

April 14, 1936.

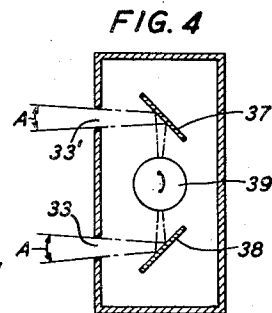
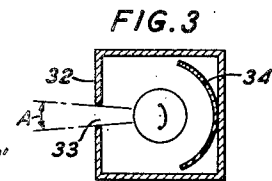
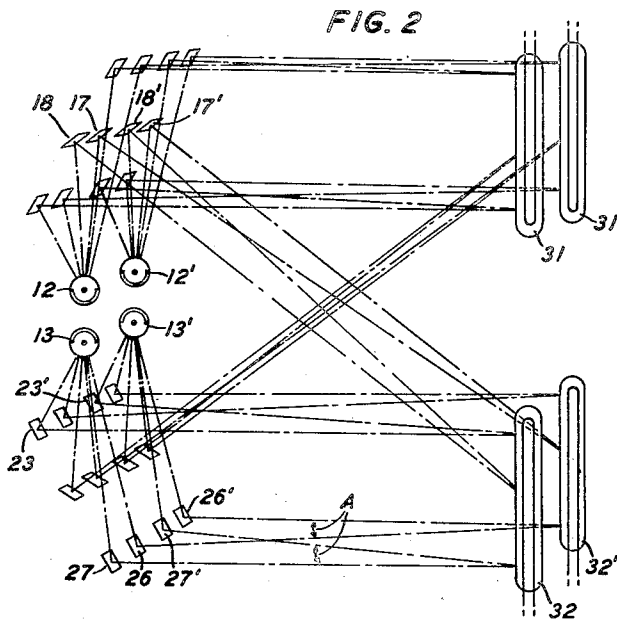
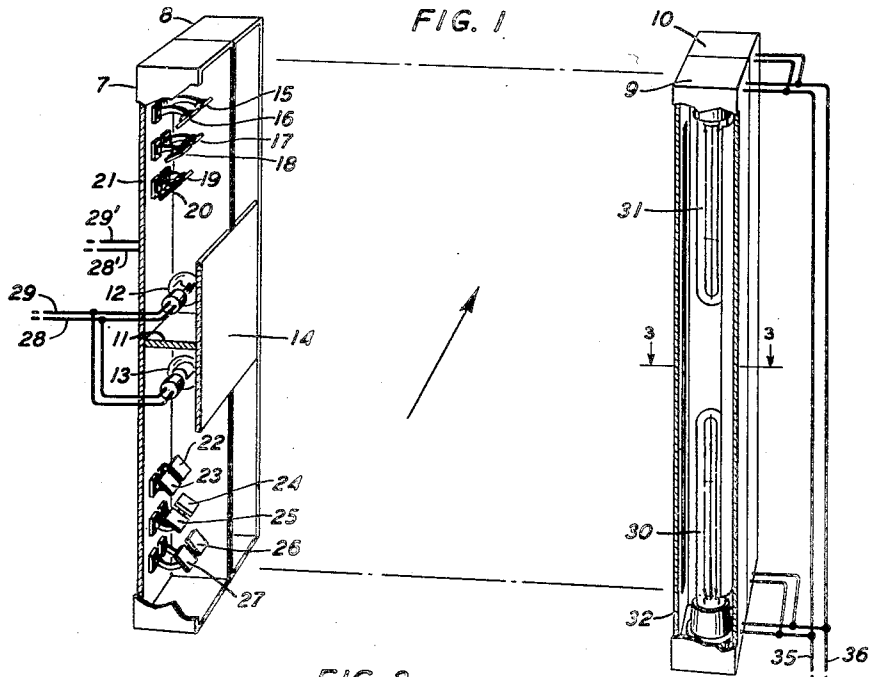
F. E. BACKER

