

## [54] OIL PRESSURE DETECTOR

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[51] Int. Cl. .... **F02b 77/00**

[58] Field of Search .... 123/198 R, 198 D, 198 DB;  
137/624.27; 251/73

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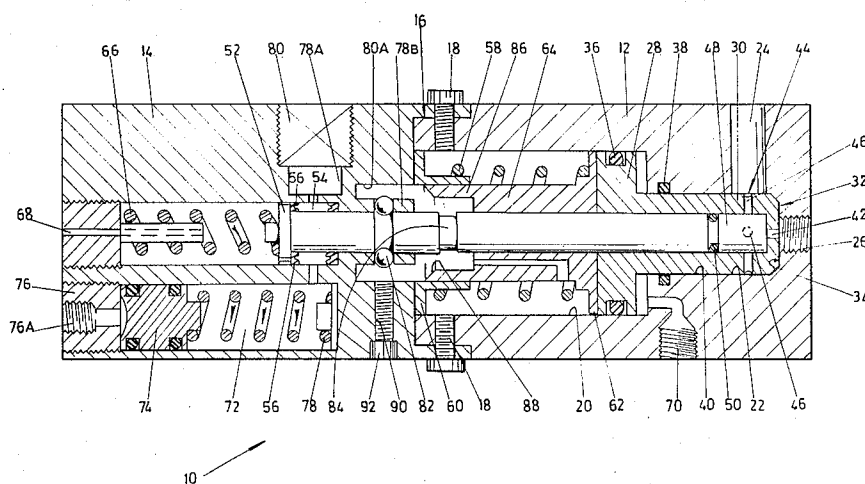
Attorney, Agent, or Firm—Young & Thompson

