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AUTOMATIC COLLISION PREVENTION, ALARM AND CONTROL SYSTEM

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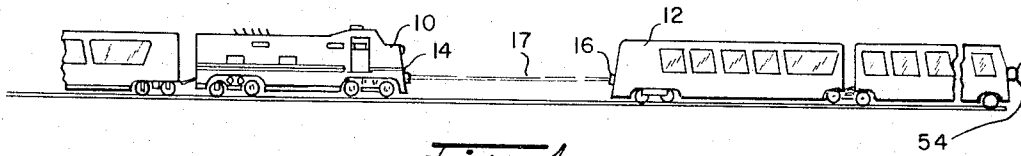


Fig. 1

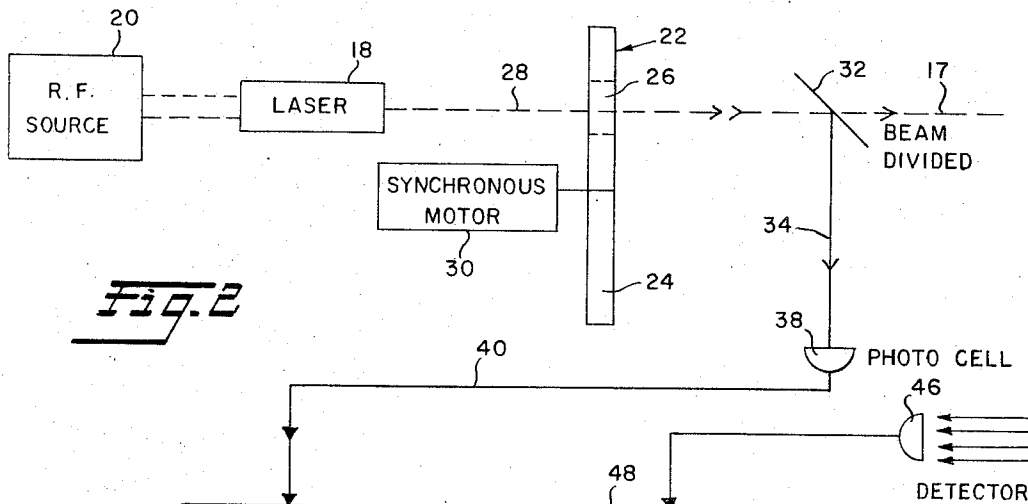


Fig. 2

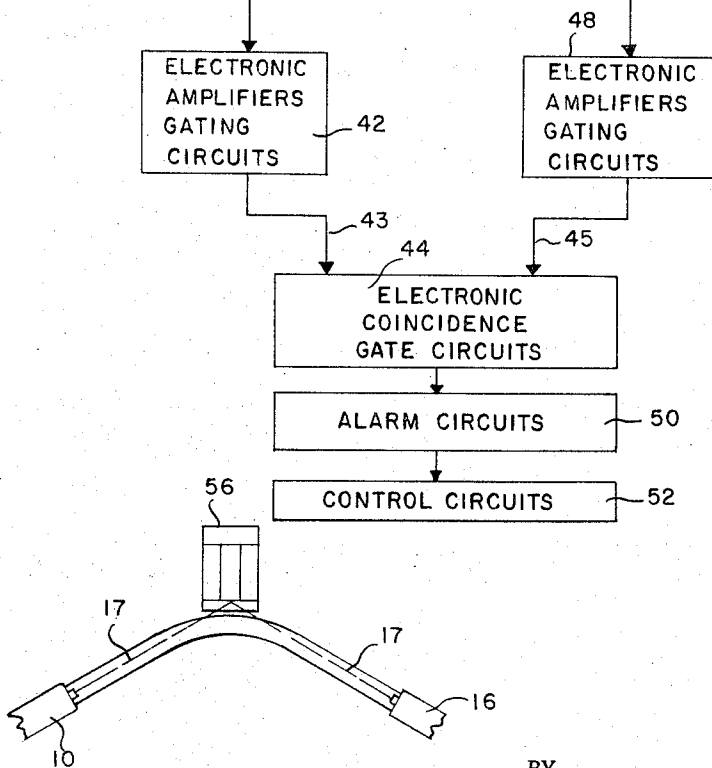


Fig. 3

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**AUTOMATIC COLLISION PREVENTION, ALARM
AND CONTROL SYSTEM**
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ABSTRACT OF THE DISCLOSURE

A collision prevention means for railroad trains comprising continuous beam lasers at each end of a train, whose beams are modulated and projected ahead of and rearwardly of a train and a pair of separate photo cell detectors for each laser, one of said detectors receiving only a reflected part of the modulated beam and the other of which is capable of receiving only a beam traveling toward the train parallel to the emitted beam, in combination with a coincidence circuit which becomes conducting only when it receives two substantially identical signals from the first and second detectors to operate alarm and/or control means on the train in time to prevent a collision.