2,037,191

REGISTERING DEVICE

Filed Sept. 30, 1932

2 Sheets-Sheet 1



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FIG. 5

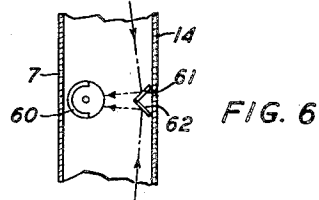
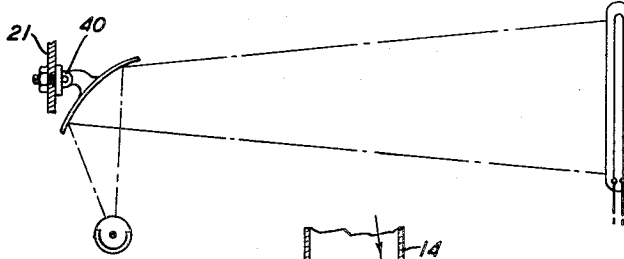
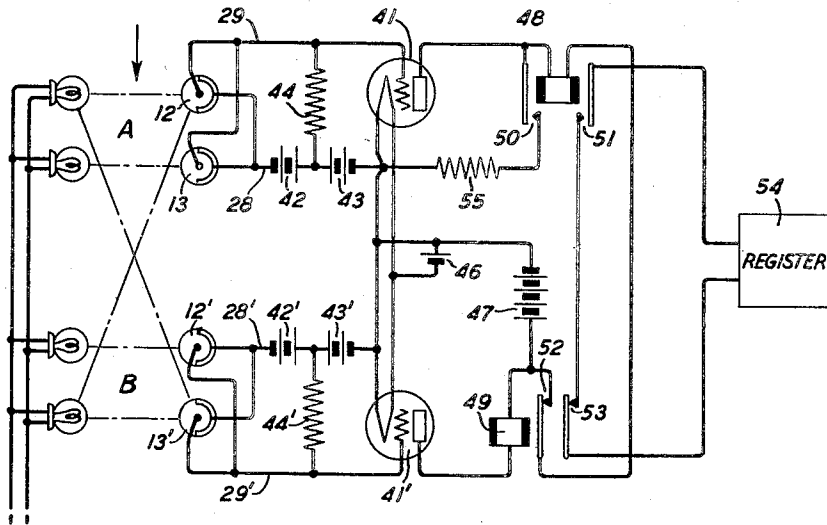


FIG. 7



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# UNITED STATES PATENT OFFICE

2,037,191

## REGISTERING DEVICE

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mesne assignments, to Western Electric Com-  
pany, Incorporated, a corporation of New York

Application September 30, 1932, Serial No. 635,506

8 Claims. (Cl. 250—41.5)

This invention relates to apparatus for auto-  
matically counting or registering persons or ob-  
jects passing a selected point and more partic-  
ularly to such apparatus employing light sensi-  
5 tive cells.

An object of the invention is to provide a light  
responsive counting device for registering the  
number of persons or objects passing a selected  
point which is of simple construction, reliable in  
10 operation and proof against fraudulent manip-  
ulation.

One feature of the present invention provides  
on one side of a passageway a source of light pro-  
jecting a sheet or curtain of light normal to the  
15 path of the persons or the objects to be counted  
and means on the opposite side of the passage-  
way for intercepting and reflecting light from a  
plurality of points in the light sheet, or curtain,  
on a light sensitive cell controlling a counting  
20 mechanism, thereby rendering the counting de-  
vice less sensitive to partial interruptions of the  
light screen.

Another feature of the invention provides two  
light screens and two light sensitive devices, one  
25 for operating the counting mechanism when the  
light screens are interrupted successively by a  
person or an object passing in one direction, and  
the other for rendering the counting mecha-  
nism inoperative when the light screens are in-  
30 terrupted successively in the opposite direction,  
both light sensitive devices being under the con-  
trol of both light screens.

Still another feature of the invention provides  
a light sensitive device for controlling a counter  
35 circuit and a separate light sensitive device for  
controlling a guard circuit and means associated  
with the counter circuit to prevent additional  
count after the counter has been operated until  
the light is shut off from the light sensitive de-  
40 vice controlling the guard circuit.

