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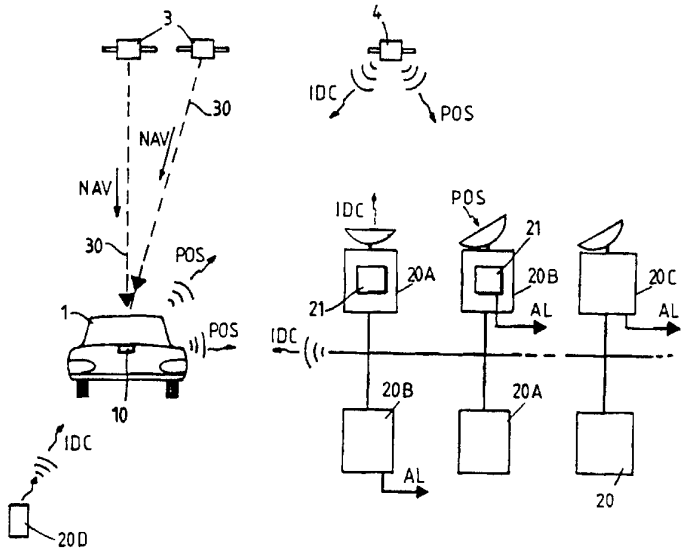

(57) Abstract

A positioning apparatus is provided on an object or carried by an individual to produce a position information signal of the object or individual in response to an enable signal, said enable signal being generated in response to an individual code signal. At least one control center is adapted for sending individual code signals and for receiving individual position information signals from an individual object or an individual. Means at the control center are adapted to display the individual positioning information contained in a received position information signal, thereby to at once locate and track the precise position of said object or individual.

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SYSTEM FOR SELECTIVELY POSITIONING AND TRACKING A MOVABLE OBJECT OR INDIVIDUAL

Field of the invention

The present invention relates to a positioning and tracking system for allowing to on-line remotely and selectively pinpoint at any desired time the location of a movable object or an individual.

A particular application of such a system is for locating and tracking vehicles, e.g. a motor car, a transport vehicle, a ship or a plane, thus allowing tracking a stolen vehicle or a vehicle having suffered disaster or crash with a great accuracy.

Background of the invention

Devices adapted to protect automotive vehicles are well known. Most of these devices consist of an appliance intended to be installed on board a vehicle for producing a sound alarm signal when somebody attempts to steal the vehicle so equipped. Such known devices are dissuasive indeed but they do not provide any assistance in an attempt to locate a missing vehicle.

EP-A-0252773 discloses a method of monitoring the movement of objects, in particular automotive vehicles, by using a passive cell on board a vehicle to be monitored, said cell comprising a receiver loop or antenna arranged to respond at a distance to a wave emission

including a unique code when it is coupled with a looped antenna of a sensor. The cell comprises means for modulating the charge of its receiver loop or antenna according to pulses representing its own unique code when its receiver loop or antenna is coupled with the looped antenna of the sensor thereby to modulate by the absorption the waves emitted.

The drawback of this known method resides in that it requires a network of detectors to be implemented over the area of the territory under control because coupling between a vehicle antenna and a detector can take place on a short distance only. In addition, each passive cell on board a vehicle must be identified by its unique code, with the result that each vehicle is required to be dependent on or tied to the detector network. As a consequence, this prior art system lacks flexibility in use.

The present invention tackles the problem of locating an object or an individual by an alternative approach, in particular using telecommunication links.

Telecommunication links in effect have been utilised already in operating navigation systems, e.g. for on-line planning and managing fleets of transport vehicles. However, such telecommunication links generally are used for exchanging direct messages between a dispatcher at a dispatch center and the driver of vehicles.

A satellite-based communications system (Euteltracs) however has been reported not only to provide exchange of information messages between a dispatcher and moving vehicles but also to allow the dispatcher to pinpoint

the position of a given vehicle. A vehicle's location can be calculated by triangulation using twin EUTELSAT satellites. The drawback of this state-of-the-art system is that it requires national service providers responsible for interconnecting customers to the Euteltracs network and requires a specialized location software to be installed on a computer at the dispatch center.

The disadvantages of the prior art are overcome by the present invention.

Summary of the invention

It is an object of the present invention to provide an easy-to-operate positioning and tracking system for permitting fast selective remote tracking of movable entities, either objects or individuals among other entities, across any region.

Another object of the invention is to provide a user-friendly positioning and tracking system capable of selectively and accurately pinpoint the precise position of a given entity among other entities.

Yet another object of the invention is to provide an apparatus which can be readily fixed to a movable inanimate object or carried by an individual for operating in a selective tracking system.

