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J. EDWARDS

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AUTOMATIC PUMP SHUTOFF APPARATUS

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FIG. 1

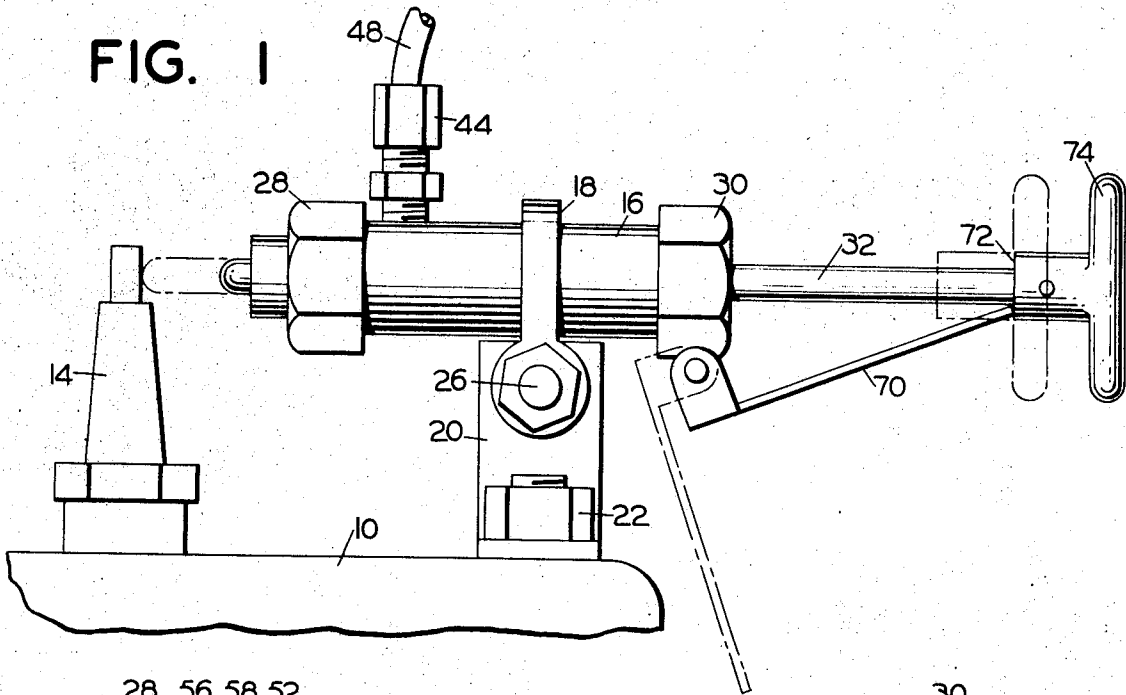
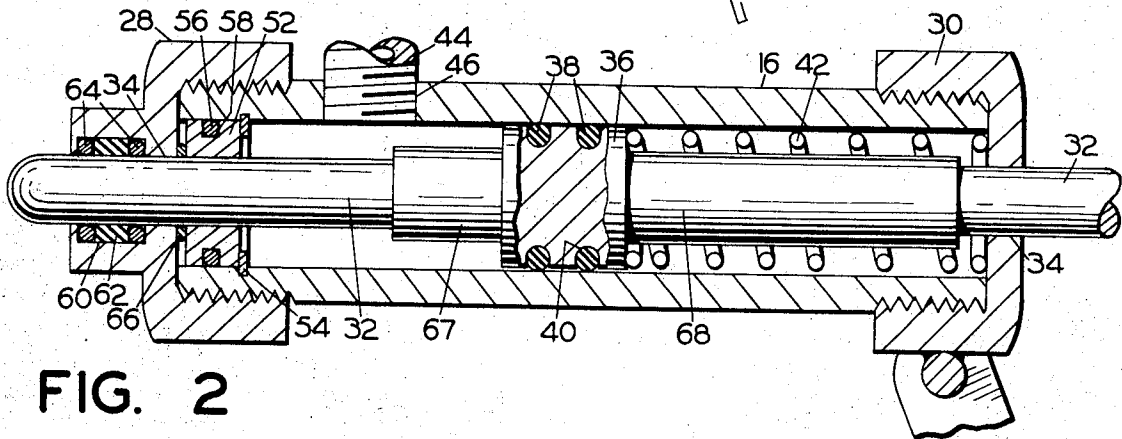


