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[54] **EMERGENCY STOP DEVICE FOR AN ENGINE SUPPLIED BY THE INJECTION OF LIQUID FUEL**

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[51] **Int. Cl.** **F02b 77/08,** F02d 17/04

[58] **Field of Search** ..... 123/198 R, 198 D, 123/198 DB, 198 A, 142, DIG. 11, 1, 1 A, 119 E

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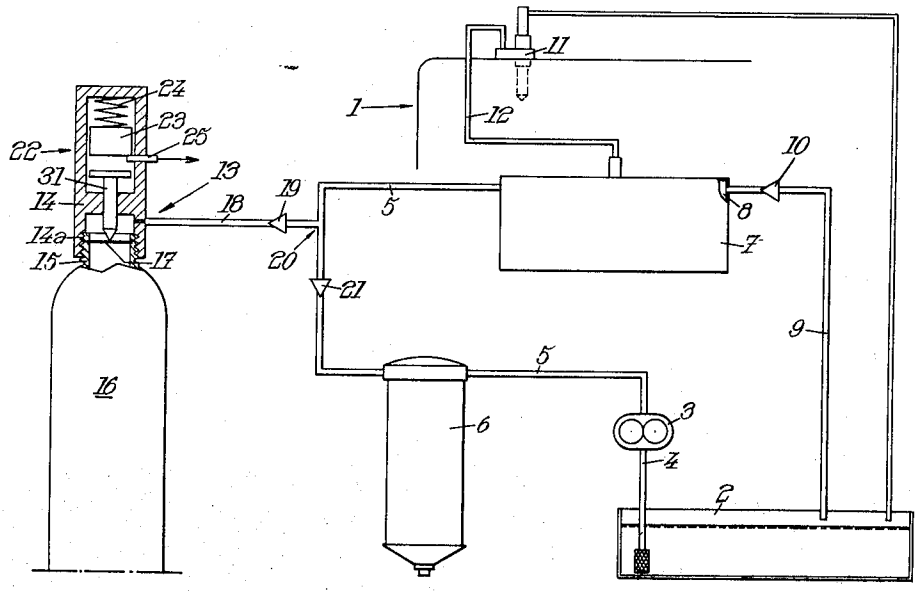
[57] **ABSTRACT**

The supply chamber of the injection pump is provided with a scavenging valve. A supply pump sends fuel through a fuel filter to the supply chamber. A bottle of gas has its mouth sealed by a diaphragm which is pressurized by a percussion mechanism in the case of an accident. The gas is thereby released, flows rapidly through a check-valve into the pipe leading to the supply chamber of the injection pump, sweeps the fuel from this chamber through this scavenging valve and stops the engine.

