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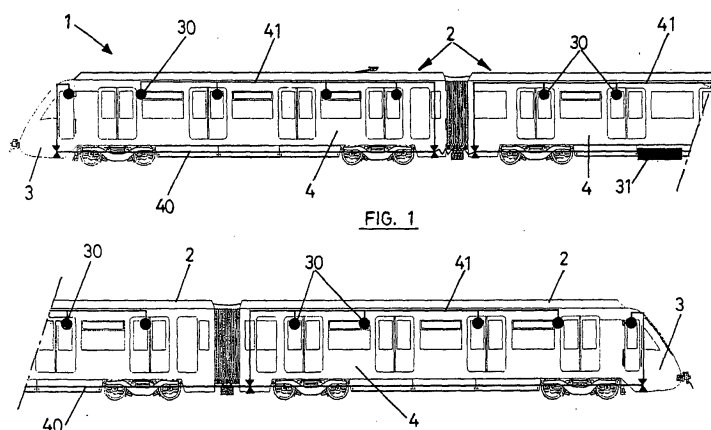
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(54) **FIRE PROTECTION SYSTEM AND METHOD FOR MOBILE UNITS**

(57) System and method for protection against fire in mobile units, such as railway mobile units (1) consisting of coaches (2) that comprise at least one area (3) and/or 4) of risk to be protected, which system comprises

a detection unit, with means of suction and analysis; a control unit with means of evaluation and communication; an execution unit with push-buttons for activation of an extinction unit with spray nozzles (30) fitted in areas (3 and/or 4) of risk and fed through ducts (40-41).



Description

FIELD OF THE INVENTION

[0001] The present invention is included within the systems of protection against fire for railway mobile units.

BACKGROUND OF THE INVENTION

[0002] Systems for protection against fire are very widespread in premises where there is a stationary room wherein the control and of pumping gear is housed, as well as a stationary structure on which the installation is implemented and an interior air space that facilitates the detection of smoke. Indeed, the systems presently implanted in fixed facilities are not extendable to railway rolling stock, due to the particular characteristics of the latter.

[0003] For this reason and due to the complications it involves, no such system exists of protection against fire in rolling or mobile stock; the systems existing in other underground railways do not contemplate both detection and extinction, but rather are limited only to providing fire warnings, and only in some railway operations do they employ the system of breaking a glass bulb by heat to apply the extinction action.

DESCRIPTION OF THE INVENTION

[0004] The object of the present invention is to resolve the problems described by means of a system and a method for protection from fire that contemplates detection, control and information, execution and extinction. Said system endeavours to avoid all sources of fire, as well as the effects associated therewith, such as the evacuation of passengers in the tunnel (always a complicated operation), guaranteeing extinction without the need to evacuate until the train has reached the next station, where the evacuation conditions are always better and vacating is possible in a much shorter time. Thus user evacuation conditions are improved in this means of transport, and serious perturbation is avoided in railway exploitation.

[0005] Notwithstanding, should fire finally be declared, the system suppresses or slows its propagation, reduces the emission of gases and smoke, reduces possible harm to people, goods and environment and assures the return to normal service as soon as possible. The system of protection against fire of the invention is applicable to railway rolling stock, and adapts to the particular characteristics of the latter which are indicated here below:

- it is a system that is located in a medium permanently in motion and subjected to sharp recurrent acceleration-deceleration and which has to be able to withstand vibrations, magnetic fields, important

relative movements between the coaches that form the train;

- it is a system that circulates in tunnels and outdoors, which implies that it has to be able to withstand extreme temperatures (between -15°C and 45°C), with sudden changes thereof;
- it is a system subjected to air currents, since in the rolling stock currents are generated as a consequence of the train's own ventilation, air conditioning, opening and closing of doors of passenger carriages and the train's own movement, besides the characteristic air currents of the tunnels;
- it is a system that is mounted on rolling stock in which the space is very limited. The size of the protection systems implanted in other facilities exceeds that allowed in railway rolling stock.

[0006] In brief, contrary to the system of the invention for mobile units, the systems of protection for fixed facilities:

- work at a pressure of around 25 kg/cm^2 . To work with a permanent pressures of this order in rolling stock is very complex;
- use wet pipe arrangements for the whole pipe system, which is not acceptable in railway rolling stock, in which all possible risks of leakage should be avoided in the passenger carriages under normal running conditions.

[0007] The invention relates to a system for protection against fire in railway mobile units. The term railway mobile unit will be given to the smallest convoy of coaches with autonomy, and the term coach to each of the elements of the convoy that is structurally indivisible. Each unit can be formed by one or several coaches, and each train will be formed by one or several units coupled for circulation thereof.

[0008] Inside each mobile unit there is a distinction between the motor coach and a trailer coach. The motor coach is that which has a complete traction assembly and a trailer coach is one which has no traction assembly and is towed by the motor coaches that form the unit. In the formation of units there can be trailer coaches, although these are not indispensable for the formation thereof.

[0009] In each coach of the mobile unit it is possible to distinguish the enclosure that is the body of the railway vehicle intended for passengers and driver's cab, and on the underframe the enclosed area in which are located miscellaneous equipment and piping and ducting systems.

[0010] Each mobile unit comprises at least one area of risk to be protected, areas of risk being understood to be those eligible for protection through being intended for the use of people or for goods. There are two areas of risk initially contemplated: the driver's cab and the passenger carriage. The driver's cab is the enclosure

provided for the personnel who drive the train.

[0011] The system comprises a remote position connected with each mobile unit through a radio set and, for each mobile unit, a detection unit, a control unit, an execution unit and an extinction unit. These units are incorporated on board the rolling stock.

[0012] The system is permanently active whenever the mobile unit is under power.

[0013] The detection unit comprises a suction unit and an analysis unit. This analysis unit comprises a detection module and a communications module.

[0014] The suction unit comprises an ensemble of suction mouthpieces, located in each area of risk, and ducting means. Preferably, said suction mouthpieces are located in the roof, and continuously draw samples of air from the areas of risk to be protected, and channel these samples of air through the ducting means to the detection module of the analysis unit.

[0015] Preferably, the detection module employs laser technology.

[0016] The control unit carries out the evaluation and administration of the information received through the detection unit. This control unit comprises an evaluation unit and a communications unit.

