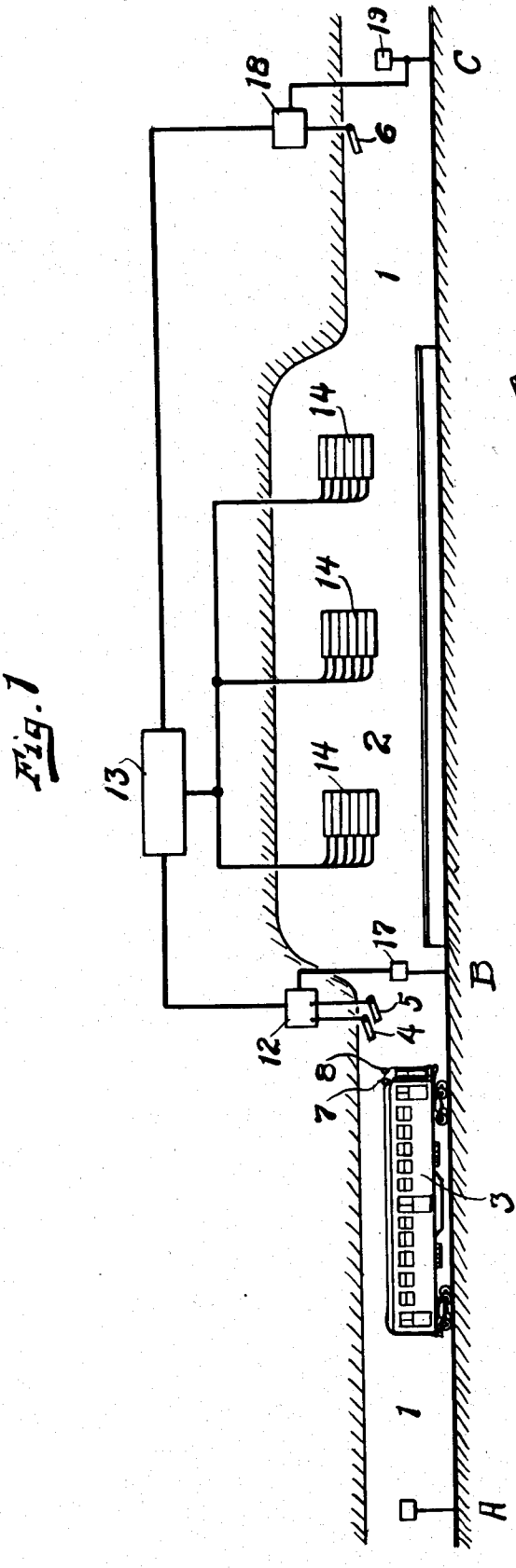
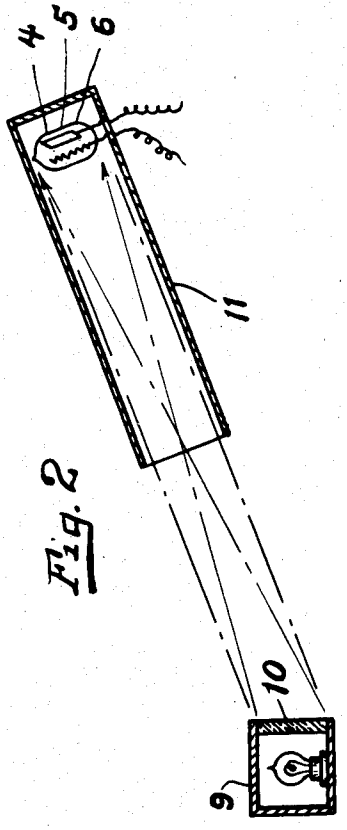
Jan. 5, 1932. M. BERGSTEIN 1,840,014

