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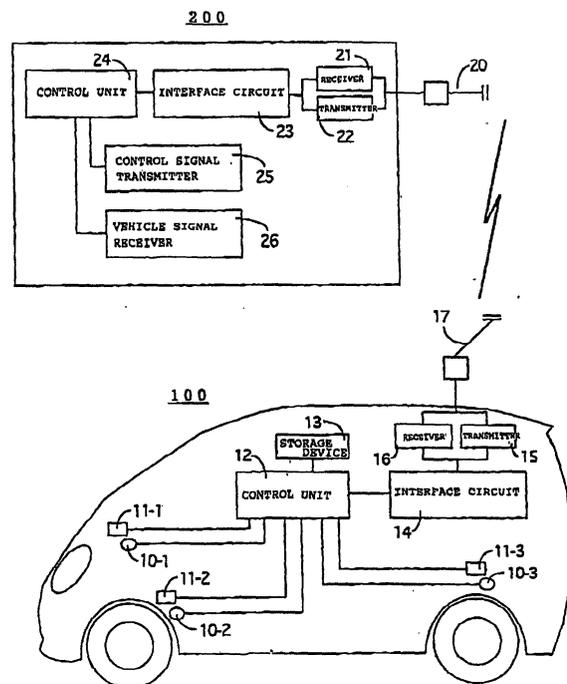
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(54) **METHOD AND SYSTEM FOR DIAGNOSING MOBILE OBJECT**

(57) Disclosed is a mobile object diagnostic system having a mobile object and a fixed station for centralized control of the operation state of this mobile object, wherein the mobile object is diagnosed through transfers of information via radio communication between the mobile object and the fixed station. The mobile object comprises detection means disposed for monitoring the state of at least one component of the components constituting the mobile object, and outputting a detection signal; a first control unit for processing to code the detection signal from the detection means; and first information communication means for transmitting the code-processed detection signal to the fixed station as a first radio signal. The fixed station comprises second information communication means for receiving the first radio signal; a second control unit for processing to decode the first radio signal received by the second information communication means, and outputting it as a decoded detection signal; and diagnostic means for analyzing the decoded detection signal to diagnose the state of the mobile object.

Fig. 1



Description

Technical Field

[0001] The present invention relates to a mobile object diagnostic system and a diagnostic method. More particularly, it relates to a mobile object diagnostic system and a diagnostic method wherein the operation state of a mobile object such as a vehicle is monitored, the result is computerized and transmitted outside of the mobile object via radio communication, thereby the state of the mobile object can be diagnosed outside the mobile object, and various managements and controls can be realized.

Background Art

[0002] Conventionally, on-vehicle information communication devices carried on mobile objects such as vehicles have been widely put in practical use, and the functions of those devices are various.

[0003] As a representative on-vehicle information communication device, a car navigation system can be mentioned in which the position of a vehicle is detected and a course to a desired destination is guided.

[0004] Further, an electronic toll collection system (ETC), which is currently under examination and development, and so on can be mentioned.

[0005] However, data transfer quantity in these conventional on-vehicle information communication devices is very low capacity, besides it is the present state that no on-vehicle information communication device capable of data transfer using two-way communication means has been put in practical use.

[0006] On the other hand, information communication devices used in applications other than on-vehicle are in progressive technical development, and it is desired that a novel on-vehicle information communication device specified to on-vehicle is put in practical use by applying these information communication techniques.

[0007] Further, any diagnostic system for a vehicle by monitoring the operation state of the vehicle, computerizing the result, and two-way communication between the vehicle and the manager of the vehicle has also not yet been put in practical use.

Disclosure of the invention

[0008] In view of the above points, the present invention provides novel mobile object diagnostic systems and diagnostic methods.

[0009] A mobile object diagnostic system according to the present invention has a mobile object and a fixed station for centralized control of the operation state of this mobile object, and diagnoses the mobile object through transfers of information via radio communication between the mobile object and the fixed station.

[0010] The mobile object comprises detection means

disposed for monitoring the state of at least one component of the components constituting the mobile object, and outputting a detection signal; a first control unit for processing to code the detection signal from the detection means; and first information communication means for transmitting the code-processed detection signal to the fixed station as a first radio signal.

[0011] The fixed station comprises second information communication means for receiving the first radio signal; a second control unit for processing to decode the first radio signal received by the second information communication means, and outputting it as a decoded detection signal; and diagnostic means for analyzing the decoded detection signal to diagnose the state of the mobile object.