Detailed description

This invention relates to railroad signaling systems and more particularly to an automatic alarm and control system particularly adapted to the prevention of collisions between railway vehicles.

Heretofore, there have been proposed train collision prevention systems which rely on the use of forwardly and/or rearwardly projected light beams but such systems have never been adopted as a practical matter because it has not been possible to project an undispersed light beam over a distance sufficiently far from the train so that a detector on a second train could detect and discriminate the projected beam from other stray light sources in time to operate appropriate collision prevention control means.

The broad object of the present invention is to provide a light beam responsive, collision prevention system which is capable of responding to a distant signal in ample time to prevent collision.

More particularly, it is an object of the invention to provide a train collision prevention system wherein the light beam source is a modulated laser beam and wherein a detecting system employed in conjunction with the transmitted laser is arranged to respond only to a received laser beam signal having substantially the same characteristics as the beam which is transmitted.

Other objects and their attendant advantages will become apparent as the following detailed description is read in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational view of two trains approaching each other, each being equipped with the signal and detection system of the present invention;

FIG. 2 is a diagrammatic view of the signal and detection system of the present invention; and

FIG. 3 is a horizontal schematic view illustrating the manner of use of the invention in connection with a railroad curve.

Referring now to the drawings, FIG. 1 illustrates two approaching trains 10, 12 on the front of each of which is a transmitter and detector broadly indicated by the numerals 14, 16 respectively. As will be explained in detail hereinafter, each of the trains transmits a signal, indicated by number 17, which is a modulated laser beam, and when the signal from each train is detected by re-

ceiving means on the other train alarms and/or controls are energized to stop the trains or to signal the existence of collision conditions.

Referring now to FIG. 2, the signaling system of the invention comprises a laser 18 which receives excitation power from an RF power supply 20. Desirably the power supply generates a radio frequency of 25 to 30 megacycles with a capacity of 5 to 10 watts output and would operate directly out of the power system available in railway engines or locomotives. Desirably the laser beam of light should act within the infra-red or red region of the light spectrum, and for an example of a particular laser suited to the mentioned power supply, reference is made to Bendix Corporation's model TL-1 helium-neon gas laser or its equivalent.

In order to eliminate ambiguities from stray light sources, the laser beam is modulated between on and off conditions at a pre-determined frequency rate which is desirably achieved through the use of a mechanical chopper generally indicated by the numeral 22. The chopper comprises a wheel 24 having an opening 26 therein which is driven past the laser beam 28 at a pre-determined rate by means of a synchronous motor 30 and produces a steady off and a steady on light signal emerging from the chopper. From the chopper, the light signal passes through a beam divider 32 which reflects approximately 10% of the light back to the locomotive as indicated by the line 34 while passing approximately 90% of the light forwardly in the form of a beam as indicated by the numeral 17.

The reflected beam 34 and the forwardly extending beam 17 are both alternating between fully off and fully on conditions at the identical rate due to the action of the chopper wheel 24, and placed in the path of the reflected beam 34 is a light detector, such as a photo cell 38, which is connected by suitable circuitry, indicated by the numeral 40, with conventional amplifying and gating circuits indicated by the numeral 42. The circuits 42 are connected to one input 43 of an electronic coincidence gate circuit 44 whose second input 45 is derived from a detector photo cell 46 which is connected to the input 45 through a second set of electronic amplifiers and gating circuits 48. From the following description of operation it will be apparent that the first detector 38 must be positioned so as not to receive any of the beam received by the second detector 46 and vice versa.

In operation, the front of every locomotive or train employed in a particular railway system is equipped with the system of the invention with the transmitting beam 17 and the detecting photo cell 46 being placed parallel to and in close adjacency with each other on the locomotive and facing directly ahead. Because it is assumed that all trains in the particular railway system are equipped with the present invention, each train, wherever it may travel, transmits directly ahead of it a laser beam which is flashing on and off at a fixed, pre-determined frequency which is identical for every installation. Thus, when two trains are approaching each other on the same track the coincidence circuit, which is already conditioned by the reflected signal derived from the photo cell 38 on the same locomotive is, upon reception by detector 46 of a signal transmitted by the oncoming train at the same frequency, rendered fully conducting to energize an alarm circuit 50 which may serve to warn the engineer audibly and visually of the danger of collision and, at the same time, automatic control circuits 52 may be operated to effect an emergency brake application or the automatic closing of the throttle. In any event, in a head-on approach situation safety signals will be received on each of the trains and both will respond in one fashion or another in ample time to prevent collision. The detector 46 may be ar-

ranged to admit a laser beam signal only, other light having no effect on the system.

