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(54) **Anti-fire security device located on the fuel supply circuit of an internal combustion engine**

(57) An anti-fire security device located on the fuel supply circuit to the injectors of the internal combustion engine of a vehicle, of the type including a delivery line (5) and a distribution line (6), for fuel distribution. The circuit is equipped with a fuel intercepting electrovalve (3), controlled by the inertial switch (9). Said distribution line is connected to a vacuum pump (15), controlled by an inertial switch, with the interposition of an unidirectional valve (11) being controlled by the depression.

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Description

[0001] The present invention relates to an anti-fire security device located on the fuel supply circuit of the internal combustion engine of a vehicle. Said device is designed for the main purpose of preventing fuel spillage. When in contact with hot sections of the engine discharge pipe, turbine) the fuel could catch fire, causing serious danger for vehicle passengers.

[0002] Other devices are commonly known, that interrupt fuel supply from the supply pump, and substantially consist of an inertial switch. In the event of a vehicle shock, said switch interrupts electric power supply to the fuel pump, in order to interrupt the supply of the latter to the injectors. This device does not, however, eliminate dangers residing in the fact that the pressurized fuel will remain inside the conduits leading from the pump to the injectors. This pressurized fuel could spill out in a jet-like way and catch fire even on the slightest break (fessure) of the lines.

[0003] It is an object of the present invention to carry out a device that will eliminate any pressure left, absorbing, partially or totally, fuel contained in the lines extending between the delivery pump and the injectors.

[0004] Another object of the present invention is to carry out a device that can be reactivated after each intervention, in the event that no fuel has leaked from the lines.

[0005] Said objects and other objects can be attained by the provision of an anti-fire security device located on the fuel supply circuit of an internal combustion engine of a vehicle, presenting the characteristics of claim 1.

[0006] Other characteristics and advantages will appear clear from the following description, reference made to the accompanying figure, given by way of example, in schematic form, illustrating the device and all its components. This figure should in no way be considered as limiting device configuration possibilities.

[0007] Reference being made to the figure, a fuel intercepting device composed of an electrovalve 3, normally activated, is located on the delivery line 5 of a pump (not illustrated) to the fuel distribution line 6 (also known as fuel rail), connected to injectors 7.

[0008] Electrovalve 3 is controlled by an inertial type switch 9, that interrupts electric power supply in the event of a vehicle shock of intensity higher than a set value. Distribution line 6 is linked via a unidirectional valve 11, activated by the depression and integrated in line 13, to a vacuum pump 15. Line 13 should, preferably, be made of rubber, and the vacuum pump located in a section of the engine compartment that is less likely to be subjected to shocks. The unidirectional valve 11 is designed to allow the passage of air or fuel from line 6 to line 13 and not vice versa, and only when a depression is present in line 13.

[0009] Vacuum pump 15 is composed of a cylinder shaped body 15a, forming a chamber 16, where a piston 18 is located, axially movable, held by way of a joint

17, and pushed by a spring 20 that operates by compression. Piston 18 is equipped with a manoeuvre stem 22, that protrudes from the upper wall of the cylinder shaped body of chamber 16, coaxially to the latter. Stem 22 presents an opening 24, that is intercepted by pin 26 when the stem is in the maximum extracted position from the body of chamber 16, and consequently, spring 20 is in the maximum compression position. The position of pin 26 is controlled by way of an actuator 27 (an electrovalve, for exemple) normally deactivated, controlled by the inertial switch 9.

[0010] A push switch 29 is located in the lower section of the cylinder-shaped body, normally closed, electrically connected in series to electrovalve 3 for fuel interception, and to inertial switch 9.

[0011] The device of the invention operates in the following way in the event of a shock.

[0012] Inertial switch 9 interrupts the supply to electrovalve 3, that blocks fuel supply from the pump to the injectors. Actuator 27 is activated simultaneously. This actuator controls the position of pin 26, in order that it be removed from opening 24 and, in this way, free piston 18. Piston 18, pushed by spring 20, which is stretched, creates a depression in chamber 16 and in line 13 linked to the latter.

[0013] Device operation can give rise to two situations.