In accordance with one embodiment of this in-  
vention there is provided on one side of a passage-  
way two adjacent sources of light which project  
45 vertical sheets of light across the passageway  
on two sets of reflectors which direct the light  
from each source on two adjacent photoelectric  
units, one for operating a registering circuit and  
the other for operating a guard circuit which  
50 limits the operation of the device to the count-  
ing of persons or objects when they move in one  
direction only.

Referring to the drawings:

Fig. 1 is a perspective view of the optical ap-  
paratus of the counting device in accordance  
55 with the invention showing the units partly in

section and their relative positions when installed  
on opposite sides of a passageway;

Fig. 2 shows diagrammatically the optical sys-  
tem;

Fig. 3 is a cross-section of one light unit 5  
through 3—3 of Fig. 1;

Fig. 4 is a horizontal section through an al-  
ternative form of light unit;

Fig. 5 shows a modified form of reflector for  
the optical system;

Fig. 6 is a partial longitudinal section of a  
modification of the photoelectric unit; and

Fig. 7 shows diagrammatically a circuit suit-  
able for use with the invention.

As shown in Fig. 1 there are on one side of 15  
a passageway such, for example, as that used  
for keeping persons entering a theater or other  
places of amusement in single file for the pur-  
pose of collecting tickets, two similar light sensi-  
tive or light detecting units 7 and 8. On the 20  
opposite side of the passageway there are two  
similar light sources or light units 9 and 10 which  
project two vertical sheets or curtains of light  
across the passageway on the detecting units.

The light sensitive unit 7 comprises a casing 25  
or hollow column having an open side facing  
the passageway and the light unit 9. Midway  
between the top and the bottom of the casing  
is a horizontal opaque partition 11 on opposite  
sides of which are two photoelectric cells 12 30  
and 13 which are protected from the direct rays  
of the light units 9 and 10 by means of an opaque  
screen 14. In the upper end of the casing and  
adjustably secured, by any suitable means, to the  
back 21 thereof are six similar mirrors 15 to 35  
20, inclusive, adjusted as hereinafter described  
to reflect the light downwardly on the photo-  
electric cell 12, and in the lower end of the cas-  
ing are six similar mirrors 22 to 27, inclusive,  
to reflect the light upwardly on the photoelectric  
40 cell 13. The unit 8 is identical with unit 7 with  
the exception of the adjustment of the mirrors.  
The photoelectric cells 12 and 13 are connected in  
multiple to the counting circuit by means of con-  
ductors 28 and 29 and the photoelectric cells 12' 45  
and 13' of unit 8 are connected in multiple by  
means of conductors 28' and 29' to the guard  
circuit.

The light unit 9, as shown, comprises a vertical  
casing or hollow column in which are secured 50  
two long counter lamps 30 and 31 one standing  
upright on the base of the casing and the other  
depending from the top. They project a vertical  
sheet of light practically the height of the unit.  
The front of the casing is provided with a verti- 55

cal slit or opening 33 and behind the lamps is a vertical reflector 34. The light unit 10 is identical with light unit 9 and all of the lamps are connected in multiple to a suitable current supply by means of conductors 35 and 36.

In Fig. 4 there is shown an alternative arrangement for the light units 9 and 10. This has one light source for both light screens making use of two long vertical mirrors 37 and 38 on each side of the lamp to reflect the light through the openings 33 and 33'. These mirrors may be considered as separate light sources.