These objects are achieved by a method for selectively positioning and tracking an individual movable entity and a system and device for carrying out the method as defined in the appended claims. Briefly stated, a spe-

cific positioning apparatus is provided on each entity to be protected, including vehicles of any type, movable objects and individuals, e.g. a GPS receiver known per se, which is currently in a non-active powered-down mode and is activated by being selectively turned to its active mode in response to an individual code assigned to it, which identifies it among other positioning apparatus. The code signal is transmitted on demand from a remote transmitting control center.

When thus activated, the positioning receiver provides position information in a manner known per se, which position information is transmitted to a receiving control center by means of telecommunication links of any type known in the art, e.g. radiotelephone links, radio communication links, satellite communication links and the like.

At the receiving control center, the position information is immediately analyzed and the precise position of the entity is quickly displayed within a few minutes and used to promptly track the precise location of the vehicle or individual entity being monitored.

When a vehicle provided with a positioning apparatus according to the invention has been stolen, the entity's owner sends its individual code from a control center or contacts the operator at the nearest control center and notifies him of the individual code signal assigned to the code sensor associated with the entity to be tracked. The operator then operates its terminal to send the required individual code signal for causing the on-board apparatus to transmit the position of the vehicle or entity being tracked in order to allow a police brigade to be alerted with a view to quickly

head off and catch said entity or vehicle.

Particular embodiments of the system and apparatus to achieve the objects of the invention are defined in the sub-claims.

The advantage of the invention is that a moving vehicle or object or an individual can be tracked at any time on demand and can be located very quickly with an accuracy to within a few tens of meters. Such a high accuracy is very valuable in case of disaster or crash in scarcely inhabited districts or regions. Easy-to-install and easy-to-use, the invention also warrants privacy because tracking is only made possible and actually performed on demand by the owner or authorized user himself.

The invention will be more fully described and understood in the following specification in view of the accompanying drawings.

Brief description of the drawings

Fig. 1 is a schematic diagram showing a selective tracking system according to the invention.
Fig. 2 is a block diagram of a transponder used in the system of the invention.

Description of a preferred embodiment

The invention will be described by way of example only with respect to the protection of personal motor cars or other vehicles.

Referring to Fig. 1, reference numeral 10 designates a transponder secured to a vehicle 1 to be protected and reference numeral 20 designates a control center. In accordance with this invention, at least one and preferably a plurality of transmit and/or receive control centers are provided.

The transponder 10 may consist of a unit to be secured to a vehicle or other object to be protected or a portable unit provided for being carried by an individual who is to be protected. As shown in the block diagram in Fig. 2, the transponder generally comprises a specific positioning apparatus 11, a code sensor 12 and an interface unit 13. The technology for implementing the positioning apparatus is known in the art. For instance, positioning GPS (Global Positioning System) receivers are manufactured by Trimble Navigation and by Panasonic. Such positioning receivers are multichannel digital receivers designed to track and query several navigation satellites (e.g. NAVSTAR navigation satellite system) to determine the vehicle's position within a few second or a few minutes depending on the type of the receiver used. The available GPS receivers are adapted to determine the position and other information (e.g. latitude, longitude, altitude, speed, etc.) and some receiver types (e.g. the Trimble TransPak II GPS receiver) permit interfacing with a personal computer or other equipment to allow exchange of data. The known GPS receivers have a position accuracy ranging down to some 15 meters and less.

According to this invention the positioning receiver 11 is currently in a non-active powered-down mode wherein it does not provide any position information. It is activated and turned to its active mode in response to an

enable signal ENB produced by the code sensor 12. Thus, the positioning receiver 11 has an input connected to the output of code sensor 12 which has an input connected to receive an incoming code signal IDC coupled through the receive section of interface unit 13. The code sensor 12 is assigned an individual code by the owner of the vehicle. Code sensor 12 is adapted to compare an incoming code signal with the stored individual code signal and produce said enable signal ENB for activating the positioning receiver 11 when the incoming and stored code signals match.

Thus, in use, the code sensor 12 activates the position receiver 11 and turns same from its powered-down mode to its active mode when and only when the correct code signal is received. Each code signal thus identifies one specific apparatus among other apparatus. The individual code signal identifying the particular apparatus is transmitted from a remote control center 20 and is received through the receive portion of interface unit 13.

Upon receipt of the correct individual code assigned to it, the positioning receiver 11 operates in a manner known per se to acquire navigation information via navigation satellites and at once to determine the vehicle's position as well as any other suitable information. Referring to Fig. 1 again there is shown two navigation satellites 3 (known per se) which continuously transmit navigation information NAV via links 30. It then at once determines the vehicle's position and any other information (e.g. the speed of the vehicle).