TRAIN INDICATOR SYSTEM

Filed March 22, 1928 2 Sheets-Sheet 1





INVENTOR
Milton Bergstein

By

Otto Raty
ATTORNEY

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TRAIN INDICATOR SYSTEM

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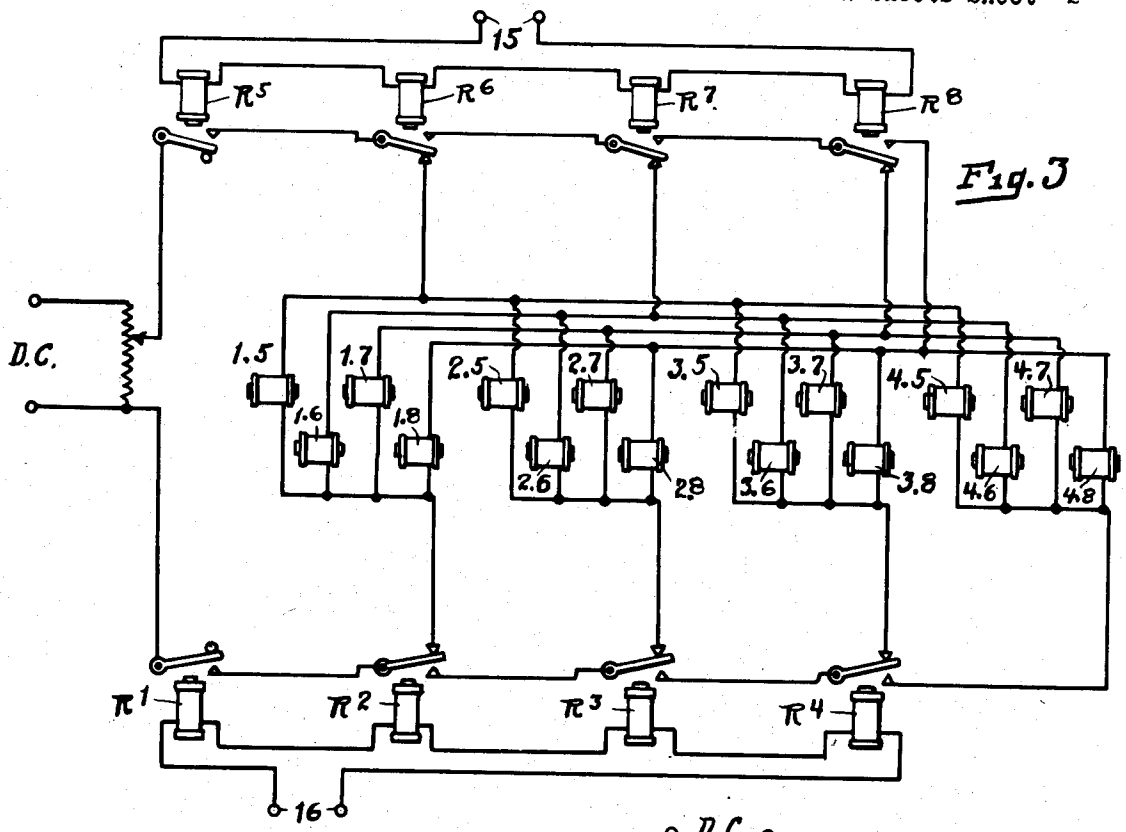


Fig. 3

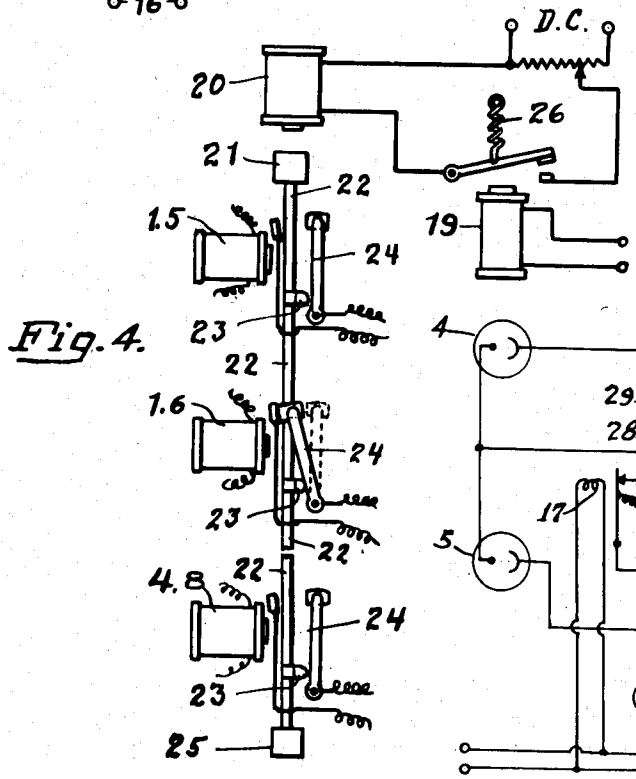
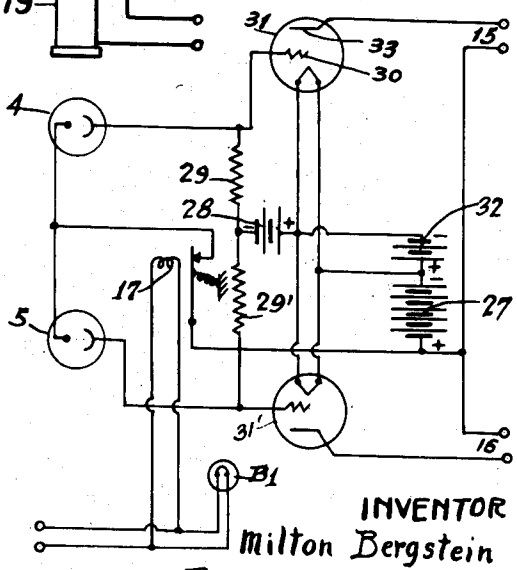