Fig. 2 represents diagrammatically the optical system of the arrangement shown in Fig. 1. For purposes of illustration and to simplify the description three points have been selected on each of the lamps and the mirrors adjusted accordingly. It will be noted that the light from the lower point of lamp 32 is reflected on the photoelectric cells 13 and 13' by mirrors 27 and 27' respectively. (The prime characters represent elements in the photoelectric unit 8 and the light unit 10 similar to those in units 7 and 9, respectively, of the same numbers.) The light from the central point of lamp 32 is reflected on the photoelectric cells 12 and 12' by mirrors 18 and 18', respectively, and the light from the upper point is reflected on cells 13 and 13' by mirrors 23 and 23', respectively. In a similar manner the transmission of light may be easily traced from the three selected points on the lamps 32', 31 and 31'. Actually even with plane mirrors as shown in Fig. 2 the light from a substantial length of filament is reflected. In practice it is also preferable to adjust the mirrors so that they reflect light from different portions of the filament. Practically all the light is then utilized and the interruption of the light from any one lamp or portion thereof on any cell will not necessarily exclude the light from that lamp from any other cell. The number of reflectors depends upon the degree of sensitivity required, the more light reflected the less sensitive the device and therefore the more difficult it is to defraud by intercepting the light with small objects such as the foot or the hand. The angle A of each wedge-shaped screen should be sufficient for the light to cover the mirrors intended to reflect it in each unit. The least sensitivity may be obtained by using curved mirrors as shown in Fig. 5 to reflect the light from substantially every point of the source on the photoelectric cell. Suitable curved mirrors may be made of chromium-plated or silver-plated sheet metal or other suitable material. Each mirror is preferably adjustable with respect to the light source. This may be accomplished by any suitable arrangement as a ball and socket joint or as shown in Fig. 5 where a vertical adjustment may be had by a friction hinge 40 and a rotatable adjustment may be had by means of a screw through the back 21 of the casing.

Fig. 6 shows a modification of the cell units 7 and 8 of Fig. 1 in which only one cell 60 is used in each unit with two mirrors 61 and 62 for directing the light from the upper and lower mirrors, respectively, as indicated by the arrows.

In Fig. 7 which shows one circuit arrangement suitable for use in the invention there are two photoelectrically controlled circuits, namely, the counter circuit A and the guard circuit B. In the counter circuit A the cells 12 and 13 are connected in parallel in the input circuit of the amplifiers 41 and in series with opposing batteries 42 and 43. Connected between the common ter-

minal of batteries 42 and 43 and the grid of the amplifier is a grid resistor 44. This circuit arrangement is commonly known as the "reverse circuit", that is, when the cell is illuminated the current in the plate circuit is substantially zero. The input circuit of the amplifier 41' in the guard circuit B is identical with that of the counter circuit A. The filaments of both amplifiers 41 and 41' are supplied with current from the battery 46, and the plate potential of the amplifiers is derived from battery 47 in series with relay 48 in the counter circuit and in series with a relay 49 in the guard circuit.

The relay 48 is provided with two sets of normally open contacts 50 and 51 and the relay 49 is provided with two sets of normally closed contacts 52 and 53. Contacts 52 are in series with the winding of relay 48 and open and close the plate circuit of amplifier 41. The normally closed contacts 53 and the normally open contacts 51 are in series with each other and with a counter 54 including its own source of current, not shown. The contacts 50 in series with a resistance 55, the relay winding and the battery 47, and the contacts 52 provide a holding circuit for the relay 48.

Under normal operating conditions the light sensitive cells 12 and 13, and 12' and 13' are illuminated and the negative bias on the grid due to the drop of potential across the grid resistors 44 and 44' is sufficient to prevent current from the batteries 42 and 42' from flowing through the plate circuit of the amplifiers 41 and 41', respectively. When the light cells are dark no current flows through the grid resistors 44 and 44' from the batteries 42 and 42'. The grids then have a positive bias due to the batteries 43 and 43' and current will flow in the plate circuit.

The operation is briefly as follows: A person or object passing in the direction indicated by the arrow will first interrupt the light falling on cells 12 and 13 in the counter circuit A. Relay 48 will then be energized and contacts 50 and 51 will be closed, the latter operating the counter 54 and the former completing a hold-up circuit for the relay 48 through the resistance 55, the battery 47, relay contact 52 and the relay winding. The object of the hold-up circuit is to prevent the subsequent operation of the counter until a person in passing has interrupted the light from cells 12' and 13' when relay 49 will be energized and open both the circuits through counter 54 and the relay 48. After the person passes the light sensitive cells 12' and 13' light again falls on all cells and the circuit returns to normal. The guard circuit B also prevents the operation of the counter by a person going in the opposite direction. If, for example, the light is first interrupted from the cells 12' and 13' the counter circuit being normal, relay 49 is energized and the contacts 52 and 53 are opened thus preventing the operation of relay 48 and the counter 54. It will be seen, therefore, that the device is unidirectional and that the counter cannot be operated successively by simply cutting off the light from the cells in the counter circuit. In practice the two light columns should be as close together as practicable and the cell units should also be close together so that the person or object in passing will at some instant cut off the light from all of the cells.