[0012] The mobile object can further comprise storage means for storing the code-processed detection signal for a predetermined period.

[0013] The fixed station further comprises control command signal generation means for judging on the basis of a diagnostic result of the diagnostic means whether or not a control or adjustment for the operation of the mobile object is necessary, and generating a control command signal when judging to be necessary, processes to code the control command signal by the second control unit, and transmits it as a second radio signal from the second information communication means.

[0014] The mobile object can further comprise control means disposed for outputting a control signal to a component having need of control or adjustment, receive the second radio signal from the first information communication means, process to decode it by the first control unit, and output it to the control means.

[0015] The fixed station can further comprise diagnostic data making means for making diagnostic data indicating the state of the mobile object, on the basis of a diagnostic result of the diagnostic means, process to code the diagnostic data by the second control unit, and transmit it as a third radio signal from the second information communication means.

[0016] A mobile object according to the present invention is a mobile object used in a mobile object diagnostic system wherein the mobile object is diagnosed through transfers of information via radio communication with a fixed station for centralized control of the operation state of the mobile object.

[0017] The mobile object comprises detection means disposed for monitoring the state of at least one component of the components constituting the mobile object, and outputting a detection signal; a first control unit for processing to code the detection signal from the detection means; and first information communication means for transmitting the code-processed detection signal to the fixed station as a first radio signal.

[0018] The mobile object can further comprise storage means for storing the code-processed detection signal for a predetermined period.

[0019] The mobile object can further comprise control means disposed for outputting a control signal to a component having need of control or adjustment, receive a second radio signal, which is transmitted to the mobile object when the fixed station judges on the basis of the first radio signal that a control or adjustment of the operation of the mobile object is necessary, from the first information communication means, process to decode it by the first control unit, and output it to the control means.

[0020] In the mobile object diagnostic system of the present invention, at least one of the detection means can be constructed to be a detector for detecting the oil quantity and/or the oil temperature of engine oil of the mobile object.

[0021] In the mobile object diagnostic system of the present invention, at least one of the detection means can be constructed to be a detector for detecting the mileage of the mobile object.

[0022] In the mobile object diagnostic system of the present invention, at least one of the detection means can be constructed to be a detector for detecting a tire pressure of the mobile object.

[0023] In the mobile object diagnostic system of the present invention, the first information communication means and the second information communication means can be communication means via a satellite.

[0024] In the mobile object diagnostic system of the present invention, the first information communication means and the second information communication means can be communication means using PHS (Personal Handy System).

[0025] In the mobile object diagnostic system of the present invention, at least the detection means and the first control unit can be connected through an optical fiber.

[0026] In the mobile object of the present invention, at least one of the detection means can be constructed to be a detector for detecting the oil quantity and/or the oil temperature of engine oil of the mobile object.

[0027] In the mobile object of the present invention, at least one of the detection means can be constructed to be a detector for detecting the mileage of the mobile object.

[0028] In the mobile object of the present invention, at least one of the detection means can be constructed to be a detector for detecting a tire pressure of the mobile object.

[0029] In the mobile object of the present invention, the first information communication means can be communication means via a satellite.

[0030] In the mobile object of the present invention, the first information communication means can be communication means using PHS (Personal Handy System).

[0031] In the mobile object of the present invention, at least the detection means and the first control unit can be connected through an optical fiber.

[0032] A diagnostic method of a mobile object of the present invention monitors the state of at least one component of the components constituting a mobile object, transmits this monitoring result outside of the mobile object by radio, and diagnoses the operation state of the mobile object outside the mobile object on the basis of the monitoring result.

[0033] In the diagnostic method, it is possible that the diagnostic result is transmitted to the mobile object, and the mobile object controls or adjust the operation state on the basis of the diagnostic result.

[0034] In the diagnostic method, it is possible that the monitoring result is received outside the mobile object and made into a data base, and a mobile object that transmitted a specific monitoring result is extracted.

Brief Description of the Drawings

[0035]

FIG. 1 is a diagram for explaining a schematic construction of a mobile object diagnostic system according to the present invention;

FIG. 2 is a diagram showing the construction of a mobile object diagnostic system according to an embodiment of the present invention; and

FIG. 3 is a diagram showing the construction of a mobile object diagnostic system according to another embodiment of the present invention.

