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PHOTOELECTRIC MESSAGE DETECTOR

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FIG. 1

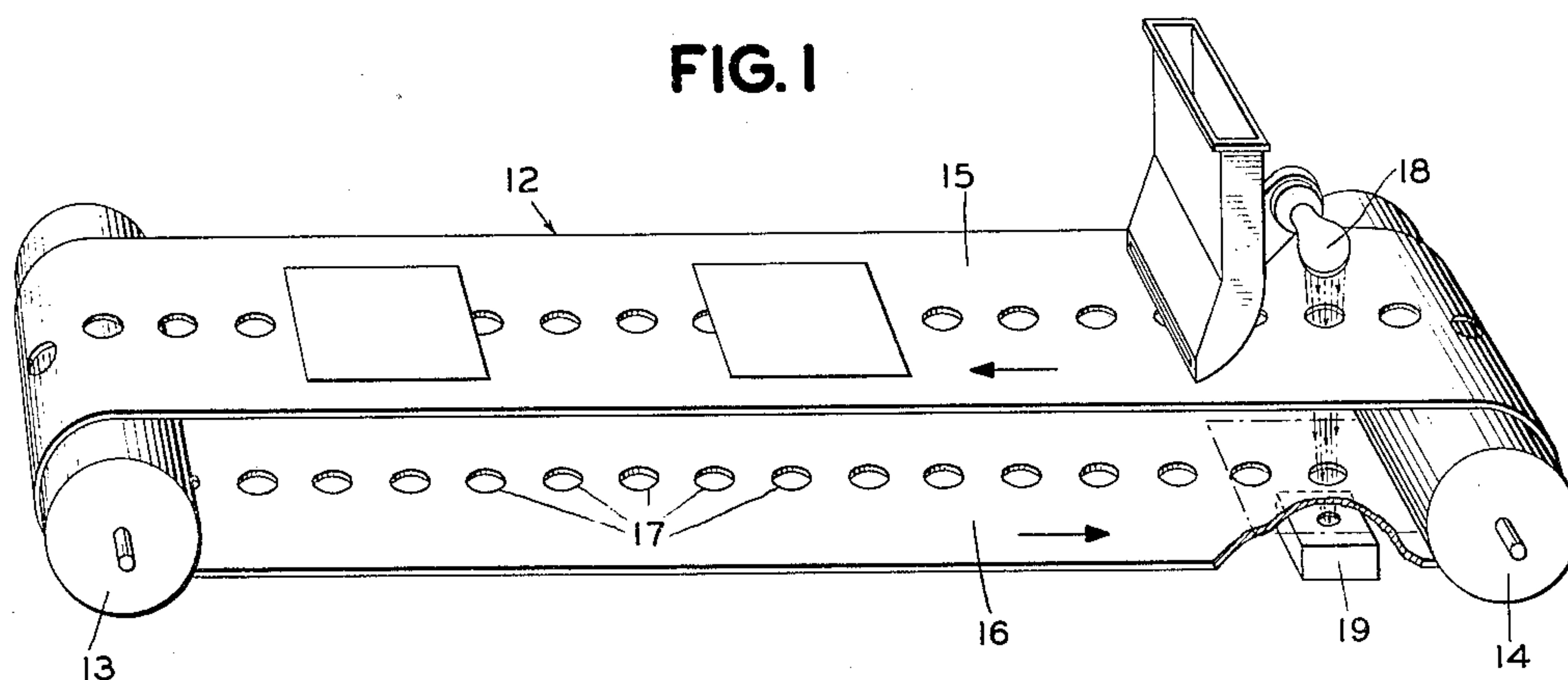
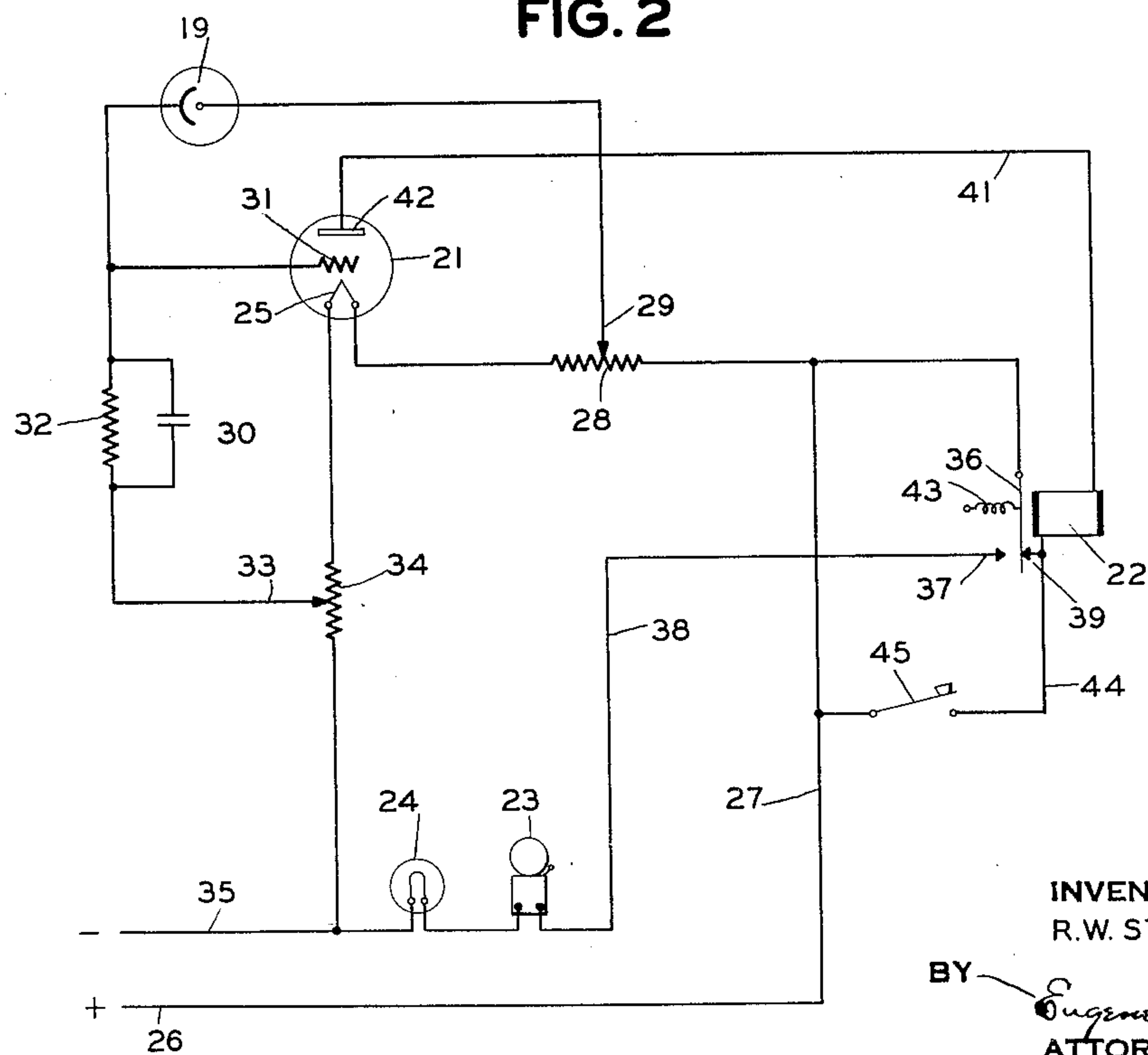