For the purpose of this invention, however, this in-

formation is not required to be displayed at the vehicle. Rather, the vehicle's position POS and other information associated with it are passed to the transmit section of the interface unit 13 whence they are transmitted via a conventional telecommunication link to a receiving control center 20. A suitable antenna should be provided on the vehicle or the transponder unit for interfacing with the communication network. The antenna will preferably be provided so as to be unnoticeable.

The telecommunication link can be established through a conventional data transmission network, e.g. a satellite communication link established via a purposemade communication satellite, a radiotelephone link, a radio link or the like. It will be apparent to one skilled in the art that telecommunication links of different types may be used for the signal transmission to and from the control centers.

The position information POS transmitted from a transponder 10 shall include the position data and other information determined by the GPS receiver or other positioning receiver 11 together with identification data, e.g. the individual code assigned to it as stored in code sensor 12, so as to identify which transponder is actually being tracked and active. Such identification data being included in the information composition is commonly used in the art as does some checking code as well. The position information POS may be transmitted in digital or analog mode according to the kind of telecommunication network utilized. It is to be understood that the interface unit may include the required modem as appropriate for permitting the exchange of data in analog form. The position information POS is

preferably transmitted as an intermittent signal having a repetition rate of e.g. one signal every five or ten minutes in order to reduce the power consumed by each transmission by the transponder and keep the supply battery as small as possible.

At the receiving control center 20, the position information POS is received at a display terminal 21 which immediately tracks the vehicle and quickly displays its precise position within a few minutes or a few seconds. As soon as the vehicle's position is displayed, the operator is able to take any action, e.g. to alert a police brigade by sending an alarm signal AL with a view to quickly head off and catch the missing vehicle being tracked.

As mentioned, a particular embodiment of the invention includes at least one and preferably a plurality of control centers. An advantageous feature of the invention resides in that the position information that is caused to be transmitted from a transponder can be received at a control center different from that particular control center which transmitted the individual code signal IDC for initiating the command for selective tracking. Fig. 1 shows by way of example control centers 20A adapted for operation as transmit centers, control centers 20B adapted for operation as receive centers and control centers 20C adapted for operation both as transmit and/or receive centers. It is to be noted that some control centers are shown to be adapted for operation via satellite communication links and some control centers ar shown to be adapted for operation via radio links.

Accordingly, the code signal being sent from a tran-

smit control center may include the individual code for the particular transponder to be tracked together with address data to identify the particular receive control center which is to receive the position information POS. Said address data are used in the transponder to direct the transmission of the relevant position information POS. The interface unit 13 may be provided with means to format the position information POS to be transmitted so as to include the position data and identification data and signals indicative of the address data and possible other information. Means for performing the required functions can be readily implemented by one skilled in the art with state-of-the-art components.

In the receiving control center, the incoming information is analyzed under control of a suitable software which will be apparent to persons skilled in the art. It is to be understood that the information processing may include signal refining steps in order to improve accuracy.

By virtue of the present invention, any vehicle or movable entity for which protection is sought can be readily provided with a transponder according to the invention such that when the vehicle is missing, it can be easyly and quickly located and tracked on demand with great accuracy until the vehicle is caught. When the vehicle is reported missing, the owner or an authorized user of the vehicle simply proceeds to have the individual code assigned to the transponder provided on his vehicle transmitted from the nearest control center. It is emphasized that the transmit control center may be a simple remote control unit available to the owner or authorized user of the ve-

hicle. Such a simple remote control unit is represented by way of example at 20D in Fig. 1.

Upon receiving the individual code sent from the remote control center or unit, the positioning apparatus in the on-board transponder then operates and tracking proceeds as set forth in the foregoing.

More generally, the invention allows a movable vehicle or entity to be tracked at any time on demand and to be located very quickly with an accuracy to within a few tens of meters. Such a high accuracy is very valuable in case of disaster or crash in a scarcely inhabited region.

The description of the preferred embodiments of the selective tracking system contained herein is merely illustrative of the principles underlying the inventive concept of the tracking system. Various modifications, embodiments, substitutions and equivalents will be apparent to those skilled in the art without departing from the spirit and scope contemplated by the invention.