Though the apparatus of the invention may be installed on both the front and rear ends of operational trains and such installation would be recommended for regular trains in transit, there are frequently fatal accidents caused by a string of cars standing idle on tracks on which another train is traveling, or frequently a stalled automobile or other obstruction is on the tracks. Where railroad cars are not attached to a locomotive or other source of electrical power, a laser obviously could not operate and under these circumstances, either or both ends of the string of cars or an idle locomotive could have releasably attached thereto a suitable reflector indicated by the numeral 54 in FIG. 1. The purpose of the reflector 54 is to receive and reflect back to an oncoming locomotive the laser beam 17 generated on the locomotive with the reflected beam being received by the detector cell 46 to operate the electric coincidence circuit substantially as if a beam was derived from another locomotive, with the alarm and control circuits being operated on the approaching train exactly as if the obstructing cars were in fact a second oncoming locomotive. In like manner, many other objects, particularly shiny objects such as automobiles, will reflect a beam sufficiently strong to energize the signal circuitry on the oncoming train.

Where two locomotives are approaching each other around a curve, as shown in FIG. 3, two reflectors can be provided at the apex of the curve to reflect an oncoming signal on one side of the curve down the other side where it may be received by the detector 46 of a second locomotive and vice versa, or suitable detectors for each side of the curve, along with coincidence circuitry and alarm circuits, may be provided as indicated at 56 to operate signal lights in sufficient time to warn the engineers of the respective locomotives of a pending collision; also alarm signals might be fed back through the tracks to the respective locomotives to operate automatic alarms or controls in the locomotives in any manner calculated to prevent collision. The feeding of signals to locomotives through tracks is, of course, a well known expedient and forms no part of the present invention. Obviously similar arrangements may be used on grades.

As those skilled in the art will recognize, the coincidence circuit may comprise a recognized "AND" circuit, wherein two coordinated inputs are required in order to achieve an output, the circuit being otherwise non-conductive merely upon the reception of a single input. An important feature of the invention resides in the use for the first time of a laser beam as highly efficient and reliable means for the prevention of collisions between railway trains. It will be apparent to those skilled in the art that the system of the invention is susceptible of a variety of changes and modifications without, however, departing from the scope and spirit of the appended claims.

What is claimed is:

1. A railway signaling system for use with railway vehicles comprising a laser, means for mounting said laser at an end of a railway vehicle so that the laser projects a horizontal beam parallel to the longitudinal axis of the vehicle, means modulating said laser beam between fully on and fully off conditions at a pre-determined cyclic rate, a beam detector carried by said vehicle, a beam divider on said vehicle in the path of said modulated beam for reflecting a portion of said beam towards said detector, a second detector, means for mounting said second detector on said vehicle in a position to receive a beam traveling towards said vehicle in a horizontal path parallel to said first beam, each of said detectors being

positioned with respect to the other so as to be incapable of receiving any part of a beam received by the other of said detectors, means connected to said first and second detectors for comparing the characteristics of beams received by the respective detectors, signal receiving means operatively connected to said detectors, and means for energizing said signal receiving means only when the beams received by the respective detectors have substantially identical characteristics.

2. The railway signaling system of claim 1 wherein said signal receiving means comprises electrically operated alarm means.

3. The railway signaling system of claim 1 wherein said signal receiving means comprises electrically operated movement control means.

4. A railway signaling system comprising a continuous beam laser, a photo cell detector responsive to a laser beam, means mounting the laser and the detector in side by side relation at an end of a railroad vehicle and positioned to emit and receive laser signals traveling in horizontal beams substantially parallel to the longitudinal axis of the vehicle, means for modulating the continuous laser beam comprising a disc having at least one aperture there-through and means for rotating said disc at a constant pre-determined rate so that said aperture sweeps past said beam to alternate the latter between fully on and fully off conditions at a rate determined by the rotational speed of said disc, a beam divider in the path of said modulated beam for reflecting a portion of the modulated beam, a second photo-cell detector carried by the vehicle in a position to receive the reflected part of the laser beam, each of said detectors being positioned with respect to the other so as to be incapable of receiving any part of a beam received by the other detector, a coincidence circuit having first and second inputs connected to the respective first and second detectors and an output, electrical signal receiving means connected to the output of the coincidence circuit, said coincidence circuit being constructed and arranged to be normally non-conducting but responding only to substantially identical signals received at the first and second inputs from the respective first and second detectors so as to become conducting to energize said signal receiving means.

5. The railway signaling system of claim 4 including a beam reflector mounted on the end of a second railway vehicle in a position to receive and reflect back to said first detector the modulated laser beam transmitted by said laser.

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