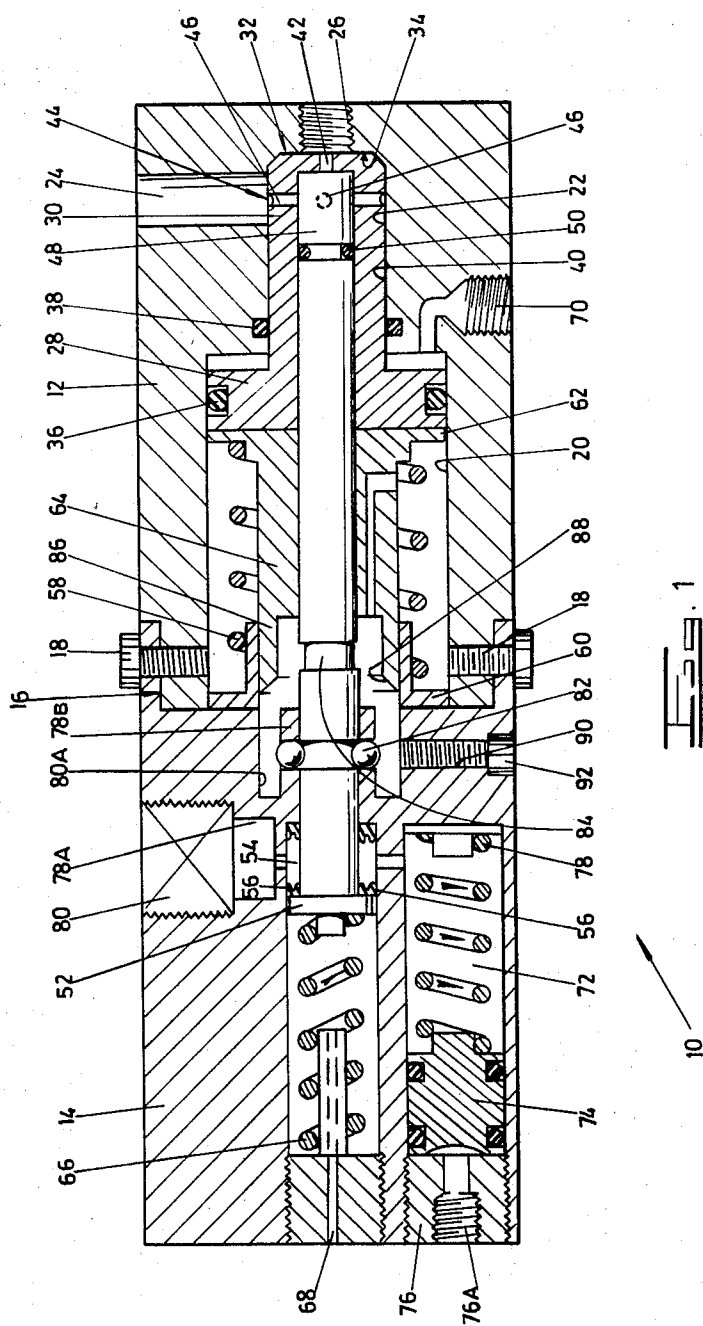
## [57] ABSTRACT

The invention is concerned with a safety device for a fuel driven engine which is lubricated by liquid lubricant under pressure. The invention is particularly concerned with such a safety device comprising a first operating member; a first spring acting on the first operating member to bias the latter into a first position; a pressure sensitive device adapted to be subject to the pressure of the liquid lubricant and being connected to the first operating member to move the latter from its first position to a second position when the pressure detected is more than a predetermined minimum; a second operating member normally movable freely relative to the first operating member from a first position to a second position; second spring means for biasing the second operating member into its first position; and detector means for detecting when a predetermined operation has taken place and for moving the second operating member into its second position when such predetermined operation has taken place.

The invention provides locking means for locking the second operating member in its second position, which locking means is controlled by the first operating member when in its second position.