[0017] Both units, for detection and control, are essentially of an electrical - electronic nature.

[0018] The control unit basically carries out the evaluation of the information received from the detection unit, the administration of information sent to the driver's cab and the remote position, as well as the triggering of the extinction caused by the execution unit.

[0019] The execution unit comprises at least one manual actuator. Preferably, said actuator is a re-settable push-button of the press-press type, for the purpose of halting the extinction if need be.

[0020] When the mobile unit comprises at least five coaches, the execution unit comprises a switch, to select the coaches (four-coach convoy) for the extinction action.

[0021] The extinction unit comprises a pumping set that serves to provide the necessary pressure to the extinction fluid, located on the underframe, a pipe system, a set of electro-valves, and a spray nozzle assembly.

[0022] This extinction unit is essentially hydraulic in nature.

[0023] There is one pumping set for each mobile unit. Said pumping set comprises a storage unit for extinction fluid, and a group of elements to impel said extinction fluid.

[0024] The pipe system is made up of a wet pipe network, located on the underframe of each coach that comprises the mobile unit, and a dry pipe network, located in the false ceiling of each coach forming part of the mobile unit.

[0025] Preferably, the wet pipe network is pressurized by means of a jockey pump, a pressurizing pump to ensure the operation of the extinction unit.

[0026] The set of electro-valves consists of a main

valve, located in the pumping set and a selector valve for each area of risk to be protected in each coach.

[0027] Preferably, these electro-valves are solenoid valves.

5 **[0028]** The wet pipe network connects the pumping set with each selector valve, and the dry pipe network connects each selector valve with the spray nozzle assembly.

10 **[0029]** The system of protection against fire of the invention will be operative both when the mobile unit is in motion and when it is stationary.

[0030] The invention also refers to a method for protection against fire in mobile units. This method comprises a first detection stage, a second stage of information management and a third extinction stage, this third extinction stage being activated manually by operating an actuator.

[0031] This operation can be implemented from the train itself or via radio from a remote position.

20 **[0032]** The detection stage, implemented by the detection unit, comprises the suction of air through the suction mouthpieces inside each coach and the conduction of said air through the ducting means to the detection module of the analysis unit.

25 **[0033]** The detection module analyses said air and produces a first set of signals.

[0034] Said first set of signals generated by the detection module is transmitted to the control unit.

30 **[0035]** The control stage comprises the evaluation of said first set of signals establishing pre-alarm and alarm levels, the transmission of a second set of pre-alarm signals and a third group of alarm signals, the information to the execution unit, remote position and driver's cab, administration of the extinction stage, maintenance check of the system, and generation of historical records.

35 **[0036]** The extinction stage comprises the application of extinction fluid through the spray nozzles. Preferably said extinction fluid is water or the like.

40 **[0037]** The extinction can be carried out by three procedures.

[0038] If the extinction is carried out following normal procedure, it is necessary that transmission takes place of said third set of alarm signals and said actuator is a first push-button located in the driver's cab. In this case, the execution unit acts directly on the control unit and this on that of extinction.

45 **[0039]** If the extinction is carried out following emergency procedure, this actuator is a second emergency push-button located in the driver's cab. In this case, the execution unit acts directly on the extinction unit.

50 **[0040]** If the extinction is carried out remotely via the radio set, it is necessary that transmission takes place of said third set of alarm signals and said actuator is a third push-button located in the remote position. In this case, the execution unit acts via radio on the control unit and this on that of extinction.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0041] Next a very brief description is given of a series of drawings that assist in a better understanding of the invention and that are expressly related with an embodiment of said invention, which is presented as a non-restrictive example thereof.

Figure 1 shows a railway mobile unit in accordance with an embodiment of the invention, constituted by three coaches, in which some of the elements are shown of the system of protection against fire of the invention.

Figure 2 shows the constituent elements of the suction unit.

Figure 3 shows a schematic of the pumping set of the extinction unit.

Figure 4 shows the panel with the different push-buttons in the driver's cab.

Figure 5 shows the electronic card of the control unit.

Figure 6 is a block diagram of the electronic card of figure 5.

Figure 7 shows a suction mouthpiece and a spray nozzle, both located in the roof of a coach.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

[0042] In accordance with an embodiment of the invention shown in figure 1, a railway mobile unit 1 is constituted by three coaches 2.

[0043] It is considered that the area of risk to be protected encompasses the driver's cab 3 and the passenger carriage 4.

[0044] In accordance with a second embodiment (not shown), each railway mobile unit is constituted by six coaches 2. In such a case, the term half-unit is given to the group of four coaches closest to the operations cabin (front half-unit), or to the group of four coaches farthest from the operations cabin plus the tail cab (rear half-unit).

[0045] The operations cabin is that which has control of the train when the unit is in service and the tail cab it is that which does not.

[0046] The system of protection against fire comprises a central control position or remote position connected with each mobile unit through a radio set, and for each mobile unit a detection unit, a control unit, an execution unit and an extinction unit.

[0047] The detection unit comprises a suction unit and an analysis unit. The suction unit, as is shown in figure 2, comprises a group of suction mouthpieces 11 for taking samples of air, and ducting means 12. In figure 7 a suction mouthpiece 11 located in the roof of a coach 2 is shown in greater detail.

[0048] In this case four suction mouthpieces are installed per passenger carriage 4 and one suction mouth-

piece 11 in the driver's cab 3.

[0049] The analysis unit comprises, at least, one detection module 13, and a communications module.

[0050] In the case of a mobile unit 1 with three coaches, a detector module is installed that will draw, in parallel, air from the two driver's cabs and from the three passenger carriages.

[0051] In the case of a mobile unit with six coaches, two detector modules are installed, each of which will draw in parallel from one driver's cab plus the three adjoining passenger carriages.

[0052] Detectors are used with a detection chamber employing laser technology. In short, the detector chosen is the VESDA LASER PLUS (VLP), the signal from which is picked up by an extinction station wherein it is possible to program different operating modes.

[0053] As a function of the obscuration of the air detected by the VLP (detection range: 0.005% - 20%/m), the system is programmed for different modes of actuation.

[0054] Two detection levels are envisaged: pre-alarm and alarm. The settings of the alarm and pre-alarm levels will be sufficiently removed from everyday smoke levels to avoid false alarms. Both levels will be displayed on a computer screen located in the driver's cab.