Fig. 4.

Fig. 5.



INVENTOR
Milton Bergstein
By. Otto Raty
ATTORNEY

Patented Jan. 5, 1932 1,840,014

UNITED STATES PATENT OFFICE

MILTON BERGSTEIN, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO RADIO PATENTS CORPORATION, OF NEW YORK, N. Y.

TRAIN INDICATOR SYSTEM

Application filed March 22, 1928. Serial No. 263,856.

This invention refers to an automatic system for indicating the destination of a train such as a subway train.

The object of this invention is to provide means for making the entrance of a train to the station operate a train indicator in such a way that the destination or other information relative to the train can be readily seen by people at the station.

Another object of this invention is to utilize photo-electric cells for the purpose of signalling in connection with traffic control.

A further object of this invention is to provide systems of relays dependent on photo-electric cells to selectively distinguish between signal lights of different colors.

A further object of this invention is to tie up a train indicator system with a track signal system in such a way that the operation of the train indicator system is safeguarded against improper sequence of signals.

Still another object of this invention is to provide means for releasing and resetting the train indicator system after its function has been performed.

I have described my invention in reference to the appended figures, in which

Fig. 1 is a diagrammatic representation of my system as applied to subway train indicators,

Fig. 2 is the arrangement of photo-electric cell and signal lights which I employ for the purpose of signal control,

Fig. 3 is a diagram of connections of the relay arrangement for operating train indicators,

Fig. 4 is a diagram of a relay which I employ for the release of the train indicator system after its function has been performed, and

Figure 5 shows the circuit connections between the photo-electric cells, the amplifiers and the track signaling system, which is a detail of the parts illustrated in Figure 1.

Fig. 1 illustrates diagrammatically the subway (1) with a station (2) and entering train of which the leading vehicle (3) is shown. Three cells are used in connection with each system of signs, two of them (4 and 5) are placed above the tracks at the entrance to the station, and the third (6) similarly at the exit from the station. They are shielded and located in such a way that the only light of reasonable intensity which affects either of them is one of the two colored lights (7 and 8) on the top front of the train entering the station. Each light affects one cell only. These cells are located between two successive track signals A and B at the entrance to the station and less than a car's length distant from the second signal. These track signals may be operated by any well known track signal system such as a block signal system. Both track signals will be at red (danger-stop) position when a train is at the station ahead. When the train pulls out and the line is clear they will change to green (or yellow). When the train (3) pulls into the station (2), the following events take place:

As it goes past the first signal light A the latter turns red, thus preventing other trains from going past that point and reaching the photo-electric cells before these cells are properly reset, as explained later. When the leading car reaches the two cells its own signal lights (7 and 8) set up a momentary photo-electric current in these cells.