15 Claims, 6 Drawing Figures





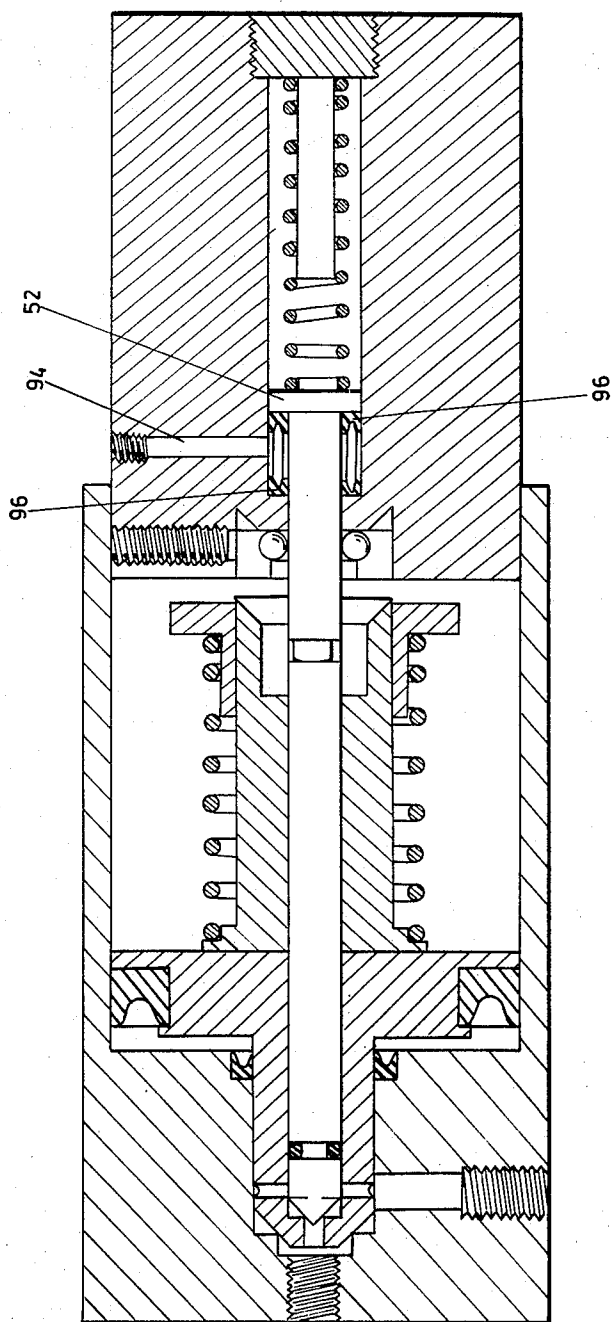


FIG. 2

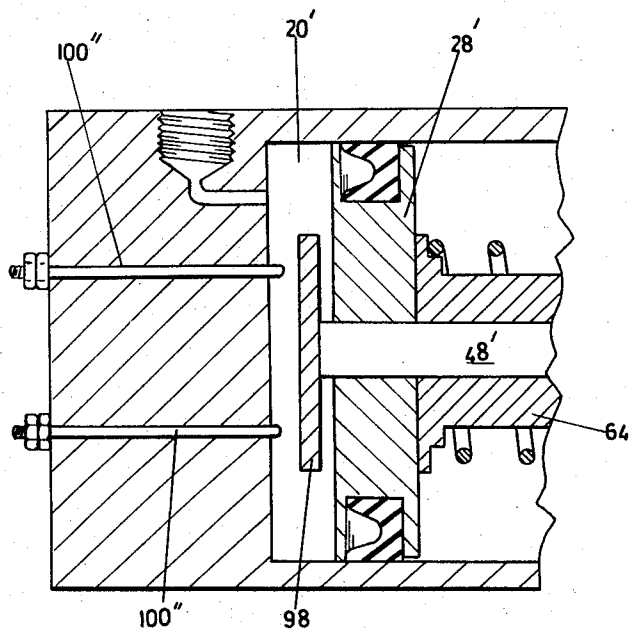


Fig. 3

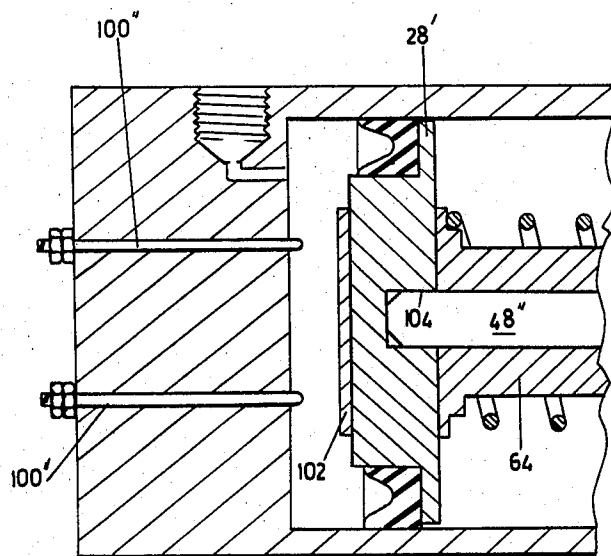
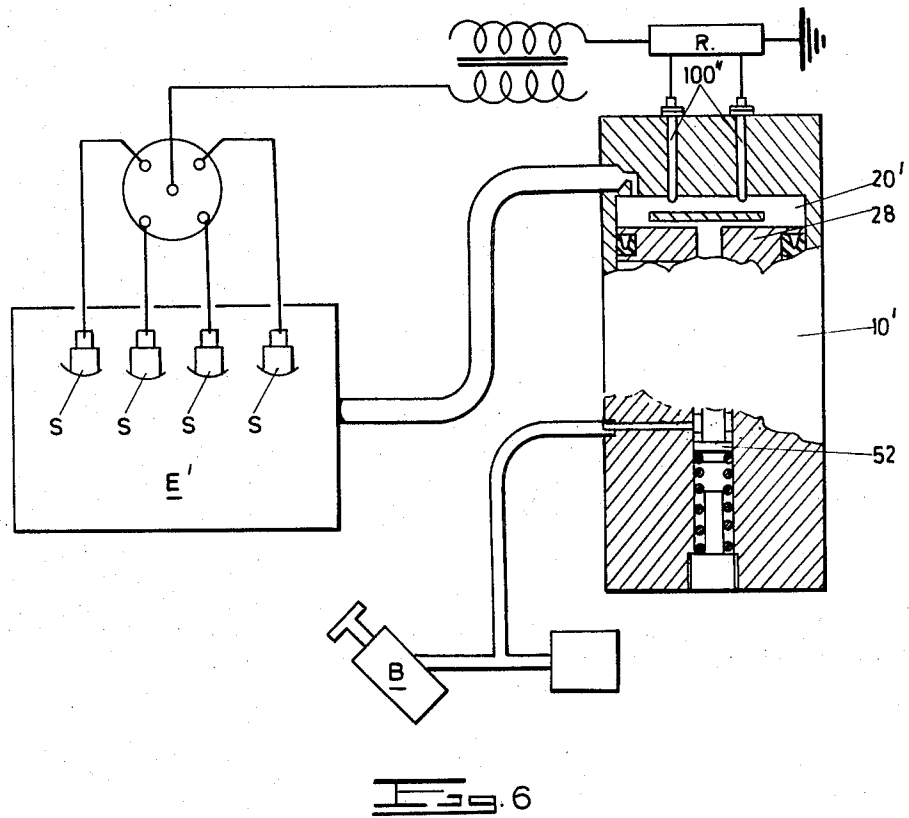
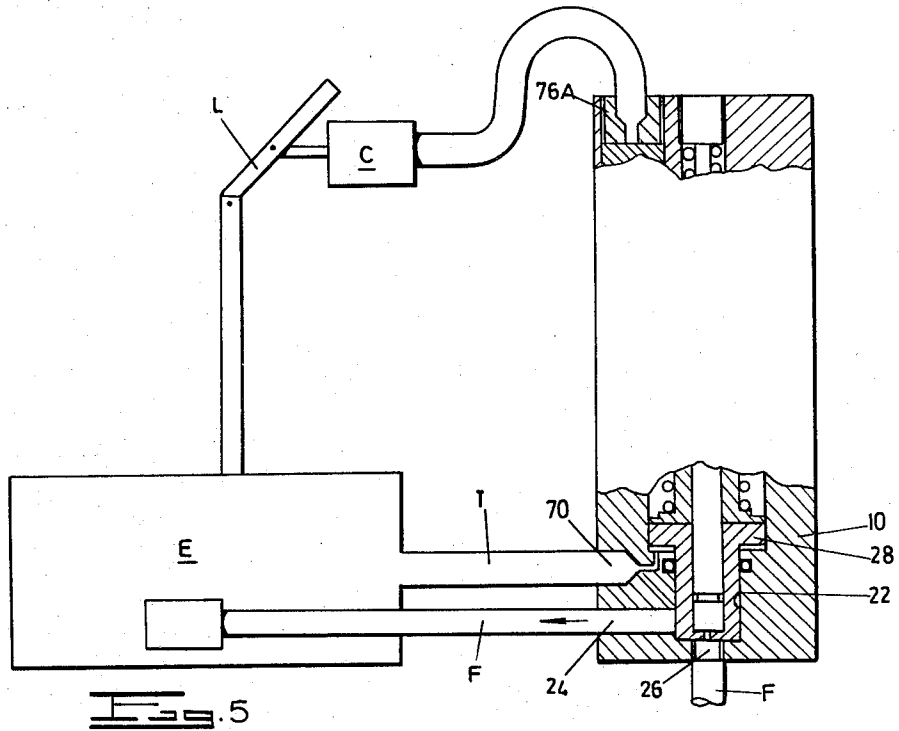


Fig. 4



## OIL PRESSURE DETECTOR

This invention relates to safety devices for engines.

The invention is concerned with a safety device for a fuel driven engine which is lubricated by liquid lubricant under pressure.

