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E. F. STEVENS

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TAPE-ACTUATED REPRODUCER AND LIGHT GATE THEREFOR

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2 Sheets-Sheet 1

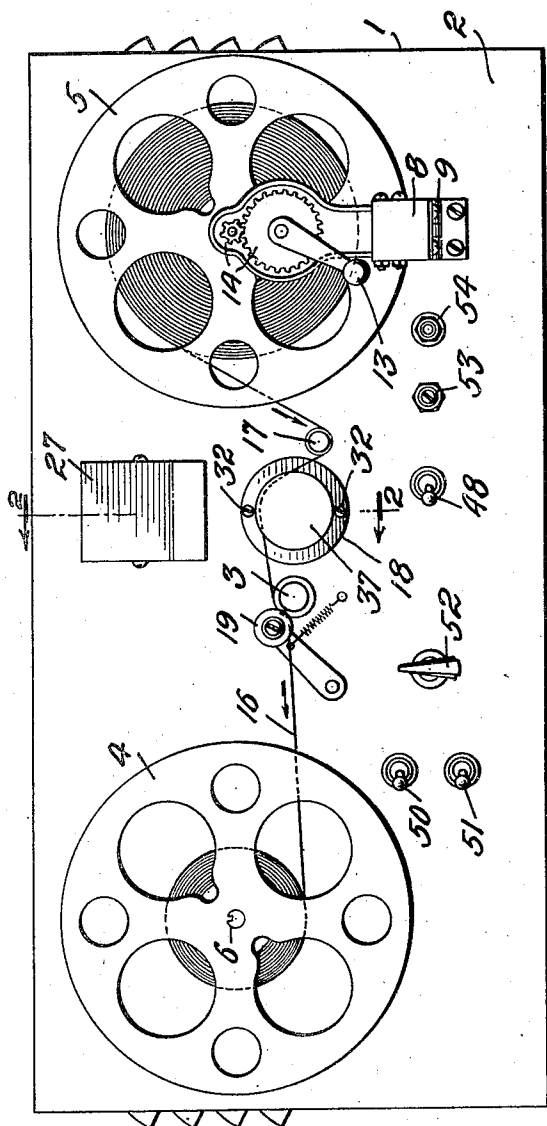


Fig. 1.

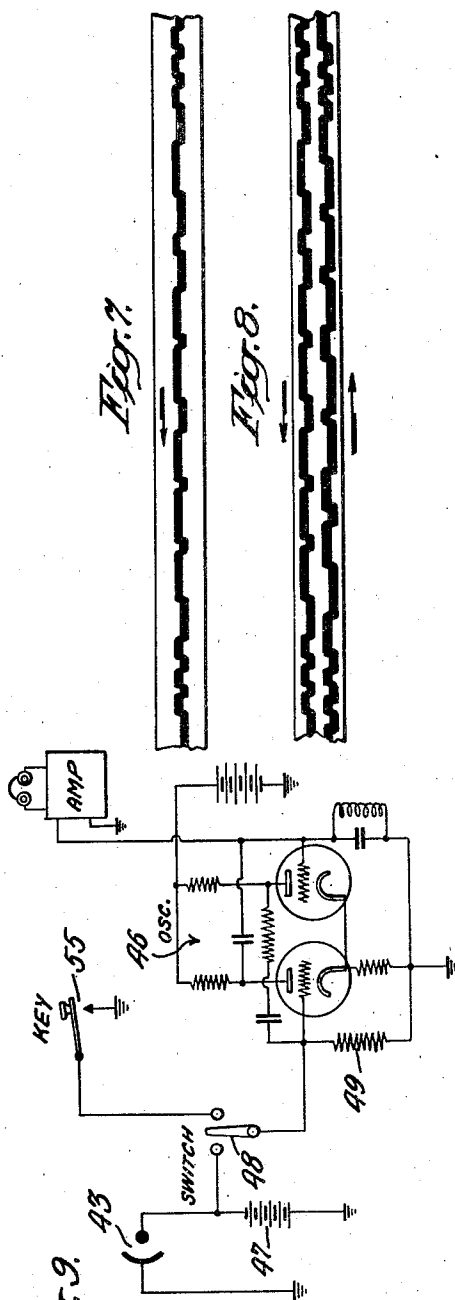


Fig. 2.

INVENTOR
EDWIN F. STEVENS

By *Eager & Malcolm*
ATTORNEYS

May 26, 1942.

