Aug. 18, 1964 A. EDELMAN 3,144,926

INSTALLATION FOR SELECTIVELY DISPATCHING ARTICLES

Filed May 17, 1961 2 Sheets-Sheet 1

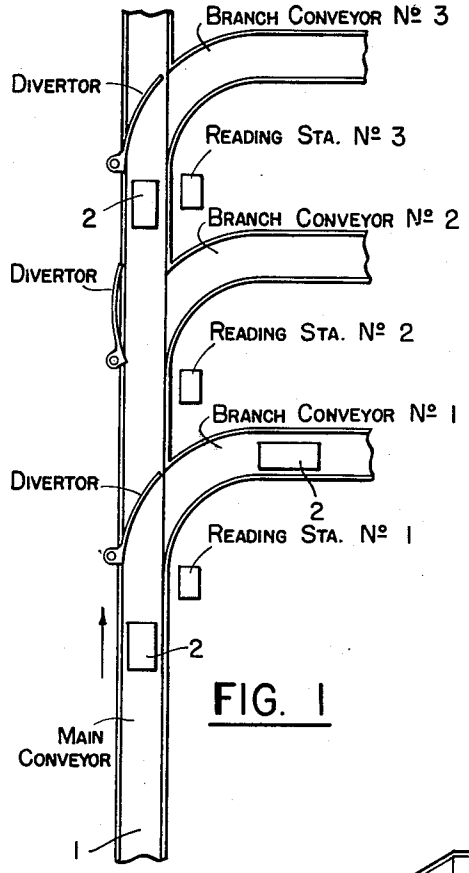


FIG. 1

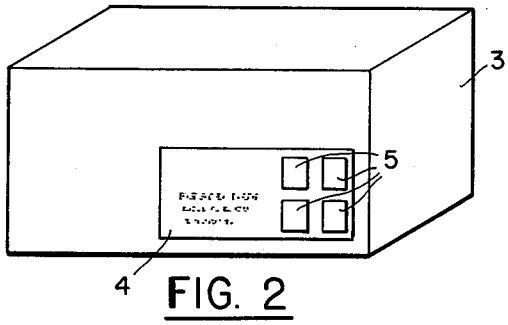


FIG. 2

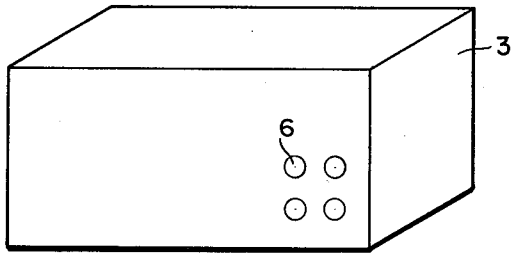


FIG. 3

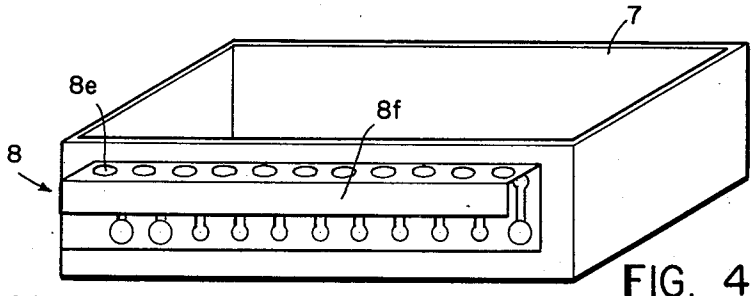


FIG. 4

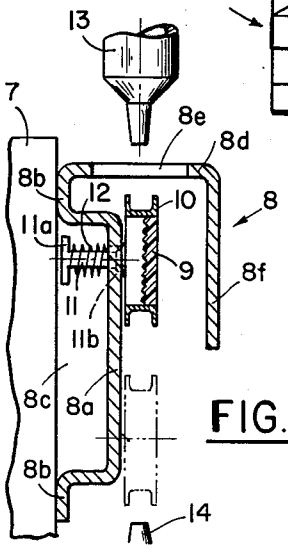


FIG. 5

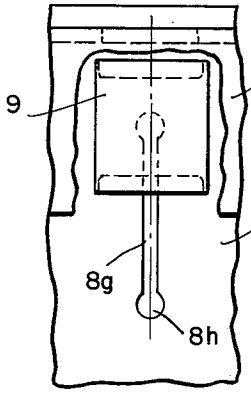


FIG. 6

INVENTOR.
ABRAHAM EDELMAN
BY Hane and Nydick
ATTORNEYS

INSTALLATION FOR SELECTIVELY DISPATCHING ARTICLES

