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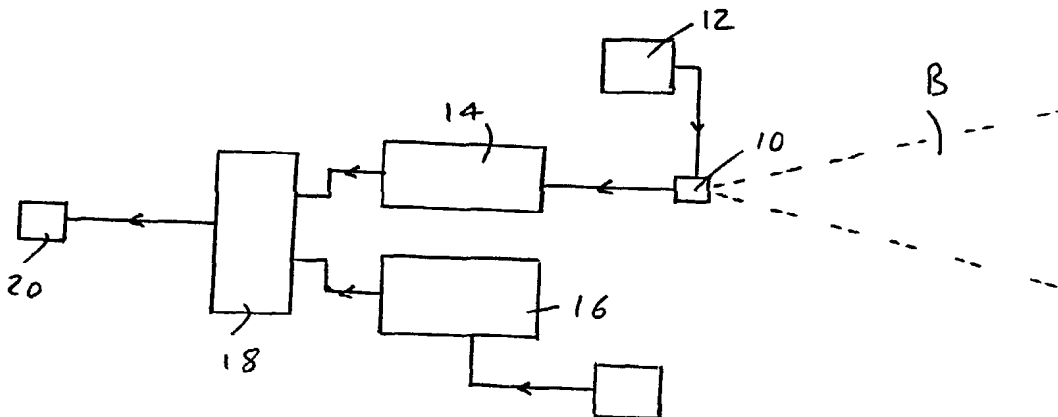
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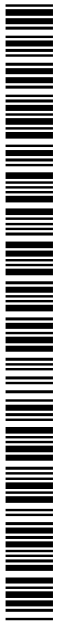
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(54) Title: RAILWAY SAFETY SYSTEM



(57) Abstract: A safety system for a railway train comprises means (10) for producing successive sets of data corresponding to successive real-time images of the track ahead of the train as the train advances along its track, and a reference store (16) holding sets of data corresponding to forward-view images of the track at successive points along it. Comparing means (18) compare the data for the successive real-time images with the data for successive pre-stored images for corresponding positions along the track, to provide an alarm signal in the event of any discrepancy between any pair of compared images, indicative of an obstruction ahead of the train.



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RAILWAY SAFETY SYSTEM

The present invention relates to a safety system for railway trains.

In the event that a railway line becomes obstructed, it is often difficult for the train driver to see the obstruction
5 until the train is too close to the obstruction for the driver to take appropriate action.

I have now devised a system which provides for the automatic detection of an obstruction on the track ahead of a train.

10 In accordance with the present invention, there is provided a safety system for a railway train, the system comprising means for producing successive sets of data corresponding to successive real-time images of the track ahead of the train as the train advances along the track, a reference
15 store holding sets of data corresponding to forward-view images of the track at successive positions along the track, and comparing means for comparing the data for successive real-time images with the data for successive pre-stored images for corresponding positions along the track, the comparing means
20 being arranged to provide an alarm signal in the event of a discrepancy between any pair of compared images, indicative of an obstruction on the track ahead of the train.

The system may have a learning mode of operation, in which it captures data for successive images at successive
25 positions along the track, as the train advances along the track in the absence of any obstruction, the successive sets of data being written into the reference store. Instead, a data file may be formed by a train advancing along the track, then copied onto any convenient medium for use in the safety
30 system of other trains using the same track.

The data read out from the reference store, for each comparison step, must correspond to the actual position of the train at the time. The reading out of data from the reference store may be controlled by any convenient means arranged to

determine the position of the train at the corresponding instant of time: for example, this may be arranged to determine the distance that the train has travelled along the track from a predetermined or datum point, or it may comprise a global
5 positioning system (GPS).

The sets of image data may be captured using a scanning device which directs a beam forwardly from the train and picks up reflections of the beam. The beam is preferably scanned both horizontally and vertically and may perform a raster
10 scan, in the same manner as the electron beam of a video camera. The beam may be a light beam, preferably a laser beam, a radar beam or an ultrasound beam, for example.