Referring to Fig. 2, illustrating the signal lights on the train, in the device here indicated it is assumed that the light source (9) is fairly constant in intensity and that it is covered by glasses of different colors (10) to give different color effects. In the system according to the present invention it will be found that these lights "of different colors" also have different effects on the photo-electric cells (4, 5, and 6). The color determines the strength of the photo-electric current within narrow limits. To minimize the effect of the distance of the signal light from the cell, the cells may be arranged to focus on the light in one position, only for instance, by means of a hood (11) directed towards the signal lights as they pass at a close distance. Moreover as explained below, the operation is dependent only on the maximum of the current obtained during the impulsing interval which corresponds in each case to the definite minimum distance of the signal light from the cell. This photo-electric cur-

rent is amplified (in amplifiers 12 of Fig. 1) and allowed to flow through a number of relays in series sensitive to different strengths of current. These relays may be assembled in a bank indicated as 13 in Fig. 1 to operate the corresponding train indicators (14) arranged at different points along the station platform.

Fig. 3 shows in detail the manner of connecting the different relays for their proper operation. The incoming leads (15) are supplied by the amplifiers operated by one of the cells, say 4, while the leads 16 are similarly controlled by the other cell 5.

Assume relays R_1 and R_5 operate on 3 milliamperes; R_2 and R_6 on 4 milliamperes; R_3 and R_7 on 5 milliamperes; R_4 and R_8 on 6 milliamperes. These values are taken at random. It is not assumed that color screens of such quality will be found that the photo-electric currents produced will differ from each other with such regularity as here indicated. But in any case, each pair of relays is adjusted to be responsive to the value of current derived due to one of the signal colors, while the color giving next lower value would leave them unaffected.

The system of relays as illustrated may be extended to more than four colors.

If one cell is affected by a light which will give 4 milliamperes in the amplified stage and the other by a light which will give 6 milliamperes in the amplified stage, then relays R_1 and R_2 on one hand and R_5, R_6, R_7, and R_8 on the other hand will be momentarily actuated. This will cause heavy duty relay 2.8 to be actuated momentarily, its armature (not shown) will be pulled over and the proper sign lighted, by means of a circuit (not shown) closed by the movement of this armature.

The train indicator signs illustrated diagrammatically as 14 in Fig. 1 may consist in the usual manner of elongated boxes containing electric lamps with translucent fronts on which, stencilled or painted names of stations or other information appears when the corresponding lamps light up. Any desired information can be thus communicated, to the people on the platform. It is of course possible to have the same heavy duty relay (such as 2.8 above) control directly or through other relays a number of sign boxes, each with its own legend.

The circuit connections from the photo-electric cells 4 and 5 to the amplifiers and from there to the terminals 15 and 16 of selective relays of Figure 3, is illustrated in Figure 5. It will be seen that two separate amplifiers are provided for each of the photo-electric cells. The amplifiers are shown as single stage, although two or more stages may also be supplied if necessary. The operating voltage for the photo-electric cells 4 and 5 is supplied by the anode battery 27, the heating battery 32 and the grid biasing battery 28 of the vacuum tubes, all three being connected in series in respect to the photo-electric cells. The photo-electric currents through the cells may be traced as follows:— from the anode of the cells through the resistances 29 or 29′ respectively through the grid battery 28, heating battery 32, anode battery 27, contacts of relay 17, back to the cathodes of the cells. This voltage is applied in series with resistances 29 and 29′ respectively for the photo-electric cells 4 and 5. On exposure to illumination of cell 4, a current will flow through this cell and raise the potential drop through the resistance 29, thus reducing the potential at the grid 30 of the vacuum tube 31. This vacuum tube as well as vacuum tube 31′ for cell 5, is supplied with filament power from the battery 32 and with plate power from the battery 27. The plate 33 of tube 31 is connected to one of the terminals 15, while the other terminal returns to the plate battery 27. The connection of the tube 31′ is identical with reference to cell 5 and terminal 16. This figure also illustrates the red track signal light B_1 of the track signal which is marked B on Figure 1. In parallel with this red light, there is the relay device 17 which corresponds to Figure 1 arranged to open the circuit to the photo-electric cells 4 and 5 and thus render them inoperative after the passage of the train 3 past the track signal B when the latter has turned red.

Referring again to Fig. 1, when the leading car passes the second track signal light B it flashes red and the same circuit which operates this track signal may actuate a relay represented diagrammatically as 17, opening the photo-electric cell circuits, for instance in the amplifier assembly 12. The construction of heavy duty relays (such as 2.8) as described above, is such that it remains set until released by special means to be described below.