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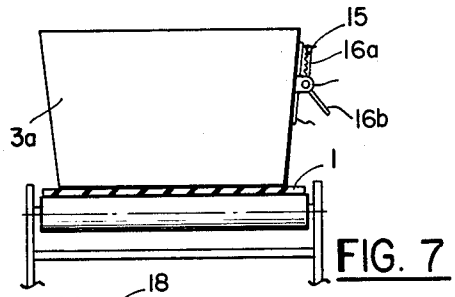


FIG. 7

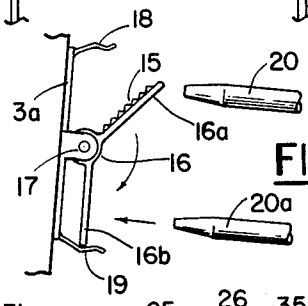


FIG. 8

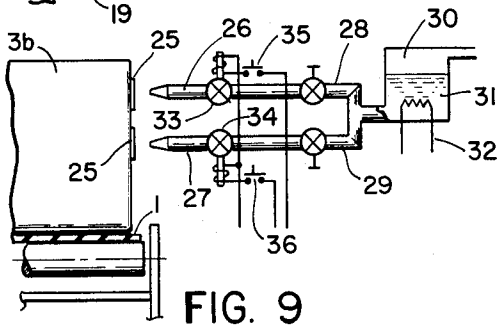


FIG. 9

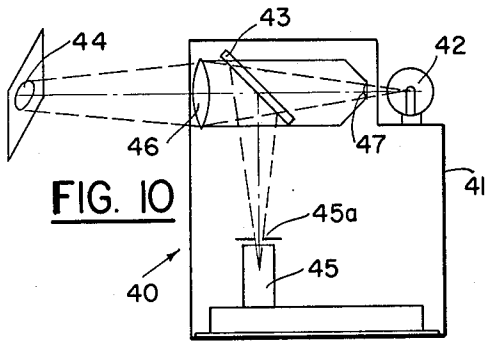


FIG. 10

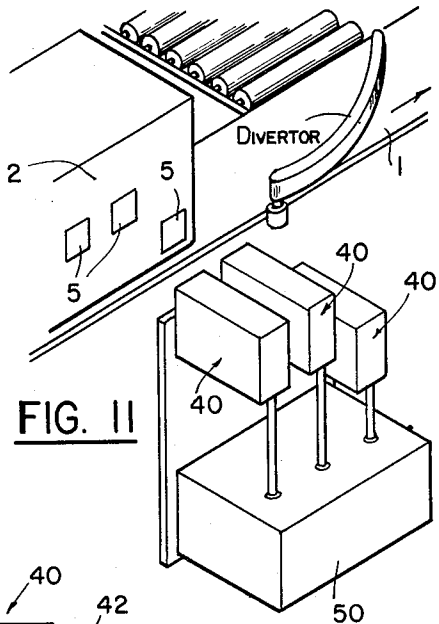


FIG. 11

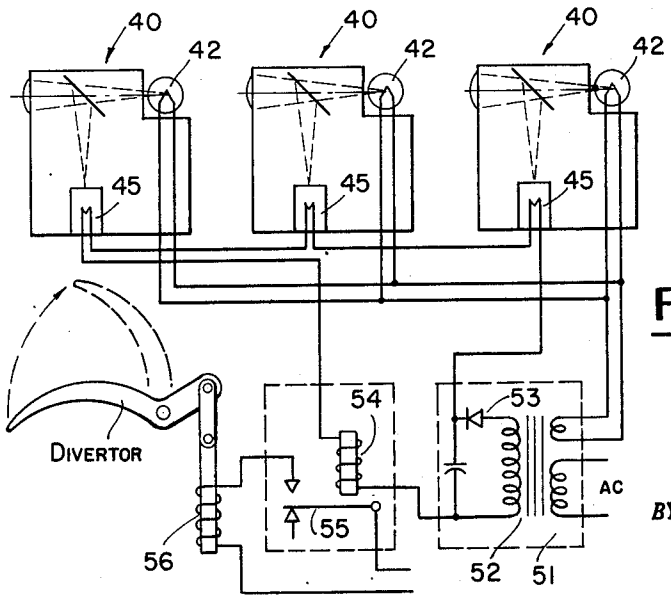


FIG. 12

INVENTOR.
ABRAHAM EDELMAN
BY Hane and Nydick
ATTORNEYS

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3,144,926

INSTALLATION FOR SELECTIVELY DISPATCHING ARTICLES

Abraham Edelman, 12 E. 22nd St., New York, N.Y.