[0055] Information of the pre-alarm and alarm levels will be sent automatically via radio to the central control position or remote control position.

[0056] Only the alarm level will allow extinction, by acting on a corresponding first push-button of "normal extinction" in the mode termed normal extinction or remote extinction.

[0057] The control unit comprises an evaluation unit and a communications unit. This control unit has been wholly developed by METRO DE MADRID.

[0058] In figure 5 the electronic card 20 of the control unit is shown, which has been designed according to the requirements established to comply with the standards regarding Electromagnetic Compatibility (EMC), Temperature Ranges, Vibrations and Impact tests. Figure 6 shows the block diagram of said electronic card.

[0059] Its basic functions are:

[0060] Verification of faults in the wiring, as well as in peripheral devices connected thereto.

[0061] Self-numbering of the mobile units of the train.

[0062] Communication with the control module of the train auxiliary equipment, which is the equipment that controls train entrances / departures and incidents, with the central control position through the radio set and recording in the black box of the train (which is a particularly robust module of the train, mechanically designed to preserve the information stored after a crash, accident or incident, based on the reception and recording over a period of time - several days - of diverse analogue and digital signals which allow the circumstances to be reconstructed surrounding a determined accident or event.

- Communication with the detection module, carrying out the analysis of the signal received by said detector and thereby generating the pre-alarm and alarm levels, producing the corresponding pre-alarm and alarm signals.
- Control of the extinction fluid pressure and storage plant.
- It receives the status of the emergency lines, push-buttons and half-unit selector switch.
- Storage of the incidents in internal tables that can be sent to the control module of train auxiliary equipment, or extracted to a PC connected to the card, for carrying out maintenance tasks.

[0063] Figure 6 shows a block diagram of the electronic card of figure 5, with a clock 101, a random access memory RAM 102 for data, a latch circuit 103, a micro-processor 105, with a FLASH memory 105 and an EPROM 106, a series of digital inputs 107, analogue inputs 108 and digital outputs 109; the analogue inputs 108 pass through an analogue-to-digital converter 110. Said card 20 also has a communications interface, an isolated power supply unit 112, and a filter 113, as well as a DC/DC converter 114. The card also includes a reset mechanism 115, as well as communication and data buses 116 between the different components of the card.

[0064] The extinction unit comprises a pumping set 31, located on the underframe, a pipe system, a set of electro-valves, and a spray nozzle assembly 30. One of these spray nozzles 30 is shown in more detail in figure 7. One spray nozzle 30 is fitted for each driver's cab and four spray nozzles 30 for each passenger carriage, located in the false ceiling inside the coaches.

[0065] For each mobile unit there is a single pumping set 31. As is shown in figure 3, this pumping set comprises a storage unit 32 for extinction fluid, and an assembly of elements 33 for impelling said extinction fluid.

[0066] In accordance with this preferred embodiment, the extinction fluid is water 32 and the impelling elements 33 are cylinders of air under pressure. The pump set also has a jockey pump and control and actuation elements. The whole assembly is lodged on the underframe in the trailer coach (in the case of a three-coach mobile unit) or in one of the trailer coaches (in the case of a six-coach mobile unit).

[0067] The set of electro-valves is formed by solenoid actuating valves comprising a main valve, located inside the pumping set and a selector valve for each of the enclosures (driver cabs and passenger carriage), located on the underframe of the area of risk to be protected.

[0068] As is shown in figure 1, the pipe system comprises a wet pipe network 40 and a dry pipe network 41. The wet pipe network 41 runs the full length the mobile unit on the underframe, connecting the pumping set 31 with each of the selector valves of each area of risk. The wet pipe network is pressurized by means of the jockey pump. The dry pipe network 41 connects the selector

valve of each area of risk with the spray nozzles 30 located inside the coaches 2.

[0069] The triggering of the extinction action will always be manual, by operation of the push-buttons located in the driver's cab 3 of the mobile unit or on the command panel of the central control position or remote position, in the case of remote extinction via radio.

[0070] Thus, in the case of mobile units with both three coaches and six coaches, the execution unit comprises the first push-button 50 of "normal extinction", a second push-button 51 of "emergency extinction" and a third push-button 52 of "cab extinction", the three push-buttons being located in the driver's cab, separated from the console (located inside the driver's cab), whereby any manipulation thereof is performed consciously.

[0071] Said push-buttons can be reset immediately, since they are press/press type push-buttons. These push-buttons will not incorporate any irreversible system of actuation (seals, windows), in spite of their manipulation being performed consciously. However, so as to avoid any chance manipulation, each push-button will be protected with a transparent cover.

[0072] In the case of a mobile unit with six coaches, the execution unit also comprises a two-way switch 55 so that a driver located in the driver's cab may select one of the two half-units, front or rear. It will be possible to change the switch position at any time.

[0073] The first push-button of "normal extinction" is to trigger the extinction in the passenger carriages and in the tail cab in normal extinction mode: that is, this mode depends on the detection of the alarm level, and of the depressing of the first push-button of "normal extinction".

[0074] In the case where the extinction stage is carried out remotely via the radio set from the central control position or remote position, said central control position will have a first push-button of "normal extinction" the function of which is equivalent to that of the first push-button of "normal extinction" in the driver's cab.

[0075] The second push-button of "emergency extinction" is to trigger the extinction process in the passenger carriages and in the tail cab in emergency extinction mode; that is, it does not depend on the detection level (pre-alarm or alarm) and is only conditioned by the depressing of the second "emergency extinction" push-button.

[0076] The third push-button of "cab extinction" is to trigger the extinction process in the driver's cab itself. The triggering of the extinction process in the driver's cab itself does not depend on the detection and is only conditioned by the positioning of the inverter, element of the train used to define the direction in which the train runs, in Ad (forward motion) or At (reverse motion) in this cab, as well as operating said third push-button of "cab extinction".

[0077] Each push-button will come with an associated optical indicator, nearby and clearly visible, which will be illuminated on operation of the corresponding push-

button. In the unique case of the first push-button of "normal extinction", the optical illumination will be a flashing effect produced by the control module, after the alarm is detected, in order to direct the driver to the push-button to be pressed. Once pressed, illumination will be steady, the same as in the remaining push-buttons.