FIG. 2

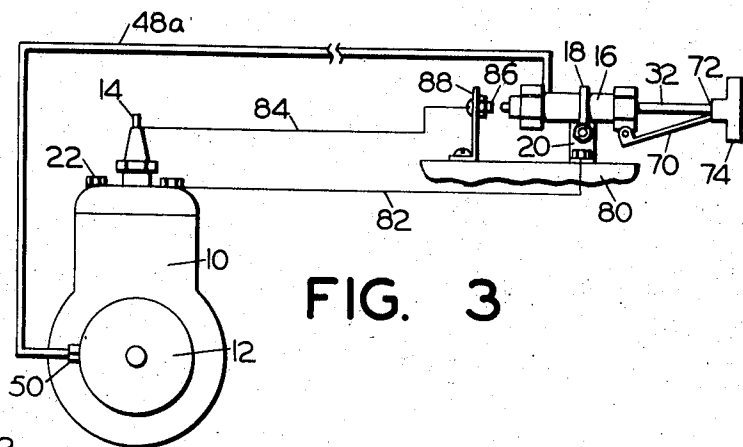


FIG. 3

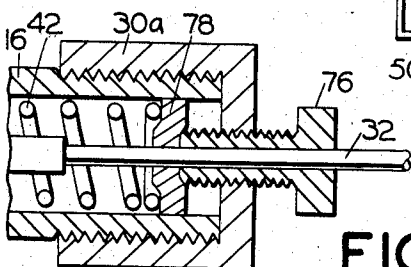


FIG. 4

JACK EDWARDS
INVENTOR.
BY *Eugene M. Eckelman*
ATTY.

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AUTOMATIC PUMP SHUTOFF APPARATUS

Jack Edwards, 8217 SE. McLoughlin Blvd.,

Portland, Oreg. 97202

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5 Claims

ABSTRACT OF THE DISCLOSURE

The apparatus includes a tubular housing in which a stem is slidably mounted. The stem carries a piston, and a spring is enclosed within the housing to urge the stem to a position such that one end thereof is adapted to engage and electrically ground a spark plug of a pump motor for shutting off the motor. A pressure line from the outlet of the pump is connected into the housing, and pressure from the pump outlet is arranged to retract the piston and hold the stem away from the spark plug. When the pump pressure falls the spring causes the stem to engage the spark plug of the pump motor to shut the motor off and prevent it from running excessively without a load. Gravity operated latch means are engageable with the stem to hold the stem retracted while the pump motor is being started as well as until such time that pressure builds up to hold the piston retracted, the latch being released automatically when a selected pressure has been built up. The piston has surface O-rings for sealing engagement with the interior of the housing in a rearward direction of the latter and front seals are provided for sealing in a forward direction. The shutoff apparatus of the present invention may be supported on the pump motor or if desired it may be located remotely from the pump motor and operable to electrically ground the spark plug by a connecting wire.

BACKGROUND OF THE INVENTION

This invention relates to new and novel pump shutoff apparatus operative automatically to shut off the pump when the pump pressure is down.

Many pumps have been ruined because of operation thereof after their pumping loads no longer exist. For example, many pumps are used to lift a liquid to a higher level or to eject liquid under pressure from tanks such as fire pumps. As often occurs, the source of liquid to the pump is stopped, such as by a depletion of the liquid or a stoppage in the line to the pump, whereby the pump without a load will run at excessive speed. Continued operation of a pump motor without a load damages the motor.