FIG. 2



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PHOTOELECTRIC MESSAGE DETECTOR

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7 Claims. (Cl. 177—311)

This invention relates, in general, to belt conveyors for transporting sheet material, such as telegraph blanks and the like, and has particular reference to a warning or signaling device for indicating the presence of misdirected or lost messages.

In large telegraph offices or communication centers where message blanks are routed to their various destinations, and where the necessity for speed in transportation has made it advisable to install a system of belt conveyers, the message blanks occasionally become entangled in the apparatus, or fall between the carrying and return portions of the flat endless belts used in such systems. As a result, a message may become wrapped about one of the pulleys between the belt and the pulley, and so become lost for a period of time. Since dependability and speed of transportation or transmission of messages is one of the important determining factors of the utility of the system or service, the problem of lost or delayed messages may have serious consequences. Thus, it has been necessary in the past to assign to some clerk or supervisor the duty of carefully checking the apparatus to search out these lost messages before an unreasonable delay has taken place.

It is therefore one of the principal objects of this invention to provide a means for eliminating or minimizing the number of these periodic inspection trips, with their consequent loss of time and cost of labor.

It has been found that the more serious delays are caused, not when the message blanks slip from the belt to the floor, where they are usually readily discernible, but, when the blanks fall between the working and return portions of the conveyor belt. With the modern safety devices and shields installed about moving machinery and belts as a safeguard against injury to workmen, it is possible for the message to be hidden from the view of the careful observer and, hence, it is a more specific object of this invention to provide a device for detecting the presence of message blanks lost in the aforementioned manner.

Still another object is to provide a light sensitive device suitably disposed in a position to detect the presence of a message blank and to perform certain functions as a result thereof.

A still further object is to provide a system of warning signals, the operation of which is initiated by the activity of the light-sensitive device, to effectively indicate not only the presence of lost messages, but also the failure of any of the

equipment, including the detector apparatus and the conveying equipment.

These and other objects are effected by this invention as will be apparent from the following description and claims taken in connection with the accompanying drawing forming a part of this application in which:

Fig. 1 is a diagrammatic perspective view showing the belt construction and the arrangement of the photo-electric cell apparatus in relation to the belt, and

Fig. 2 is a wiring diagram showing the circuit arrangement of the cell and signaling devices.

As shown diagrammatically in Fig. 1, my invention comprises an endless conveyor belt 12 extending between, and supported by, a pair of rollers 13 and 14 to form a working belt surface 15 and a return portion 16. The belt is of the type commonly used at distribution centers, in which the broad flat upper surface of the belt is disposed in a horizontal plane for the purpose of conveying articles of sheet material from one or more remote points to one or more sorting clerks suitably positioned along one or both sides of the belt for handling or rerouting by the clerks. It will be noted that a plurality of apertures 17 extending through the belt material are equispaced longitudinally along the entire center-line periphery of the belt.

A constantly operating light source 18, suitably shielded so as to direct a beam of light downward, is disposed above the working belt surface 15 directly over the center line of the belt. This light source is placed behind the point where the belt receives the articles to be conveyed, so that material traveling on the upper surface of the belt will not pass beneath the light source and thus interrupt the beam of light.

Directly below the return portion 16 of the belt is a photo-electric cell 19 disposed in the path of the light beam from the source 18. The perforations in the flat surface of the belt permit the light rays to pass through and fall upon the photo-electric cell maintaining a condition of uniform excitation in the cell.

Any abnormal interruption of the light beam caused by an object riding on the surface of either the working or return portions of the belt in a manner to cause some of the apertures to be obstructed will immediately affect the photo-electric cell and initiate the operation of the signaling devices.

Fig. 2 shows a circuit arrangement comprising the standard photo-electric cell 19 and an amplifier tube 21 cooperating therewith to en-

energize an electro-magnet relay 22 which in turn closes the signaling circuit containing a warning buzzer 23 and a signaling lamp 24.

The photo-electric cell 19 is connected in parallel with the amplifier tube cathode 25, both being provided with a suitable operating potential from the positive current source 26 by means of the conductor 27. A potentiometer 28 is in series with the filament 25 and has an adjustable tap 29 to provide a suitable potential for the anode of the cell 19. The light sensitive cathode of the cell is connected to the grid 31 of the amplifier tube and also through a suitable grid leak 32 to the adjustable tap 33 of a potentiometer 34 inserted in the return or negative lead 35 of the cathode circuit. The grid leak 32 is provided with a suitable condenser 30 in parallel therewith so as to delay the response of the cell in order to render it non-critical to slight interruptions of the light beam.

The plate circuit includes the winding of the electro-magnet relay 22, the armature 36 of which is connected to the conductor 27. The back contact 37 of the relay is connected by conductor 38 to the buzzer 23 and lamp 24, which latter may be connected either in series or parallel, and then to the negative lead or conductor 35. The front contact 39 of relay 22 is connected to the winding of the relay, and serves to supply current from the positive source 26, over conductor 27, armature 36, relay winding 22 and conductor 41, to the plate 42 of the amplifier tube 21.