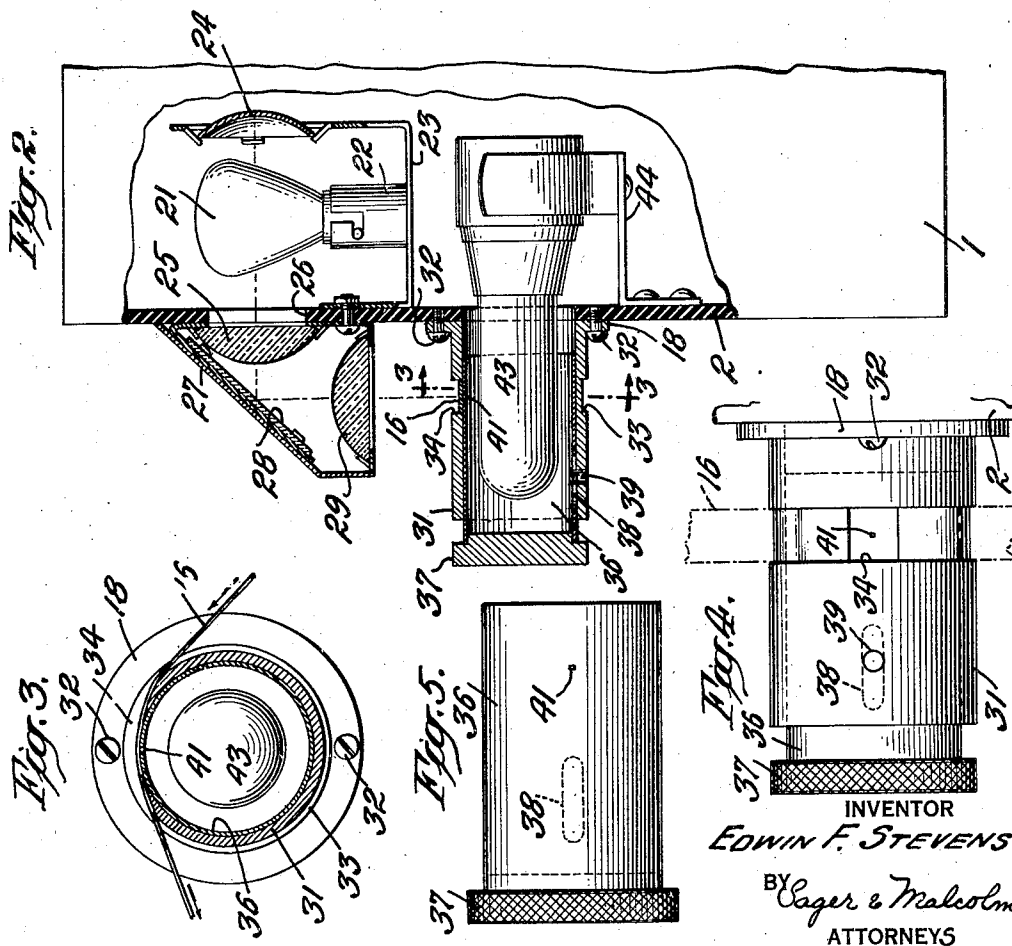
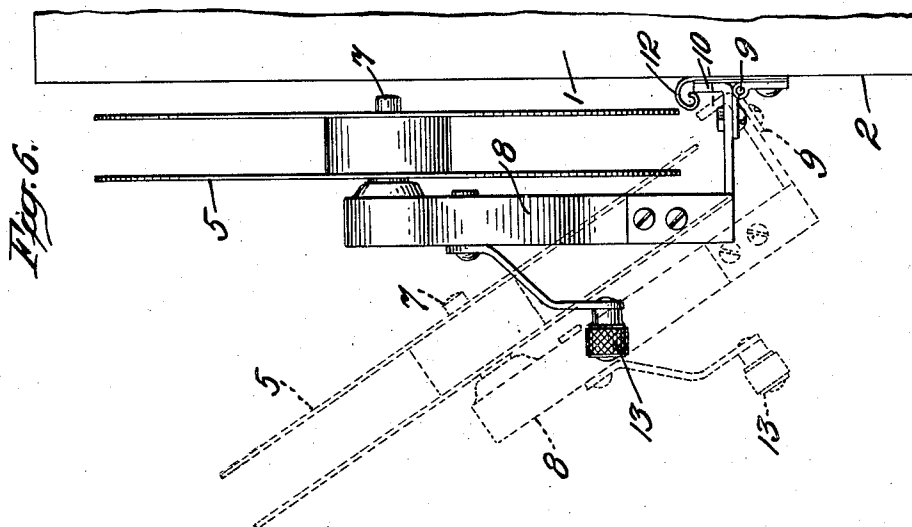
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INVENTOR
EDWIN F. STEVENS