Best Mode for Carrying out the Invention

[0036] FIG. 1 is a schematic construction diagram for explaining the principle of a mobile object diagnostic system of the present invention.

[0037] Note that, in the system shown in FIG. 1, a vehicle 100 as a mobile object and a fixed station 200 as a management center for centralized control of the operation state of the vehicle 100 are provided.

[0038] In the vehicle 100, detectors 10-1 to 10-3 are disposed in portions (elements) considered to be necessary for grasping conditions of the vehicle. Further, controllers 11-1 to 11-3 are disposed in portions (elements) considered to be necessary for controlling the vehicle. The reception of detection signals from the respective portions (elements) detected by the detectors 10-1 to 10-3, and the transmission of control signals to the controllers 11-1 to 11-3 are under the centralized control of a control unit 12. Besides, a storage device 13 is provided for storing or holding detection signals detected through the respective detectors 10-1 to 10-3 and control signals for controlling the respective controllers 11-1 to 11-3.

[0039] Here, detection signals detected by the detectors 10-1 to 10-3 are coded by the control unit 12, sent through an interface circuit 14 to a transmitter 15, and transmitted outside the vehicle through a communication antenna 17. The detection signals transmitted out-

side the vehicle are received and processed by the fixed station 200 disposed outside the vehicle.

[0040] A signal received by a communication antenna 20 of the fixed station 200 is via a receiver 21, and decoded by a control unit 24 through an interface circuit 23. The decoded signal is analyzed in a vehicle signal receiver 26.

[0041] Here, when a control or adjustment for a component of the vehicle is required as a result of the analysis of a detection signal, a control signal transmitter 25 transmits a control command signal, and this control command signal is coded by the control unit 24, transmitted from a transmitter 22 through the interface circuit 23, and delivered through the communication antenna 20 to the vehicle 100.

[0042] The vehicle 100 receives this control command signal through the communication antenna 17, decodes it by the control unit 12 through the receiver 16 and the interface circuit 14, and delivers it to the controllers 11-1 to 11-3. The controllers 11-1 to 11-3 are thereby driven so that the component of the mobile object having need of control or adjustment is controlled or adjusted.

[0043] In FIG. 2 shown is an example of a mobile object diagnostic system of the present invention. In the vehicle 100, detectors 30-1 to 30-3 are disposed in media (components) considered to be necessary for grasping conditions of the vehicle.

[0044] In the embodiment shown in FIG. 2, the detectors 30-1 to 30-3 are disposed in a water temperature gauge for cooling water, an oil temperature gauge in the engine, and a tire gauge, respectively. Detection signals from the detectors 30-1 to 30-3 are coded by a control unit 32 and stored in a storage device 33. The coded detection signals stored in the storage device 33 are regularly sent at predetermined timings to a transmitter 35 through an interface circuit 34, and transmitted outside the vehicle by a communication antenna 37. Note that each of the detectors 30-1 to 30-3 and the control unit 32 can be connected through an optical fiber to make up a so-called in-vehicle LAN.

[0045] A detection signal coded and transmitted outside the vehicle is received and processed by the fixed station 200 constituting a vehicle information centralized center. The signal received by a communication antenna 40 of the fixed station 200 is decoded by a control unit 44 through a receiver 41 and an interface circuit 43, and analyzed by a vehicle signal receiver 46.

[0046] Here, it has an information processor 47 for analyzing conditions of a plurality of vehicles, and detection signals from the respective vehicles are made into a data base and stored in this information processor 47. As a result of the analysis and diagnosis of detection signals from the respective vehicles, when a vehicle is judged to require a maintenance, that is, it is judged that a control or adjustment for the operation of the vehicle is required, a control signal transmitter 75 makes a control command signal. This control command signal

made can also be stored in the information processor 47. Besides, by transmission from a not-shown transmitter to the vehicle 100 at a predetermined timing, or notifying the owner of the vehicle, state reports of the vehicle can be regularly performed.

[0047] FIG. 3 is a construction diagram of a mobile object diagnostic system showing another embodiment of the present invention.

[0048] In this embodiment, detectors 50-1 to 50-3 are disposed in the vehicle 100. The detectors 50-1 to 50-3 are disposed in a water temperature gauge for cooling water, an oil temperature gauge in the engine, and a tire pressure gauge, respectively. Besides, various controllers 51-1 to 51-3 are disposed in components of the mobile object necessary for control or adjustment. Note that the detectors can also detect information signals such as mileage and engine speed from an engine control circuit 52.