9 Claims, 3 Drawing Figures



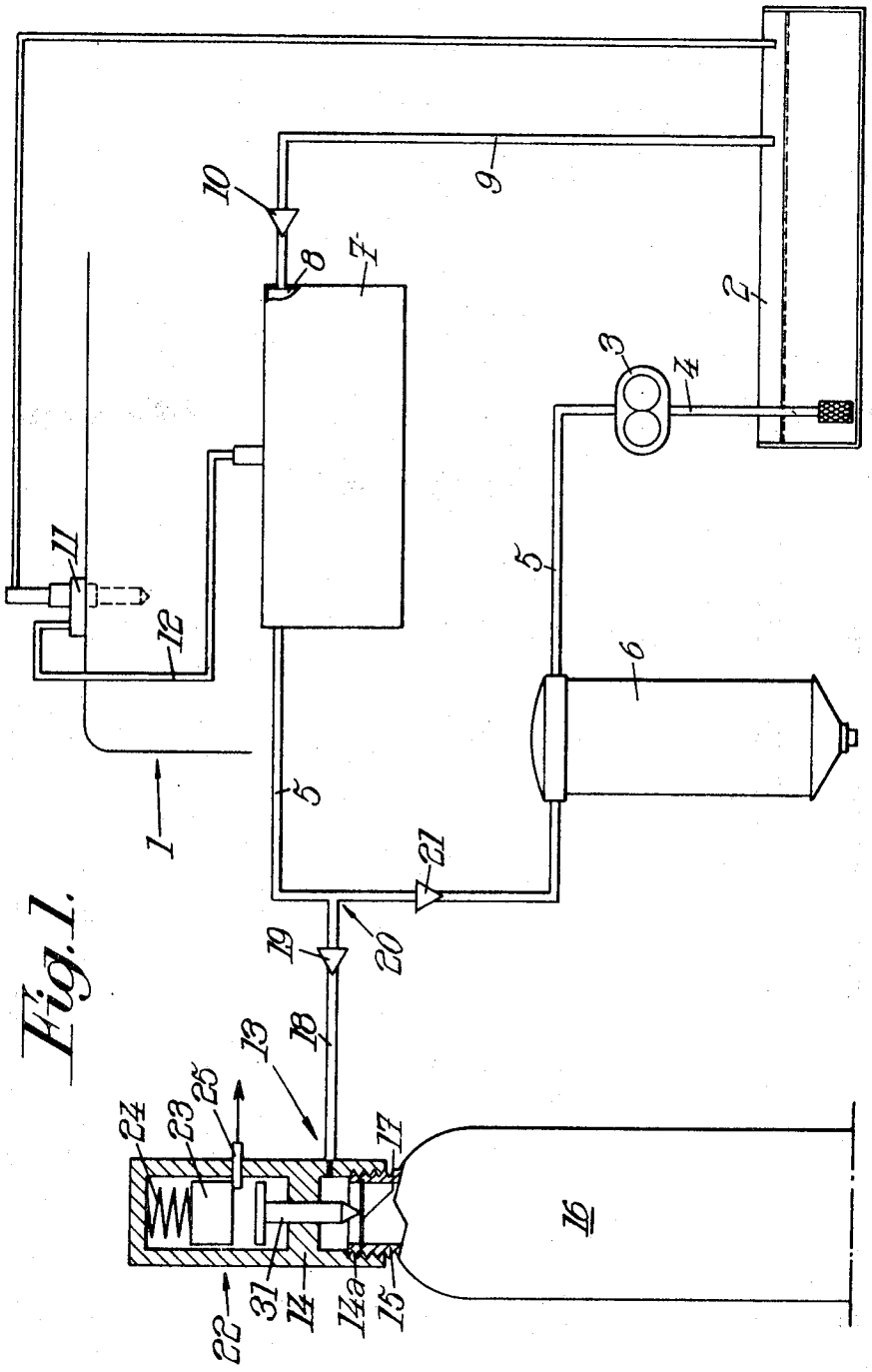


Fig. 1.

Fig. 2.