BY *Eager & Malcolm*
ATTORNEYS

UNITED STATES PATENT OFFICE

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TAPE-ACTUATED REPRODUCER AND LIGHT GATE THEREFOR

Edwin F. Stevens, New York, N. Y., assignor to
Lon-Ga-Tone, Inc., New York, N. Y., a cor-
poration of New York

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5 Claims. (Cl. 178—115)

This invention relates to a system for transmitting electrical impulses in accordance with indicia on a movable tape, and particularly to a novel light gate therefor, its principal object being to provide an improved light gate which may be quickly and accurately adjusted to insure the faithful reproduction of the signals to be transmitted.

I shall illustrate the invention in its application to an electronic system for reproducing telegraph code messages which are printed, punched or otherwise formed on a movable tape. The system shown herein for purposes of illustration is intended primarily for the instruction of students in the telegraph codes, but it will be evident that the invention may be used for a wide variety of other purposes.

In the system illustrated, the moving tape passes between a light source and a photoelectric cell. The dots and dashes, which are inked or otherwise formed on the tape, interrupt the light which illuminates the photoelectric cell, and these light interruptions are used to start and stop an audible tone. The tape may be driven by a variable speed motor so that it is possible to reproduce the dots and dashes at any desired speed.

My improved light gate comprises a housing which is adapted to receive the photoelectric cell referred to above, and this housing has an opening which extends therethrough and in which the tape is adapted to run. A light shield is slidably mounted in the housing and contains an aperture lying within the field of the aforesaid opening so as to be traversed by the tape running past said opening, and means are provided for adjusting the position of said aperture to bring it into exact alignment with the indicia on the tape.

In the preferred form of the invention the light gate containing the photoelectric cell comprises a cylindrical housing having a peripheral groove containing an opening which extends through said housing and in which the tape is adapted to run. A close-fitting cylindrical light shield is slidably mounted in the housing, this shield containing the aperture which lies within the field of said opening so as to be traversed by the tape which runs through the peripheral groove in the housing. The aperture in the light shield corresponds in size to the width of the code signals or indicia on the tape, hence, in the case of a printed tape, the passage of a printed portion of the tape across the aperture

will block the transmission of light to the photoelectric cell within the light gate.

The light shield is slidable within the housing, as previously stated, and means are provided for adjusting said shield longitudinally of the housing while preventing it from rotating therein. In this way the shield may be adjusted quickly and accurately to any extent desired to align its aperture with the indicia on the tape, or with any one of a plurality of indicia on a tape. With this adjustment it is possible to reproduce faithfully and accurately any one of a plurality of indicia on the tape, or to adjust the device to accommodate tapes of different manufacture.

The various features and advantages of the invention will be described in connection with the accompanying drawings, in which:

Fig. 1 is a front view of an improved automatic code reproducer employing my novel light gate;

Fig. 2 is a vertical section on line 2—2 of Fig. 1, showing the optical system, the light gate and the photoelectric cell;

Fig. 3 is a transverse section on line 3—3 of Fig. 2, showing the passage of the tape over the light gate;

Fig. 4 is a plan view showing the assembly of the light gate and shield;

Fig. 5 is a plan view of the light gate shield;

Fig. 6 is a side view of the keyer panel, as viewed from the right in Fig. 1, showing the hinged rewind bracket supporting one of the tape reels;

Figs. 7 and 8 are plan views showing two different tapes which may be used in the machine; and

Fig. 9 is a diagram of the oscillator circuit and associated elements.

The apparatus shown in the drawings comprises a cabinet 1 having a front panel 2 upon which the operating mechanisms are mounted as shown in Figs. 1, 2 and 6.

The apparatus includes a drive roller 3 for driving the tape, a take-up reel 4, and a rewind reel 5, which are preferably mounted on the front panel 2 in the relative positions shown in Fig. 1. The drive roller 3 is driven by a suitable variable speed motor, not shown. The take-up reel 4 is journaled on a spindle 6 which is suitably driven, as by means of a spring belt connected to the motor which drives the roller 3.

