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(71) Applicants:
- **Technologie Ambientali S.r.l.**
  **24021 Albino (BG)**
- **Mangili, Aldo**
  **24060 Vigano San Martino, Bergamo (IT)**
- **Medica, Maurizio**
  **24020 Ardesio, Bergamo (IT)**

(72) Inventors:
- **Medica, Maurizio**
  **24020 Ardesio (BG) (IT)**
- **Pegurri, Dario**
  **24021-Albino (BG) (IT)**
- **Radici, Marco**
  **24020 Gandino (BG) (IT)**
- **Mangili, Aldo**
  **24060 Vigano San Martino (BG) (IT)**

(74) Representative: **Pezzoli, Ennio et al**
**c/o Maccalli & Pezzoli S.r.l.,**
**Via Settembrini, 40**
**20124 Milano (IT)**

## (54) Fire-extinguishing device for a motor vehicle

(57) A fire-extinguishing device (120) for a motor vehicle (100) is proposed. The fire-extinguishing device includes a reservoir for a pressurized extinguishing fluid (125) suitable to be placed in a driver compartment (110) of the motor vehicle, at least one nozzle (150) for delivering the extinguishing fluid in an engine compartment (105) of the motor vehicle, and a duct (140) for distributing the extinguishing fluid from the reservoir to the at least one nozzle; the fire-extinguishing device further includes a valve (135) for controlling opening of the reservoir, means (155) for automatically detecting a fire starting in the engine compartment, means (160,265) for automatically opening the valve in response to the detection of the fire starting and means (145) for manually opening the valve inside the driver compartment.

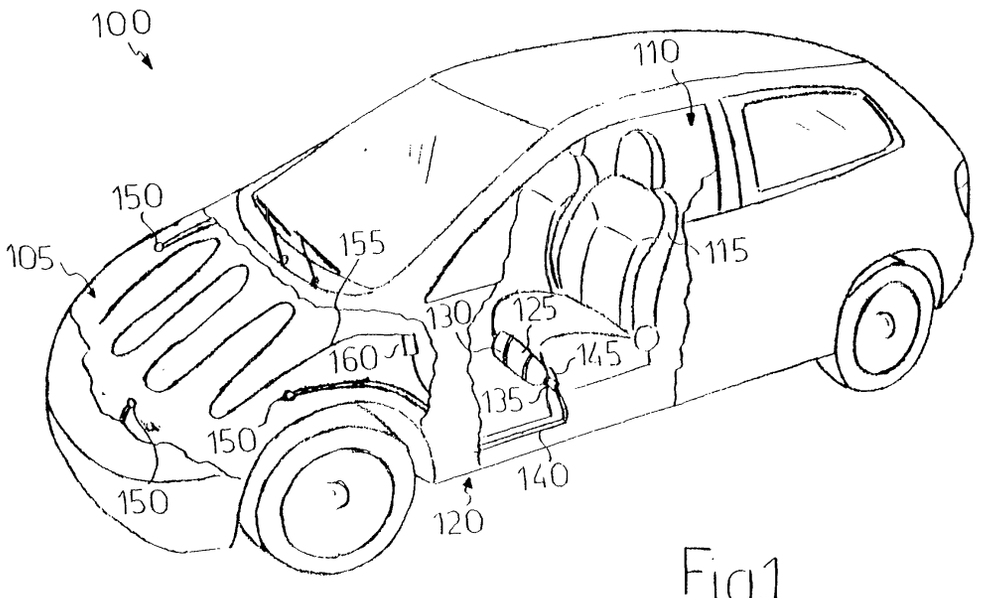


Fig.1

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## Description

**[0001]** The present invention relates to a fire-extinguishing device for a motor vehicle.

**[0002]** Some devices for extinguishing fire starting that should occur inside an engine compartment of a motor vehicle have been proposed in the last years.

**[0003]** A particular type of known fire-extinguishing device, which is intended for use exclusively on a racing car, includes a reservoir of pressurized extinguishing fluid; the reservoir is housed inside a driver compartment of the car; a distribution duct connects the reservoir to delivery nozzles placed in the engine compartment. A tap couples the reservoir with the distribution duct; a valve, which is controlled through an opening rope placed outside the car, is mounted along the distribution duct.

**[0004]** At the beginning of every race, the tap connecting the reservoir to the distribution duct is opened. If a fire should break out in the engine compartment, the driver of the car goes out of the driver compartment and pulls the rope; in this way, the valve is opened and allows the extinguishing fluid to reach the delivery nozzles.

**[0005]** A drawback of the fire-extinguishing device described above consists of the fact that it can be operated exclusively in a manual way. As a consequence, its effectiveness is entirely dependent on the quickness of the driver. Moreover, the speed of intervention is further reduced by the fact that the driver has to go out of the driver compartment for opening the valve.

**[0006]** An additional drawback consists of the fact that accidental leakage of the extinguishing fluid can occur (without the device being actuated) in the distribution duct that goes from the reservoir to the valve, since the tap is open throughout the race.