The invention is particularly concerned with such a safety device comprising a first operating member; a first spring acting on the first operating member to bias the latter into a first position; a pressure sensitive device adapted to be subject to the pressure of the liquid lubricant and being connected to the first operating member to move the latter from its first position to a second position when the pressure detected is more than a predetermined minimum; a second operating member normally movable freely relative to the first operating member from a first position to a second position; second spring means for biasing the second operating member into its first position; and detector means for detecting when a predetermined operation has taken place and for moving the second operating member into its second position when such predetermined operation has taken place. A safety device as set out in the preceding sentence will herein be referred to as a safety device of the kind set forth.

According to one aspect of the invention there is provided a safety device of the kind set forth further comprising locking means for locking the second operating member in its second position, which locking means is controlled by the first operating member when in its second position. Preferably the second spring acts on the first operating member through the second operating member to supplement the first spring in biasing the first operating member to its first position. Thus when the first operating member moves slightly from its second position, the locking means releases the second operating member so that both springs act on the first operating member to move it into its first position.

As the second spring is normally considerably stronger than the first spring, this means that the safety device will have the twin advantages of incorporating a sensitive pressure sensitive device and at the same time a quick operating first operating member.

The first operating member is conveniently a valve for cutting off the fuel flow to the engine. The second operating member may in these circumstances preferably comprise a by-pass device to allow a small amount of fuel to pass to the engine so that the pressure of the lubricant may build up so as to move the first operating member into its second position. Alternatively the device may incorporate electric switch means that may be actuated by either member.

The detector means may be a piston subject to the hydraulic pressure in the clutch or brake circuit of a vehicle incorporating the safety device. Yet again the detector device may be a piston movable by the pneumatic pressure of a pneumatic brake circuit of the vehicle or by pressure generated when a lever is actuated or any such means. In these circumstances there is preferably provided an intermediate piston which moves when it detects actions as mentioned to apply the pneumatic pressure to the piston and preferably there is a bleed to allow the pressure on the first mentioned piston to fall should the intermediate piston be subject as aforesaid for a period exceeding a certain amount.

Embodiments of the invention will now be described with reference to the accompanying drawings

In the drawings

FIG. 1 is a longitudinal section through a safety device of the invention,

FIG. 2 is a similar view of another safety device of the invention,

FIGS. 3 and 4 are partial views of two further modified safety devices of the invention,

FIG. 5 is a diagrammatic circuit diagram of an engine utilising a safety device of FIG. 1, and

FIG. 6 is a similar diagram of an engine utilising a safety device of FIG. 3.

The safety devices shown in the drawings are operable when the pressure of the lubricating fluid of the engine falls below a predetermined amount.

The safety devices shown in FIGS. 1 and 2 when operated interrupt the fuel flow to an engine. The safety devices of FIGS. 3 and 4 are electric switch devices. The embodiment of FIG. 1 is intended for use particularly with stationary engines where a lever or the like is pushed when the engine is started. The other embodiments are intended for use with an engine in a vehicle where there is a member which supplies pressure when operated and which can be operated on starting up the engine. Typically this member may be the clutch or the brake which may be connected to a source of hydraulic or pneumatic pressure that may be connected to the safety device when the clutch or brake is operated.

It will be noted that it will not be possible to travel in the vehicle under the full power of the engine when the clutch or brake is operated.

Reference is now made to FIG. 5. A safety device 10 of the invention is shown in the fuel line F of an internal combustion engine E. A tapping T is taken from the lubricating oil system of the engine E and leads to a port 70 in the safety device so that the latter is subject to the lubricating oil pressure.

A lever L which is operable to start the engine E is connected to a pneumatic cylinder C to provide fluid under pressure and to supply it to a port 76A as will be described.

The safety device is shown in FIG. 1.

The safety device 10 comprises a body formed of two aligned cylindrical parts 12 and 14. The inner end of the part 12 is turned down at 16 and is received within a corresponding recess in the part 14. Suitable screws 18 hold the two parts 12 and 14 together.

The part 12 (which is hereinafter called the "forward part" for convenience) has a main co-axial cylinder 20 extending over part of its length. The cylinder 20 has a co-axial continuation 22 of smaller diameter. A radially extending fuel outlet port 24 leads from the continuation 22 and a co-axial fuel inlet port 26 leads into the continuation.