[0078] There will be another optical indicator to indicate detection of the alarm level. Additionally, in the driver's cab there will be a fourth push-button 53 the function of which is that of resetting the detection system, since it is regulated that in the event of an alarm actuation, the system interlocks. Resetting of this fourth push-button is not carried out automatically and it will only be effective if the alarm level has really disappeared. The optical indicator of the previous paragraph is integrated in this push-button.

[0079] This situation implies a bi-directional communication between the detection module and the control unit. Additionally these actions will be recorded in the control module of the auxiliary equipment and in the black box of the train.

[0080] The system is operational both with the mobile unit 1 in motion and when stationary.

[0081] Extinction in normal mode is controlled and enabled by the detection unit. The extinction will take place when the first push-button of "normal extinction" is operated and after the alarm level has been reached, the detection unit having transmitted the corresponding alarm signal. If this first push-button of "normal extinction" is operated without having reached the alarm level, said first push-button will be inoperative.

[0082] In any event, there will always be optical information that a push-button has been activated.

[0083] In the case of a mobile unit with six coaches, the switch allows the selection of the half-unit for the extinction process. In the case of selecting the rear half-unit, the extinction will also be applied in the tail cab.

[0084] Said switch is operative solely in emergency extinction, since in normal mode extinction it is the control unit that together with the corresponding detection module orders extinction to be applied in the mobile unit where the alarm level has been detected.

[0085] Once the extinction has been activated, this will function constantly until exhaustion of the extinction fluid, unless the extinction is detained in the event of:

- In so-called normal mode extinction, on resetting manually the corresponding first push-button of "normal extinction".
- In so-called emergency mode extinction, on resetting manually the corresponding second push-button of "emergency extinction".
- In the case of remote extinction, on cancelling the extinction command.

[0086] That is, both during normal and emergency mode extinction, resetting is allowed of the push-buttons

at any time, after having been operated; once the corresponding push-button is reset, extinction is halted.

[0087] The system is capable of positioning each of the electro-valves in the mobile unit and recognizing their status.

Claims

1. A system for protection against fire in mobile units, each railway mobile unit is constituted by, at least, one car, each mobile unit comprising, at least, one area of risk to be protected, **characterised in that** said system comprises
 - a remote position connected with each mobile unit through a radio set, and for each mobile unit
 - a detection unit,
 - a control unit,
 - an execution unit and
 - an extinction unit
 - said units being incorporated on board the mobile unit, and the system being permanently activated provided the mobile unit is under power.
2. System according to claim 1, **characterised in that** the area of risk is constituted by, at least, a driver's cab and a passenger carriage.
3. System according to claim 1, **characterised in that** the detection unit comprises
 - a suction unit, and
 - an analysis unit.
4. System according to claim 3, **characterised in that** the detection unit is essentially electrical-electronic in nature.
5. System according to claim 3, **characterised in that** the suction unit comprises
 - an assembly of suction mouthpieces, located in each area of risk, and
 - ducting means.
6. System according to claim 3, **characterised in that** the analysis unit comprises
 - at least one detection module, and
 - a communications module.
7. System according to claim 6, **characterised in that** the detection module works by laser technology.
8. System according to claim 1, **characterized in that** the control unit comprises
 - an evaluation unit
 - a communications unit.
9. System according to claim 8, **characterised in that** the control unit is of an essentially electronic nature.

10. System according to claim 1, **characterised in that** the execution unit comprises at least one manual actuator.
11. System according to claim 10, **characterised in that** said actuator is a resettable push-button type press-press. 5
12. System according to claim 1, **characterised in that** the execution unit comprises a switch when the mobile unit comprises at least five coaches. 10
13. System according to claim 1, **characterised in that** the extinction unit comprises
 a pumping set, located on the underframe, 15
 a pipe system,
 a set of electro-valves, and
 a spray nozzle assembly.
14. System according to claim 13, **characterised in that** the extinction unit is of an essentially hydraulic nature. 20
15. System according to claim 13, **characterised in that** for each mobile unit there is a single pumping set. 25
16. System according to claim 16, **characterised in that** the pumping set comprises
 a storage unit of extinction fluid, and 30
 an assembly of elements to impel said extinction fluid.
17. System according to claim 13, **characterised in that** the pipe system is composed by 35
 a wet pipe network, located on the underframe of each coach that comprises the mobile unit, and
 a dry pipe network, located in the false ceiling of each coach that comprises the mobile unit. 40
18. System according to claims 16 and 17, **characterised in that** the wet pipe network is pressurized by means of a jockey pump.
19. System according to claim 13, **characterised in that** said set of electro-valves comprises
 a main valve, located in the pumping set and
 a selector valve for each area of risk. 45
20. System according to claim 17, **characterised in that** said electro-valves are solenoids. 50
21. System according to claims 17 and 19, **characterised in that**
 the wet pipe network connects the pumping set with each selector valve, and
 the dry pipe network connects each selector valve with the collection of spray nozzles.
22. System according to any one of the previous claims, **characterised in that** said system is operative both with the mobile unit in motion and when stationary.
23. Method for protection against fire in mobile units, **characterised in that** said method comprises
 a first detection stage,
 a second stage of information management, and
 a third extinction stage, activated in a manual way by means of operating an actuator.
24. Method according to claim 23, **characterised in that** the detection stage comprises
 suction of air through the suction mouthpieces in the areas of risk,
 conduction of this air through the ducting means to the detection module of the analysis unit, analysis of said air by the detection module, and
 generation of a first set of signals for the detection module, this detection stage being carried out by the detection unit.
25. Method according to claim 23, **characterised in that** the control stage comprises
 evaluation of the first set of signals generated by the detection module establishing pre-alarm and alarm levels,
 transmission of a second set of pre-alarm signals and a third set of alarm signals, information to the execution unit, remote position and driver's cab,
 administration of the extinction stage, maintenance check of the system, and generation of historical records.
26. Method according to claim 23, **characterised in that** the extinction stage comprises the application of extinction fluid.
27. Method according to claims 23 and 25, **characterised in that** if the extinction stage is carried out by normal procedure, it is necessary that the transmission takes place of said third set of alarm signals and said actuator is a first push-button located in the driver's cab. 55
28. Method according to claim 23, **characterised in that** if the extinction stage is carried out by emergency procedure said actuator is a second emergency push-button located in the driver's cab.
29. Method according to claims 23 and 25, **characterised in that** if the extinction stage is carried out re-

motely through the radio set, it is necessary that the transmission takes place of said third set of alarm signals and said actuator is a first push-button located in the remote position.