The rewind reel 5 is mounted on a spindle 7 carried by a bracket 8 which is hinged at 9 to the front panel 2 as shown in Figs. 1 and 6. The

bracket 8 has an upwardly extending ledge 10 adjacent the hinge 9, which is adapted to be engaged and held by a spring catch 12 on the panel 2 to hold the bracket as well as the reel 5 in the upright position shown in Fig. 6 of the drawings. When it is desired to remove the rewind reel 5 from its spindle 7, however, the bracket 8 containing said reel is swung downwardly about its hinge 9, disengaging the ledge 10 from spring catch 12, the bracket and reel thus assuming the position shown in dotted lines in Fig. 6, in which position the reel may be removed from its spindle. For rewind purposes the bracket 8 contains a hand crank 13 which actuates the spindle 7 through suitable gears 14, rewinding being accomplished by turning the crank 13 and reel 5 in a clockwise direction as viewed in Fig. 1.

The tape 16 is pulled from reel 5 and passes beneath an idler roller 17, and thence over the light gate 18 which is hereinafter described in detail. On the opposite side of the light gate 18 the tape runs on the drive roller 3, being held in engagement therewith by a spring-actuated idler roller 19, from which the tape runs onto the take-up reel 4 as shown in Fig. 1 of the drawings.

The tape

The tape employed in the apparatus may be of any suitable type, such as that illustrated in Fig. 7 which shows a strip of paper slightly less than one-half inch in width, and of any desired length. A telegraph code is printed on the tape, that shown in Fig. 7 consisting of a single continuous ink line running the length of the tape, said ink line being displaced to one side to form the dots and dashes constituting the code. The inked line is approximately $\frac{1}{8}$ " in width. To print the dots and dashes this inked line is displaced to one side to a distance equal to the width of the inked line. The interval of displacement, that is, the length of displacement, determines the various dots and dashes; a short length of displacement represents a dot, and a greater length of displacement represents a dash.

It is also possible to print two different series of code messages on a single tape, as shown, for example, in Fig. 8. In the embodiment of Fig. 8 the two series of code signals are printed to run in opposite directions. The operation of the apparatus with the tapes of Figs. 7 and 8 will be described later.

Optical system

An exciter lamp 21 of any suitable type is mounted in a socket 22 carried by a bracket 23 which is secured to the panel 2 within the housing 1 as shown in Fig. 2. Mounted on bracket 23 behind exciter lamp 21 is a concave reflecting mirror 24. This mirror reflects the light from the rear of the exciter lamp to the front of said lamp. Thus the light which is emitted from the rear of the lamp is reflected to the front so that said light is not lost.

The combined light, that is the light from the front of lamp 21 and the reflected light from the back of said lamp, is focussed by means of a lens 25 which is mounted adjacent an opening 26 in the front panel 2 as shown in Fig. 2. The lens 25 is enclosed by a housing 27 containing a plane mirror 28 which is mounted at an angle of 45° to panel 2 and therefore reflects the light from the exciter lamp 21 at right angles as indicated by the dot-and-dash line in Fig. 2.

A second lens 29 is mounted in the bottom of

housing 27 to collect the light from the mirror 28. The lenses 25 and 29 and the mirror 28 form a light condensing system. The two lenses condense the light and the mirror reflects it at right angles. The condensed light beam produced by the lens system is focussed upon the tape 16 as it passes over the light gate 18. The size of the image is adjusted so that it covers the entire width of the tape.

Light gate

The novel light gate 18 comprises a cylindrical housing 31 and is secured to the front panel 2 as by means of screws 32 as shown in Figs. 1 and 2. A peripheral groove 33, wide enough to admit the tape 16, is formed around the outside of the housing 31. At the top where the light strikes the housing 31, said housing is cut away at 34 to form an arcuate opening which extends directly through this portion of the housing as shown in Figs. 2 and 3.

A close-fitting cylindrical light shield 36 having a knurled front plate 37 is slidably mounted within the cylindrical housing 31 of the light gate 18. The shield 36 contains an elongated slot 38 extending in the longitudinal direction in which it is desired to move the shield for adjusting purposes as hereinafter described. A screw or pin 39 extends through the housing 31 of the light gate into engagement with the slot 38 in shield 36, thus permitting the shield to be adjusted lengthwise in the housing 31 of the light gate while preventing the shield from rotating.