Filed May 17, 1961, Ser. No. 110,786
9 Claims. (Cl. 198—38)

The present invention relates to an installation for selectively dispatching articles traveling on a conveyor to selected receiving conveyors, and more particularly, to a control system for automatically diverting articles from a main conveyor to receiving stations selected by a dispatcher.

It is a broad object of the present invention to provide a novel and improved control system of the general kind above referred to by means of which the desired destination of the article can be conveniently selected.

A more specific object of the invention is to provide a novel and improved control system which permits a rapid and simple marking of the article for a selected destination and an equally rapid and simple changing of the marking if it is desired to direct the article to another destination.

Another more specific object of the invention is to provide a novel and improved control system, the marking means of which allows a practically infinite number of convenient and distinctive markings of the articles to be dispatched to selected destinations.

Still another more specific object of the invention is to provide a novel and improved control system including sensing means which are highly discriminatory in their response to marking patterns on articles, thus assuring that the marked articles are correctly directed toward the selected destinations.

The aforementioned objects, features and advantages of the invention and other objects, features and advantages which will be pointed out hereinafter are attained by providing on each article to be diverted to a selected destination an array of retrodirective reflectors, and one or several Reading Stations including one or several Sensors arrayed in a pattern, each Sensor responsive to the reflectors of the pattern. When the entire pattern of Sensors in a Reading Station is simultaneously activated by a corresponding pattern of reflectors on a passing article, then the Reading Station controls a diverter and causes it to direct such article toward a predetermined destination, but to fail to direct or divert the article when the pattern thereon is such that it fails to activate all the Sensors of the Reading Station.

The term "article" as herein sometimes used, is intended to refer to the article itself, the packaging of the article, and containers or trays, etc. in which the articles may be placed while traveling on the conveyor toward a selected receiving station.

In the accompanying drawing, several preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a diagram of a dispatching installation according to the invention;

FIG. 2 shows an article labeled with marking means according to the invention;

FIG. 3 shows an article labeled with a modified arrangement of the marking means;

FIG. 4 is a perspective view of a marking means in which the position of the reflectors is variable to form a selected reflector pattern;

FIG. 5 is a detail view of the marking means of FIG. 4;

FIG. 6 is a front view of FIG. 5;

FIG. 7 is a side view of a further modification of a marking means including movably disposed reflectors;

FIG. 8 is a detail view of FIG. 7 on an enlarged scale;

FIG. 9 is a further modification of the marking means in which selected patterns may be formed by varying the reflection characteristics of selected ones of an array of reflectors;

FIG. 10 is a diagrammatic view of one of the sensing units of the installation;

FIG. 11 is a perspective diagrammatic view of a reading station and of an article just reaching the reading station; and

FIG. 12 is a circuit diagram of a reading station forming part of the dispatching installation.

Referring first to FIG. 1 in detail, this figure shows a conventional dispatching installation in conjunction with which the control system according to the invention can be advantageously used.

The showing of the installation is generally self-explanatory. The articles to be directed to selected receiving stations are upon a main conveyor 1 after having been appropriately marked by a dispatcher in a dispatching station. The dispatching station is equipped to mark a desired pattern and to eliminate prior patterns. Three branch conveyors are shown to lead off the main conveyor and, depending upon the position of the Diverter associated with each branch conveyor, an article either continues to travel on the main conveyor or is diverted to the selected branch conveyor on which it travels to a receiving station. Diverters Nos. 1 and 3 are positioned to direct articles to the respective branch conveyor while Diverter No. 2 permits continued travel of articles on the main conveyor. If desired, all the Diverters may, of course, be so set that all the articles will remain on the main conveyor which should be visualized as also leading to a receiving station.

Some of the articles to be dispatched are indicated by blocks 2. As pointed out before the term "article" as herein used is intended to encompass the articles themselves and also containers, trays, or skids in which the articles proper may be placed. In other words, the term "article" designates the body or structure to which the pattern determining the path of travel of the article is applied.