SUMMARY OF THE INVENTION

Objectives of the present invention therefore are to provide apparatus for automatically shutting off a pump motor when pressure in the outlet of the pump reaches a selected low minimum; to provide apparatus of the type described which has a housing in which is incorporated pressure operated retractable means urged to an extended position for engagement with the operating control means of the pump motor, such as a spark plug, for shutting off the motor but being arranged to be held in a retracted position away from the operating control means of the pump motor as long as the pumping pressure of the pump is maintained above the selected minimum; to provide apparatus of the type described employing gravity operated latch means which serve to hold the pressure operated retractable means initially while the pump motor is being started and before the pressure builds up to a selected minimum but which is automatically released

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when the pump exceeds the minimum pump pressure so that the pressure operated retractable means is capable of movement to its extended position for shutting off the motor; and to provide novel sealing means interiorly of the housing for operation of the pump pressure with the piston.

A further object of the invention is to provide pump shutoff apparatus of the type described which is simple in construction and inexpensive to manufacture.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the present shutoff apparatus as mounted on a pump motor;

FIG. 2 is a longitudinal sectional view of the shutoff apparatus;

FIG. 3 illustrates a slightly modified form of the invention wherein structure is utilized to remotely locate the shutoff apparatus with relation to the pump motor; and

FIG. 4 is a fragmentary sectional view of one end of the apparatus illustrating spring adjustment means to vary the pressure at which the device shuts off a motor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 and 3, the numeral 10 designates generally a conventional motor for operating a pump 12. As set forth above, such a pump can cause itself extensive damage if allowed to run free of load, such as would occur if the supply of liquid to be pumped is depleted or if the inlet to the pump is plugged. Pump motor 10 has a spark plug 14, and to stop the motor the spark plug is usually grounded to the motor housing by a switch or trigger, not shown.

With reference to FIGS. 1 and 2, the present invention includes apparatus adapted to electrically ground the spark plug and stop the motor when the pump pressure is down as a result of a lack of liquid to be pumped or for other reasons. Such apparatus comprises a tubular housing or cylinder 16 mounted in a clamp 18 adapted for supporting the cylinder 16 adjacent to the spark plug 14 by a suitable bracket 20. Bracket 20 may be suitably secured to the motor such as by one of the head bolts 22 of the motor, and clamp 18 is a U-shaped or split-type clamp secured to the bracket by a cross bolt 26 releasably supported in the bracket 20 so that the housing 16 can be adjustably positioned lengthwise for selective location with relation to the spark plug.

Housing 16 has a pair of end caps or nuts 28 and 30 threadedly mounted thereon, and for the purposes hereof the cap 28 will be referred to as a front cap and the cap 30 will be referred to as the rear cap. An elongated stem 32 projects axially through the housing 16 with the end caps 28 and 30 having suitable apertures 34 which slidably receive the stem. Secured on the stem 32 is a piston 36 slidable in the housing and having surface sealing engagement with the interior surface of the housing by a pair of O-rings 38 set peripherally in grooves 40 in the surface of the piston. The piston 36 is urged in one direction, namely, toward the front of the housing, by a compression spring 42 engaged between the piston 36 and the rear end cap 30. The piston is moved in the other direction by pump pressure, namely to the rear of the housing, and for this purpose housing 16 has a fitting 44 which is mounted in a threaded bore 46 in the side wall of the housing toward the front of the latter. The specific positioning of the fitting 44 will be explained in greater detail hereafter. Such fitting connects to a line or conduit 48 leading to pump pressure chamber, and connection of the line 48 to the pump pressure chamber is accomplished by a suitable fitting 50. The fitting 50

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is shown in FIG. 3, and although such figure illustrates a second embodiment to be described later, the connection of the line to the pump outlet is identical. The inlet of line 48 to the housing is in front of the maximum forward movement of the piston 36, whereby upon the existence of a selected pump pressure in the line 48 to overcome the force of spring 42, the piston is adapted to be moved rearwardly.