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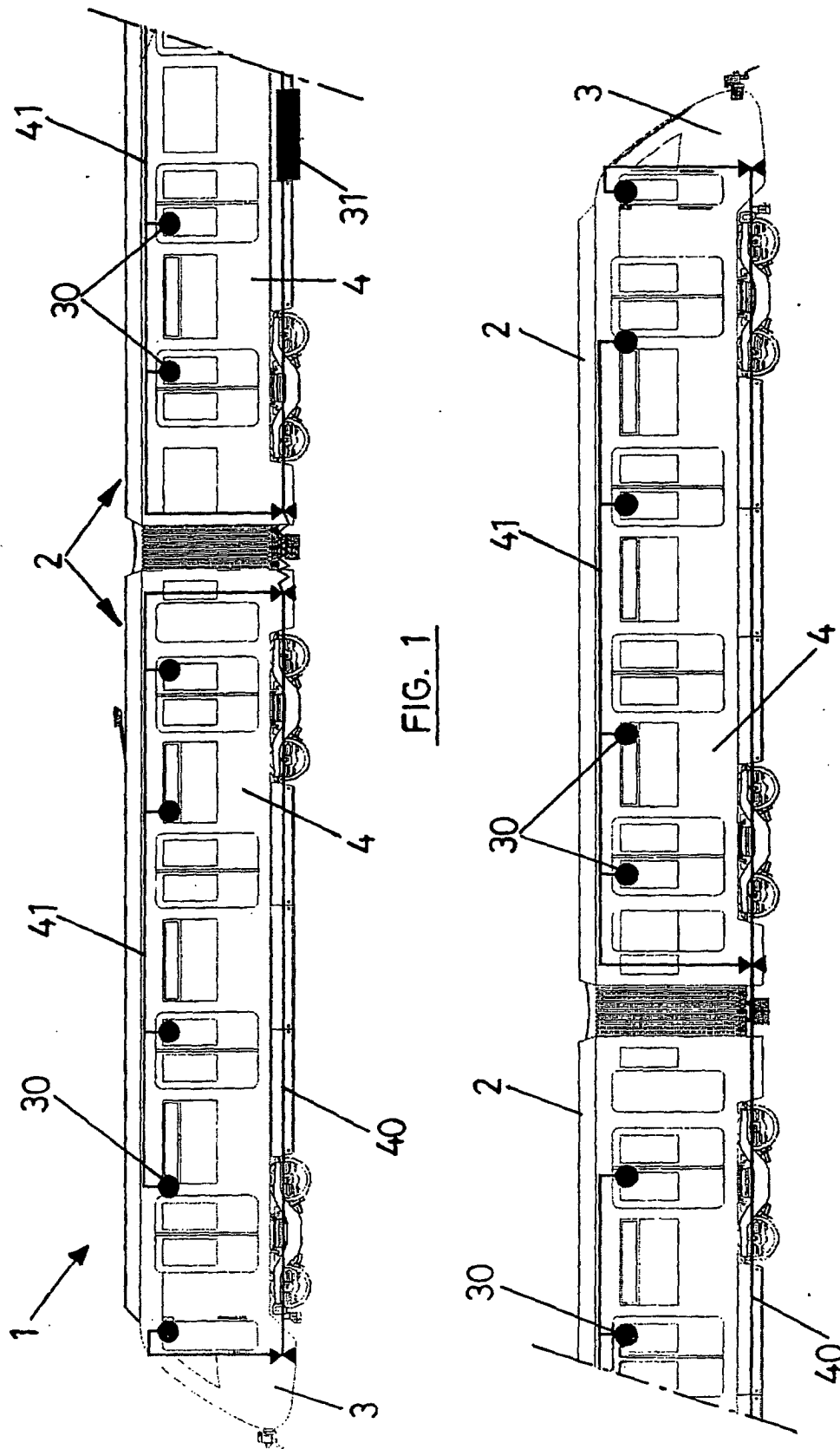
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