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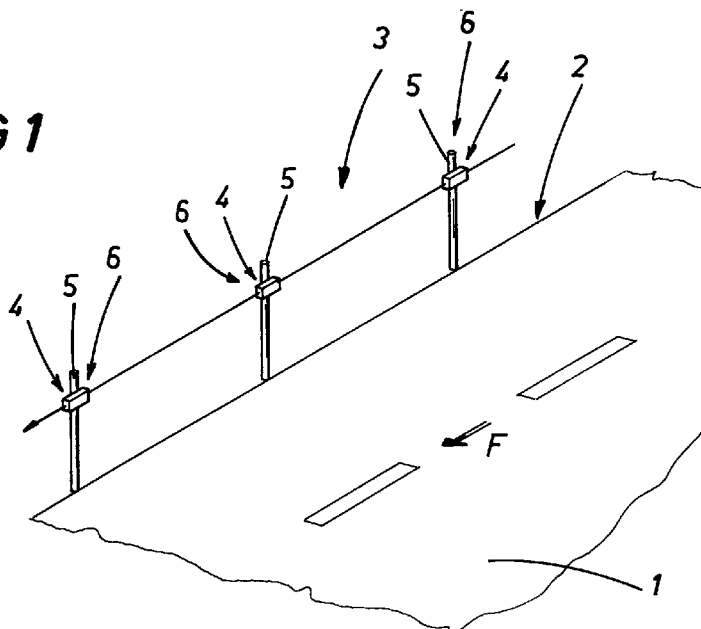
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(54) A traffic aid apparatus to be used under conditions of low visibility

(57) The invention concerns an apparatus (3) to be used as an aid for traffic when visibility is bad, consisting basically of a plurality of laser units (4) each emitting a beam of laser light at a frequency within the visible light spectrum and installed at regular intervals along at least

one side (2) of a section of carriageway (1); the light from each laser unit (4) being emitted roughly in the direction of one of the other two nearest laser units.

FIG 1



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Description

The present invention concerns an apparatus to be used as an aid for traffic when visibility is low on account of bad weather, and particularly as a signalling aid in the event of fog on roads, motorways, airport runways and taxiing lanes, harbours, navigable canals, and other heavy traffic areas.

It is well known that one of the major difficulties plaguing present-day transport and freight systems is the rapid lowering of safety conditions caused by adverse weather (for example, fog and smog) considerably reducing visibility. Such weather conditions slow down vehicle traffic and are the cause of frequent accidents.

In this description, reference is made to road and motorway traffic solely for convenience, without thereby excluding the other forms of traffic mentioned above from the scope of the inventive concept described.

According to a known practice, illuminated signalling elements are placed at equal intervals of a few metres from each other along one or both sides of roads, motorways or interchanges in areas subject to frequent fog, the said signalling elements being equipped with lights which are switched on when visibility is bad. These signalling elements are located mainly along dangerous sections of the roads and motorways and are designed to provide visual reference points for people driving through the fog. Under extremely bad weather conditions, however, the effectiveness of such signalling elements may be very limited.

The object of the present invention is to reduce the difficulties caused to traffic by adverse weather conditions by providing a traffic aid apparatus which greatly improves visibility and, consequently, driving safety, even under very poor visibility conditions.

This object is achieved in a traffic aid apparatus, as claimed below, which may be used when visibility is very bad and which is characterized in that it comprises a plurality of laser units installed at regular intervals along at least one side of a carriageway, the light from each unit being within the visible light spectrum and being emitted roughly in the direction of one of the other two nearest laser units.

In a preferred embodiment of the present invention, each of the said laser units comprises a laser beam emitting device, an optical detector located at a point on the path followed by the laser beam emitted by one of the two aforesaid laser units, and a drive unit designed to control the related emitter according to the intensity of the electrical signal sent to it by the detector associated to one of the two laser units themselves.

In addition, the beam from each laser unit is emitted preferably in the direction of the laser unit upstream of it with respect to the direction of the vehicle traffic along the section of road concerned.