This arrangement serves to lock the armature against its front contact once the relay is energized. When the relay is deenergized a spring 43 pulls the armature against the back contact 37 thus causing the buzzer and lamp to operate. A shunt conductor 44, including a normally open key 45, is connected between the conductor 27 and the winding of the relay.

The operation of the circuit will now be described. As previously stated, under normal operating conditions a beam of light constantly impinges on the light sensitive material forming the cathode of the photo-electric cell. The electronic emissions in the cell induced by the light beam provide a bias for the grid 31 of the amplifier tube. The circuit is so adjusted that under these conditions a substantially large plate current will flow, sufficient to hold the relay armature 36 against its front contact 39. Any abnormal interruption of the light beam focused on the cell will cause a decrease in the grid bias causing it to become more negative. The resultant decrease of plate current causes the armature 36 to swing, under the action of the spring 43, against the back contact 37. Current is now applied through conductor 38 to the buzzer and lamp causing the former to give a warning call and the latter to light up so as to attract the eye to the particular device disturbed, where more than one are in operation.

The removal of the obstruction to the light beam, as where the conveyed material has only momentarily caused an interruption, does not automatically restore the circuit to normal. Although the removal of the obstruction restores the grid bias to a higher potential, there is no positive potential being supplied to the plate 42 of the amplifier tube while the armature 36 is being held against its back contact 37. Hence in order to energize the relay 22, a positive potential must be supplied to the plate. This is done by the manual closing of the key 45, to supply potential directly from the power source 26, over con-

ductor 27, through the winding of relay 22, and conductor 41 to the plate of the amplifier tube 21. Once the plate potential has been restored, and provided there is no obstruction of the light beam, current will flow in the plate circuit causing the relay 22 to be energized, and the armature 36 drawn against its front contact 39.

Only after the armature 36 reaches its front contact may the push button 45 be released. Since the armature is no longer supplying current through the back contact 37, the buzzer is silenced and the lamp extinguished, thus restoring the entire circuit to normal.

As hereinbefore stated, the detector mechanism is adjusted for non-critical operation by means of the condenser 30 inserted in the cathode circuit of the photo-electric cell in parallel with the grid leak 32. The purpose of this condenser is to delay the response of the photo-electric cell so that it will be non-critical to slight interruptions of the light beam. Since the solid portions of the belt between the apertures intermittently interrupt the beam, and the duration of the interruption is determined by the speed of the belt, it is necessary to provide a condenser of suitable capacity so that only a prolonged interruption, such as that caused by a sheet of material obstructing the aperture, or by a failure of the light source, or of the conveying apparatus, will operate the warning devices. Should the conveyor equipment cease to operate for any reason, the deceleration of the belt in coming to a stop causes the light interruption to be prolonged sufficiently to actuate the warning devices.

From the foregoing description it will be observed that I have provided an efficient and useful device, to be used in a sheet material conveyor system, for detecting strayed or misconveyed sheet material, and for indicating the failure in operation of the detector mechanism, the light source, or the conveying apparatus.

It is obvious, of course, that various other modifications of the construction shown and described herein may be made without departing from the spirit or essential attributes of my invention, and, therefore, I do not desire to be limited to the specific details shown and described.

What I claim is:

1. In a conveyor, a light source, a light-sensitive device, an endless moving belt having alternate transparent and opaque sections along the direction of travel thereof, said belt being disposed between said light source and said light sensitive device, means partially controlled by said light-sensitive device having two conditions, a second means cooperating with said light-sensitive device for maintaining said first named means in a first one of said conditions for a predetermined rate of interruption of the light from said light source to said light-sensitive device by opaque sections of said belt, means operative by said light sensitive device on slower rates of interruption of light thereto for conditioning said first named means to the second of said conditions, an electro-responsive device and means controlled by the second condition of said first named means for rendering said electro-responsive device operative.