Although a device has been shown and described as a battery operated device, it may be modified in a manner well known to those skilled in the art of vacuum tube circuits so that it may

be used on a direct or alternating current lighting system.

What is claimed is:

1. A counting device for registering the number of persons or objects passing a selected point in one direction only comprising a source of light, means for projecting the light beam from said source in the form of a vertical sheet across the path of the person or the object, a circuit including a counter, a light sensitive unit for controlling said circuit and counter, said unit being disposed on the opposite side of the path from the light source, and means disposed above and below said unit for intercepting and reflecting the light rays from a plurality of spaced points in said beam and focusing them on said unit.
2. A counting device for registering the number of persons or objects passing a selected point in a given direction, a source of light means for projecting the light beam from said source in the form of a vertical sheet across the path of the person or the object, a circuit including a counter and a photoelectric cell for controlling said counter, said cell being disposed on the opposite side of the path from said light source, and means disposed above and below said cell for intercepting and reflecting the light rays from a plurality of points in said beam and focusing them on said cell.
3. A counting device for registering the number of persons or objects passing a selected point in one direction only, means projecting two vertical sheets of light normal to the path of the person or the object, a circuit including a counter and a light sensitive unit controlling the counter, a second circuit including a separate light sensitive unit for preventing the operation of said counter by said first circuit when a person or object passes in the opposite direction, and means reflecting and directing the light from each light sheet on both of the light sensitive units.
4. A counting device for registering the number of persons or objects passing a selected point, comprising a light source on one side of said point, means for projecting a vertical sheet of light from said source normal to the path of the person or object passing said point, a register, two light sensitive devices operably associated with said register opposite said light source, and means disposed substantially vertical above and below said light sensitive devices for reflecting the light rays from various points of said source on each of said devices.
5. A counting device for registering the number of persons or objects passing a selected point

in one direction only, comprising a register, a light sensitive unit and a light source defining a path, a housing for said light source having an elongated vertical slit through which is projected a vertical sheet of light, said light sensitive unit comprising an elongated vertically disposed casing, a plurality of light sensitive cells disposed between the ends of the casing, means for shading said cells from the direct rays of said source, a partition between said cells and reflecting means at each end of said casing for reflecting and directing rays of said source on each of said cells, and means associated with said cells for operating said register.

6. A counting device for registering the number of persons or objects passing a given point comprising a counting circuit having a light sensitive cell, a relay controlled thereby and a counter controlled by said relay, a holding circuit for said relay to prevent the false operation of said counting circuit, and a guard circuit including a second light sensitive cell and a second relay controlled by said second cell for opening said holding circuit to release said first relay and conditioning said counting circuit for subsequent operation.

7. A counting device for registering the number of persons or objects passing a selected point in one direction only, comprising a register, two light sensitive units disposed side by side and two light sources disposed side by side forming with said light sensitive units a passageway, means for projecting a light beam in the form of a vertical sheet of light from each of said light sources on each of said light sensitive units, means associated with one of said light sensitive units for operating said register when an object passing in one direction interrupts the light on that unit, and means associated with the other light sensitive unit for preventing the operation of said register when an object passing in the opposite direction interrupts the light on said other unit.

8. A counting device for registering the number of persons or objects passing a given point comprising a light unit, a light sensitive device, said unit and said device defining a passage and a circuit including a counter and said light sensitive device, said light unit comprising elongated light sources disposed vertically, means for supporting said light sensitive device substantially midway between the uppermost and the lowermost horizontal rays from said sources and means for deflecting, substantially said rays and other rays therebetween on said light sensitive device.

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