[0049] Each of the engine control circuit 52, the detectors 50-1 to 50-3, and the controllers 51-1 to 51-3 is connected to an in-vehicle LAN 58 disposed on a ring, and this in-vehicle LAN 58 is connected with a control unit 53. By the control unit 53, detection signals detected by the detectors 50-1 to 50-3 are coded and temporarily stored in a storage device 54. Besides, they are regularly transmitted at predetermined timings outside the vehicle from a communication antenna 58 through an interface circuit 55 and a transmitter 56.

[0050] A coded detection signal transmitted outside the vehicle is received by the fixed station 200 constituting a vehicle information centralized center, and processed. The signal received by a communication antenna 60 of the fixed station 200 is delivered through a receiver 61 and an interface circuit 63 to a control unit 64, where it is decoded and sent to a vehicle signal receiver 65 to analyze the detection signal.

[0051] The fixed station 200 has an information processor 67 for analyzing conditions of a plurality of vehicles, and detection signals from the respective vehicles are made into a data base and under the centralized management by this information processor 47. And, when it is judged as a processing result of a detection signal that a control or adjustment for a vehicle is necessary, a control command signal is transmitted to the vehicle. In this case, a control signal transmitter 65 transmits the control command signal, and the control unit 64 codes it and transmits it from the communication antenna 60 through the interface circuit 63 and a transmitter 62.

[0052] This control command signal is received by the communication antenna 57 of the vehicle 100, sent through a receiver 59 and the interface circuit 55 to the control unit 53, and decoded. The control unit 53 drives each of the controllers 51-1 to 51-3 to perform the control or adjustment. Further, by driving the engine control circuit 52, the control unit 53 can perform not only engine control but also control such as engine stop of a stolen vehicle.

[0053] In the above-described embodiments, note that the radio communication between the vehicle 100 and the fixed station 200 can also be constructed as a communication system via a communication satellite.

[0054] Besides, PHS (Personal Handy System) widely used for mobile communication can also be used.

[0055] As described above, in the present invention, since a detection signal from a detector disposed in a vehicle can be received and grasped outside the vehicle, the operation state of the vehicle can be under centralized management outside the vehicle.

[0056] Note that it is needless to say that the present invention not only is directed to vehicles as mobile objects but also can be applied to mobile objects such as ships.

Possibility of Industrial Utilization

[0057] The present invention can perform centralized management of the operation state of a mobile object, and by regularly transmitting detection signals from a detector disposed in the mobile object, to a fixed station, it becomes possible to diagnose the mobile object in the fixed station, inform the mobile object owner of the mobile object state, and intend to make necessity of the mobile object maintenance or each maintenance service efficient.

[0058] Further, it can be combined with a system for transmission and reception of navigation information, positional detection of a stolen vehicle, or the like.

[0059] Besides, it is also possible to send control command signals to various controllers disposed in the mobile object, and automatically perform control adjustment from the outside.

[0060] As detection examples by disposing detectors, detection of cooling water, detection of oil temperature/oil pressure of engine oil, detection of exhaust concentration/temperature, detection of mileage, detection of engine speed, detection of wear of brake pads or the like, and so on can be mentioned.

[0061] Besides, as examples of disposition of controllers, suspension control, engine control, and so on can be mentioned.

Claims

1. A mobile object diagnostic system having a mobile object and a fixed station for centralized control of the operation state of this mobile object, wherein said mobile object is diagnosed through transfers of information via radio communication between said mobile object and said fixed station, **characterized in that**

said mobile object comprises:

detection means disposed for monitoring the state of at least one component of the compo-

nents constituting said mobile object, and outputting a detection signal;

a first control unit for processing to code said detection signal from said detection means; and

first information communication means for transmitting said code-processed detection signal to said fixed station as a first radio signal, and

said fixed station comprises:

second information communication means for receiving said first radio signal;

a second control unit for processing to decode said first radio signal received by said second information communication means, and outputting it as a decoded detection signal; and

diagnostic means for analyzing said decoded detection signal to diagnose the state of said mobile object.

2. The mobile object diagnostic system described in claim 1, **characterized in that**

said mobile object further comprises

storage means for storing said code-processed detection signal for a predetermined period.