The position of each Diverter is controlled by the reading of the pattern on an article by the respective Reading Station. Three such Reading Stations are shown by way of example, one for each branch conveyor. Each Reading Station incorporates a predetermined pattern and when a passing article bears a corresponding pattern, the Reading Station will cause movement of the Diverter from one position to the other, say from the position shown for the Diverter No. 2 into the position shown for the Diverters 1 and 3. After passage of the article, the Reading Station will permit the return of the respective Diverter to its initial position. It is, of course, also possible and within the scope of the invention to utilize the reading of a pattern by a Reading Station for performing upon an article the pattern of which has correspondence with the pattern of the Reading Station, an operation other than diverting the article. For instance, certain stamping, closing, rotating, displacing or addressing may be applied to the article.

The installation as hereinbefore described and the function thereof are generally conventional. The present invention is concerned with the means by which reading of a pattern applied to an article is effected by and in a Reading Station.

Broadly speaking, the invention resides in providing on the article a pattern of reflectors which return the light incident thereupon and as sensing means in the Reading Station a combination of Sensors including photocells, each responsive to the light reflected by the reflectors in the pattern and which when all simultaneously energized initiate the actuation of the respective Diverter.

More specifically, the invention uses as reflectors so-called retrodirective reflectors. Such reflectors return light incident upon their reflecting surfaces in a direction which is substantially identical with the direction of the incident light. Various types of retrodirective reflectors are well known in the art and available in the market. One kind of retrodirective reflector known by the trade name "Stimsonite" uses three reflecting surfaces, mutually at right angles. The incident light is always reflected by such combination of surfaces so that it returns parallel to its incident direction. Another kind of retrodirective reflector known by the trade name "Scotchlite" uses glass balls as lenses to concentrate the incident light to a focal area which is highly reflective. The light is then reflected back on itself. Glass balls used for the purpose have, for example, a diameter of about 0.005" and are adhered to the surface of a sheet of reflective material. Any retrodirective reflector of the kind above referred to and other kinds known and available in the market are suitable for the purpose of the invention. The reflectors themselves do not constitute part of the invention and are hence not described in detail.

Pattern Marking Means

FIG. 2 shows an article **3** to which is adhered a label **4**. The label has attached thereto by silk-screening, painting, printing, etc., four retrodirective reflectors **5** which constitute a pattern capable of activating, for instance, Reading Station No. 1. Label **4** may, of course, be printed with appropriate information such as shipping instructions.

The dispatcher before placing the article on the main conveyor simply selects a label bearing the appropriate pattern and adheres such label to the article.

FIG. 3 shows an article **3** to which is applied a pattern formed by four adhering reflectors **6**. The reflectors may be attached to independent gummed labels which can be applied by a group of conventional label applying machines each capable of attaching on selected or a plurality of labels. Such a machine group can be controlled by a keyboard control to form a selected pattern of reflectors. Machines suitable for the purpose are well known in the art and the specific arrangement of such machine does not constitute part of the invention.

As is evident, the patterns as shown in FIGS. 2 and 3 are fixed once the reflectors have been applied to the article.

FIGS. 4, 5 and 6 show an arrangement which permits a convenient changing of the pattern. According to the arrangement of FIGS. 4 through 6 a tray **7** has mounted on its side which will face the Reading Stations when the tray is placed upon the conveyor a pattern carrier **8**. Branch **8***a* of the carrier is secured at **8***b* to the side wall of tray **7** and bent off in its middle portion to form a clearance **8***c*. The bight **8***d* includes a row of apertures **8***e*, the purpose of which will be explained hereinafter and the other branch **8***f* of the carrier constitutes an apron partly covering branch **8***a*.

The middle portion of branch **8***a* includes a plurality of slots **8***g* widened at both ends to form detention opening **8***h*. The number of slots **8***g* is selected in accordance with the number of reflectors which it is desired to have available for the selection of patterns. Eleven slots are shown by way of example. Accordingly, eleven openings **8***e* are also provided. Each of the slots accommodates a retrodirective reflector **9** of the kind previously described. Each reflector is held in a mount **10** which has a channeled cross section and is secured to a pin **11** terminating in a flange **11***a*. The end of pin **11** is enlarged at **11***b*, somewhat in the manner of a screw head. A loaded coil spring **12** abutting against flange **11***a* and the respective wall of branch **8***a* of the carrier urges the reflector assembly **9**, **10** toward branch **8***a*. Accordingly, the reflector assembly will occupy the position shown in FIG. 5 when the reflector is in its uppermost position and

will occupy a similar position when it is in its lowermost position. As is evident, the provision of enlargements **8***h* in conjunction with pinhead **11***b* and spring **12** constitue a releasable detention for the reflector assembly in either limit position thereof.