**[0007]** A different type of known fire-extinguishing device is completely installed inside the engine compartment. The fire-extinguishing device includes a reservoir of an extinguishing fluid, which reservoir is coupled with a container of pressurized carbon dioxide through an explosive bulb. A sensor automatically triggers the explosion of the bulb when a fire starting is detected; the explosion puts the container of pressurized carbon dioxide in communication with the reservoir of extinguishing fluid, thereby causing delivery of the extinguishing fluid (through corresponding nozzles). In this way, it is possible to obtain a good speed of intervention of the fire-extinguishing device.

**[0008]** However, this solution is not very reliable. In fact, the explosive bulb used for obtaining the automatic actuation of the device is housed in the engine compartment and it is then exposed to the atmospheric agents; therefore, its operation can be easily impaired in time.

**[0009]** A further drawback consists of the fact that it is not possible to intervene in any way for remedying a missed actuation of the fire-extinguishing device; in fact, the structure described above is incompatible entirely with any manual driving organ.

**[0010]** It is an object of the present invention to overcome the above-mentioned drawbacks. In order to achieve this object, a fire-extinguishing device as set out in the first claim is proposed.

**[0011]** Briefly, the present invention provides a fire-extinguishing device for a motor vehicle including a reservoir for a pressurized extinguishing fluid suitable to be placed in a driver compartment of the motor vehicle, at least one nozzle for delivering the extinguishing fluid in an engine compartment of the motor vehicle, and a duct for distributing the extinguishing fluid from the reservoir to the at least one nozzle; the fire-extinguishing device further includes a valve for controlling opening of the reservoir, means for automatically detecting a fire starting in the engine compartment, means for automatically opening the valve in response to the detection of the fire starting and means for manually opening the valve inside the driver compartment.

**[0012]** Moreover, the present invention also provides a motor vehicle including the fire-extinguishing device, and a corresponding method of installing the fire-extinguishing device on the motor vehicle.

**[0013]** Further features and the advantages of the solution according to the present invention will be made clear by the following description of a preferred embodiment thereof, given purely by way of a non-restrictive indication, with reference to the attached figures, in which:

Figure 1 schematically depicts a car in which the fire-extinguishing device of the invention is installed;
Figure 2a is a cross-section view of a valve of the fire-extinguishing device in a close condition;
Figure 2b is a further cross-section of the valve taken along the axis I-I;
Figure 2c and Figure 2d are cross-section views taken along the axis II-II and along the axis III-III, respectively, of the valve in an open condition.

**[0014]** With reference in particular to Figure 1, a car 100 is shown. The car 100 includes an engine compartment 105 and a driver and passenger compartment 110; the driver and passenger compartment 110 houses a seat 115 for a driver of the car 100 (in addition to further seats for possible passengers).

**[0015]** A fire-extinguishing device, denoted as a whole with 120, is installed on the car 100. The fire-extinguishing device 120 includes a reservoir 125 of a pressurized extinguishing fluid. For example, the reservoir 125 consists of an extinguisher-like container, which is filled with a gas composed by a mixture of halogenated hydrocarbons (mixtures of HFC, HCFC and inert gases), such as for instance the products commercially known with the names NAF-P4 or FE36. The reservoir 125 is placed inside the driver and passenger compartment 110, and particularly under the seat 115. A couple of straps 130 is used for fastening the reservoir 125 in-

side the driver and passenger compartment 110 (for example, on its bottom).

**[0016]** A valve 135 connects the reservoir 125 to a distribution duct 140; the valve 135 is provided with a manual-driving lever 145, which is within easy reach of the driver. The distribution duct 140 supplies the extinguishing fluid to a series of delivery nozzles 150 (three in the example depicted in the figure), which are scattered in the engine compartment 105. Preferably, the nozzles are of the type described in the Italian patent application No.MI98U-00432.

**[0017]** The fire-extinguishing device 120 further includes a probe-cable 155, which is placed along a preset path inside the engine compartment 105, so as to pass by zones that are particularly prone to the breaking out of fires. The probe-cable 155 provides an electric signal, indicative of the exceeding of a threshold temperature, to an electronic card 160. In response to such electric signal, the electronic card 160 accordingly controls a system for automatically opening the valve 135 (described in detail in the following).

**[0018]** Similar considerations apply if the fire-extinguishing device is installed on any other motor vehicle (such as a truck), if the reservoir has a different form, if an equivalent extinguishing fluid is used, if the reservoir is installed in the driver and passenger compartment in a different way, if the delivery nozzles have another structure or they are in a different number (down to a single one), if the probe-cable and the electronic card are replaced with equivalent means, and the like.

**[0019]** Considering now Figure 2a, the valve 135 includes a body 205 that is associated with a mouth of the reservoir 125. A chamber 210 (substantially cylindrical-shaped) is formed in the valve body 205. The chamber 210 has a port 215a in communication with the inside of the reservoir 125; a further port 215b (formed in a side branch of the chamber 210) is connected to the distribution duct 140. A stopper 220 slides axially along the chamber 210; a spring 225 keeps the stopper 220 in a closing position, in which the stopper 220 interrupts the connection of the port 215a with the port 215b.