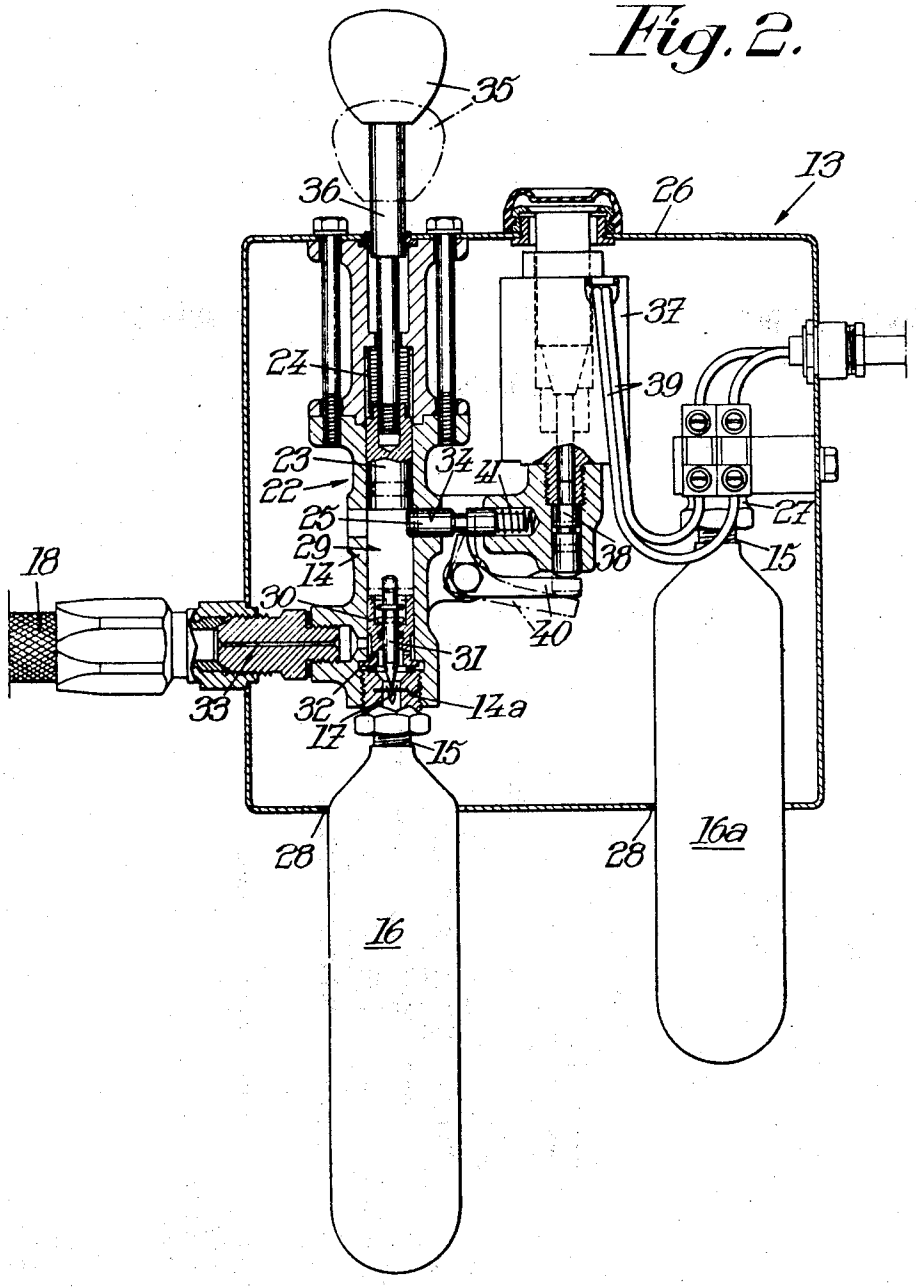

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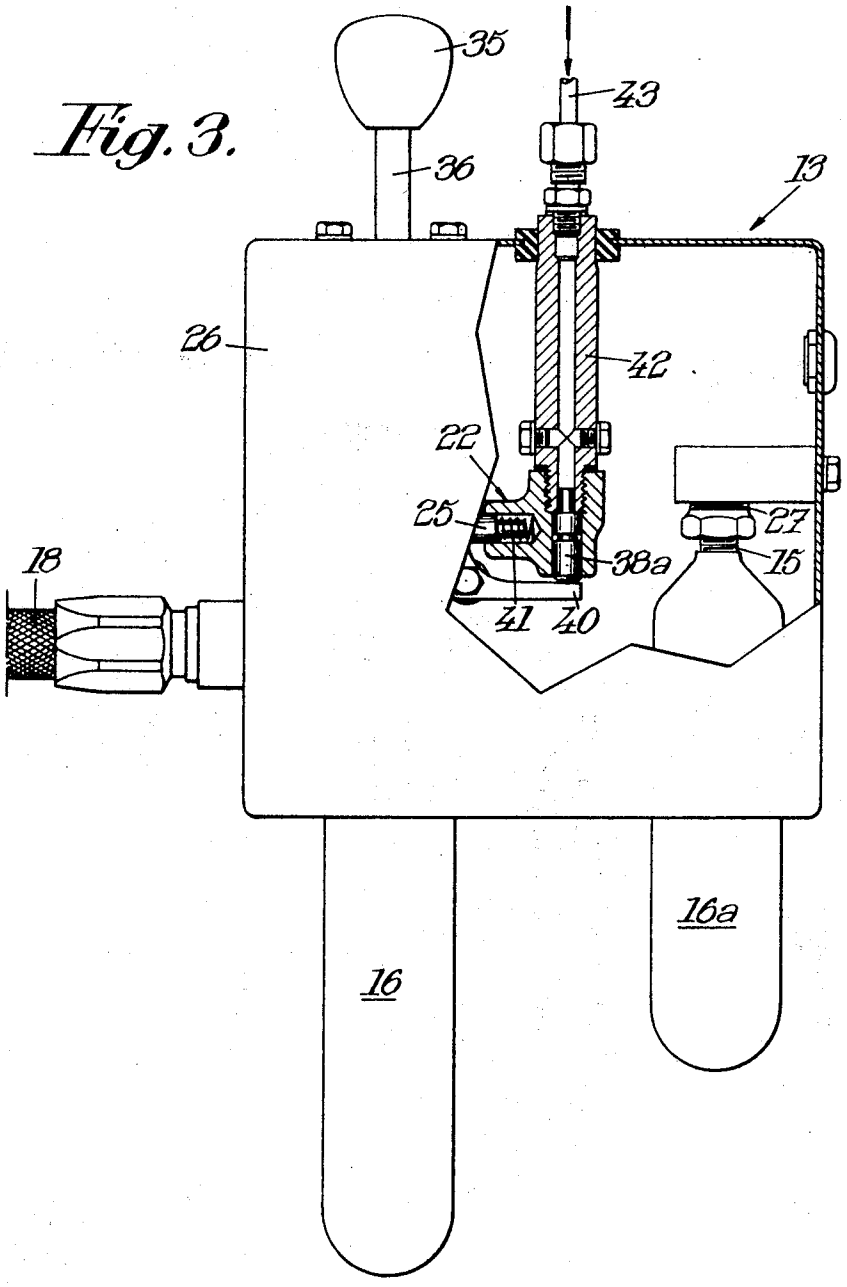
Fig. 3.



EMERGENCY STOP DEVICE FOR AN ENGINE SUPPLIED BY THE INJECTION OF LIQUID FUEL

The invention relates to an emergency stop device for internal combustion engines whose supply system comprises a reservoir of liquid fuel ; a primary pump having a suction pipe connected to the fuel reservoir and a delivery pipe; an injection pump having a supply chamber where this delivery pipe ends and which is connected to the reservoir by means of a spring-biased valve (called a "scavenging valve") adapted to be opened when the pressure in this chamber exceeds a predetermined threshold; and at least one injector receiving the fuel from the injection pump to introduce it into the engine. The invention relates more particularly, but not exclusively, among these stop devices, to those for electrogenerating systems (stationary or traction systems for locomotives), marine installations (propulsion or electrogenerating units on board ship), industrial units (for drilling rigs, for pumping stations), all types of units for which any risk of excessive speed or "running away" exists.

It is known that, in numerous installations, it is desirable to stop internal combustion engines as rapidly as possible after the detection of an accident such as the excessive speed of an electrogenerating unit.

It has already been proposed (U.S. Pat. No. 2,095,349) to combine with an injection pump a stop device adapted to expel by a gaseous current the liquid fuel contained in the supply chamber of this pump. This chamber, which does not possess a scavenging valve, receives fuel by means of an overflow system of which the diverter is connected to the fuel reservoir and it is connected permanently to a source of pressurized gas, such as an air compressor through a passage on which a mechanically actuated valve is mounted. In case of accident, this valve is opened and the gas emerging from the said source penetrates into the supply chamber and expels the fuel through the diverter of the overflow system.