A reflector in its lowermost position is exposed to light incident upon the pattern carrier, whereas the reflector in the uppermost position is shielded against such light.

In FIG. 4 three reflectors are shown in the exposed position and these reflectors constitute the selected pattern. As is evident, a great variety of patterns can be selected by simply moving reflectors up or down.

Setting of the reflectors in the upper or the lower position can be effected by any suitable means, manually operated or by remote control. Such means may comprise an upper air nozzle **13** and a lower air nozzle **14** for each reflector. Each upper air nozzle is disposed in alignment with a respective hole **8***e*. As is evident, a flow of air under pressure directed by nozzle **13** upon a reflector in the upper position will move such reflector into the lower position, and similarly an air blast by the lower nozzle will lift a reflector. The control of the air flow to the selected nozzle may be effected by a suitable pipe and valve arrangement in the dispatching station. Suitable controls installations for directing the flow of pressure air to selected nozzles are well known in the art and do not constitute part of the invention.

FIGS. 7 and 8 show another modification of an arrangement for selecting a pattern from an array of retrodirective selectors.

According to FIGS. 7 and 8, a tray **3***a* is placed upon main conveyor **1**. The side wall of the tray facing the Reading Stations as the tray travels on the conveyor mounts a plurality of carriers, each supporting one retroactive reflector **15** of the kind previously described. Each reflector is supported on one arm **16***a* of an angle bracket **16**. The bracket is secured to the tray pivotal about a pivot **17** so that the reflector carrier may occupy either the position of FIG. 7 or the position of FIG. 8. The position of FIG. 7 is the active position of the reflector, that is, the reflector is positioned to reflect light incident upon it from a sensing unit of a Reading Station as will be more fully described hereinafter. In FIG. 8 the reflector is in its inactive position, that is, the reflector is incapable of efficient retrodirective reflection of light emanating from the sensing unit. The reflector carrier is frictionally retained in either position by means of springly detents **18** and **19** engageable with arms **16***a* and **16***b*, respectively, of bracket **16**.

The bracket can be moved into one or the other position by means of an air stream directed by nozzles **20** and **20***a* upon one arm or the other of the bracket. As is apparent a blast of air directed by nozzle **20** upon arm **16***a* will pivot the reflector from the inactive position of FIG. 8 into the active position of FIG. 7 and vice versa.

The flow of pressure air through nozzles **20** and **20***a* should be visualized as being controlled by the dispatcher by means of suitable control valves and pipe connections as is well known.

By moving selected reflectors of the array on the tray into the active position and others into the inactive position a great variety of reflector patterns may be formed on the tray.

In FIGS. 4 through 8 arrangements are shown in which a desired reflector pattern is produced by varying the position of selected reflectors in an array of reflectors. According to FIG. 9 the same result is attained by rendering the surface of selected reflectors reflecting or non-reflecting by coating or non-coating the surfaces of the reflectors with a coating which will completely, or at least substantially, prevent reflection of incident light. Such coating may be effected by directing a short burst of a spray of a suitable material such as a paraffin having a low melting point upon the reflector surface. A spray of liquid paraffin can be made to freeze into tiny droplets

upon contact with the reflector surface. The coating may be removed in a similar manner by spraying a solvent upon the surface of the reflector which will dissolve the paraffin or other coating, thereby restoring the reflecting properties of the reflector. As is shown in FIG. 9, a plurality of retrodirective reflectors **25** are fixedly secured to the wall of a tray *3b*, two reflectors of the array being visible.

The reflectors in the array may be arranged in two parallel rows, in which case two spray devices are sufficient to effect coating of selected reflectors in each row, or removing the coating from selected reflectors. The spraying arrangement is shown as comprising two spray nozzles **26** and **27**, one for each row. Each nozzle is connected by a pipe **28** and **29**, respectively, to a supply container **30** which may contain a supply of paraffin **31** heated by a heating element **32**. The flow of paraffin through pipes **28** and **29** is controlled by solenoid valves **33** and **34**, respectively. The valves are normally closed and are opened when and while normally closed push button switches **35** and **36**, respectively, are closed. It is, of course, also possible to provide a remote control of the valves by remote control circuits well known for such and similar purposes.