**[0020]** A further chamber 230 is made in the valve body 210; the chamber 230 has a cylindrical shape as well and it is preferably coaxial to the chamber 210. A piston 235 slides axially along the chamber 230. The piston 220 is provided with an extension 220e; the extension 220e is arranged along the axis of the chamber 210 and extends towards the chamber 230, so as to face a lower surface of the piston 235. A shaft 240 integral with the piston 235 projects upward from an upper surface thereof; the shaft 240 (coaxial to the chamber 230) has a free end protruding from the body valve 210. The lever 145 is hinged to the body valve 210 so as to act on the free end of the shaft 240.

**[0021]** A peg 245 for locking the shaft 240 slides, along a direction substantially perpendicular to the axis of the shaft 240, in a side recess of the chamber 230. A spring 250 presses the peg 245 against the shaft 240; a groove 240g mating the peg 245 is formed around the shaft 240.

**[0022]** A seat 255 for mounting a manometer is made in the valve body 210; the manometer communicates with the inside of the reservoir 125 through a channel 260; in this way, the manometer constantly detects and displays the pressure of the extinguishing fluid in the reservoir 125.

**[0023]** Moving to Figure 2b, the system for automatically opening the valve 135 is formed by two explosive capsules 265, each one releasing a pressurized gas when actuated. The explosive capsules 265 are housed inside respective explosion chambers 270. The explosion chambers 270 are made in side branches of the valve body 210, and they communicate with the chamber 230 through a ring-shaped passage formed around the shaft 240; the explosion chambers 270 are in communication with the chamber 230 on the side of the piston opposite to the stopper.

**[0024]** An electric circuit consisting of the probe-cable, the electronic card and the explosive capsules 265 is fed by an electric power supply, for instance consisting of an accumulator of the motor vehicle. In addition (or in alternative) an independent back-up accumulator is provided.

**[0025]** Should a fire starting occur in the engine compartment, this is detected by the probe-cable; the probe-cable transmits a corresponding electric signal to the electronic card, which actuates both the explosive capsules 265 at the same time. As shown in Figure 3b, the pressurized gas released by the explosion of the capsules 265 passes from the respective explosion chambers 270 to the chamber 230; this causes the piston 235 to move towards the stopper 220. The piston 235 act on the extension 220e of the stopper; in this way, the stopper 220 is lowered in opposition to the spring 225. The explosive capsules 265 are designed so that each one of them is able to cause such movement of the stopper 220 on its own.

**[0026]** If (for accidental causes) the capsules 265 should not explode, the same result can be obtained operating the lever 145 (as shown in Figure 2d). Particularly, the lever 145 acts on the protruding end of the shaft 240. Therefore, when the driver pulls the lever its rotation causes the sinking of shaft 240 and then of the piston 235 integral thereof; the piston 235 likewise acts on the extension 220e, so as to lower the stopper 220 in opposition to the spring 225.

**[0027]** In both cases, the stopper 220 is moved from the closing position to an opening position, in which it connects the port 215a with the port 215b. Following the opening of the valve 135, the extinguishing fluid contained in the reservoir 125 reaches the delivery nozzles (through the distribution duct 140) and it is distributed inside the engine compartment putting out the fire. At the same time, when the shaft 240 is lowered the groove 240g is placed opposite the peg 245. As a consequence, the peg 245 engages the groove 240g under the pres-

sure of the spring 250; in this way, the shaft 240 is locked axially, thereby maintaining the stopper 220 in the opening position.

**[0028]** Similar considerations apply if the explosive capsules have a different structure, if the lever acts in another way, if the spring is replaced with equivalent resilient means, if different locking means are provided instead of the peg and of the respective spring, if the valve has a different number of explosive capsules, if the manometer is replaced with equivalent signaling means, and the like.

**[0029]** More generally, the present invention provides a fire-extinguishing device for a motor vehicle. The fire-extinguishing device includes a reservoir for a pressurized extinguishing fluid, which is suitable to be placed in a driver compartment of the motor vehicle. One or more nozzles are used for delivering the extinguishing fluid in an engine compartment of the motor vehicle. A duct distributes the extinguishing fluid from the reservoir to the nozzle. The fire-extinguishing device further includes a valve for controlling opening of the reservoir. The fire-extinguishing device is equipped with means for automatically detecting a fire starting in the engine compartment, and with means for automatically opening the valve in response to the detection of the fire starting. Means for manually opening the valve inside the driver compartment are further provided.

**[0030]** The fire-extinguishing device of the invention is really effective. In fact, the automatic driving of the valve ensures a high speed of intervention without requiring any operation on the part of the driver.