A first operating member includes a piston 28 slidable in the cylinder 20 and having a valve 30 formed on its front face and fitting the continuation 22. The front face 32 of the valve 30 is adapted, when the valve is in its forward or "first" position, to seal against the end face 34 of the continuation to prevent fuel flow from the inlet 26 to the outlet 24. An O-ring 36 is provided in a groove in the piston 28 to seal the latter to the cylinder 20 and an O-ring 38 in a groove surrounding the continuation 22 seals against the valve 30.

The piston 28 and valve 30 have co-axial bore 40 which terminates near the front face 32. A co-axial bleed hole 42 leads to this bore 40. An annular groove 44 surrounds the valve in such a manner to align with

the fuel outlet port 24 and this groove 44 is connected to the bore 40 through radial holes 46.

Slidable within the bore 40 is one end of a second operating member comprising an elongated valve stem 48, which serves as a by-pass device as will become apparent, and which is sealed to the bore 40 by an O-ring 50. This stem 48 is adapted to prevent fuel flow from the holes 46 to the bleed hold 42 when the stem 48 is in its forward or "first" position. The stem 48 has a piston 52 at its rear end which piston is subject to pressure in a chamber 54. Suitable seals 56 are provided on the piston 52 and where the stem passes out of the chamber 54.

A first spring 58 acts between a collar 60 and a flange 62 on a member 64 to be described below which flange 62 bears on the piston 28 to bias the first operating member 28, 30 into its first or forward position. A second spring 66 acts between an adjusting screw 68 and the piston 52 to bias the stem 48 into its forward or first position. By adjusting the screw 68 the bias of the spring 66 can be varied. By adjusting three elongated screws (not shown) which pass through the body part 14 and act on the collar 60, the tension of the spring 58 can be varied.

A port 70 leads the operative face of the piston 28. This port is connected in use to be subject to the pressure of the lubricant in an engine. The spring 58 is chosen so as to allow the piston 28 to be moved to a rear or "second" position when the engine lubricant pressure is at its desired pressure, which may be a very few pounds per square inch.

The chamber 54 is connected to a chamber 72 containing a piston 74 (hereinafter called the "intermediate piston"). The intermediate piston 74 is subject to pressure through an apertured plug 76 (having a port 76A) which is normally connected to a pneumatic cylinder C which is pressurised by the lever L operable by a user on starting up the engine. When this pressure reaches a predetermined level, the intermediate piston 74 is moved against the bias of a spring 78 to move the piston 52 and hence the valve stem 48 to a rear or "second" position against the bias of the spring 66. The pressure on the piston 52 is normally quite high and the spring 66 must be substantially stronger than the spring 58.

A further chamber 78A is connected to the chamber 54. This chamber 78A has a one way valve 80 to allow air into the chamber 78A. There is also a bleed past the valve 80. This allows the air in the chamber 78A to escape after a lapse of time so that the piston 52 will be moved forwardly by the bias of the spring 66.

Locking means is provided to prevent the second spring 66 acting on the first operating member when the piston 28 is subject to the lubricating oil pressure. This is necessary because the strength of the spring 66 would overcome the force exerted by the lubricating oil pressure. The locking means comprises a boss 78B in a recess 80A in the part 14 and through which the stem 48 passes. The boss 78B has two passages within which ball bearings 82 are slidable. The length of the passages is slightly less than the diameter of the ball bearings 82. The stem 48 has an annular recess 84 which will be opposite the passages when the stem 48 is in the second position so that the balls 82 can be received in the passages. The member 64 has a skirt 86 with a tapered edge 88. This skirt 86 encompasses the boss 78B when the first operative member is in the second position.

When so encompassing the boss 78B, the skirt 86 prevents the balls 82 from moving out of the recess 84 and hence the balls lock the stem 48 in position.