The forward end of the housing 16 supports a sealing insert 52 positioned against rearward movement by a snap ring 54 and having an O-ring 56 disposed in a suitable peripheral groove 58 therein to establish sealing engagement with the interior surface of the housing. Pump pressure introduced through the line 48 to the housing is confined in the housing by the O-rings 38 in the piston 36 and by the O-ring 56 in the insert 52. The escape of pressure along the surface of the stem 32 in a forward direction of the housing is prevented by a sealing assembly mounted in a counterbore 60 in the forward cap 28, the sealing assembly comprising a sealing washer 62 and an O-ring 64 on each side thereof. Also, pressure sealing at the forward end of the housing is accomplished by an O-ring 66 encircling the stem 32 and disposed between the rear wall of cap 28 and the sealing insert 52. Insert 52 is slidably supported on the stem 32 and it is apparent that the greater the pressure in the housing the more the O-ring 66 will be compressed and the greater will its sealing effect be.

The stem carries a first sleeve 67 on the forward side of the piston 36 and a second sleeve 68 on the rear side of the piston. Sleeve 67 is adapted to abut against the insert 52 to limit forward movement of the stem and the sleeve 68 is adapted to abut against the cap 30 to limit rearward movement of the stem. The precise movement of the stem 32 in the functions of the apparatus will be described in greater detail hereinafter.

A latch finger 70 is pivotally mounted adjacent the rear end of the apparatus, such as on the rear end cap 30, and is arranged to engage a forward edge portion 72 of a handle 74 on the stem for holding the stem in a rearward cocked position against the force of the spring 42 as shown both in FIGS. 1 and 2. The parts are dimensioned and arranged such that when the stem is held in a rearward latched or cocked position, by means of the latch finger 70, the rearward end of sleeve 68 is just short of engagement with the cap 30 whereby the stem is capable of a slight rearward movement in order that the latch finger 70 can be released. Such latch finger is mounted on the lower end of the housing so that when released from the edge 72 by the handle 74 it will fall by gravity to an unlatched position. The latched position of the latch finger 70 and the retracted position of the stem 32 is shown in full lines in FIG. 1, and the unlatched position of the finger and extended position of the stem is shown in phantom lines in the same figure. It is to be understood that any form of latching edge can be provided on the stem 32 such as notches or the like, and the use of the handle edge is merely illustrative.

In the operation of the present apparatus, it is secured to the pump motor 10 by means of the clamp 18 and bracket 20 in such a position that when the stem 32 is in a forwardmost or extended position, it engages the spark plug 14 so as to ground the circuit and stop the motor, it being understood that the stem and housing, as well as the bracket 12 are formed of an electrically conducting material in order to conduct a grounding circuit to the motor. Before the pump is started, the stem 32 is manually retracted and latch 70 engaged with the latching edge 72 so that the stem will be held retracted. Since the stem in such position is out of engagement with the spark plug 14, the motor can be started. After the motor is started and the pump builds up pressure in the system, as well as in the line 48, the pressure interiorly of the housing operates on the forward side of piston 36. When

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sufficient pressure in the housing is built up, the piston and stem will retract an extra fraction of an inch to permit the latch finger 70 to fall free of the latching edge 72. Then, as long as a selected pressure is maintained in the system the piston 36 and the stem 32 will be held retracted. However, when the pressure in the pump stops or falls to a low output, such as when the supply to its inlet is exhausted or the inlet is plugged, the stem 32 is permitted under the action of spring 42 to move forward into engagement with the spark plug and shut off the pump motor. Thus, the pump motor will not continue to run after its load no longer exists.

The spring 42 is of selected strength so that the pump motor is rendered inoperative at a desired lowered pump pressure. That is, not only should the spring 42 stop the motor at a complete failure of outlet pump pressure but it should stop the motor at low pressures which also may cause damage to the motor. For example, the parts may be arranged such that a pump pressure of from 40 to 45 pounds would hold the stem 32 retracted, but the spring 42 would overcome a pressure of 15 to 20 pounds. However, any suitable spring force may be utilized to provide operation of the stem between selected pressures. The extent of travel of the stem 32 is controlled by the sleeves 67 and 68, with the sleeve 67 being arranged in the forward position of the stem to insure that the piston 36 does not pass to a point forward of the inlet 46.