An embodiment of the present invention will now be described by way of example only and with reference to the
15 accompanying drawings, in which:

FIGURE 1 is a side view of the driver's cab of a train fitted with a safety system in accordance with the present invention;

FIGURE 2 is a block diagram of a safety system in
20 accordance with the present invention;

FIGURE 3 is a view of a train, fitted with the safety system, approaching another train on the same track; and

FIGURE 4 is a view of a train, fitted with the safety system, approaching an obstruction in the form of a landslip
25 on the track.

Referring to Figure 1, the driver's cab of a train is fitted with a safety system in accordance with the present invention. The system includes a scanning device 10 mounted to the front of the train and directing a beam forwardly and
30 along the track ahead of the train. The scanning device 10 is arranged to scan the beam horizontally and vertically and preferably performs a raster scan, in the manner of the electron beam of a television camera.

As shown in Figure 2, the safety system comprises a
35 controller 12 for controlling the scanning operation of the

scanning device 10. The device 10 includes a receiver for responding to the reflected beam, to provide a corresponding electrical signal which is passed to an image capturing store 14. Each complete scan, or frame, is captured by the store 14, then the next scan is performed and overwritten into the store 14. The system further comprises a reference store 16, which stores successive images, corresponding to successive scans made by a train previously travelling along the same track.

The safety system also comprises a comparator unit 18 for comparing data read out from the image capturing store 14 and from the reference store 16, respectively. A positional unit 18 controls the reference store 18 to read out, from the store 18, data for successive images, corresponding to successive true positions of the train along the track: data for successive real-time images is read out from the image capturing store 14, for comparison (by unit 18) with the successive images read out from the reference store 16; each comparison step thus compares the data for a real-time image with data from the reference store corresponding to a pre-stored image of the same position along the track.

The two images which are thus compared (the real-time image and the pre-stored image) should correspond. In the event, however, of an obstruction on the track, the two images will not correspond: the comparator 18 detects any substantial discrepancy between any pair of images which it compares, in order to actuate an alarm.

By way of example, and as shown in Figure 3, the safety system will detect the presence of an obstruction in the form of another train ahead of it on the same track. As another example, and as shown in Figure 4, the safety system will detect the presence of an obstruction in the form of a landslip across the track.

Claims

- 1) A safety system for a railway train, the system comprising means for producing successive sets of data corresponding to successive real-time images of the track ahead of the train as the train advances along the track, a reference store holding sets of data corresponding to forward-view images of the track at successive positions along the track, and comparing means for comparing the data for successive real-time images with the data for successive pre-stored images for corresponding positions along the track, the comparing means being arranged to provide an alarm signal in the event of a discrepancy between any pair of compared images, indicative of an obstruction on the track ahead of the train.
- 2) A safety system as claimed in claim 1, having a learning mode of operation in which it captures data for successive images at successive positions of the train as it advances along its track in the absence of any obstruction, the successive sets of data being written into said reference store.
- 3) A safety system as claimed in claim 1 or 2, in which the reading out of data from said reference store is controlled by means arranged to determine the position of the train at a corresponding instant of time.
- 4) A safety system as claimed in claim 3, in which said position-determining means is arranged to determine the distance travelled by the train along the track from a datum point.
- 5) A safety system as claimed in claim 3, in which said

position-determining means comprises a global positioning system.

- 6) A safety system as claimed in any preceding claim, in which said means for producing successive sets of image data comprises a scanning device which directs a beam forwardly from the train and picks up reflections of the beam.
- 5
- 7) A safety system as claimed in claim 6, in which said scanning device scans said beam both horizontally and vertically.
- 10