**[0031]** The proposed structure is very reliable, since any accidental leakage of the extinguishing fluid in the distribution duct is prevented. Moreover, the arrangement of the reservoir (and therefore also of the valve and of the relative automatic opening system) inside the driver and passenger compartment avoids their exposure to the atmospheric agents; this ensures that the fire-extinguishing device maintains its effectiveness unaffected for a long time.

**[0032]** The devised solution is also very safe, since the valve for opening the reservoir can be always operated manually if necessary. Besides, such operation is directly performed inside the driver and passenger compartment thereby ensuring a good speed of intervention.

**[0033]** The preferred embodiment of the invention described above offers further advantages.

**[0034]** Particularly, the fire-extinguishing device is provided with means for fastening the reservoir inside the driver and passenger compartment.

**[0035]** This allows the fire-extinguishing device to be installed in a practical and fast way on any motor vehicle.

**[0036]** Preferably, a manometer is used for signaling the pressure inside the reservoir.

**[0037]** This feature makes it possible to verify the state of effectiveness of the fire-extinguishing device.

**[0038]** Advantageously, the valve is opened acting on a lever within easy reach of the driver.

**[0039]** In this way, the maximum speed of manual intervention of the fire-extinguishing device is ensured.

**[0040]** Alternatively, the motor vehicle is arranged for housing the reservoir directly, no manometer is provided, the lever for opening the valve is placed elsewhere, or the valve is opened through a push-button or other equivalent means.

**[0041]** In a preferred embodiment of the invention, the valve is provided with a stopper that is opened using one or more explosive capsules.

**[0042]** The proposed structure is very simple, but at the same time effective.

**[0043]** As a further improvement, more explosive capsules are actuated simultaneously.

**[0044]** In this way, a great reliability of intervention of the fire-extinguishing device is ensured.

**[0045]** Moreover, the stopper is driven by a piston (on which both the pressurized gas released by the explosive capsules and the lever act).

**[0046]** This feature results in an extremely compact structure of the valve.

**[0047]** Advantageously, the valve is locked in the open condition.

**[0048]** This prevents any accidental closing of the valve after the actuation of the fire-extinguishing device.

**[0049]** However, the solution of the present invention leads itself to be implemented even with a single explosive capsule, with a different system for automatically opening the valve, using a valve of another type, without locking the valve in the open condition, and the like.

**[0050]** Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many modifications and alterations all of which, however, are included within the scope of protection of the invention as defined by the following claims.

## Claims

1. A fire-extinguishing device (120) for a motor vehicle (100) including a reservoir for a pressurized extinguishing fluid (125) suitable to be placed in a driver compartment (110) of the motor vehicle, at least one nozzle (150) for delivering the extinguishing fluid in an engine compartment (105) of the motor vehicle, and a duct (140) for distributing the extinguishing fluid from the reservoir to the at least one nozzle,

   **characterized in that** the fire-extinguishing device further includes a valve (135) for controlling opening of the reservoir, means (155) for automatically detecting a fire starting in the engine compartment, means (160,265) for automatically opening the valve in response to the detection of the fire starting and means (145) for manually opening the valve inside the driver compartment.

2. The fire-extinguishing device (120) according to

claim 1, further including means (130) for fastening the reservoir inside the driver compartment (110).

**3.** The fire-extinguishing device (120) according to claim 1 or 2, further including means (255,260) for providing an indication of the pressure inside the reservoir (125).

**4.** The fire-extinguishing device (120) according to any claim from 1 to 3, wherein the means for manually opening the valve includes a lever (145) suitable to be operated by a driver of the motor vehicle.

**5.** The fire-extinguishing device (120) according to any claim from 1 to 4, wherein the valve (135) includes a stopper (220) movable between an opening position and a closing position in which the stopper closes and opens, respectively, a connection between the reservoir (125) and the duct (140) and resilient means (225) for biasing the stopper in the closing position, the means for automatically opening the valve (160,265) including at least one explosive capsule (265) for releasing a pressurized gas moving the stopper from the closing position to the opening position in opposition to the resilient means.

**6.** The fire-extinguishing device (120) according to claim 5, wherein the at least one explosive capsule consists of a plurality of explosive capsules (265) each one suitable to cause the movement of the stopper from the closing position to the opening position, the explosive capsules being actuated simultaneously in response to the detection of the fire starting.

**7.** The fire-extinguishing device (120) according to claim 5 or 6, wherein the valve (135) has a body (205) in which there are formed a first chamber (210) housing the stopper (220), the first chamber having a first port (215a) in communication with the reservoir (125) and a second port (215b) in communication with the duct (140), a second chamber (230) housing a piston (235) for actuating the stopper, and at least one explosion chamber (270) each one housing a corresponding explosive capsule (265), the lever (145) acting on the piston when operated and the second chamber being in communication with each explosion chamber for having the pressurized gas released by the corresponding explosive capsule (265) act on the piston.

**8.** The fire-extinguishing device (120) according to any claim from 1 to 7, further including means (240g,245,250) for automatically locking the valve (135) in a condition of opening the reservoir (125).