Some few feet past the exit to the station there is the third photo-electric cell 6, referred to before. It is in the roof of the subway in line with one of the signal lights on the leading car and so shielded and located as to be affected only by it. It is connected through amplifiers 18 to a sensitive relay 19 in Fig. 4. The amplifier 18 may be identical to the amplifier 12 illustrated in Figure 5 except that duplicate circuits are not necessary since there is only one photo-electric cell. When the light of the leading car passes it, it actuates this relay momentarily. This relay actuates momentarily a second relay 20 shown in Fig. 4, which is mounted in the relay bank 13. This draws up an armature 21 together with a light aluminum rod 22. This rod has on it a series of insulated pins 23 which open any armatures 24 of the heavy duty relays which may be in

contact position, and thus turn off the light on the sign previously lighted. The armature 21 and rod 22 then fall back into their original position, controlled say, by weight 25, as the armature of relay 19 is released by any suitable means such as spring 26 with the passing of the train and of the consequent action of the cell 6.

At stations where trains follow each other very closely it may be advisable to have in this latter photo-electric circuit also a breaking switch (not shown) actuated by a relay in the circuit of the next track signal light C. The connection of this relay to the track signal light C, is identical to the connection of relay 17 to the track signal B as illustrated in Figure 5 and it performs a similar function in the photo-electric circuit. The reason for this is obvious. If this precaution is not taken a light on one of the following cars may turn off the sign lighted for the next incoming train while the latter is still pulling into the station. Such precautions, however, may not be necessary where the train signal lights are built into the car. This precautionary break switch is closed again when the red lights on the track are turned green by the proper functioning of track signal system, thus permitting the signal lights of the next train leaving the station to have the same effect as described above.

A photo-electric cell may be connected to an amplifying device in two different ways. First: Light falling on the cell may cause an increase of current in a secondary circuit proportional to the intensity of the incident light. Second: Light falling on the cell may cause a decrease of current in a secondary circuit proportional to the intensity of the incident light. In the diagrams shown (such as Fig. 3) it has been assumed that the photo-electric cell is connected in the first way although it is specifically understood that a system based on the second method can just as well be constructed using a proper arrangement of connections.

With four different colors of light sixteen different signs may be controlled. However, it is not necessary to have a system as complicated as this where fewer than that number of signs are required. Some local stations may need only one photo-electric cell at the entrance and one at the exit. A complicated case has been considered. Simplifications depend upon the special conditions in effect at each station and on each track. It is very unlikely that any one track will carry enough different traffic to require a system as complicated as indicated.

The system may, of course, be used for elevated trains at night and might be adapted for day-time use if strong enough signal lights and properly shielded cells be used. The system may also be adapted for automatic switching devices in subways and in this application it would be much simpler in design and very efficacious. For such an arrangement, it may be desirable to locate the signal lights on or near the track and the light sensitive devices and associated controls on the train.

Having described my invention, what I believe to be new and desire to secure and protect by Letters Patent of the United States is:—

1. A system of indicating trains having distinctive signal lights, comprising means near a station responsive to said signal light, selector mechanism to differentiate between these distinctive signals, indicator signs at a station and operating means associated with said selector mechanism to indicate each train by a sign corresponding to the distinctive signal lights.

2. A system of indicating trains comprising distinctive signal lights on trains, light sensitive devices responsive to said signal lights, and means actuated by said light sensitive devices to indicate each train by a distinctive sign.

3. A moving vehicle signalling system comprising distinctive light signals predetermined in relation with vehicle traffic control, light sensitive devices responsive to said signals, and means controlled by said light sensitive devices to operate a mechanism corresponding to said light signals.

4. A moving vehicle signalling system comprising distinctive light signals predetermined in relation with vehicle traffic control, light sensitive devices responsive to said signals, and means in operative relation to said light sensitive devices to differentiate between said distinctive light signals to operate a mechanism distinctively in accordance therewith.

5. A moving vehicle signalling system comprising distinctive light signals predetermined in relation with vehicle traffic control, light sensitive devices responsive to said signals, means associated with said light sensitive devices distinctively responsive to said light signals and operative mechanism controlled by said responsive means, in accordance to the light signals.

6. A system as in claim 3 and a track control system with means operatively related to it to safeguard against incorrect operation of the system.