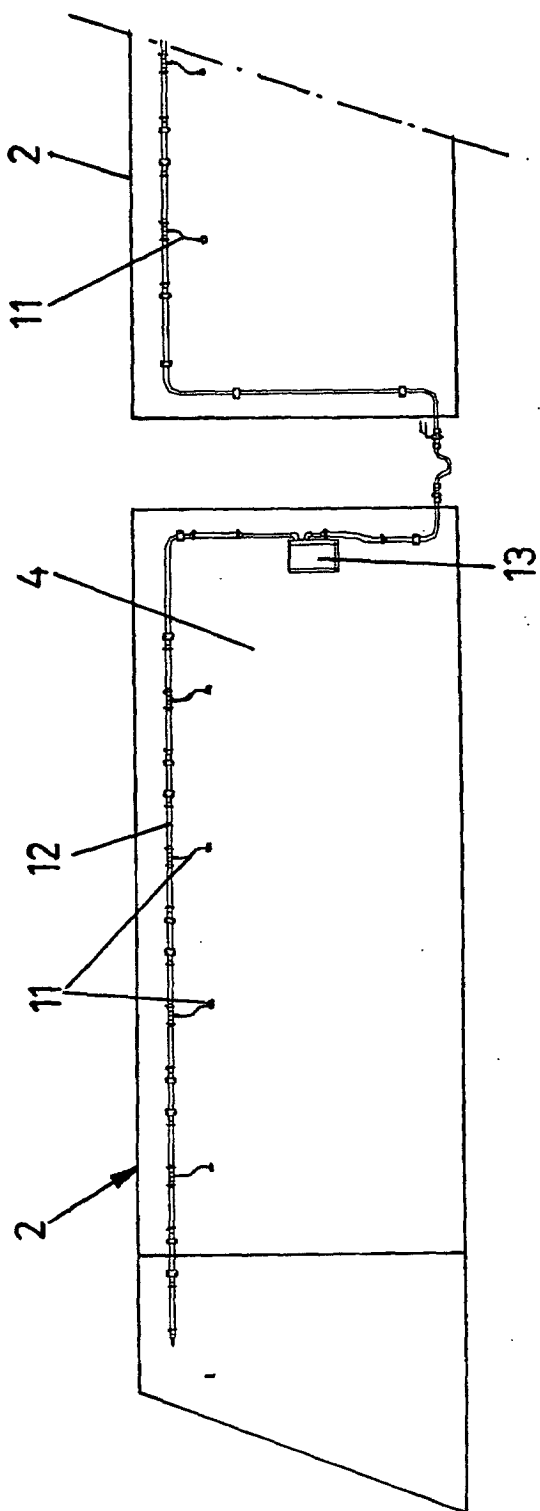
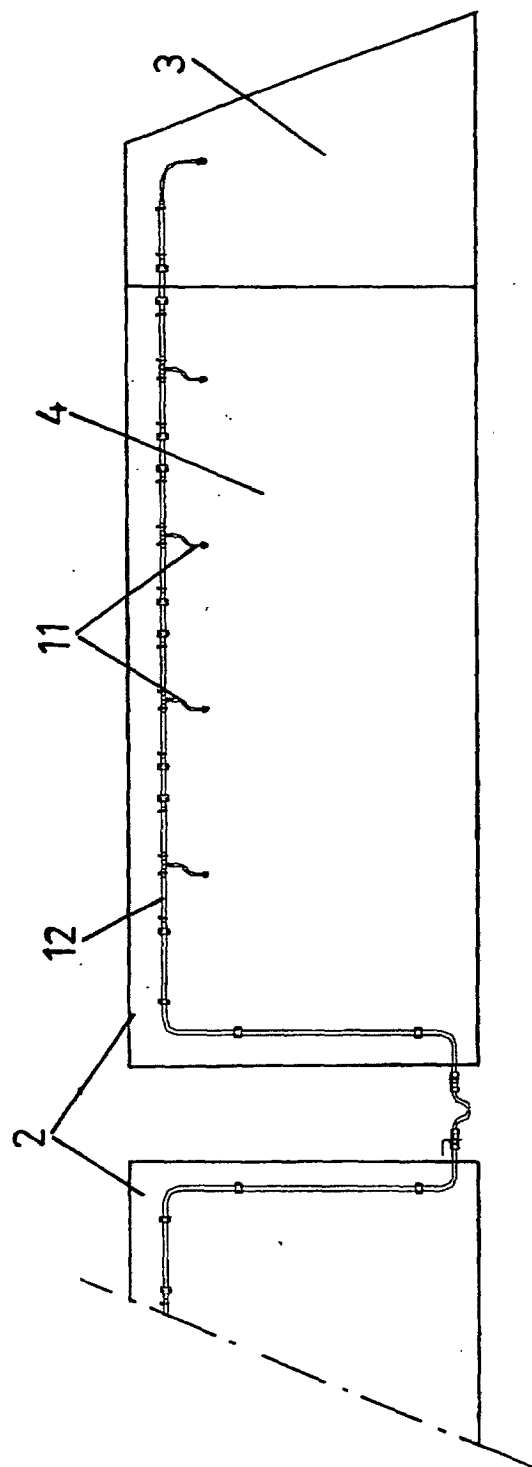
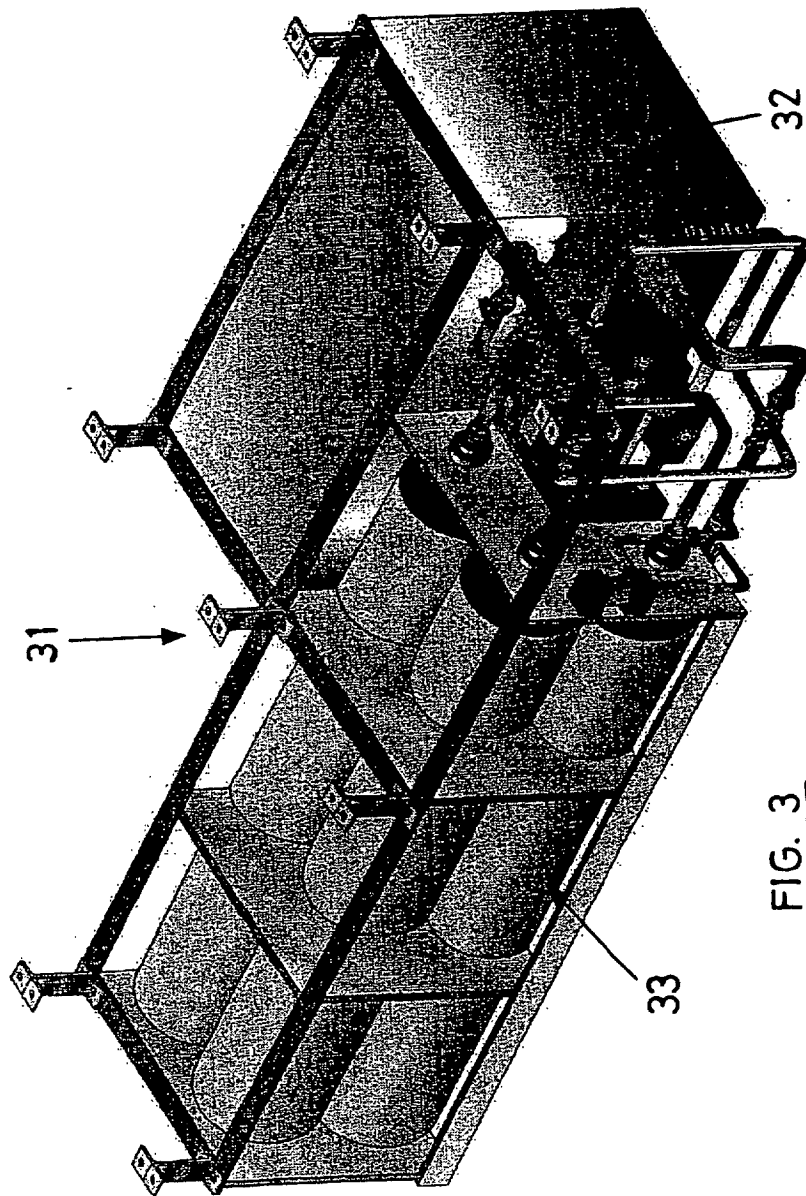