The drawbacks of this stop device are as follows :

1. the pressure of the source of gas varies according to the conditions of operation of the engine and can become insufficient to expel the fuel rapidly from the supply chamber ;

2. the mechanical actuating valve, if it has defects of fluid-tightness, can allow gas to pass towards the supply chamber, on the normal operation of the engine, which disturbs the injection by introduction of gas bubbles in the fuel to be injected;

3. the overflow system must have a considerable volume to be able to remove the liquid fuel from the supply chamber in case of sudden stopping and a portion of this fuel risks being jetted to the outside through the aerating device which normally includes such a system at its upper part;

4. in the case of a sudden stop, the gas under pressure can expel the fuel from the whole of its supply circuit, in particular from the primary pump, which renders the restoration into starting condition of the engine more difficult.

It is an object of the invention to provide a stop device which overcomes these drawbacks and especially which is reliable and does not risk disturbing the normal operation of the engine.

To achieve this purpose, the stop device according to the invention is characterized by the fact that it comprises a hollow body which is arranged to receive the neck of a bottle of gas under pressure, normally obturated by a fluid-tight diaphragm, which body is connected, through a first check-valve, to a point of the abovesaid delivery pipe situated downstream of a second check valve and possessing a sudden action mechanism adapted to pierce the abovesaid diaphragm in case of accident which creates, in the portion of the abovesaid delivery pipe situated downstream of the abovesaid point and in the supply chamber of the injection pump, a rapid and momentary current of gas which expels the fuel therefrom towards the reservoir through the scavenging valve and thus causes the stopping of the engine.

It is clear, in fact, that the first check-valve prevents the fuel from arriving at the hollow bottle-carrying body. On the other hand, it allows to pass the gas coming from the hollow body that the second check-valve obliges to flow towards the supply chamber of the injection pump.

In principle, the abovesaid mechanism is a percussion mechanism comprising a weight movable between an armed position where it is loaded by a spring and retained by a bolt and a released position which it can reach after liberation by its bolt and whereby it causes the piercing of the diaphragm.

The invention will, in any case, be better understood with the aid of the supplementary description which follows as well as of the accompanying drawings, which supplement and drawings relate to preferred embodiments, given purely by way of illustrative but non-limiting example.

In the drawings:

FIG. 1 shows diagrammatically, in elevation with portions in section , the essential elements of a supply system for an internal combustion engine and one embodiment of an emergency stop device constructed according to the invention;

FIG. 2, shows, in a more detailed manner and in vertical section, an embodiment of the emergency stop device of FIG. 1, and

FIG. 3, lastly, shows with portions in elevation and portions in vertical section , a modification of the embodiment of the device constructed as in FIG. 2.

Firstly, as regards the internal combustion engine 1, it is constructed so that its supply circuit comprises:

a reservoir for liquid fuel 2;

a primary pump (or supply pump) 3 having a suction pipe 4 connected to the reservoir 2 and a delivery pipe 5 on which there is generally mounted a fuel filter 6;

an injection pump 7 having a supply chamber 8 wherein the delivery pipe 5 ends and which is connected to the reservoir 2 by a channel 9 through a scavenging valve 10;

and at least one injector 11 receiving fuel from the injection pump 7 through a channel 12 to introduce it into the engine 1.

Now as regards the stop device 13 of the engine 1, it comprises essentially, according to the invention, a hollow body 14 arranged to receive the neck 15 of a bottle of gas under pressure 16, normally closed by a sealing diaphragm 17, which body is connected, through a channel 18 provided with a first check-valve 19, to a point 20 of the delivery pipe 5 situated downstream of the second check-valve 21 and possesses a sudden action mechanism 22 adapted to pierce the diaphragm 17 in case of an accident requiring the stopping of the en-

gine. If the neck 15 possesses a threaded portion, it suffices to provide the hollow body 14 with a collar 14*a* threaded internally to receive the neck.

The mechanism 22 is advantageously a percussion mechanism comprising a weight 23 movable between an armed position (position illustrated in FIG. 1 and shown in full lines in FIG. 2), wherein it is loaded by a spring 24 and held by a bolt 25, and a released position (shown in mixed lines in FIG. 2) that it can reach after liberation by its bolt 25 and under the action of the spring 24 and wherein it causes the piercing of the diaphragm 17.