The technical characteristics of the invention are laid out in the claims below and the advantages of the disclosure are apparent from the detailed description which follows, with reference to the accompanying drawings,

which illustrate a preferred embodiment of the invention by way of example and in which:

- Figure 1 schematically illustrates a portion of a carriageway along the side of which there is installed a traffic aid apparatus made in accordance with the present invention;
- Figure 2 is a cross section view, partly in the form of a block diagram, of a part of the traffic aid apparatus illustrated in Figure 1;
- Figure 3 illustrates in the form of a wiring diagram the basic components of the traffic aid apparatus illustrated in Figure 1;
- Figure 4 is a block diagram of the traffic aid apparatus illustrated in the previous three drawings.

With reference to Fig.1, the numeral 1 indicates a lane (a carriageway for convenience) along a side 2 of which there is installed a traffic aid apparatus labelled 3 as a whole. In the description which follows, it is assumed, as shown in Figure 1, and purely by way of example, that the apparatus 3 is installed only along one side 2 of carriageway 1, but the apparatus could also be installed on both sides of carriageway 1.

As illustrated, especially in Figs. 1 and 2, apparatus 3 comprises a plurality of laser units 4, mounted on supporting elements 5 arranged along the side 2 and adjustable in orientation and height.

Each laser unit 4 consists of a housing 6, basically box-shaped or cylindrical, attached to the upper section of a supporting element 5 and containing an emitter 7 and an optical sensor 8, both electrically connected to a drive unit 9 whose function is explained below. A focussing device 10 is mounted inside the housing 6 between the emitter 7 and an opening 11 made in one of the vertical sides 12 of the housing 6 itself, in such a way as to be situated at a point on the path followed by the laser beam emitted when the emitter 7 is on. The optical sensor 8 is mounted inside housing 6 in such a way as to be in line with an opening 13 made in the vertical side 14 of the housing 6 opposite and parallel to the aforesaid side 12.

The drive unit 9 is equipped with control logic (for example, an appropriately programmed single-chip microprocessor) and is connected to a power supply line 15 (Fig.4) through a power pack 16 (Fig.3), which supplies the drive unit 9 with a regulated voltage sufficient to power the entire unit 4. The drive unit 9 also has an inhibiting input 17 which, when an electrical inhibit signal is applied to it, as explained below, is capable of switching off the emitter 7. The said drive unit 9, finally, has an input 18 connected to the optical sensor 8 (Fig. 3) and an output 19 capable of issuing the aforesaid electrical inhibit signal in response to a state of the optical sensor 8, as described below. In other terms, the aforesaid inhibiting input constitutes the input stage of an inhibiting unit, forming part, for example, of the aforesaid single-chip microprocessor, illustrated diagrammatically as a block 20 and forming part of the drive unit 9.

As shown in Fig. 4, the output 19 of each drive unit 9 is electrically connected to the inhibiting input 17 of the unit 4 located immediately downstream of it, with reference to the direction in which the vehicles (not illustrated) travel along the section of carriageway 1.

The operation of the traffic aid apparatus 3 will now be described bearing in mind that the frequency of the laser beams issuing from the emitters 7 must be selected in such a manner that the light produced is within the visible light spectrum, preferably in a part of it in which the sensitivity of the human eye is high.

As we have said, the apparatus 3 comprises a plurality of units 4 and the emitter 7 of each laser unit 4 must be positioned in such a way as to direct the laser beam, under poor visibility conditions, towards the optical sensor 8 of the unit 4 upstream of it, with reference to the direction of travel of the vehicles on the carriageway 1, indicated by the arrow F. When all the laser beams are on, they "connect" the units 4 to each other in pairs, essentially creating a continuous beam of light along side 2 of the section of carriageway 1, which may be perceived by and, hence, constituting an effective visual reference for, the drivers of the vehicles travelling along the section of carriageway 1.