7. A system of indicating trains comprising distinctive signal lights on trains, light sensitive devices near the track responsive to said signal lights, means associated with said light sensitive devices to differentiate between said distinctive light signals, comprising relays in operative relation to said light sensitive devices, and other signals controlled by said relays to indicate the train.

8. A system of indicating trains having distinctive signal lights comprising light

sensitive means near a station responsive to said signal lights, selective relays operatively related to said light sensitive means to differentiate between said distinctive light signals, train indicator signs, and other relays controlled by said selective relays to indicate the train in accordance to said light signals.

9. A system of indicating trains having distinctive signal lights comprising light sensitive means near a station responsive to said signal lights, electrical amplifiers for said light sensitive devices, relays selectively responsive in accordance with the magnitude of current delivered by said amplifiers, groups of train indicator signs and individual relays corresponding to each group of signs in operative relation to said selectively responsive relays to indicate the train in accordance with the light signal.

10. A system as in claim 8, with means in operative relation with said signal lights for releasing said selective relays after passing of the train.

11. A system as in claim 8, with other light sensitive devices near the exit from the station, amplifiers and relays associated with said last light sensitive devices to release said other relays after passing of the train through the exit.

12. A system as in claim 8 with connections to the track signal system to control said system and thereby to guard against incorrect operation of said indicator signs.

13. In combination, a movable vehicle having a plurality of signalling lights thereon, a signalling system having stationary photo-electric cells arranged to be variably operated by said signalling lights as said vehicle moves by, means including marginal relays controlled by said light sensitive devices and mechanism corresponding to said signalling lights variably controlled by said last mentioned means in accordance with the operation thereof by said light sensitive devices.

14. In combination, a moving train, a plurality of signalling lights carried by said train for producing rays of light of predetermined intensity, photo-electric track devices cooperating with said signalling lights to produce electric currents of different intensity in accordance with said predetermined light intensities, a track indicator sign for said vehicle, a selector mechanism for operating said indicator sign by electric currents comprising two equal sets of serially connected marginal relays, each set being controlled by one of said currents, a further set of relays, and circuit means between said two sets of relays and said further set of relays for operating a distinct indicator sign depending on a distinct relation of said signalling lights.

15. In combination, a plurality of vehicles, a station therefor, radiant energy means arranged to be distinctively operated dependent on the character of a vehicle passing a point entering the station, means controlled in accordance with the operation of said radiant energy means for variably operating said indicators in accordance with the character of the vehicle entering the station.

16. In combination, a plurality of vehicles, a station therefor, indicators at said station individual to said vehicles, photo-electric light responsive means arranged to be variably operated in accordance with the character of vehicles passing a point entering the station and means controlled in accordance with the operation of said photo-electric responsive means for variably operating said indicators in accordance with the character of the vehicles entering.

17. In combination, a plurality of vehicles, a station, indicators at the station individual to said vehicles, radiant energy means carried by each of said vehicles, means arranged at the entrance of each station and variably operated by each of said radiant energy means on a vehicle in a distinctive manner for each vehicle and means controlled by said last means for variably operating the indicator individual to the entering vehicles.

18. In combination, a plurality of vehicles, a station, indicators at the station individual to the vehicles, radiant energy means carried by each of said vehicles, means arranged at the entrance of each station and variably operated by each of said radiant energy means on a vehicle in a distinctive manner for each vehicle, means controlled by said last means for variably operating the indicator individual to the entering vehicles and means at the exit from the station for restoring said indicator to its original condition.

19. In combination, a plurality of vehicles, a station, indicators individual to the vehicles, light emitting means carried by each of said vehicles, means arranged at the entrance of each station and variably operated by each of said light emitting means on a vehicle in a distinctive manner individual thereto and means controlled by said last means for variably operating the indicator individual to the entering vehicles.

20. In combination, a plurality of vehicles, a station, indicators individual to the vehicles, light emitting means carried by each of said vehicles, means arranged at the entrance of each station and variably operated by each of said light emitting means on a vehicle in a manner individual thereto, means controlled by said last means for variably operating the indicator individual to the entering vehicles and means at the exit from the station for restoring said indicator to its original condition.

In testimony whereof I have affixed my signature.

MILTON BERGSTEIN.