Removal of the coating from a coated reflector may be effected in the same manner by using a suitable solvent instead of paraffin or other coating material **31**.

A desired pattern is produced by moving in the dispatcher station reflectors to be coated into alignment with the spray nozzles and then activating the nozzles until a coating of the desired density is formed. Similarly, coatings are removed from the reflectors which are not selected to constitute part of the pattern.

In this connection it should be pointed out that in addition to the arrangements here shown, various other arrangements are feasible and within the scope of the invention to render active or inactive selected reflectors constituting part of an array of reflectors.

Reading Stations

Each Reading Station comprises a plurality of sensing units. The number of the sensing units and the location thereof in reference to each other are so selected that the assembly of sensing units in each Reading Station can respond to a definite series of patterns of reflectors only. It is, of course, possible to rearrange the sensing units so that the Reading Station can read a different pattern, but in any event, the arrangement of the sensing units must be such that only one series of patterns can be read at one time.

The sensing unit **40** of FIG. 10 comprises a housing **41** supporting a source of light shown as a lamp **42** having an incandescent filament. The useful part of the light emanating from that lamp passes through a light deviating means **43** and strikes a retrodirective reflector **44** which constitutes part of a pattern to be read by the Reading Station, of which the sensing unit **40** constitutes a part. The light deviating means are shown as a beam splitter. Such beam splitter is, for example, a mirror which is thinly silvered on the side facing reflector **44** and as a result, the beam splitter passes part of the light of lamp **42** to thereflector and also deflects part of the light reflected upon it by reflector **44**. The light deflected by the beam splitter is directed onto a photocell **45** which is energized by the incident light.

As has been previously explained, it is characteristic for a retrodirective reflector that such reflector reflects the light in the same direction as the light incident upon it. Accordingly, light emanating from lamp **42** can reach photocell **45** only if such light originates at lamp **42** and is reflected by the reflector **44** as only such light can reenter housing **41** in which beam splitter **43** and photocell **45** are mounted. All stray light and all light reflected by reflectors other than reflector **44** will remain ineffective.

To confine the outgoing light into a narrow beam and to increase the light available for the energization of photocell **45**, condenser lenses **46** or **47**, or both, are preferably provided. Lens **47** concentrates the light of lamp **42** and lens **46** focuses both the outgoing and the reflected light, causing the reflected light to focus upon the aperture *45a* of the photocell which is located at the image-point of the filament of lamp **42**.

The sensing units **40** of each Reading Station are arranged and electrically connected in accordance with the pattern of reflectors or group of such patterns, to be responded to by the Reading Station.

FIG. 11 shows a Reading Station which includes three sensing units **40**. Two of these units are at the same level and the third one is somewhat lower, and all connected in series. Accordingly, the Reading Station is thereby arranged to respond to a pattern of three reflectors, two in one row and a third one somewhat lower, and to larger patterns of which the pattern is a part. The article **2** traveling on the main conveyor carries such pattern. Accordingly, all three sensing units **40** will each simultaneously receive into their photocells **45** a large amount of reflected light, as the article passes the Reading Station. As a result of such simultaneous energization of all the sensing units, the actuating equipment **50** for actuating the Diverter associated with the Reading Station will be operated, thereby moving the Diverter into the position for diverting the article to the respective branch conveyor. After the article has passed the sensing units the photocells thereof become again de-energized, thereby permitting return of the Diverter into its initial position, shown in FIG. 1 for Diverter No. **2**.

The circuit diagram of the actuating equipment of the Reading Station is shown in FIG. 12. According to FIG. 12, the circuit system comprises a power supply **51**. The lamps **42** of the three sensing units are connected in parallel on a low-voltage secondary of a transformer **52**. The photocells of the sensing units are connected in series to a D.C. voltage supplied by the transformer through a rectifier **53**. The series connection also includes the coil of a relay **54**, the armature **55** of which when attracted closes the circuit of solenoid coil **56**. The solenoid is linked to a Diverter to pivot the same from the rest position shown in full lines into the diverting position shown in dotted lines. In actual practice, the solenoid may control an air valve controlling an air cylinder which in turn controls the flow of pressure air to control the position of the Diverter. Various other types of conventional devices for controlling the position of the Diverter may, of course, also be used.