The distance between one unit 4 and the next will depend, obviously, on the emissive power of the emitters 7 used and on the frequency of the laser light emitted, and must be such as to guarantee that the aforesaid beams of laser light are clearly visible.

The laser beams are directed preferably in the direction opposite the direction of the traffic because the light diffraction caused by the humidity and other particles suspended in the air is greatest in the direction in which the beams themselves are propagated, and during experiments beams generated by the laser emitters 7 with the same emissive power proved much more visible when the laser emitters 7 were directed in the direction opposite the direction of vehicle traffic than those generated when the laser emitters 7 were directed in the same direction as the traffic.

When the apparatus 3 is on, the optical sensor 8 of each laser unit 4 is struck by the laser light beam emitted by the unit 4 downstream of it, with reference to the direction of vehicle traffic, and so the inhibiting input 17 of the drive unit 9 related to the laser unit 4 located downstream does not receive the electrical inhibit signal from the drive unit 9 of the laser unit 4 containing the aforesaid optical sensor 8, and the emitter 7 of the said laser unit 4 remains active and continues to emit a laser beam.

If the laser beam "connecting" two consecutive laser units 4 is interrupted by an obstacle of any kind or if one of the laser units 4 is knocked out of alignment, the laser beam switches off instantly. The reason for this is that when optical sensor 8 ceases to be struck by the laser beam, it causes the related drive unit 9 to send an inhibit signal to the inhibiting input 17 of the drive unit 9 of the laser unit 4 downstream, thus switching off the emitter 7 of the latter laser unit 4. The deactivation of the emitter 7 of a laser unit 4 thus switching off the laser beam may,

obviously, also be occasioned when, for example, a vehicle knocks against the element 5 supporting a laser unit 4 so that the emitter 7 itself is no longer properly aligned with the optical sensor 8 of the laser unit 4 upstream.

Every time an emitter is deactivated in this way for one of the reasons described above, a logic element 21, for example, again, an appropriately programmed single-chip microprocessor forming part of each drive unit 9 and constituting a reactivation means, cancels the inhibit signal for a short length of time at defined intervals, during which time the said emitter 7 switches on: each time the inhibit signal is cancelled, the emitter 7 generates a pulse of laser light at a reduced (not dangerous) power. If the aforesaid obstacle is removed from between the two consecutive laser units 4, the optical sensor 8 associated to the upstream laser unit 4 can once again receive a pulse of laser light and when it does, it interrupts the inhibit signal so as to enable the aforesaid emitter 7 to start operating at full power again.

To achieve the highest level of reliability of the traffic aid apparatus 3, the laser units 4 making up the said apparatus 3 should be connected in parallel to power supply line 15.

In a preferred embodiment of the present invention, a portion of the drive unit 9 associated to each laser unit 4, illustrated diagrammatically by a block 22 and constituting, together with an optical sensor 8 connected to it, an element for the measurement of light intensity, is capable, for example through an analog-to-digital converter built into the microprocessor, of measuring the intensity of the laser beam which strikes the optical sensor 8 itself. The intensity of the laser light, obviously, is proportional to the transparency of the air through which the laser beam propagates.

Consequently, since each drive unit 9 has a microprocessor (not illustrated) and an analog-to-digital converter (not illustrated), the drive units 9 are capable of activating the emitters 7, even at an emissive power that is inversely proportional to the transparency of the air when the level of the electrical signals from the aforesaid optical sensors 8 fall below a preset threshold. It follows that the emissive power of each emitter 7 during operation may be between zero and maximum power, according to the environmental conditions of the section of carriageway "covered" by it, which means that the laser units 4 do not require complex and costly remote control drive apparatuses.

The invention described can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A traffic aid apparatus to be used under conditions of bad visibility characterized in that it comprises a plurality of laser units (4) installed at regular intervals along at least one side (2) of a carriageway (1), the

light from each unit (4) being within the visible light spectrum and being emitted roughly in the direction of one of the other two nearest laser units (4).