CLAIMS

1. A method of selectively tracking a movable individual entity comprising the steps, in combination:

associating with said individual entity a specific positioning apparatus, said specific positioning apparatus turning ON by moving from said powered-down mode to said active mode;

transmitting an individual code signal from at least one transmitting control center, said individual code signal identifying said specific positioning apparatus among other positioning apparatus;

producing an enable signal for said specific positioning apparatus in response to said individual code signal;

moving said specific positioning apparatus from said powered-down mode to said active mode and producing a position information signal for said individual entity in response to said enable signal;

transmitting said position information signal from said specific positioning apparatus to at least one receiving control center, and

displaying individual positioning information contained in said position information signal at a control center, whereby an operator may promptly locate and track a precise location of said individual entity.

2. The method as defined in Claim 1, wherein said specific positioning apparatus is assigned a unique individual code signal and wherein said individual positioning information corresponds to said individual identification code signal.

3. The method defined in Claim 1 or 2, wherein said positioning apparatus includes a GPS receiver.

4. The method as defined in Claim 1, 2 or 3, wherein said transmit control center defines a single remote control device for sending only one individual code signal.

5. The method as defined in any of Claims 1 to 4, wherein said position information signal is transmitted as an intermittent signal.

6. The method as defined in either of Claims 1 to 5, wherein said individual entity is a person.

7. The method as defined in either of Claims 1 to 5, wherein said individual entity is an inanimate object.

8. A system for selectively tracking a movable individual entity comprising, in combination:

a specific positioning apparatus defining both a powered-down mode and an active mode, said specific positioning apparatus turning ON, by moving from said powered-down mode to said active mode, and producing a position information signal for said individual entity in response to a specific enable signal;

enabling means for producing said specific enable signal in response to an individual code signal, said individual code signal identifying said specific positioning apparatus among other positioning apparatus;

at least one transmitting control center for sending said individual code signal;

at least one receiving control center for receiving said position information signal for said individual entity;

telecommunication means for transmitting said individual code signal from a control center to said individual entity and for transmitting said position infor-

mation signal from said specific positioning apparatus to a control center; and

display means at a control center for displaying individual positioning information within said position information signal, whereby said system enables an operator to promptly locate and track a precise location of said individual entity.

9. The system as defined in Claim 8, wherein said specific positioning apparatus is assigned a unique individual code signal and wherein said individual positioning information corresponds to said individual identification code signal.

10. A system as defined in Claim 8 or 9, wherein said transmit control center defines a single remote control device for sending only one individual code signal.

11. A system defined in Claim 8, 9 or 10, wherein said positioning apparatus includes a GPS receiver.

12. The system as defined in either of Claims 8 to 11, wherein said position information signal is an intermittent signal.

13. A system as defined in either of Claims 8 to 12, wherein said individual entity is a person.

14. A system as defined in either of Claims 8 to 12, wherein said individual entity is an inanimate object.

15. An apparatus provided for being affixed to an entity for allowing said entity to be positioned and tracked, said apparatus consisting of a single unit including in combination:

a specific positioning apparatus defining both a powered-down mode and an active mode, said specific positioning apparatus turning ON, by moving from said powered-down mode to said active mode, and producing a position information signal for said individual entity in response to a specific enable signal;

enabling means for producing said specific enable signal in response to an individual code signal, said individual code signal identifying said specific positioning apparatus among other positioning apparatus;

interfacing means adapted to receive said individual code signal from a remote control center and couple same to the enabling means and to couple said position information to telecommunication means.

16. An apparatus as defined in Claim 15, wherein the enabling means consists of a code sensor adapted to store an individual code, compare an incoming code to the stored individual code and produce said enable signal when both said codes match.