Preferably, the device 13 comprises the non-return valve 21 as sole element capable of opposing the flow of gas, which enables it to cooperate with a bottle 16 having a volume corresponding to a single stopping operation. To fill the bottle 16, there is selected a gas inert with respect to the liquid fuel and inoffensive when it is released into the atmosphere and, more particularly for reasons of economy, carbonic acid gas or nitrogen. In the case of carbonic acid gas, there may be used a bottle containing a charge of 150 grams under a pressure of 60 bars, the device 13 being arranged to ensure the expansion of the gas down to a pressure of about 5 bars. As shown in FIGS. 2 and 3, it is then advantageous to provide, on a same support 26 forming part of the device 13, not only the hollow body 14 for the bottle 16 in the position of use, but also a tubular element 27 including a collar analogous to the collar 14*a* of the said body 14 to receive a reserve bottle 16*a*. The support 26 may be arranged in the form of a box shielding the essential elements of the device 13 and provided with openings 28 for the passage of bottles 16, 16*a*.

In the embodiment of FIG. 2, the hollow body 14 comprises a cylindrical bore 29 in which is guided the mass 23, also cylindrical, and housed, a bush 13 serving as a guide for a pin 31. The bush 30 is traversed by holes 32 enabling gas which arrives from the bottle 16 to reach the channel 18 and it is arranged to prevent this gas from arriving at the bore 29. On the hollow body 14 is adapted a nozzle 33 ensuring the expansion of the scavenging gas. The hollow body comprises in addition a bore 34 which penetrates at a right-angle into the bore 29 and in which the bolt 25 is guided. So that the mass 23 of the mechanism 22 can be armed, it is provided with a handle 35 to which it is connected by a rod 36 and which emerges from the box-shaped support 26 so that the position of this handle indicates in a clearly visible manner whether the stop device has or has not already functioned.

To disengage the bolt 25, there is provided, according to the embodiment of FIG. 2, an electromagnetic control constituted by a magnetic coil 37 and a plunger 38 such that, when the coil is energized by means of conductors 39, it effects the withdrawal of the bolt 25, for example by thrusting on a lever 40 of the bell crank type and against the action of a spring 41.

The modification of FIG. 3 only differs from the embodiment of FIG. 2 by the substitution of a hydraulic (or pneumatic) control for the electromagnetic control 37, 38, 39. In this case, the plunger 38 is replaced by a piston 38*a* which is adapted to slide in a cylinder 42 which can be supplied with fluid under pressure by means of a pipe 43.

Whatever the embodiment adopted, there is obtained a stop device whose operation is as follows.

It is first of all necessary to place in position in the hollow body 14 a full bottle 16 and to arm the device by pulling the handle 35, from the position in mixed lines to the position in full lines in FIG. 2. Moreover, the conductors 39 (FIG. 2) or the pipe 43 (FIG. 3) are connected to a detector system (not shown) adapted to send a current in the conductors 39 or a fluid under pressure into the pipe 43 as soon as it detects an accident requiring the stopping of the engine and such as the running away of the engine.

As soon as the abovesaid detector system comes into action, it causes disengagement of the bolt 25, which permits the weight 23 to be projected by the spring 24 against the pin 31 which then penetrates the diaphragm 17. The gas escapes from the bottle 16, expands in the nozzle 33, passes through the first check-valve 19 and, by reason of the presence of the second check-valve 21, is directed, through the portion of the delivery pipe 5 situated downstream of the point 20, towards the supply chamber 8 of the injection pump 7 from which chamber it instantaneously expels the fuel through the scavenging valve 10 towards the reservoir 2. The latter must naturally be arranged to allow the scavenging gas to escape and to prevent the fuel from being ejected to the outside. The engine 1 is thus stopped by emptying of the injection pump 7. In FIG. 2, there is shown in full line the normal position of the members 23, 25, 31, 38 and 40, that is to say before the release of the stop device, and in mixed line their position after release of the latter.