2. An apparatus according to claim 1, characterized in that each of the aforesaid laser units (4) comprises a laser beam emitting device (7), an optical detector (8) located at a point on the path followed by the laser beam emitted by one of the two aforesaid laser units (4), and a drive unit (9) designed to control the related emitter (7) according to the intensity of the electrical signal sent to it by the detector (8) associated to one of the two laser units (4) themselves. 5 10
3. An apparatus according to claim 2, characterized in that each of the aforesaid laser units (4) comprises means (20) for inhibiting the associated emitter (7), the said inhibiting means (20) being activated by the optical detector (8) associated to one of the two aforesaid laser units (4). 15 20
4. An apparatus according to claim 3 characterized by reactivating means (21) for each of the said emitters (7) which generate pulses that switch on the said emitter (7) at reduced power for a short period after the emitter (7) itself has been switched off by the inhibiting means (20). 25
5. An apparatus according to any one of the foregoing claims characterized by means (8, 22) for measuring the intensity of the laser light beam going into at least one of the said laser units (4) so as to trigger at least one said laser unit (4) and/or control the intensity of the laser light beam emitted by it. 30 35
6. An apparatus according to claim 5 characterized in that the said measuring means comprise the said optical detectors (8).
7. An apparatus according to any one of the foregoing claims characterized in that the laser light beam emitted by each of the said laser units (4) is directed essentially towards the laser unit (4) located upstream of it with reference to the direction in which vehicles travel along the section of carriageway (1). 40 45