3. The mobile object diagnostic system described in claim 1 or 2, **characterized in that**

said fixed station further comprises

control command signal generation means for judging on the basis of a diagnostic result of said diagnostic means whether or not a control or adjustment for the operation of said mobile object is necessary, and generating a control command signal when judging to be necessary, and

said control command signal is processed to be coded by said second control unit, and transmitted as a second radio signal from said second information communication means, and

said mobile object further comprises

control means disposed for outputting a control signal to a component having need of control or adjustment, and

said second radio signal is received from said first information communication means, processed to be decoded by said first control unit, and output to said control means.

4. The mobile object diagnostic system described in claim 1 or 2, **characterized in that**

said fixed station further comprises

diagnostic data making means for making diagnostic data indicating the state of said mobile object, on the basis or a diagnostic result of said diagnostic means, and

said diagnostic data is processed to be coded by said second control unit, and transmitted as a third radio signal from said second information communication means.

5. A mobile object used in a mobile object diagnostic system wherein said mobile object is diagnosed through transfers of information via radio communication with a fixed station for centralized control of the operation state of the mobile object, **characterized in that**

said mobile object comprises:

detection means disposed for monitoring the state of at least one component of the components constituting said mobile object, and outputting a detection signal;

a first control unit for processing to code said detection signal from said detection means; and

first information communication means for transmitting said code-processed detection signal to said fixed station as a first radio signal.

6. The mobile object described in claim 5, **characterized in that**

said mobile object further comprises

storage means for storing said code-processed detection signal for a predetermined period.

7. The mobile object described in claim 5, **characterized in that**

said mobile object further comprises

control means disposed for outputting a control signal to a component having need of control or adjustment, and

a second radio signal, which is transmitted to said mobile object when said fixed station judges on the basis of said first radio signal that a control or adjustment of the operation of said mobile object is necessary, is received from said first information communication means, processed to be decoded by said first control unit, and output to said control means.

8. The mobile object diagnostic system described in any of claims 1 to 4, **characterized in that**

at least one of said detection means is a detector for detecting the oil quantity and/or the oil temperature of engine oil of said mobile object.

9. The mobile object diagnostic system described in any of claims 1 to 4, **characterized in that**

at least one of said detection means is a detector for detecting the mileage of said mobile object.

10. The mobile object diagnostic system described in any of claims 1 to 4, **characterized in that**

at least one of said detection means is a detector for detecting a tire pressure of said mobile object.

11. The mobile object diagnostic system described in any of claims 1 to 4, **characterized in that**

said first information communication means and said second information communication means are communication means via a satellite.

12. The mobile object diagnostic system described in any of claims 1 to 4, **characterized in that**

said first information communication means and said second information communication means are communication means using PHS (Personal Handy System).

13. The mobile object diagnostic system described in any of claims 1 to 4, **characterized in that**

at least said detection means and said first control unit are connected through an optical fiber.

14. The mobile object described in any of claims 5 to 7, **characterized in that**

at least one of said detection means is a detector for detecting the oil quantity and/or the oil temperature of engine oil of said mobile object.

15. The mobile object described in any of claims 5 to 7, **characterized in that**

at least one of said detection means is a detector for detecting the mileage of said mobile object.

16. The mobile object described in any of claims 5 to 7, **characterized in that**

at least one of said detection means is a detector for detecting a tire pressure of said mobile object.

17. The mobile object described in any of claims 5 to 7, **characterized in that**

said first information communication means is communication means via a satellite.

18. The mobile object described in any of claims 5 to 7, **characterized in that**

said first information communication means is communication means using PHS (Personal Handy System).

19. The mobile object described in any of claims 5 to 7,

characterized in that

at least said detection means and said first control unit are connected through an optical fiber.

20. A diagnostic method of a mobile object, **characterized in that** 5

the state of at least one component of the components constituting a mobile object is monitored, 10
this monitoring result is transmitted outside of the mobile object by radio, and
the operation state of said mobile object is diagnosed outside said mobile object on the basis of said monitoring result. 15

21. The diagnostic method described in claim 20, **characterized in that**

said diagnostic result is transmitted to said mobile object, and 20
said mobile object controls or adjust the operation state on the basis of said diagnostic result. 25

22. The diagnostic method described in claim 20, **characterized in that**

said monitoring result is received outside said mobile object and made into a data base, and a mobile object that transmitted a specific monitoring result is extracted. 30