The body part 14 has a passage 90 through which the balls can be introduced into the boss 78B and a plug 92 is provided for closing off the passage.

The safety device above described operates as follows:

The ports 24, 26, 70 and 76A are connected as described above. The first and second operating members will be biased into their forward or first positions. On starting up the engine, the lever mentioned above will be operated acting on the piston 74 which pressurises the air in the chambers 72 and 54 so that the second operating member is moved into its second position. Thus fuel can bleed through openings 46 and 42 to enable the engine to commence running. The lubricant pressure in the engine will quickly rise and the piston 28, being subject to the lubricating oil pressure, will move backwardly into the second position. When this occurs, the locking mechanism will operate as mentioned above. Thus there will be free flow of fuel from port 26 to port 24 and hence to the engine and the spring 66 will not act on the first operating member.

Should the lubricating oil pressure drop, the piston 28 and with it the member 64 will move forwardly under the influence of the spring 58. As soon as the skirt 86 has moved away from the balls 82, these escape from the recess 84 and the stem 48 is urged forwardly by the second spring 66. The front end of the stem 48 now butts against the piston 28 which is now biased forward by both the springs 58 and 66. In view of the strength of the spring 66 the first operating member will "snap" over into the first position for swift interruption of the fuel flow thereby causing immediate stopping of the engine.

It will be seen that the provision of the bleed in from the chamber 78A will prevent an operator circumventing the safety device by continually holding the operating lever in the starting position.

The safety device described above is particularly useful for stationary engines or engines which require a manually operated device to be actuated to operate the piston 52 on the second operating member 48. Where it is possible for the intermediate piston 74 to be actuated by a device which prevents adequate operation of the engine, e.g. where the engine is in a vehicle and, say, the operation of the clutch or the brakes can actuate the second piston a simpler arrangement can be used. Such a simpler arrangement is shown in FIG. 2. This arrangement is substantially identical to the first embodiment except as will be described and except for minor differences of mechanical detail. As shown here the pressure from the clutch or brake cylinder enters through the port 94 and acts directly on the piston 52. It will also be seen that U-section packings 96 are used wherever possible instead of O-ring seals as in the first described embodiment. It will be understood of course that these packings can be used in other embodiments of the invention.

In FIGS. 3 and 4 there are shown safety devices of the invention which are intended for use with spark ignition engines E' having spark plugs S (see FIG. 6). Both these embodiments are substantially identical with the embodiment of FIG. 2 except as will be herein described and for this reason parts only of these embodiments are shown.

These embodiments are adapted to be connected into the electric circuit of the apparatus in which the engine E' is carried, which apparatus is normally a vehicle. To this end a pair of contact members 100'' are provided which enter into the cylinder 20' of the device'. These contact members 100'' are connected for example to a relay R which is arranged when operative to interrupt the electrical power supply to the engine E'. Alternatively the relay may be connected to a valve which may interrupt the fuel flow to the engine. Further the contact members may be connected to a hooter or other warning device.

As in the FIG. 2 embodiment, the piston 28 on the first operating member is subject to the pressure of the lubricating fluid in the engine and the piston 52 is subject to the pressure from the brake or clutch master cylinder B.

In the FIG. 3 embodiment, the first operating member comprises merely a piston 28' fitting the cylinder 20'. The second operating member or stem 48' passes freely through the piston 28' and carries a bridging member 98. As in the embodiment of FIG. 2, on start-up of the engine, the valve stem 48' is rearwardly together with the bridging piece 98 breaking the contact between the contact members 100''. When the pressure of the lubricating fluid rises, the piston 28' is moved backwardly moving the member 64 to lock the valve stem 48' in its rearward position as described above.

Should the lubricating fluid pressure fall, the piston 28' and the member 64 are moved forwardly releasing the valve 48' which is then moved forwardly by the second spring 66 (not shown) carrying with it the bridging piece 98 which now contacts the contact members 100''.

It will be noted that in the FIG. 3 embodiment, no force is applied to the piston 28' by the valve stem 48'.