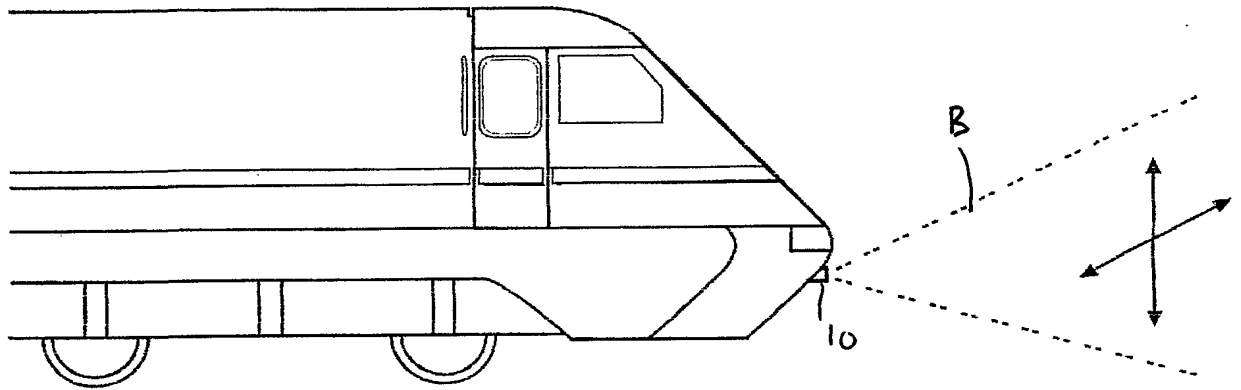


Figure 1

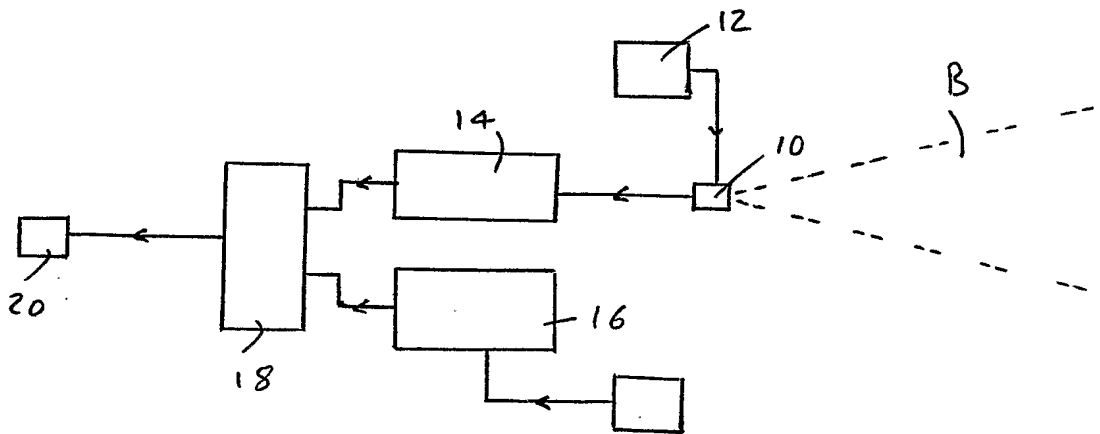