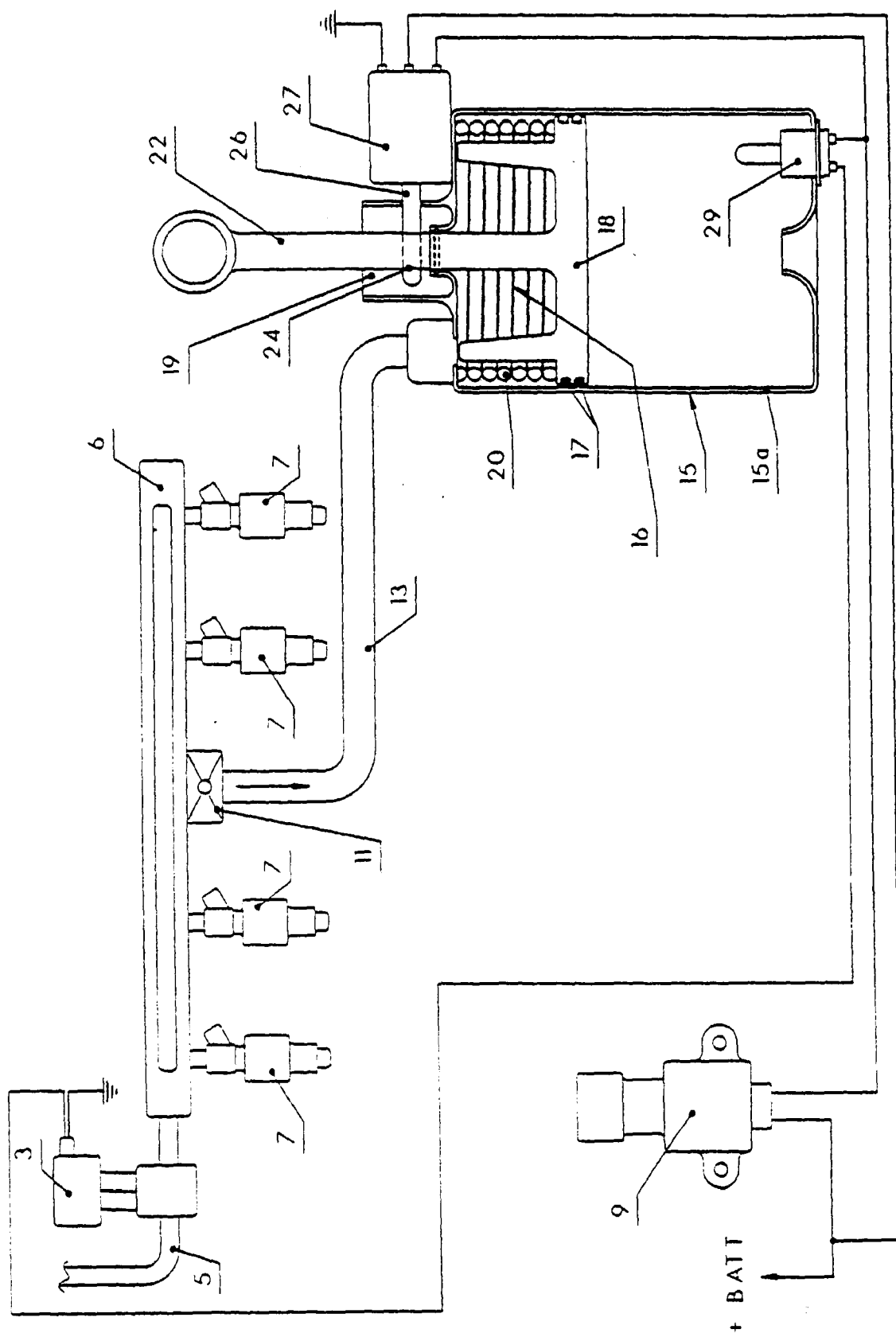
[0014] First case: the shock has not damaged the supply system. The inertial switch has commuted and has activated electrovalve 3, that has closed fuel supply to electrovalve 27, that has extracted pin 26 from the opening 24, freeing piston 18. The user checks the position of stem 22, which should not be entered entirely, after the partial run of piston 18, since the system (fuel distribution line 6, line 13 and body 16) is sealed. If stem 22 is in the intermediate position and piston 18 has not, consequently, reached push button 29, the user can bring it back to the initial position, making sure that pin 26 switches in opening 24. The inertial switch 9 can also be brought back to its initial position, in order for the engine to be reactivated, allowing the anti-fire device to remain in service for future interventions.

[0015] Second case: the shock has damaged the supply system creating a small opening in the fuel injection system. The inertial switch has been activated and has activated electrovalve 3, that has closed fuel supply and electrovalve 27, that has removed pin 26 from opening 24 releasing piston 18. Said piston, pushed by spring 20, produces a depression in chamber 16, that sucks the fuel in conduit 6 and allows the entrance of air, which enters by way of the opening created in the injection system. In this way, the fuel is not dispersed in the environment (engine compartment), which could cause a fire. Stem 22 re-enters entirely into chamber 19 and piston 18 reaches its end of run, and pushes push button 29, which interrupts the link between inertial switch 9 and electrovalve 3. In this case the device makes it impossible to reactivate the engine (for clear

security reasons) , in that it is now impossible to rewind piston 18. This can only be achieved with the assistance of an approved service centre, and push button 29 therefore remains open, and does not allow the injection system to be reactivated despite the fact that inertial switch 9 is ready. 5

Claims

1. Anti-fire security device, located on the fuel supply circuit, towards the injectors of the internal combustion engine of a vehicle, including a delivery line and a distribution line, said circuit being equipped with a fuel intercepting electrovalve (3), controlled by an inertial switch (9), characterized by the fact that the distribution line (6) is linked to a vacuum pump (15), controlled by said inertial switch, via the interposition of a unidirectional valve (11), activated by the depression. 10 15 20
2. Device according to claim 1, characterized by the fact that the vacuum pump (15) is controlled by way of an electrovalve (27) , controlled by the inertial switch (9). 25
3. Device according to claim 1, characterized by the fact that the vacuum pump (15) is equipped with means (29) designed to interrupt electric supply of said intercepting electrovalve (3). 30
4. Device according to claim 1, characterized by the fact that the vacuum pump (15) is composed of a piston (18), pushed by a compression spring (20), and located in a movable way in the inside section of a cylinder-shaped empty body (15a), said piston being equipped with a manoeuvre stem (22) designed to protrude from the cylinder-shaped body. 35 40
5. Device according to claims 2 and 4, characterized by the fact that the electrovalve (27) exerts force on a pin (26), designed to enter an opening (24) obtained in said manoeuvre stem (22) when the latter has been extracted fully. 45
6. Device according to claims 3 and 4, characterized by the fact that the means (29) designed to interrupt the electric supply of the intercepting electrovalve (3) are composed of a switch located on the cylinder-shaped body (15a), designed to be intercepted by the piston (18) when the latter has reached its maximum run position. 50 55





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EUROPEAN SEARCH REPORT

Application Number
EP 99 10 9485

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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A	DE 21 45 983 A (DAIMLER BENZ AG) 22 March 1973 (1973-03-22) * page 2, last paragraph - page 4, last line *	1	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) F02M
Place of search THE HAGUE		Date of completion of the search 22 September 1999	Examiner Torle, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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