**9.** A motor vehicle (100) having an engine compartment (105) and a driver compartment (100), the fire-extinguishing device (120) according to any claim from 1 to 8 being installed on the motor vehicle.

**10.** A method of installing a fire-extinguishing device (120) on a motor vehicle (100) including the steps of:

placing a reservoir for a pressurized extinguishing fluid (125) in a driver compartment (110) of the motor vehicle, a valve (135) for controlling opening of the reservoir being provided,
placing at least one nozzle (150) for delivering the extinguishing fluid in an engine compartment (105) of the motor vehicle,
placing a duct (140) for distributing the extinguishing fluid from the reservoir to the at least one nozzle,
placing means (155) for automatically detecting a fire starting in the engine compartment,
placing means (160,265) for automatically opening the valve in response to the detection of the fire starting, and
placing means (145) for manually opening the valve inside the driver compartment.

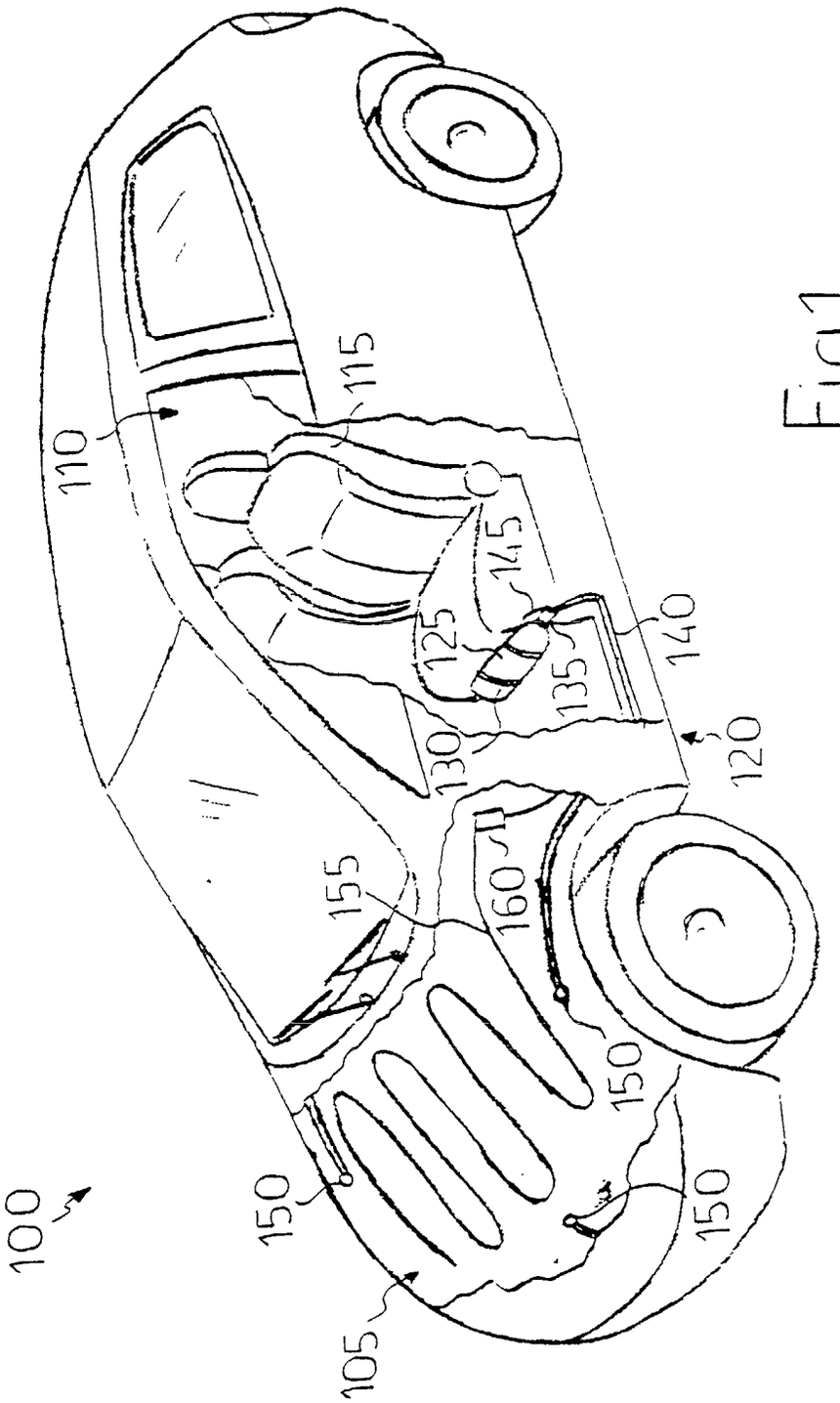


Fig.1

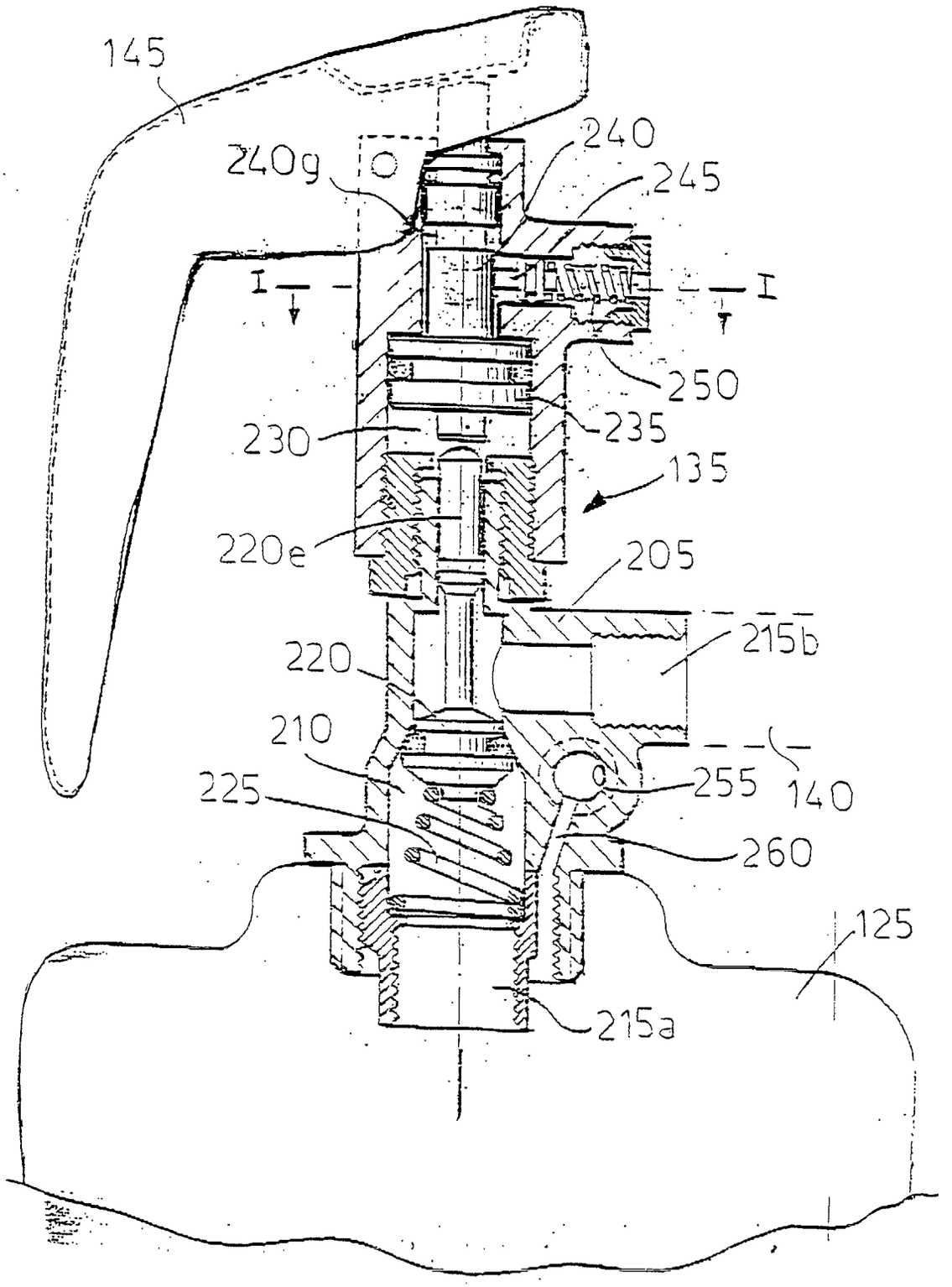
145
240g
240
245
I
I
250
230
235
135
220e
205
215b
220
210
225
255
140
260
125
215a