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Fig. 1

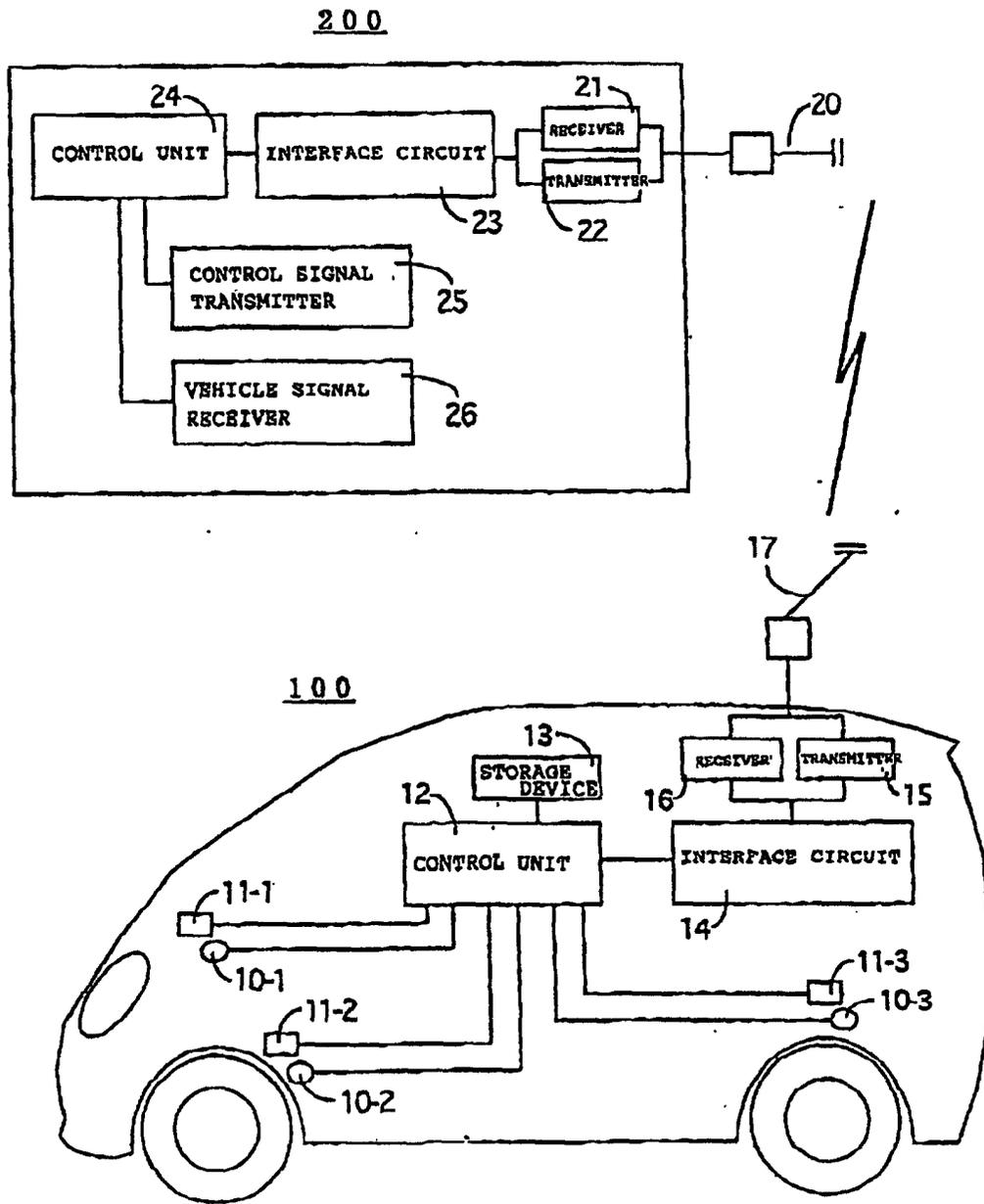