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FIG 1

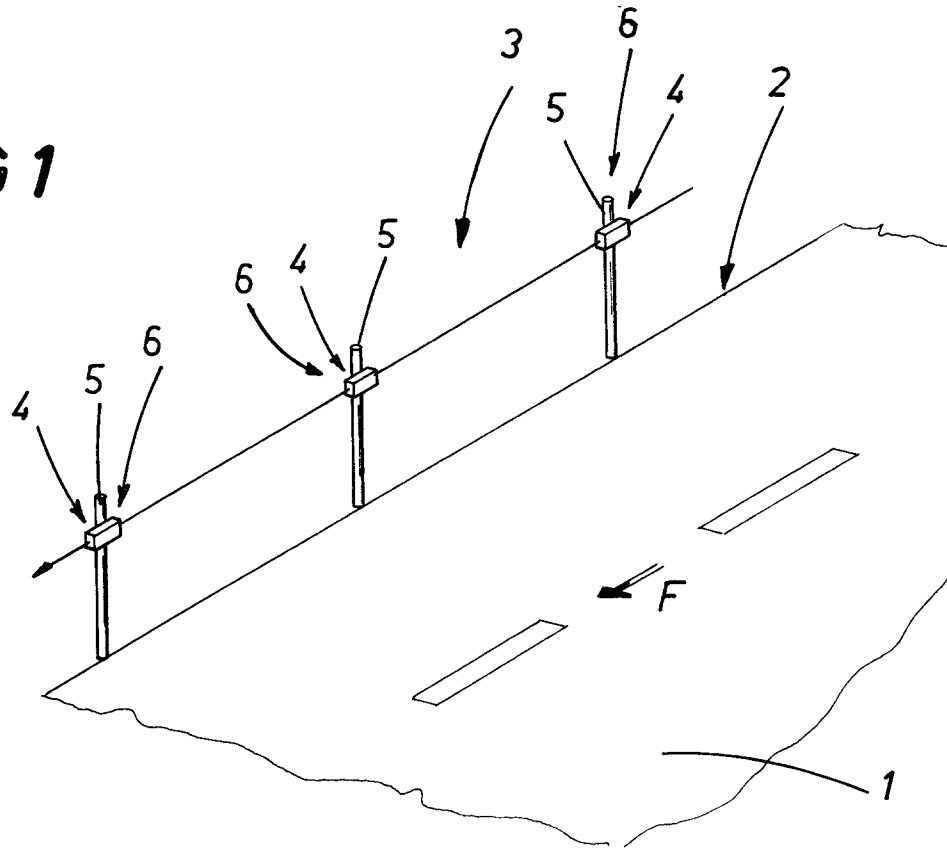


FIG 2

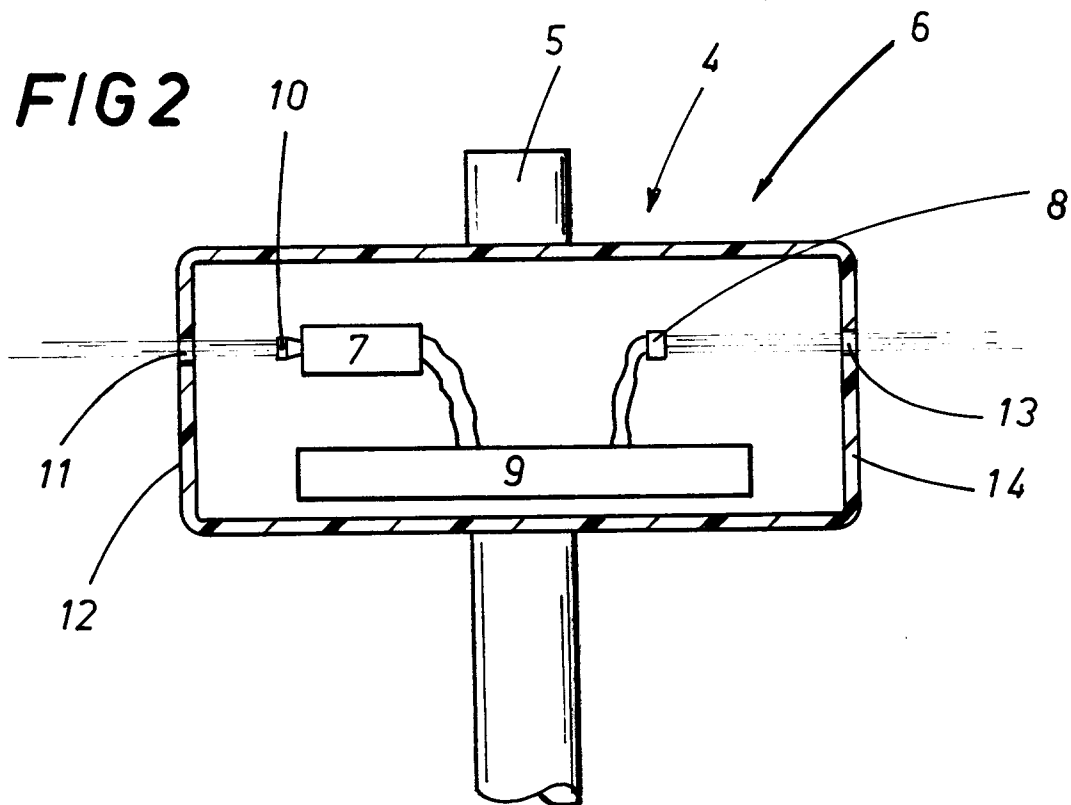


FIG 3

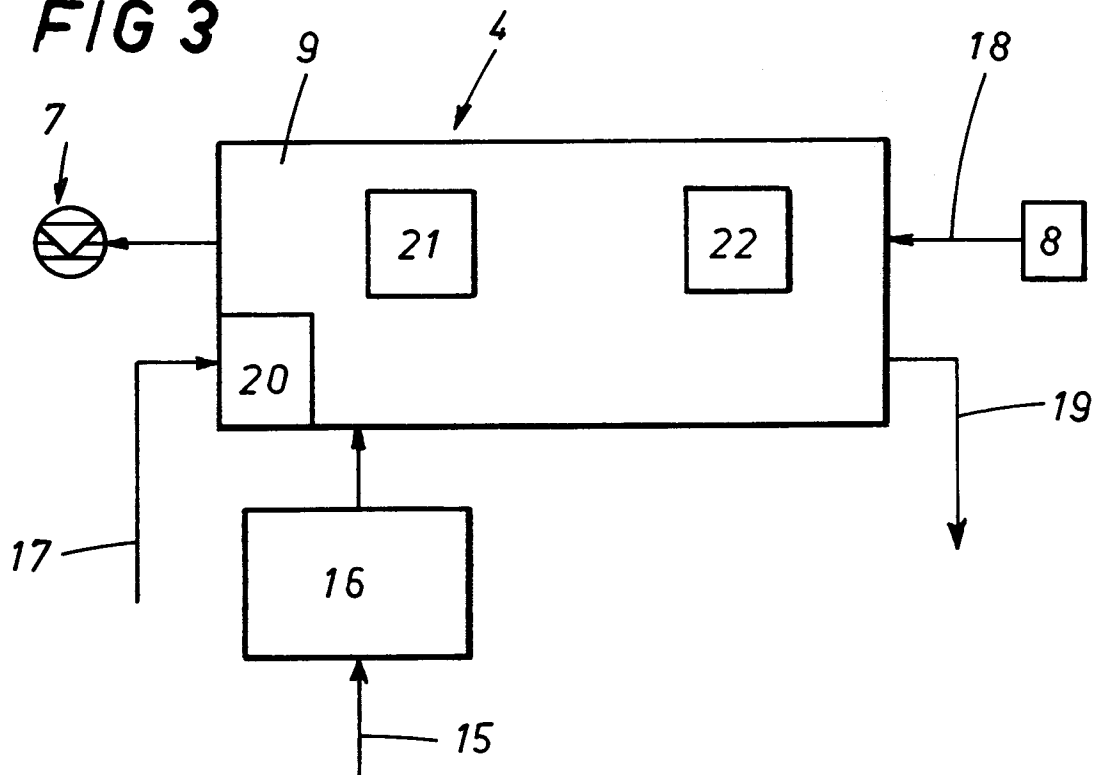
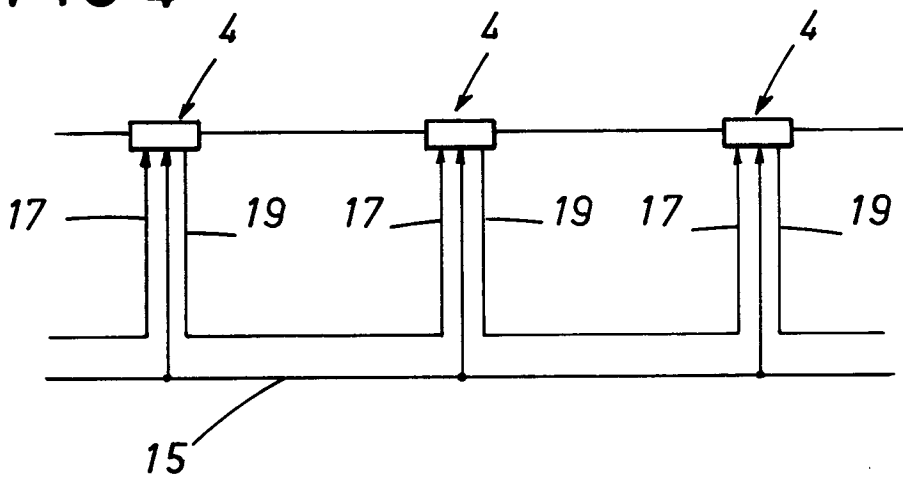


FIG 4





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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0453

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	PATENT ABSTRACTS OF JAPAN vol. 17, no. 96 (M-1372) 25 February 1993 & JP-A-04 289 306 (EBINUMA TAKAO) * abstract *	1	E01C9/00 E01F9/011
A	EP-A-0 613 981 (PRO CO GEN) * page 1, line 9 - line 17; figure 8 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E01F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 February 1995	Examiner Verveer, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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