At the point where shield 36 lies under the opening 34 of housing 31 a small aperture 41 is formed in said shield. The location of aperture 41 is such that it is possible to slide the shield 36 to and fro in housing 31 so that said aperture 41 may be located at any desired point in the field of the arcuate opening 34 of housing 31. The size of aperture 41 is slightly less than the width of the inked line on the tape 16. Accordingly, it will be observed that aperture 41 allows light to pass through the tape only where there is no inked line to block the passage of light from said aperture through said tape. The inked line can be located at any position on the tape 16, the slidable shield 36 being so adjusted that the aperture 41 registers with the inked line on the tape.

As previously described, the tape 16 is guided over the light gate by the rollers 17 and 19, the tape riding in the groove 33 formed in housing 31 of the light gate. At the opening 34 of the light gate the tape 16 rides upon the shield 36. Due to the cooperation of slot 38 in the shield and screw 39 in the housing 31 of the light gate, the shield 36 does not rotate.

A photoelectric cell 43 is mounted within the shield 36, same being supported by a suitable bracket 44 which is mounted on panel 2 within the cabinet 1 as shown in Fig. 2. The active surface of the photoelectric cell is placed directly under the opening 34 in housing 31 of the light gate. It will thus be observed that light from the optical system is prevented from reaching the photoelectric cell 43 except when clear portions of the tape 16 overlie the aperture 41 in shield 36, said clear portions of the tape representing the signals which are to be transmitted by the apparatus as hereinafter described.

It is thus possible, by properly actuating the slidable shield 36, to align the aperture 41 thereof with the inked line on tape 16, which inked line

extends lengthwise of the tape and at any desired transverse portion thereof.

Oscillator circuit

The system includes a suitable oscillator circuit, such as that illustrated diagrammatically in Fig. 9, which is adapted to produce an audible tone. The photoelectric cell 43 and a battery 47 are connected to the grid of one of the vacuum tubes of the oscillator 46 through a switch 48 as illustrated. When no light is reflected upon the photoelectric cell 43, the cell will not pass any current. However, when light strikes the photoelectric cell as previously described, current passes therethrough. The photoelectric cell 43 is connected to the grid of the oscillator tube through the common coupling resistor 49. Since current cannot pass through the photoelectric cell 43 when no light strikes said cell, all of the current from battery 47 passes through the grid of the oscillator tube at such time.

However, when light strikes the cell 43, part of the current of battery 47 passes through said cell. This reduces the amount of current passing to the grid of the oscillator tube. When the full current of battery 47 passes through the grid of the oscillator tube, the current is of such value that the grid is blocked by the presence of excessive current, which prevents the tube from oscillating. However, when the cell 43 draws current, due to the action of light thereon, the current on the grid of the oscillator tube is reduced so that the grid is no longer blocked and the tube will oscillate.

Operation

In operation, the tape 16 is placed on the rewind reel 5 which is hinged to the front panel 2 of the apparatus as previously described. The bracket 8 of the rewind mechanism is pulled down and the full reel of tape is placed on the rewind spindle 7, after which bracket 8 containing the full reel 5 is swung back toward the panel 2, in which position it is held by the spring catch 12 grasping ledge 10 as previously described.

The tape 16 is pulled from reel 5 and passed under roller 17 and over the light gate 18. The tape runs on drive roller 3 and under the spring-actuated idler 19 to the take-up reel 4. The take-up reel 4 is driven by a suitable spring belt connected to the variable speed motor which drives the roller 3, so that when the motor is started the tape 16 is pulled off reel 5, over the light gate 18 and is wound up on the take-up reel 4.

The slidable shield 36 in the light gate is adjusted so that the inked line on tape 16 is directly over the aperture 41 in the shield. The main switch 50 on panel 2, which is connected to any suitable source of alternating current, is turned on, as is also the switch 51 controlling the operation of the variable speed motor. Any suitable means, such as a control knob 52, may be provided for regulating the speed of the motor as desired.