Fig. 2

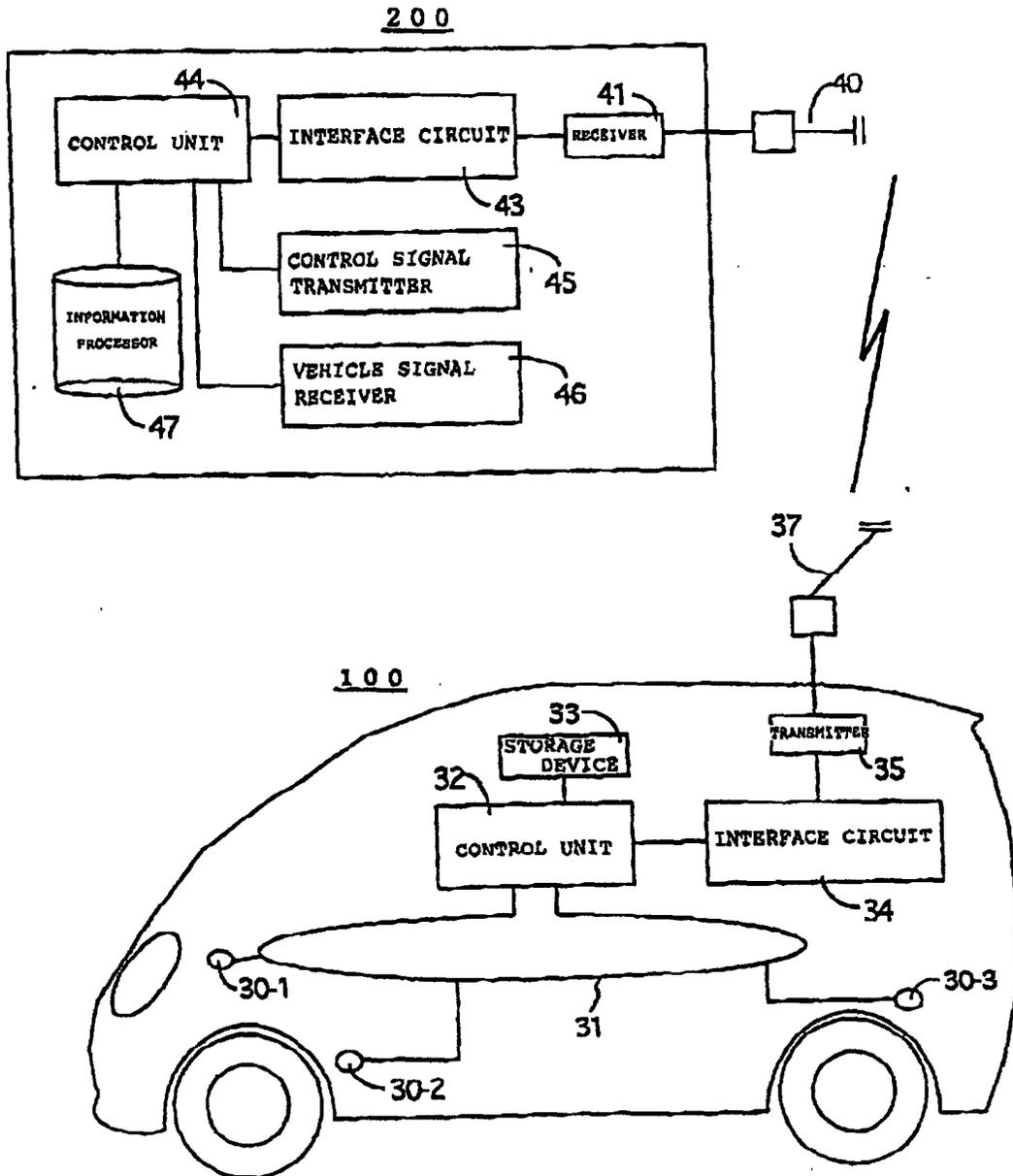
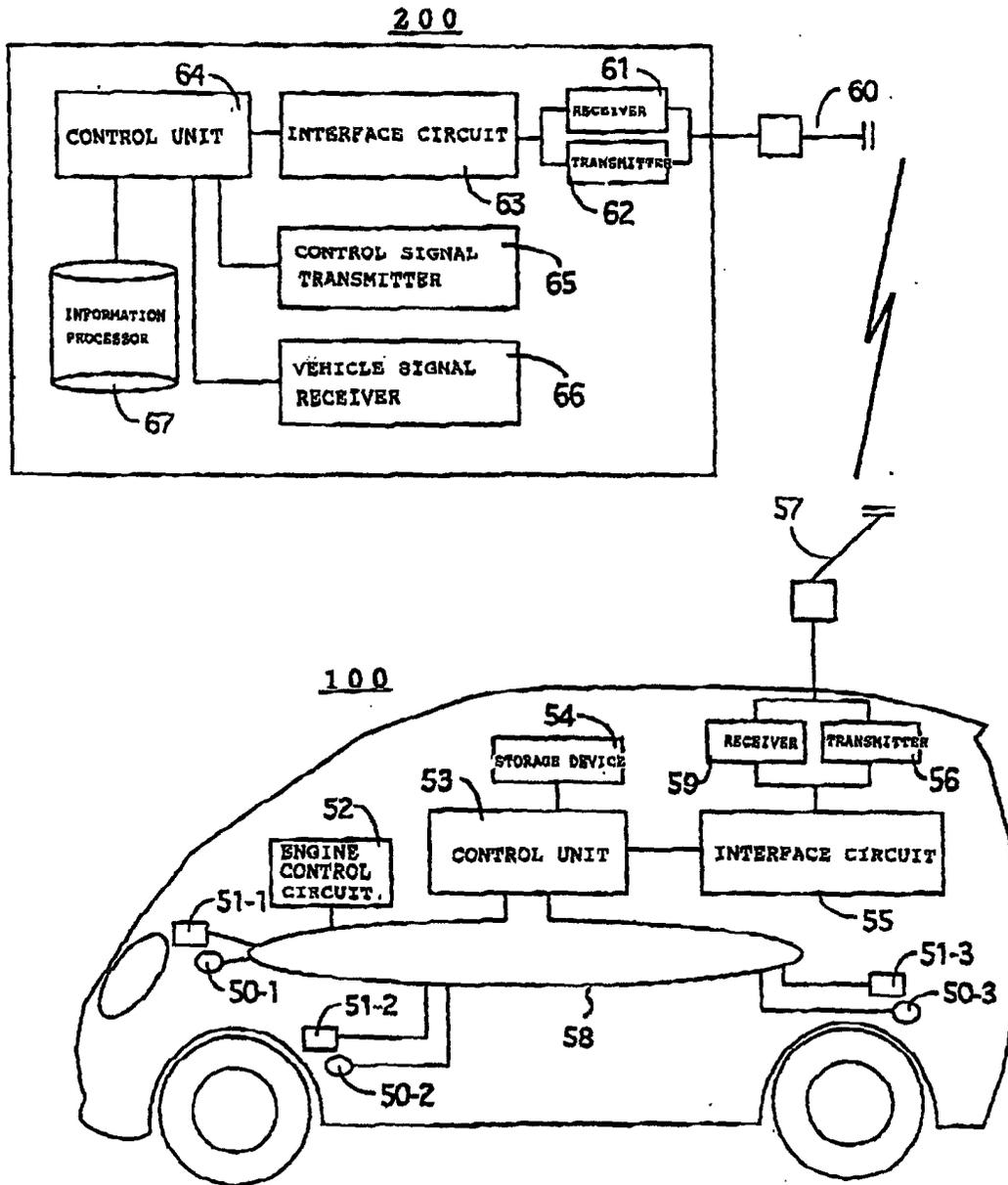