17. An apparatus as defined in Claim 15 or 16, consisting of a portable unit.

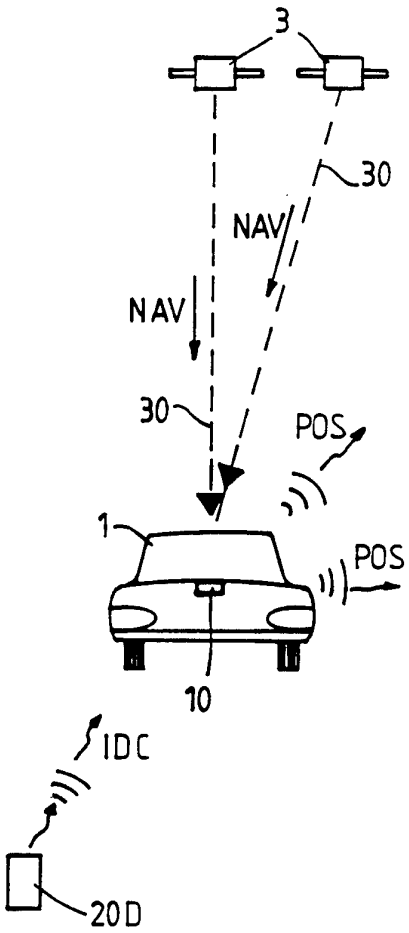
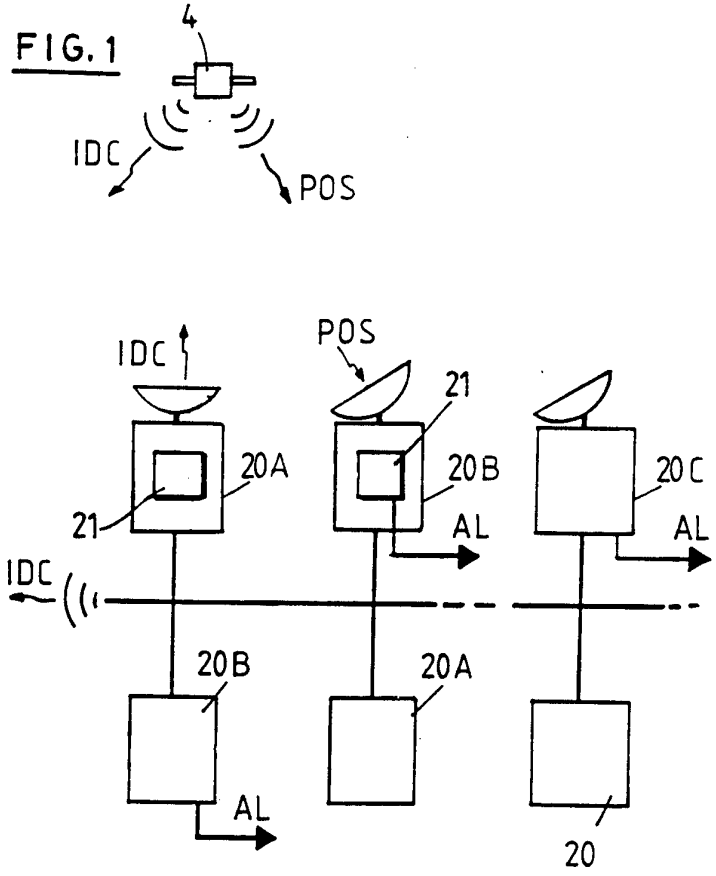

3
30
NAV
NAV
30
POS
1
POS
10
IDC
20D

FIG. 1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IDC
POS
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20C
21
AL
AL
IDC
20B
20A
AL
20

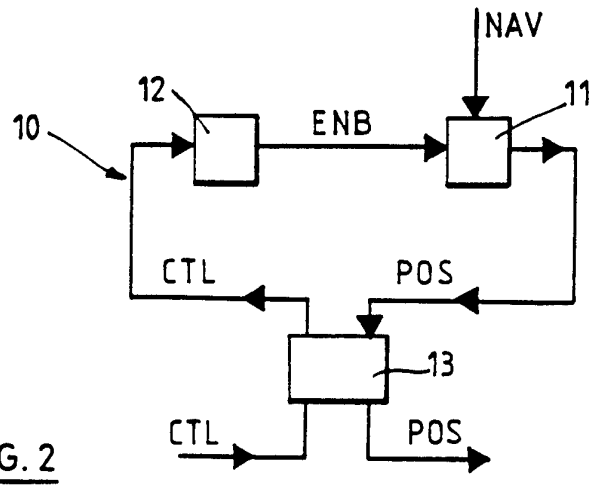
NAV
12
11
10
ENB
CTL
POS
13
CTL
POS

FIG. 2

INTERNATIONAL SEARCH REPORT

I ational Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 G08G1/127

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 5 G08G

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP,A,0 242 099 (ADVANCED STRATEGICS, INC.) 21 October 1987 see abstract see page 2, line 4 - line 5 see page 5, line 4 - line 19; figure 1 ---	1-17
Y	EP,A,0 245 555 (LO-JACK CORPORATION) 19 November 1987 see page 4, line 20 - page 5, line 13 see page 23, line 21 - page 24, line 9; figure 1 ---	1-17
A	EP,A,0 509 776 (PIONEER ELECTRONIC CORPORATION) 21 October 1992 see the whole document ---	1-17
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[X] Patent family members are listed in annex.

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29 June 1994	21. 07. 94

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR,A,2 662 286 (FAIVRE ET AL) 22 November 1991 see page 1, line 1 - line 8 see page 2, line 1 - line 7	1,8,15

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ional Application No
PCT/BE 94/00027

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		DE-A-	3685328	17-06-92
		JP-A-	62277579	02-12-87
		US-A-	4908629	13-03-90
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