It is also within the realm of the invention to utilize adjustment means for varying the strength of the spring, and for this purpose and as seen in the embodiment of FIG. 4 the end cap 30a has a screw 76 threadedly mounted in its end wall, and the inner end of such screw abuts against a washer 78 in engagement with the adjacent end of the spring. By suitable threaded adjustment of the screw 76 in the end cap, the resisting force of the spring can be varied and thus the pump pressure required to hold the stem retracted from the spark plug can be varied.

It may be desired in some cases that the shutoff apparatus be located remotely from the pump. For this purpose and with reference to FIG. 3, said apparatus is secured to a suitable support 80 at such remote place and a ground line 82 is connected between the motor 10 and the bracket 20. A hot line 84 is connected between the spark plug 14 of the motor and a contact screw 86 secured in a bracket 88 mounted on the support 80. Bracket 88 is positioned such that the contact 86 is engaged by the stem 32 in the forward position of the latter. Since the housing 16 has a grounded connection with the motor, the motor is shut off when the stem engages contact 86. In the remote positioning of the shutoff apparatus as just described, the pressure line from the pump, designated by the numeral 48a, is extended to provide communication between the outlet of the pump and the interior of the housing.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims. For example, the present apparatus is illustrated in association with a spark plug, but it is to be understood that it may be used with other portions of a motor electrical system. For example, it may be associated with the ground side of the distributor or coil of an engine to accomplish the same purpose.

Having thus described by invention, I claim:

1. Apparatus for automatically shutting off an electrically operated pump motor when the pressure in the inlet of the pump reaches a selected low minimum, the pump motor having operating control means, said apparatus comprising:
 - (a) a cylinder,
 - (b) piston means in said cylinder,
 - (c) said piston means being supported on an elongated stem extending through said cylinder and having one end projecting from one end of said cylinder arranged

- to engage electrically operating control means for the pump motor,
- (d) said stem being movable with the piston means to a retracted position in the cylinder by the pumping pressure of the pump operating on the piston means as long as the pump maintains a pressure above the selected low minimum,
- (e) biasing means opposing the retracting movement of said stem for urging said stem to an extended position and being arranged upon lowering of the pump pressure to a selected low minimum to move the stem to extended position,
- (f) said projecting end of said stem being arranged to engage the electrically operating control means for the pump motor,
- (g) said stem and cylinder being constructed of electrically conducting material,
- (h) means leading from the interior of said cylinder arranged to be connected into the pump outlet whereby to establish a pressure connection between said piston means and the pump chamber, whereby upon selected positioning of said cylinder relative to the operating control means of the pump, the stem in its retracted position is arranged to be disengaged from the operating control means of the pump to allow operation of the latter and the stem in its extended position is arranged to electrically ground the operating control means of the pump to shut off the pump motor,
- (i) and latch means engageable with said stem for maintaining said stem retracted and being arranged to release from said stem when pressure in the pump outlet reaches a selected amount.
2. The apparatus of claim 1 wherein said biasing means includes a spring, and adjustment means in said housing

engageable with the said spring for adjusting the force of the latter to vary the pressure at which said spring is retracted and therefore the minimum pressure at which the pump will operate before being shut off by the stem.

3. The apparatus of claim 1 including sleeve means on said stem disposed on opposite sides of said piston for limiting axial movement of said stem in its retracting and extending positions.

4. The apparatus of claim 1 in combination with a pump motor wherein said cylinder is arranged to be disposed in a remote location relative to the pump motor, the operating control means of said pump motor being extended from said motor to said housing whereby to be engaged by said stem in the extended position of the latter.

5. The apparatus of claim 1 wherein the other end of said stem projects from the other end of said cylinder and said latch means comprises a gravity operated latch finger engageable with said other end of said stem.

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WILLIAM L. FREEH, Primary Examiner

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123—98; 200—82