Fig.2a

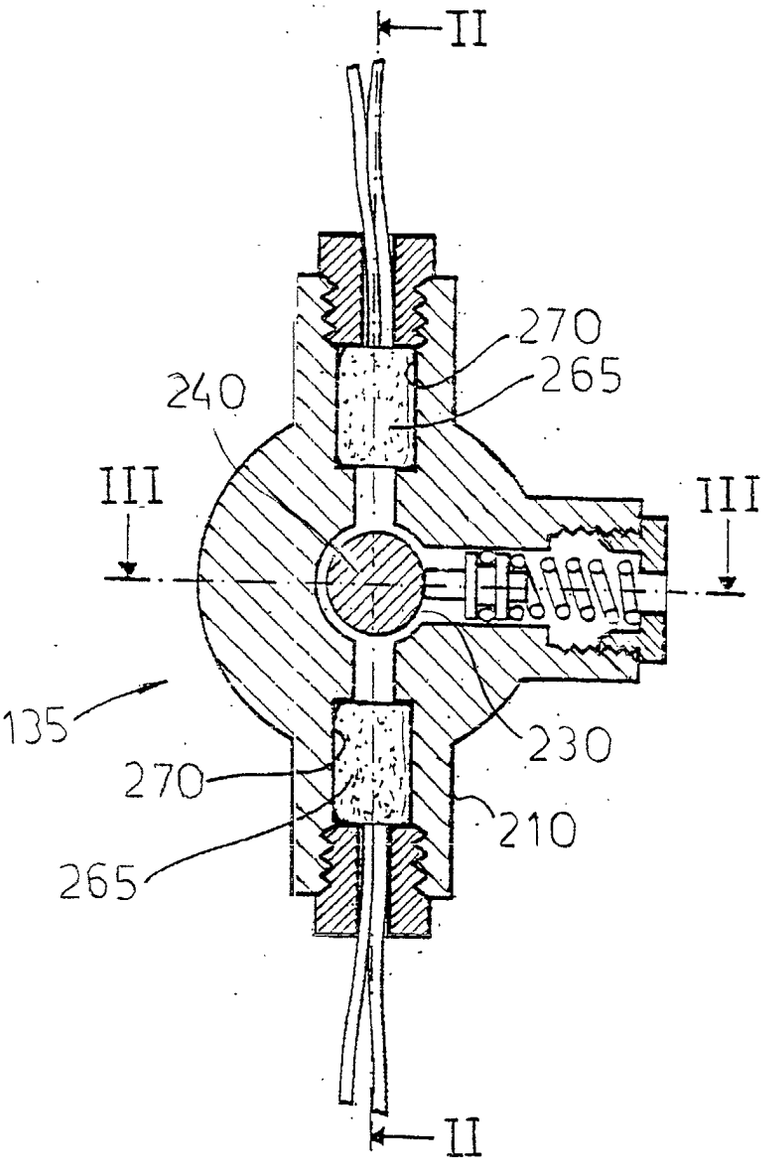


Fig.2b

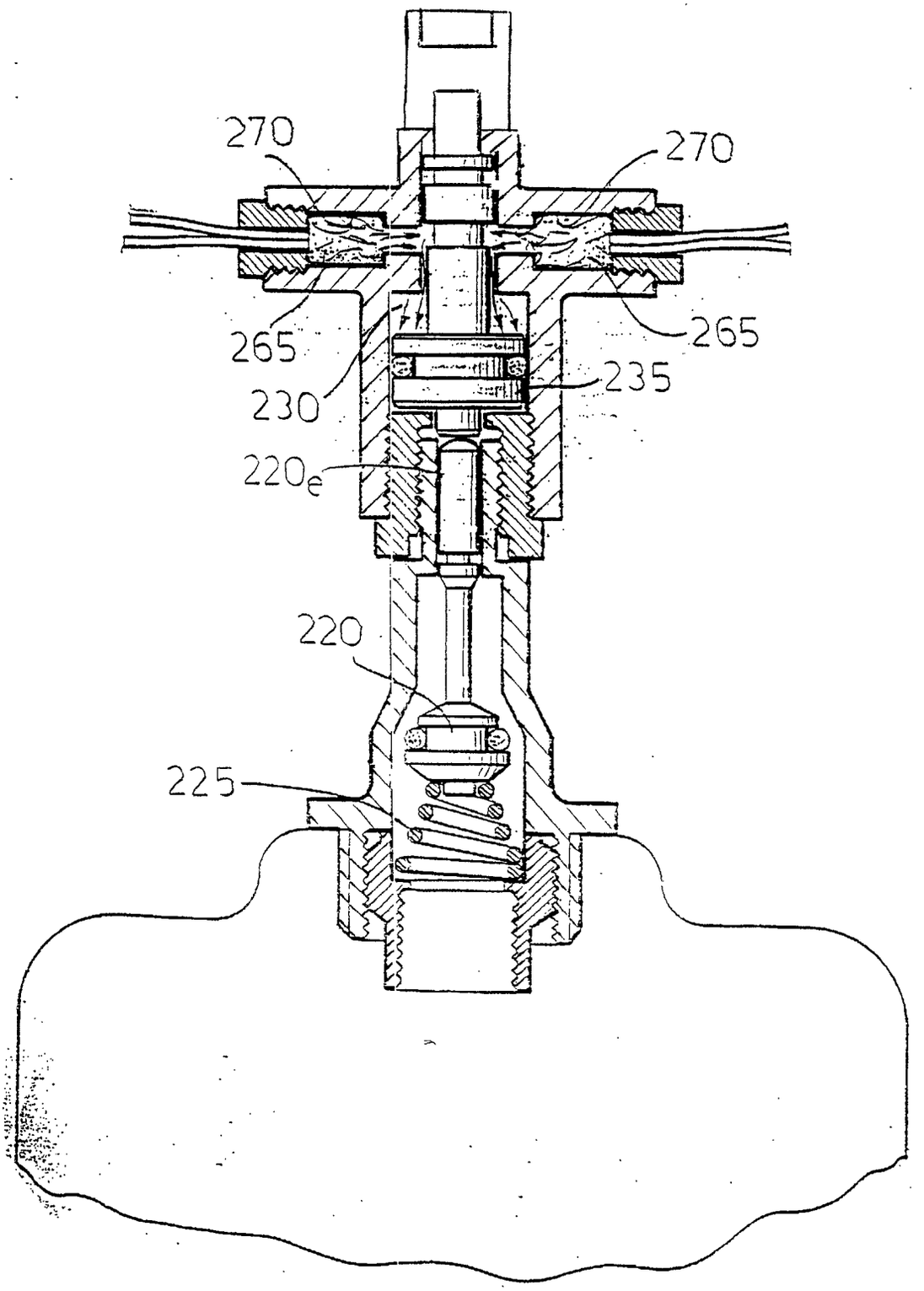


Fig.2c

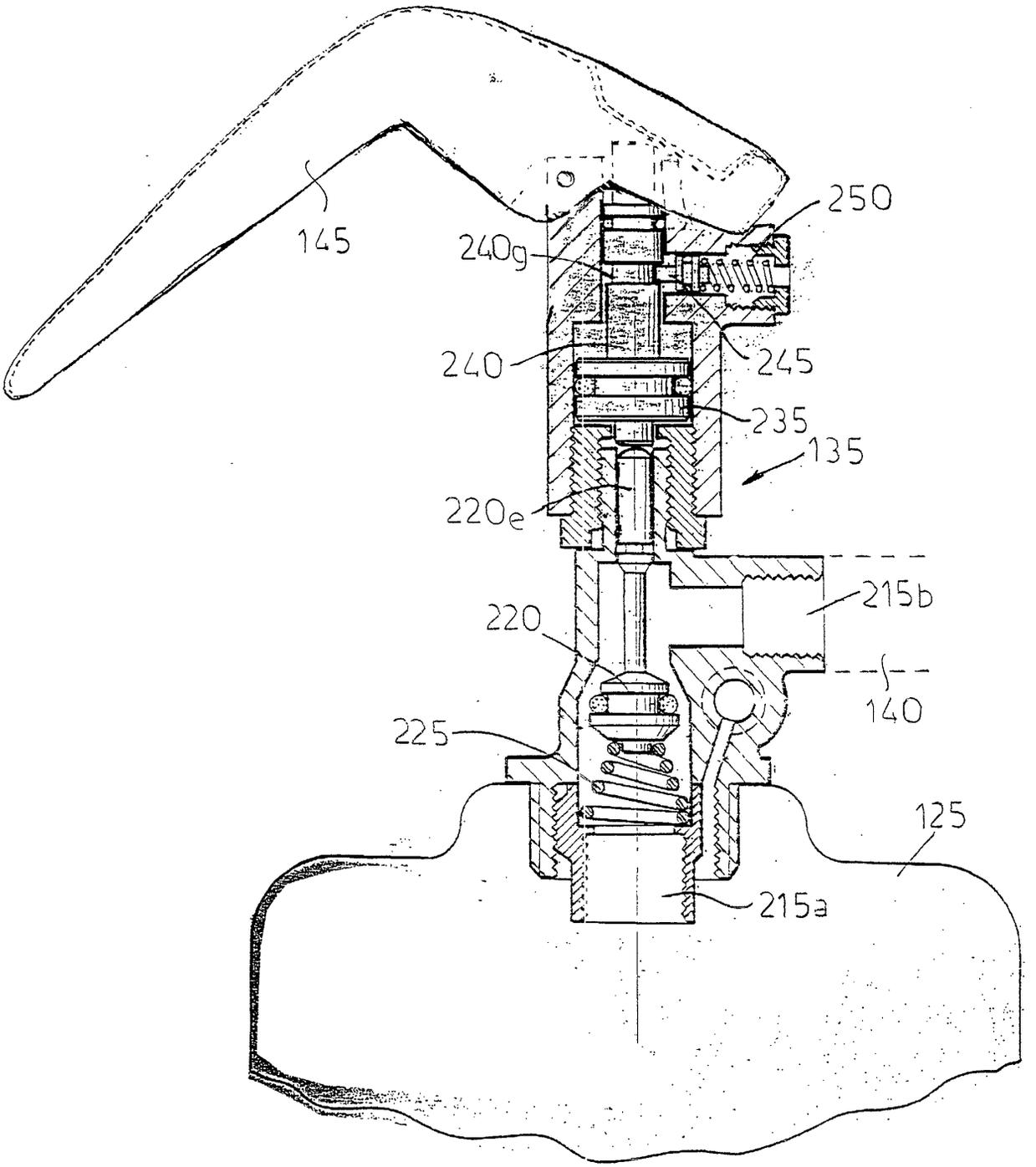


Fig.2d

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# EUROPEAN SEARCH REPORT

Application Number
EP 02 07 5471

## 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.7) |
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

A62C

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 9 July 2002 | Neiller, F |

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 07 5471

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09-07-2002

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