FIG. 2





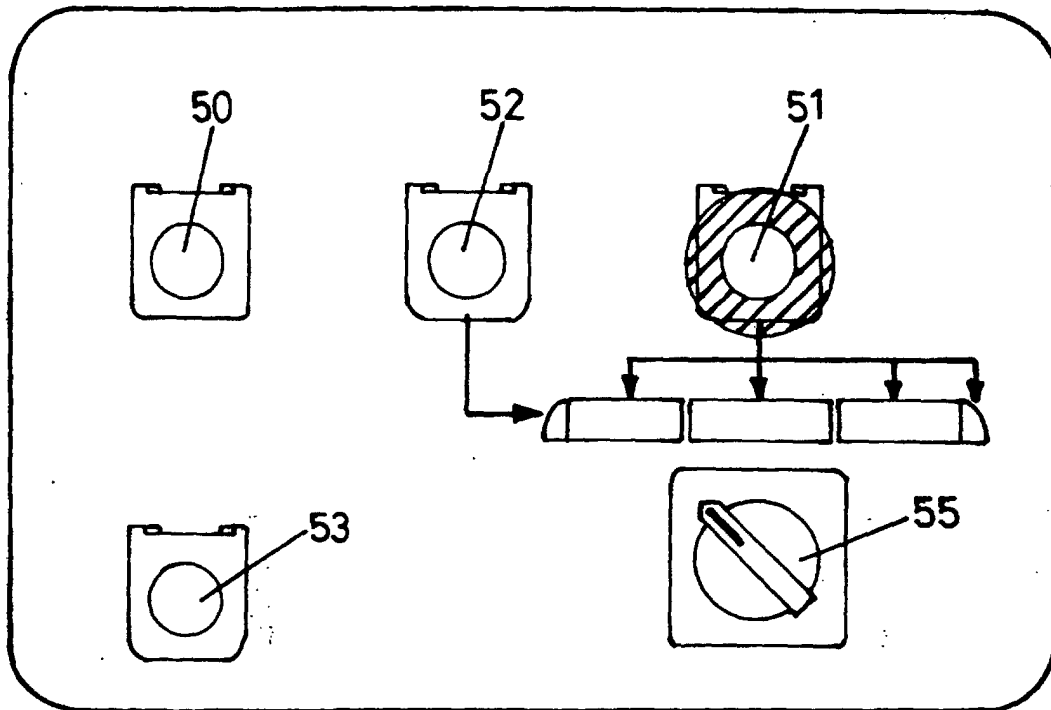


FIG. 4

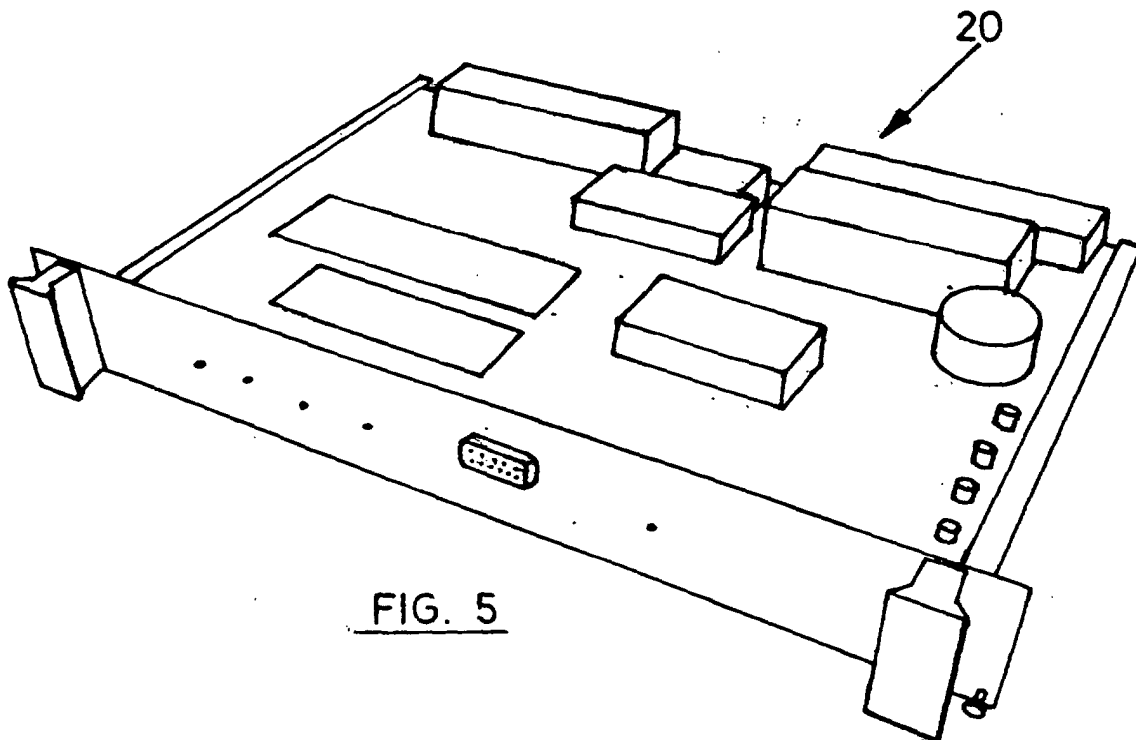
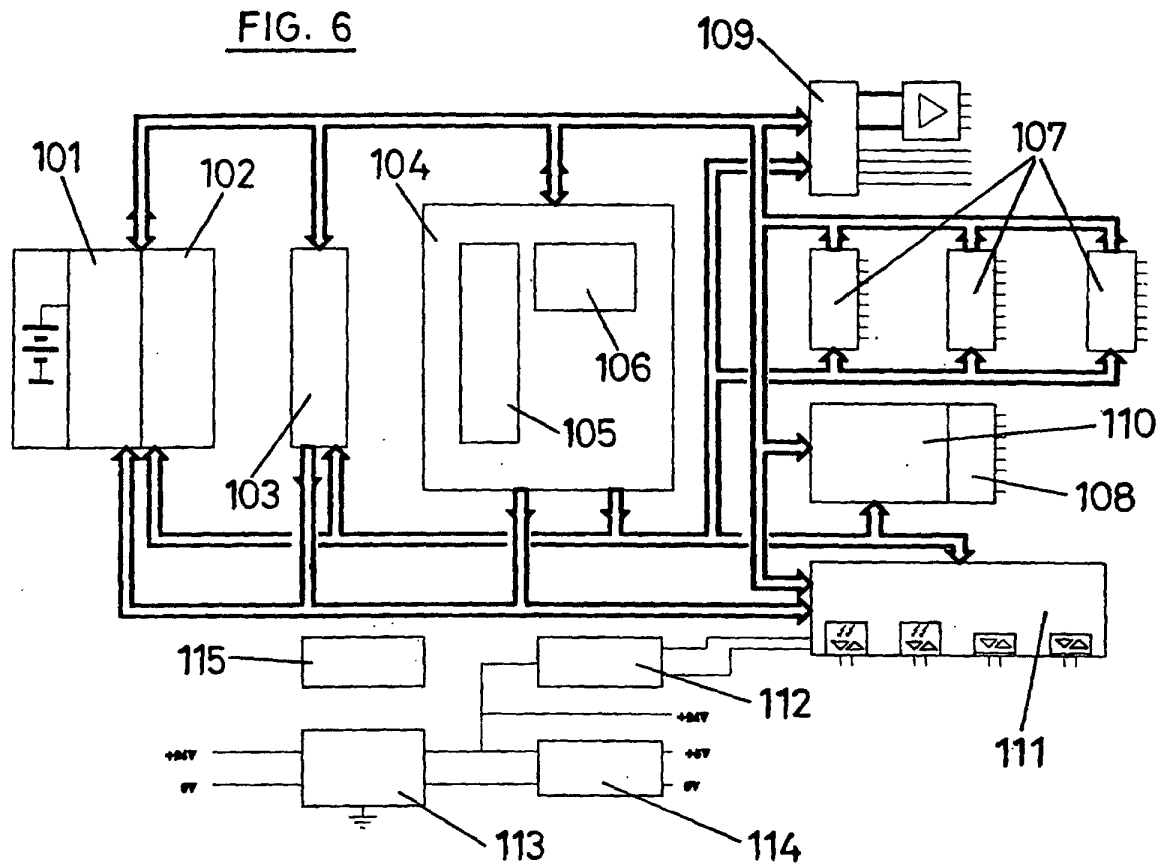