In the embodiment of FIG. 4, the piston 28'' carries the bridging member 102. Here the valve stem 48'' is received in a recess 104 in the rear face of the piston 28''. When the second spring 66 (not shown) acts on the valve stem 48'' to move it into its first position, the valve stem 48'' in turn acts on the piston 28'' moving it forwardly until the bridging member 102 contacts the contact members 100''.

In the arrangement of FIG. 4 the stem 48'' has no effect on the main operating member 28'' save to transmit to it the bias of the spring and in particular does not withdraw the bridging member 102 from the contact members. In order to allow the engine to start therefore, there is provided a time delay switch (not shown) connected to the contact members 100''. This delay switch will be opened by any conventional means when starting the engine and will subsequently close so that the safety device becomes operative.

The invention is not limited to the precise constructional details hereinbefore described and illustrated in the drawings.

I claim:

1. A safety device for a fuel driven engine which is lubricated by liquid lubricant under pressure and comprising a first operating member; a first spring acting on the first operating member to bias the latter into a first position; a pressure sensitive device adapted to be subject to the pressure of the liquid lubricant and being connected to the first operating member to move the

latter from its first position to a second position when the pressure of the lubricant is more than a predetermined minimum; a second operating member normally movable freely relative to the first operating member from a first position to a second position; second spring means for biasing the second operating member into its first position; and detector means for detecting when a predetermined operation has taken place and for moving the second operating member into its second position when such predetermined operation has taken place, further comprising locking means for locking the second operating member in its second position, which locking means is controlled by the first operating member when in its second position.

2. A safety device as claimed in claim 1 wherein the second spring acts on the first operating member through the second operating member when the latter is not locked in its second position by the locking means to supplement the first spring in biasing the first operating member to its first position.

3. A safety device as claimed in claim 1 wherein the second operating member comprises a stem having a peripheral groove therein, the stem passing through a boss having at least one radial passage and being arranged so that the groove is opposite the passage when the second operating member is in its second position, wherein there is a ball in the passage and wherein the first operating member has a skirt a part of which when the first operating member is in its second position, fits over the boss, the arrangement being such that when the skirt fits over the boss, the ball is held in the groove by the skirt thereby locking the stem to the boss.

4. A safety device as claimed in claim 1 wherein the second spring is considerably stronger than the first spring.

5. A safety device as claimed in claim 1 wherein the first operating member is a valve for cutting off the fluid supply to the engine.

6. A safety device as claimed in claim 5 wherein the second operating member comprises a by-pass device to allow a small amount of fuel to pass through the device.

7. A safety device as claimed in claim 1 incorporating switch means adapted to be connected into the electric circuit of the engine and wherein the switch means is adapted to be actuated by one of the members.

8. A safety device as claimed in claim 7 wherein the switch means comprises a pair of contacts projecting into the device and a bridging member which is carried by one of the operating members.

9. A safety device as claimed in claim 8 wherein the first operating member carries the bridging member.

10. A safety device as claimed in claim 9 wherein the second operating member is able to move the first operating member only towards its first position and wherein there is provided a time delay device connected to the contacts to delay the operation of the safety device so as to enable the engine in use to start operating and the liquid lubricant pressure to build up before the safety device becomes operative.

11. A safety device as claimed in claim 8 wherein the second operating member carries the bridging member.

12. A safety device as claimed in claim 11 wherein the second operating member is freely movable relative to the first operating member except when locked in its second position.

13. A safety device as claimed in claim 1 wherein the detector means comprises a piston subject to fluid pressure on operating of any one of the following devices namely a clutch, a brake and a starting lever.

14. A safety device as claimed in claim 13 wherein the fluid pressure is pneumatic pressure and wherein there is provided means for allowing the air to bleed to relieve the pressure on the piston should the device re-

main in its operative position for too long.

15. The combination of a safety device as claimed in claim 1 with an internal combustion engine lubricated by a liquid lubricant under pressure, wherein the pressure sensitive device is connected to the engine so as to be subject to the pressure of the liquid lubricant.

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