2. In a conveyor, a light source, a light-sensitive device, an endless moving belt having alternate transparent and opaque sections along the direction of travel thereof disposed between said light source and said light-sensitive device, means controlled by said light-sensitive device and adapted to be maintained in a uniform condi-

tion for a predetermined rate of interruption of the light from said light source of said light-sensitive device by opaque sections of said belt, means operative by said light sensitive device on slower rates of interruption of the light thereto for conditioning first named means to a non-uniform condition, a relay normally maintained energized by said first named means in a uniform condition thereof, said relay being rendered deenergized in a non-uniform condition of said first named means, an electro-responsive means adapted to operate upon deenergization of said relay and manually operated means for reenergizing said relay only upon resumption of a uniform condition of said first named means.

3. In a conveyor system for transporting sheet material, an endless moving belt comprising an upper horizontal conveying portion and a lower return portion, a light source disposed adjacent the outer face of one of said portions and a light sensitive device disposed adjacent the outer face of the other portion, said belt being alternately pervious and impervious to light rays from said light source to said light sensitive device to interrupt the light from said light source to said light sensitive device at a predetermined normal rate, an electro-responsive device and means including said light sensitive device for operating said electro-responsive device on the interruption of the light to said light sensitive device by an object on said belt.

4. In a conveyor system for sheet material, an endless moving horizontal belt comprising an upper conveying portion and a lower return portion, said belt having a plurality of equi-spaced apertures along its entire periphery, a light source trained to direct a beam of light through both of said belt portions, said beam being normally interrupted at a predetermined rate thereby, a light sensitive device disposed to receive said interrupted light beam, a signalling device, a relay, means controlled by said light sensitive device when the light thereto is interrupted at said predetermined rate for maintaining said relay in an operated condition, an armature responsive to said relay and having its fixed end connected to a source of potential, a back contact of said relay in circuit with said signalling device, a front contact of said relay in series with the winding of said relay whereby said relay in an operated condition locks said armature against its front contact and means controlled by said light sensitive device on an abnormal interruption of the light thereto for rendering said relay unoperative whereby said armature engages its back contact to apply current to said signalling device to operate the same.

5. In a conveyor system for sheet material, an endless moving horizontal belt comprising an upper conveying portion and a lower return portion, said belt having a plurality of equi-spaced apertures along its entire periphery, a light

source trained to direct a beam of light through both of said belt portions, said beam being normally interrupted at a predetermined rate thereby, a light sensitive device disposed to receive said interrupted light beam, an electro-responsive device, a relay, means controlled by said light sensitive device when the light thereto is interrupted at said predetermined rate for maintaining said relay in an operated condition, an armature responsive to said relay and having its fixed end connected to a source of potential, a back contact of said relay in circuit with said electro-responsive device, a front contact of said relay in series with the winding of said relay whereby said relay in an operated condition locks said armature against its front contact, means controlled by said light sensitive device on an abnormal interruption of the light thereto for rendering said relay unoperative whereby said armature engages its back contact to apply current to said electro-responsive device to operate the same and means comprising a normally open manually operable switch shunted between said front contact and said source of potential, the operation of which restores said relay to an operated condition during normal interruption of said light beam.

6. In a conveyor system for sheet material, an endless moving belt comprising conveying and return portions, said belt having a plurality of apertures longitudinally disposed therealong, a light source adjacent one portion of said belt, a light sensitive device adjacent the other portion of said belt, the movement of said apertures in both of said belt portions intermittently interrupting at a normal rate the light from said source to said light sensitive device, a control circuit, means controlled by said light sensitive device at the normal rate of the light interruptions thereto for maintaining said control circuit unoperative and means for rendering said control circuit operative on an abnormal interruption of the light to said light sensitive device.

7. In a conveyor system for sheet material, an endless moving belt comprising conveying and return portions, said belt having a plurality of apertures longitudinally disposed therealong, a light source adjacent one portion of said belt, a light sensitive device adjacent the other portion of said belt, the movement of said apertures in both of said belt portions intermittently interrupting at a normal rate the light from said source to said light sensitive device, a time delay electro-responsive means controlled by said light sensitive device and maintained in a normal condition by the normal rate of the light interruptions to said light sensitive device and means for rendering said time delay electro-responsive means operative on an abnormal interruption of the light to said light sensitive device by an object on one or both of said belt portions.

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