Figure 2

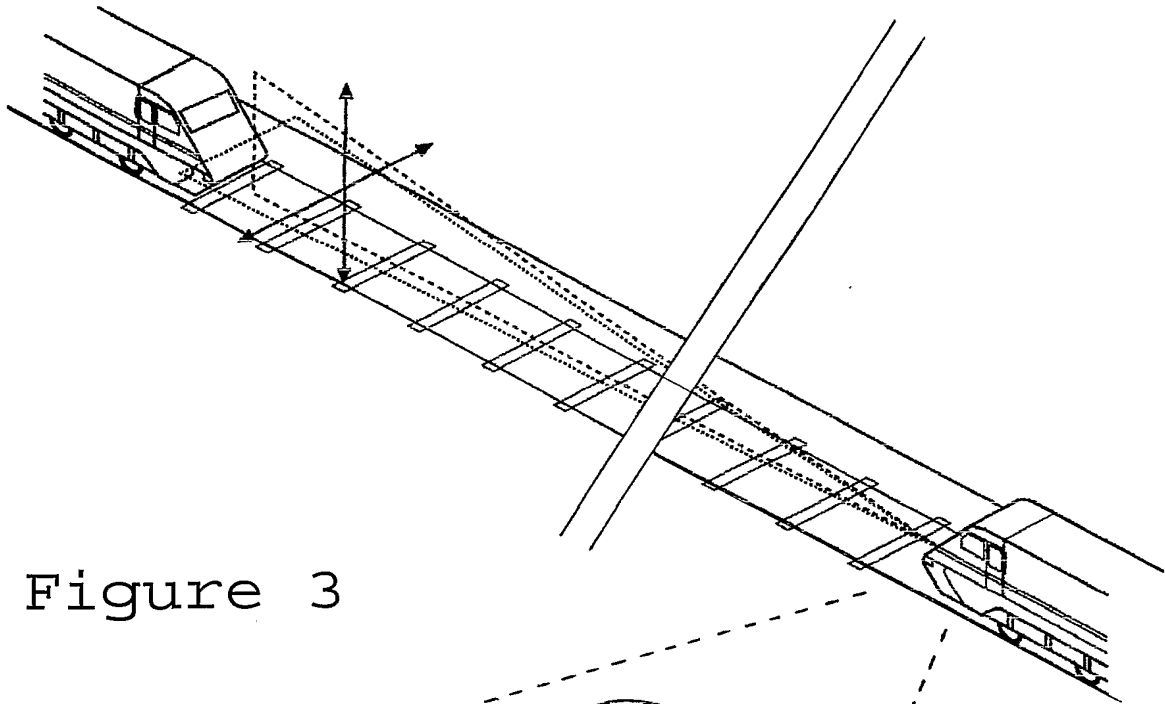
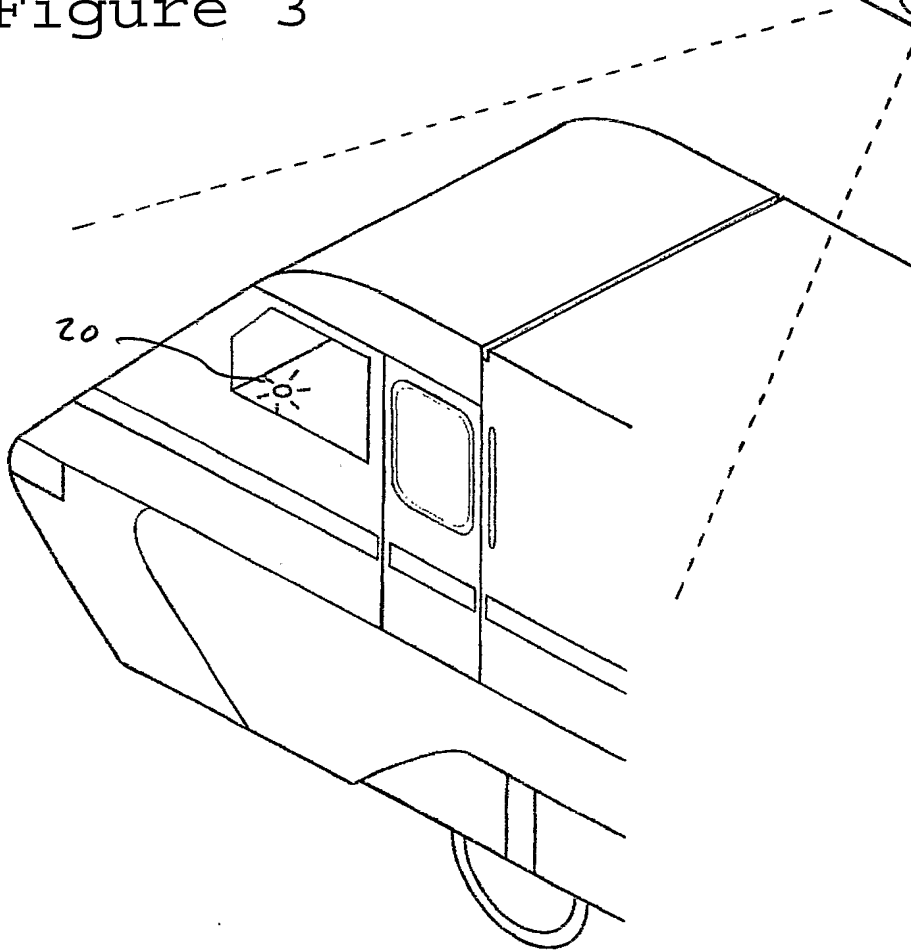