When the causes of the accident have been eliminated, it suffices to fill the pipe 5 and the supply chamber 8 again, by means of a priming pump, and the engine is again ready to operate given that the gas selected is inert with respect to the liquid fuel. The stop device 13 is besides restored into operation by substitution of the reserve bottle 16*a* for the bottle 16 then used up and by arming the mechanism 22 by means of the handle 35.

The advantages of such a stop device are especially the following :

certainty of stopping and action in less than a second;

during normal operation of the engine, the gas bottle 16 being hermetically sealed by the diaphragm 17, there is no risk of introduction of gas into the fuel but certainty of sound operation and especially easy restarting of the engine 1;

the bottle 16 is always full if there is no emergency stopping;

the position of the handle 35 enables it to be easily determined whether the device has operated or not;

the bottles 16 which are full of gas can be easily distinguished by their weight from those which are empty, the weight when empty being generally marked on the bottles;

the restoration into operating condition of the stop device after functioning requires very little time ;

moderate maintenance.

As is self-evident, and as emerges already from the foregoing, the invention is in no way limited to those of its types of application, nor to those of its embodiments of its various parts, which have been more especially indicated, it encompasses, on the contrary, all modifications.

We claim:

1. Emergency stop device for internal combustion engines whose supply system includes a reservoir of liq-

uid fuel, a primary pump having a suction pipe connected to the fuel reservoir and a delivery pipe, an injection pump having a supply chamber in which said delivery pipe terminates and which is connected to the reservoir through a calibrated valve (called "a scavenging valve") adapted to be opened when the pressure in said chamber exceeds a predetermined threshold, and at least one injector receiving fuel from the injection pump to introduce it into the engine, said device comprising a hollow body which is arranged to receive the neck of a bottle of pressurized gas, normally closed by a fluid-tight diaphragm, which body has a connecting passage to a point of said delivery pipe, a first check-valve in said passage, a second check-valve situated upstream of said point and a sudden action mechanism positioned so as to pierce said diaphragm in case of accident, whereby in the portion of said delivery pipe situated downstream of said point and in the supply chamber of the injection pump, there is released a rapid and momentary flow of said gas which displaces the fuel therefrom towards the reservoir through the scavenging valve and thus causes stopping of the engine.

2. Stop device according to claim **1**, wherein said mechanism is a percussion mechanism comprising a weight movable between an armed position wherein it is loaded by a spring and retained by a bolt and a released position that it can reach after liberation of said bolt resulting in the piercing of the diaphragm.

3. Stop device according to claim **1**, wherein it comprises the first check-valve as sole element capable of opposing the flow of said gas, which enables it to cooperate with a bottle having a volume corresponding to a single stop operation.

4. Stop device according to claim **1**, wherein said gas is carbonic acid gas.

5. Stop device according to claim **1**, comprising a support on which are mounted, not only the hollow body adapted to receive the bottle in use position, but also a tubular element adapted to receive, in analogous manner, a reserve bottle.

6. Stop device according to claim **5**, wherein the support is arranged in the form of a box shielding the essential elements of the device and provided with openings for the passage of gas bottles.

7. Stop device according to claim **2**, wherein the hollow body comprises, a first cylindrical bore in which the percussion weight is guided and housed, a bush serving as a guide for a pin, which bush is traversed by holes enabling the gas, which comes from the bottle mounted in said body, to reach said point of the delivery pipe and arranged to prevent this gas from arriving at said bore and a second bore which penetrates at a right angle into the first bore and in which said bolt is guided, a nozzle being adapted on the hollow body to ensure the expansion of the scavenging gas.

8. Stop device according to claim **6**, wherein the weight of the percussion mechanism is connected to an arming handle projecting outside of the box-shaped support.

9. Device according to claim **1**, wherein said mechanism is actuated automatically through an electromagnetic transmission or fluid under pressure, by a detector sensitive to accidents necessitating the stopping of the engine.

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