those skilled in the art that the above tabulated values are merely illustrative of an embodiment of the invention and that components of other suitable values may be utilized therewith. It further will be understood by those skilled in the art that modifications may also be made in the construction and arrangement of the parts of the above described detect-

ing device without departing from the real spirit and scope of the invention and that it is intended to cover by the appended claims any other modified forms of structures or use of equivalents which reasonably may be included within their scope.

What is claimed is:

1. Apparatus for detecting offsize articles comprising three light sensitive devices, a discharge device having a control grid, ejection means for removing said offsize articles connected in circuit with said discharge device and adapted to be actuated by the conduction of said discharge device, and biasing means including a bridge comprising four resistance arms connected to form four junctions, means connecting two of said light sensitive devices in parallel with each other to a junction of two of said resistance arms, means connecting the third light sensitive device to the junction of two different ones of said resistance arms, means connecting a third junction of said resistance arms to a source of potential, and means connecting the fourth junction of said resistance arms to the control grid of said discharge device, said biasing means normally applying a cut-off potential to the control grid of said discharge device for maintaining the latter in a normally nonconducting condition and being operative upon the blocking of a designated one or ones of said three light sensitive devices by an offsize article and to the conduction of the remaining light sensitive devices to remove the cut-off potential from said control grid and cause said discharge device to conduct.

2. Apparatus for detecting articles of predetermined size in accordance with claim 1 further comprising switch means connected to said bridge for disconnecting the latter from said light sensitive devices for enabling a balancing adjustment thereof.

3. Apparatus for detecting articles of predetermined size in accordance with claim 2 further comprising reset means adapted to be connected in circuit with said discharge device upon conduction thereof for restoring the discharge device to its nonconducting condition.

4. Apparatus for detecting articles of predetermined size or greater comprising a pair of light sensitive devices separated by a distance equal to said predetermined size, a source of light aligned with each of said devices so as to be interrupted by the passage of articles transported therebetween, a normally non-conducting discharge device, ejection means for removing said articles adapted to be actuated in response to the conduction of said discharge device, biasing means including a bridge circuit comprising a plurality of resistance arms, conductor means connecting said pair of light sensitive devices in parallel and to the junction of two of said resistance arms, said biasing means being responsive to the conducting condition of said pair of light sensitive devices for applying a cut-off potential to said discharge device for maintaining the latter in a normally non-conducting condition, and becoming operative upon the blocking of said pair of devices by an article of predetermined size or greater to remove the cut-off potential from said discharge device, and restoring means adapted to be connected in circuit with said discharge device in response to conduction therein for restoring the discharge device to its nonconducting condition after a predetermined period of time.

5. Apparatus for detecting articles of predetermined size or greater in accordance with claim 4 wherein said restoring means includes an R.C. circuit comprising a resistance and a capacitance, the time constant of which is determinative of said predetermined period of time.

6. Apparatus for detecting offsize articles comprising a pair of light sensitive devices adapted to be in a light receiving condition and a third light sensitive device adapted to be in a light blocked condition only when an article smaller than a predetermined size is conveyed thereby, a normally nonconducting discharge device hav-

ing a control grid, ejection means for removing said off-size articles connected in circuit with said discharge device and adapted to be actuated by the conduction of said discharge device, and biasing means, including a bridge, responsive to the light receiving condition of said pair of light sensitive devices and to the light blocked condition of said third light sensitive devices for removing a cut-off potential from the control grid of said discharge device to cause the latter to conduct.

7. Apparatus for detecting articles having dimension smaller than a predetermined dimension comprising a plurality of light sensitive devices including at least two light sensitive devices being separated by an amount equal to said predetermined dimension and a third light sensitive device positioned intermediate said two devices, carrier means for conveying articles past said light sensitive devices, a source of light for each of said devices disposed relative thereto so as to be interrupted by the passage of each article therebetween whereby the passage of an article having said predetermined dimension or greater blocks light from being received by said light sensitive devices, a discharge device having a control grid, ejection means for removing articles from said carrier means connected in circuit with said discharge device and adapted to be actuated in response to the conduction of said discharge device, biasing means including a bridge arrangement comprising four resistance arms connected to form four junctions, conductor means connecting said two light sensitive devices in parallel and to one of said junctions, conductor means connecting said third light sensitive device to another of said junctions, and conductor means connecting the other two junctions to a source of potential and to the control grid of said discharge device, respectively, said biasing means being adapted to apply a cut-off potential to the control grid of said discharge device for maintaining the latter in a normally nonconducting condition, and becoming operative by the conduction of said two light sensitive devices and the blocking of

said third light sensitive device by an article having dimension smaller than said predetermined dimension to remove the cut-off potential from said control grid and cause said discharge device to conduct.

8. Apparatus for detecting short length articles comprising a plurality of light sensitive devices including a pair of devices separated by a distance equal to a standard length article and a third light sensitive device positioned intermediate said pair of light sensitive devices, a source of light aligned with each of said devices so as to be interrupted by the passage of articles transported therebetween, a normally nonconducting discharge device, ejection means for removing said short length articles adapted to be actuated in response to the conduction of said discharge device, biasing means for applying a cut-off potential to said discharge device to maintain the discharge device in a normally nonconducting condition and operative in response to the conducting condition of said pair of light sensitive devices and to the blocking of said third light sensitive device by a short length article to remove the cut-off potential from said discharge device.

9. Apparatus for detecting short length articles in accordance with claim 8 further comprising restoring means adapted to be connected in circuit with said discharge device in response to conduction therein for restoring the discharge device to its nonconducting condition after a predetermined period of time.

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