Figure 3



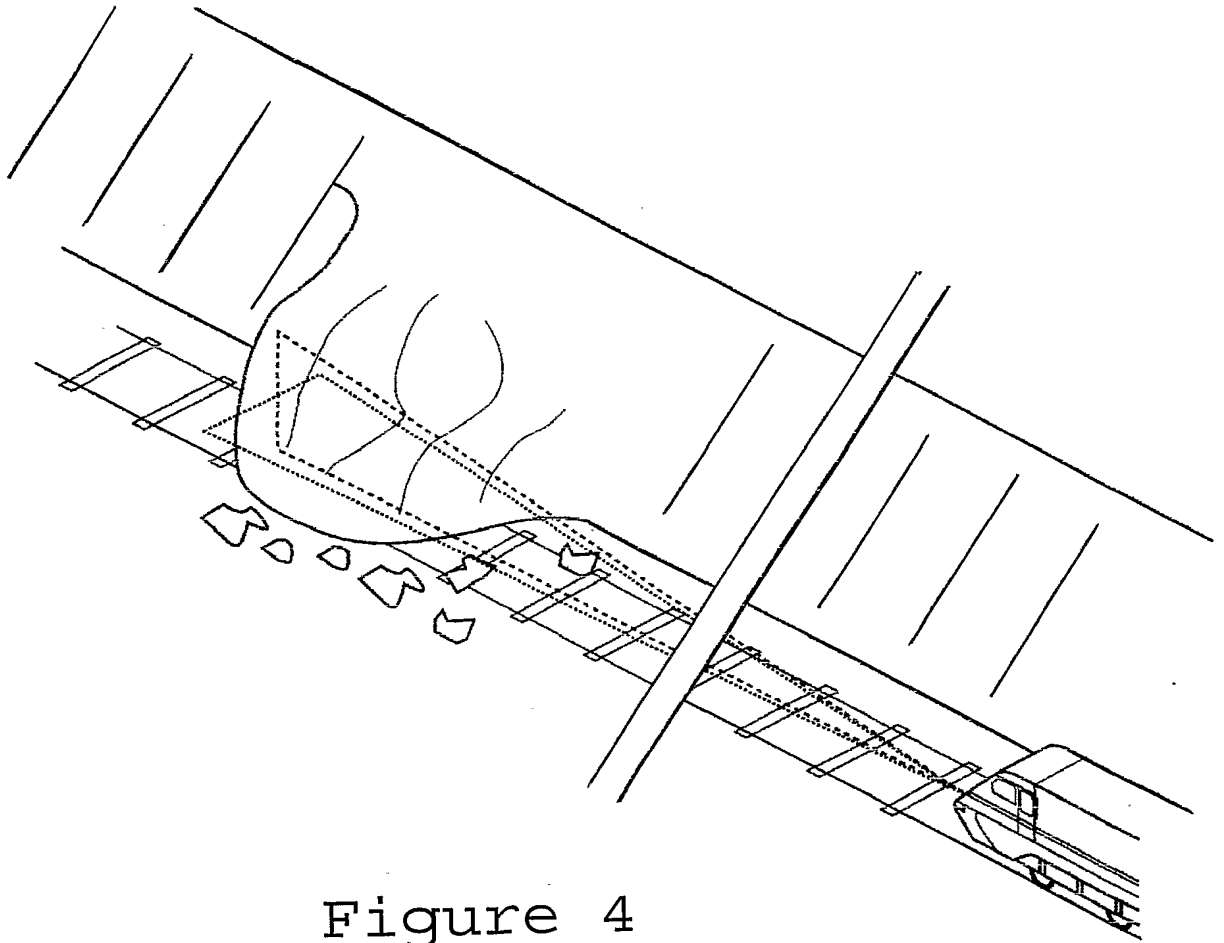


Figure 4

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
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Patent family members are listed in annex.

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