FIG. 5

FIG. 6



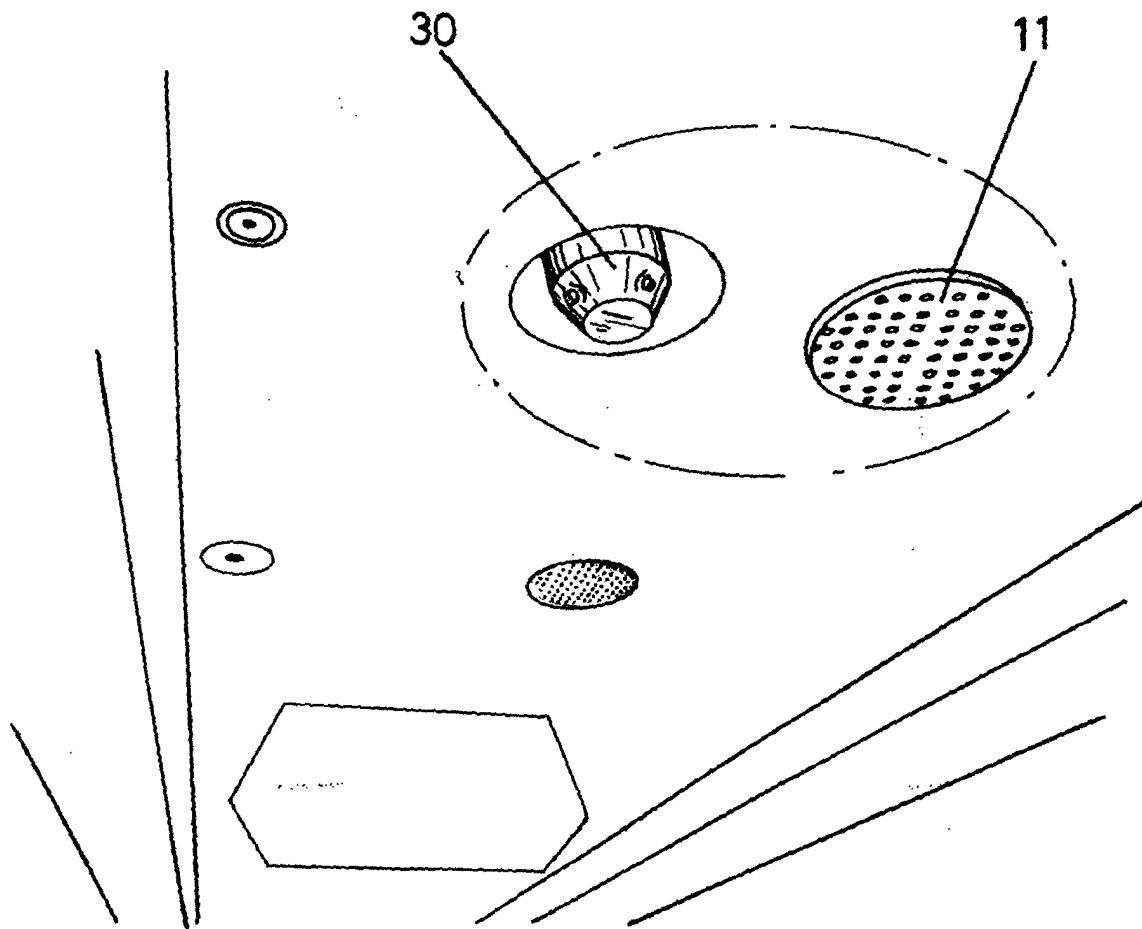


FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ES 02/00382

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A62C3/07

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 A62C

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)

WPI Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 355 929 A (SUNDHOLM GOERAN) 9 May 2001 (2001-05-09) the whole document ---	1-29
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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¹⁷ document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

4 November 2002

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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