The drive roller 3 pulls the tape over the light gate, and the tape 16 is wound up on reel 4. When the telegraph code which is printed on tape 16 passes over the light gate, the periodic displacement of the inked line permits light to strike the photoelectric cell 43 as previously described. Light striking the cell 43 causes the oscillator 46 to oscillate. The length of the displacement of the inked line on tape 16 determines the period of oscillation of the oscillator. Whenever the inked line on tape 16 blocks the aper-

ture 41 in shield 36 light no longer strikes the photoelectric cell 43, and at such times the oscillator stops oscillating. Thus by having different lengths of displacement of the inked line on tape 16, the oscillator 46 will necessarily oscillate at different time intervals, thereby producing the dots and dashes of the telegraph code in the form of audible signals which may be suitably amplified for actuating a loud speaker or any number of head phones as indicated in Fig. 9.

The use of a variable speed motor enables the speed of reproduction to be changed at will. Increasing the speed of the motor causes more dots and dashes to be reproduced in a given time than when the motor runs at a slower speed. The motor speed may be varied over a wide range by means of the control knob 52 on panel 2. In using standard tapes, printed at twenty words per minute, it is possible to reproduce at a speed from five words per minute up to sixty words per minute.

When a single track tape such as that shown in Fig. 7 reaches the end of its run, the tape is rewound upon take-up reel 5 by turning the hand crank 13 in a clockwise direction as viewed in Fig. 1, after which the full take-up reel 5 may be run over again or else removed and replaced by a new reel.

If desired, however, I may use a tape such as that shown in Fig. 8, which has two series of signal lines printed thereon. In such case the full reel 4 may be removed from the take-up side of the machine and placed on the rewind side, and the machine started to reproduce as before. In such case the slidable shield 36 is adjusted to bring the aperture 41 into position to reproduce the second inked line on the tape instead of the first.

In the machine shown in Fig. 1 the volume of the reproduced signals is controlled by a recessed screw driver adjustment 53 which is mounted on the front panel 2 adjacent the monitoring jack 54 which may be provided for monitoring purposes. Also, as shown in Fig. 9, the switch 48 may be actuated to cut out the photoelectric cell 43 and to connect a manually operated telegraph key 55 to the oscillator circuit when it is desired to transmit signals by hand.

The invention claimed is:

1. In a system for transmitting electrical impulses in accordance with indicia on a movable tape, a light gate comprising a housing adapted to receive a photoelectric cell, said housing having an opening which extends therethrough and in which said tape is adapted to run, a light shield slidably mounted in said housing and containing an aperture lying within the field of said opening so as to be traversed by the tape running past said opening, and means for adjusting the position of said aperture in said opening.

2. In a system for transmitting electrical impulses in accordance with indicia on a movable tape, a light gate comprising a housing adapted to receive a photoelectric cell, said housing having an opening which extends therethrough and in which said tape is adapted to run, a light shield slidably mounted in said housing and containing an aperture lying within the field of said opening so as to be traversed by the tape running past said opening, said aperture corresponding in size to the width of the indicia on said tape, and means for adjusting said shield longitudinally of said housing to vary the position of said aperture transversely with respect to said tape.

3. In a system for transmitting electrical impulses in accordance with indicia on a movable tape, a light gate comprising a cylindrical housing adapted to receive a photoelectric cell, said housing having an opening which extends there-through and in which said tape is adapted to run, a cylindrical light shield slidably mounted in said housing and containing an aperture lying within the field of said opening so as to be traversed by the tape running past said opening, said aperture corresponding in size to the width of the indicia on said tape, and means for adjusting said shield longitudinally of said housing while preventing it from rotating therein.

4. In a system for transmitting electrical impulses in accordance with indicia on a movable tape, a light gate comprising a cylindrical housing adapted to receive a photoelectric cell, said housing having a peripheral groove containing an opening which extends through said housing and in which said tape is adapted to run, a close-fitting cylindrical light shield slidably mounted in said housing and containing an aperture lying within the field of said opening so as to be

traversed by the tape running through said groove, said aperture corresponding in size to the width of the indicia on said tape, and means for adjusting said shield longitudinally of said housing while preventing it from rotating therein.

5. In a system for transmitting electrical impulses in accordance with indicia on a movable tape, a light gate comprising a cylindrical housing adapted to receive a photoelectric cell, said housing having a peripheral groove containing an opening which extends through said housing and in which said tape is adapted to run, a close-fitting cylindrical light shield slidably mounted in said housing and containing an aperture lying within the field of said opening so as to be traversed by the tape running through said groove, said aperture corresponding in size to the width of the indicia on said tape, and a cooperating slot and pin connection on said shield and housing permitting said shield to be adjusted longitudinally of said housing while preventing it from rotating therein.

EDWIN F. STEVENS.