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/06538

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ G01M17/007, B60S5/00, G08G1/00, G08G1/13 G07C11/00		
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) Int.Cl. ⁷ G01M17/007, B60S5/00, B60R16/02, 650		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2000 Kokai Jitsuyo Shinan Koho 1971-2000 Jitsuyo Shinan Toroku Koho 1996-2000		
Electronic data base consulted during the international search (name of data base and, where practicable, 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.
X Y	JP, 10-194095, A (Harness Sogo Gijutsu Kenkyusho K.K. et al.), 28 July, 1998 (28.07.98) (Family: none)	1, 2, 4-6, 20, 22 3, 7-19, 21
Y	EP, 718614, A2 (ALCATEL SEL AG et al.), 26 June, 1996 (26.06.96) & JP, 08-233696, A & DE, 4446512, A	3, 7-19, 21
Y	JP, 06-102148, A (Zanavy Informatics K.K.), 15 April, 1994 (15.04.94), Par. No. [0008] (Family: none)	8-10, 14-16
Y	JP, 11-134529, A (Toyota Motor Corporation), 21 May, 1999 (21.05.99), Par. No. [0017] & DE, 19847622, A	11, 17
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Date of the actual completion of the international search 16 February, 2000 (16.02.00)	Date of mailing of the international search report 29 February, 2000 (29.02.00)	
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