Each of the photocells of the system is the equivalent of a high megohm resistance when it is dark and the equivalent of a low resistance when it is illuminated by light returned from a reflector. Consequently, if any one of the three photocells in series is dark, the resistance then included in the circuit of relay **54** is sufficient to prevent energization of the relay. However, if all three photocells are illuminated simultaneously, the total resistance in series with relay **54** is small enough to permit a current flow through the relay coil sufficient to energize the relay. As is evident from the previous description, all three photocells can be illuminated simultaneously only when at least a portion of the reflective pattern on an article passing a Reading Station coincides with the arrangement of the sensing units in such Reading Station, or in other words, if the article is one that was intended to be diverted by that Reading Station.

It should be noted that the circuit of FIG. 12 is a simplified circuit to show the principle of the invention. In actual practice it may, and generally will, include amplifying circuits. It may also include delay circuits to maintain the Diverter pivoted for a period of time sufficient to assure diversion of the article to a branch conveyor. Furthermore, the photocells may be connected in parallel, or series and parallel connections of the photocells may be combined.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an article-dispatching installation including a control system for controlling the diversion of articles travelling on a plane conveyor to selected receivers by actuating article diverters wherein said control system comprises a selected pattern of several light reflectors attachable to each article to be controlled and a reading means for each of the diverters, each of said reading means comprising a physical pattern formed by several sensing units for simultaneously sensing said several reflectors of the pattern, each sensing unit including a source of light for directing a concentrated beam of light to a predetermined one of the reflectors on the articles and a photocell electrically responsive to light and positioned to receive light reflected by the respective predetermined reflector only, said beams being parallel to each other and to the plane of the conveyor, each reading means further including circuit means connecting the photocells of all the sensing units forming the pattern of the respective reading means in an energizing circuit and an electrically operated actuating means for each of the diverters of the installation, said actuating means being connected to said energizing circuit and operated to actuate the respective diverter when all the photocells connected in the energizing circuit become simultaneously electrically responsive by simultaneously receiving light reflected from the respective reflectors of the pattern of the reflectors, the light reflecting surface of each of said reflectors being a retrodirective surface reflecting from each area portion of the surface light impinging thereupon at any angle of incidence parallel to such angle.

2. An installation according to claim 1, wherein each of said sensing units comprises a light deviating means, the source of light of each unit directing light upon the respective retrodirective reflector through said light deviating means, and said light deviating means deflecting part of the light retodirectively reflected by said reflector upon the respective photocell only to energize the same, and a lens means concentrating light emanating from the respective source of light in a beam of light incident upon said light deviating means.

3. An installation according to claim 1, wherein each of said sensing units comprises a light deviating means, the source of light of each unit directing the light upon the respective retrodirective reflector through said light deviating means, said light deviating means deflecting part of the light retrodirectively reflected by said reflector upon the respective photocell only to render the same electrically responsive.

4. An installation according to claim 3, wherein each of said light deviating means comprises a beam splitter.

5. An installation according to claim 1 wherein each of said retrodirective reflecting surfaces is selectively changeable from a reflective state to a non-reflective state and vice versa to form a selected pattern of surfaces in said retrodirectively reflective state.

6. A control system according to claim 5, and comprising mounting means supporting said reflectors in a fixed array, said mounting means being attachable to an article to be controlled, means for applying to selected ones of said reflectors a reflection inhibiting coating, and means for removing such coating from a coated reflector to form a selected pattern of reflecting reflectors.

7. A control system according to claim 5, and comprising mounting means supporting said reflectors movable between a light reflecting position and a nonreflecting position, said mounting means being attachable to an article to be controlled, and actuating means coacting with said reflectors for moving selected ones from one position into the other to form a pattern of reflecting reflectors.

8. A control system according to claim 7, wherein said mounting means comprise a guide track each slidably guiding one of said reflectors, said reflectors being reflecting in one position on the respective guide track and nonreflecting in another position on the guide track, and wherein said actuating means comprise nozzle means for directing a flow of pressure fluid upon a selected one of said reflectors to move the same from one position into the other.

9. A control system according to claim 8, wherein said guide tracks are in the form of slots in a wall portion of said mounting means, and wherein retaining means are provided for each slot for releasably retaining the respective reflector in either one of said positions.

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