H. L. SMITH.

OIL SWITCH.

APPLICATION FILED MAY 24, 1906.

* 947,860.

Patented Feb. 1, 1910.

2 SHEETS—SHEET 1.

Fig. 1

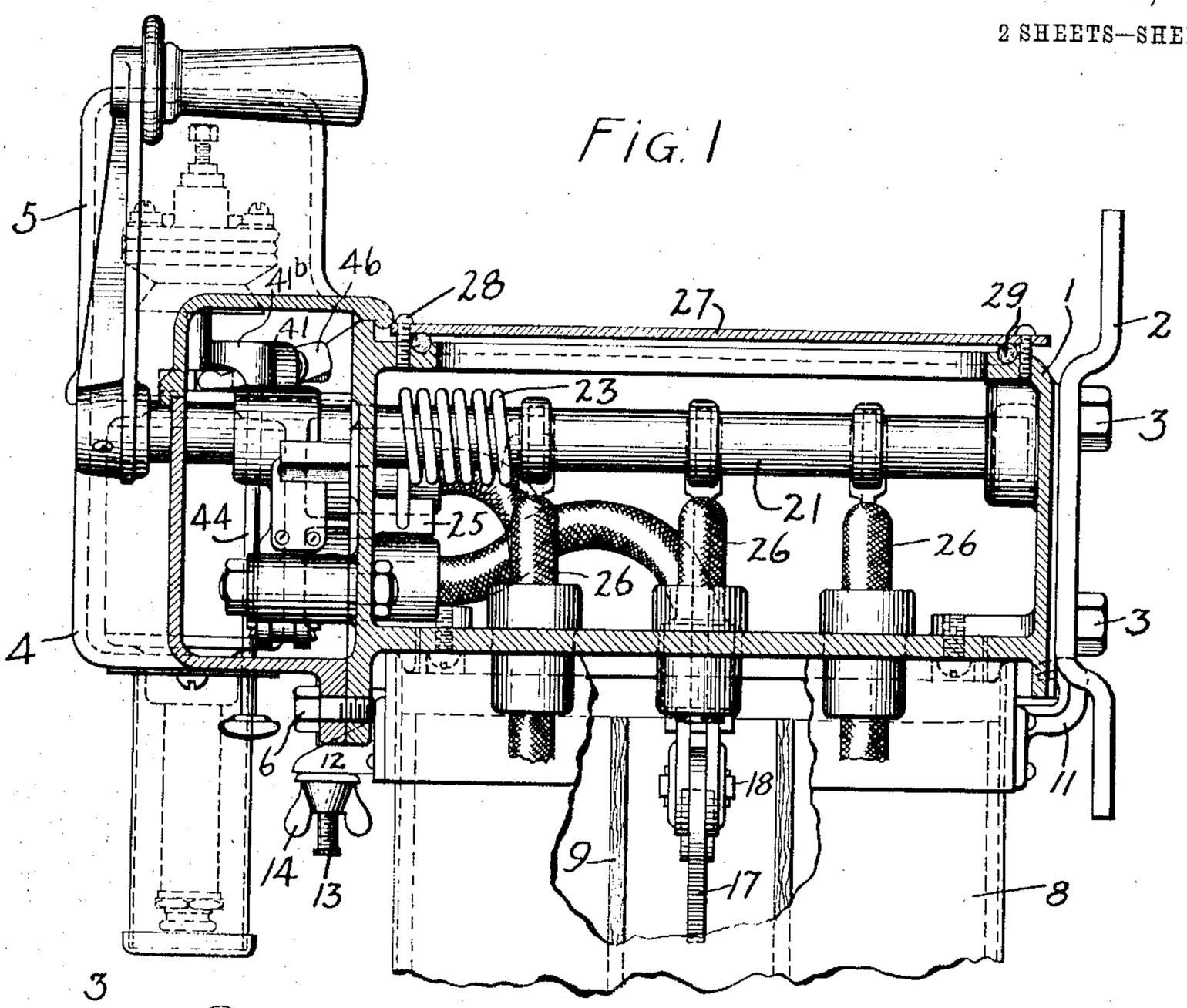

Fig. 2

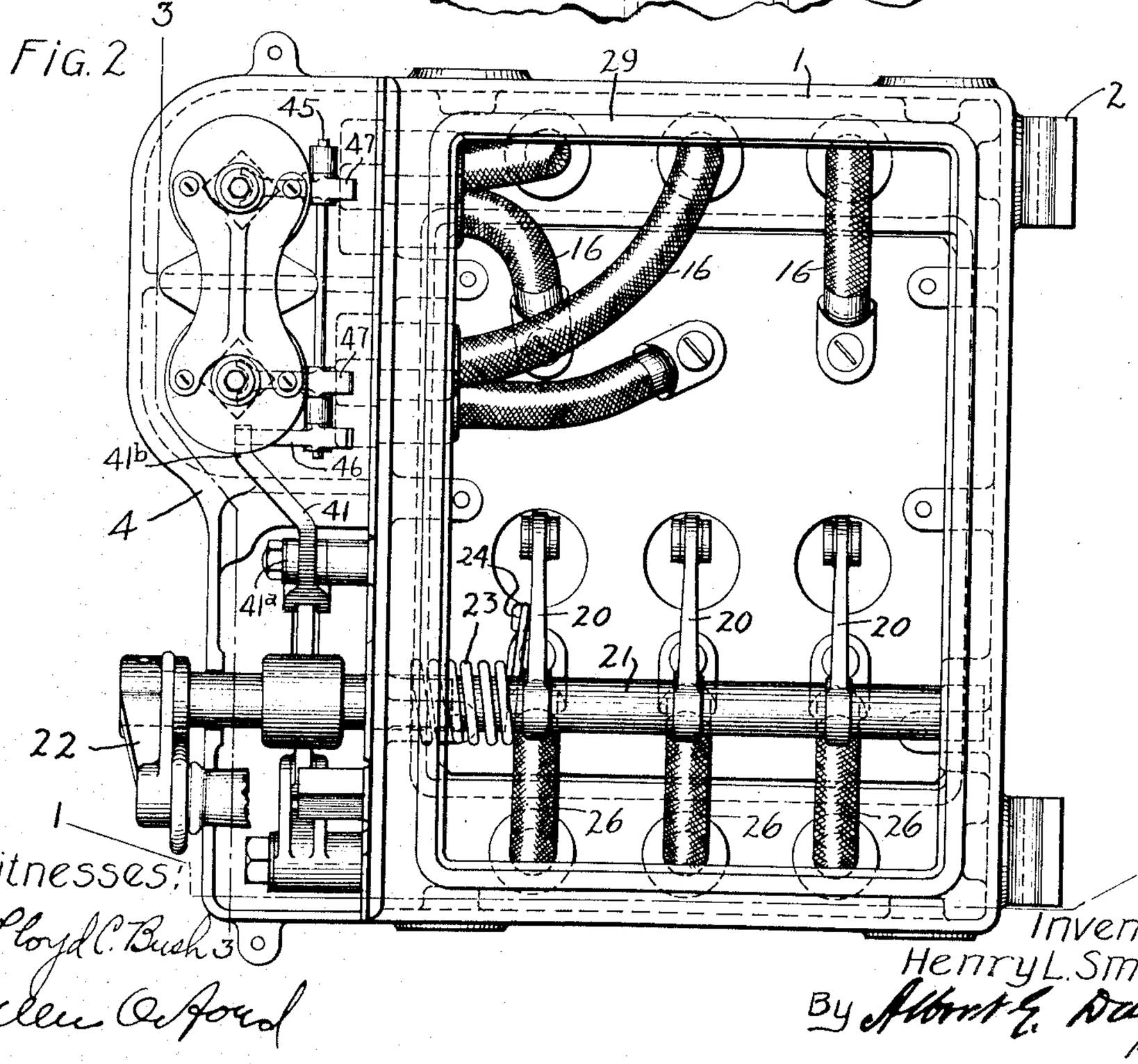

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Fig. 3

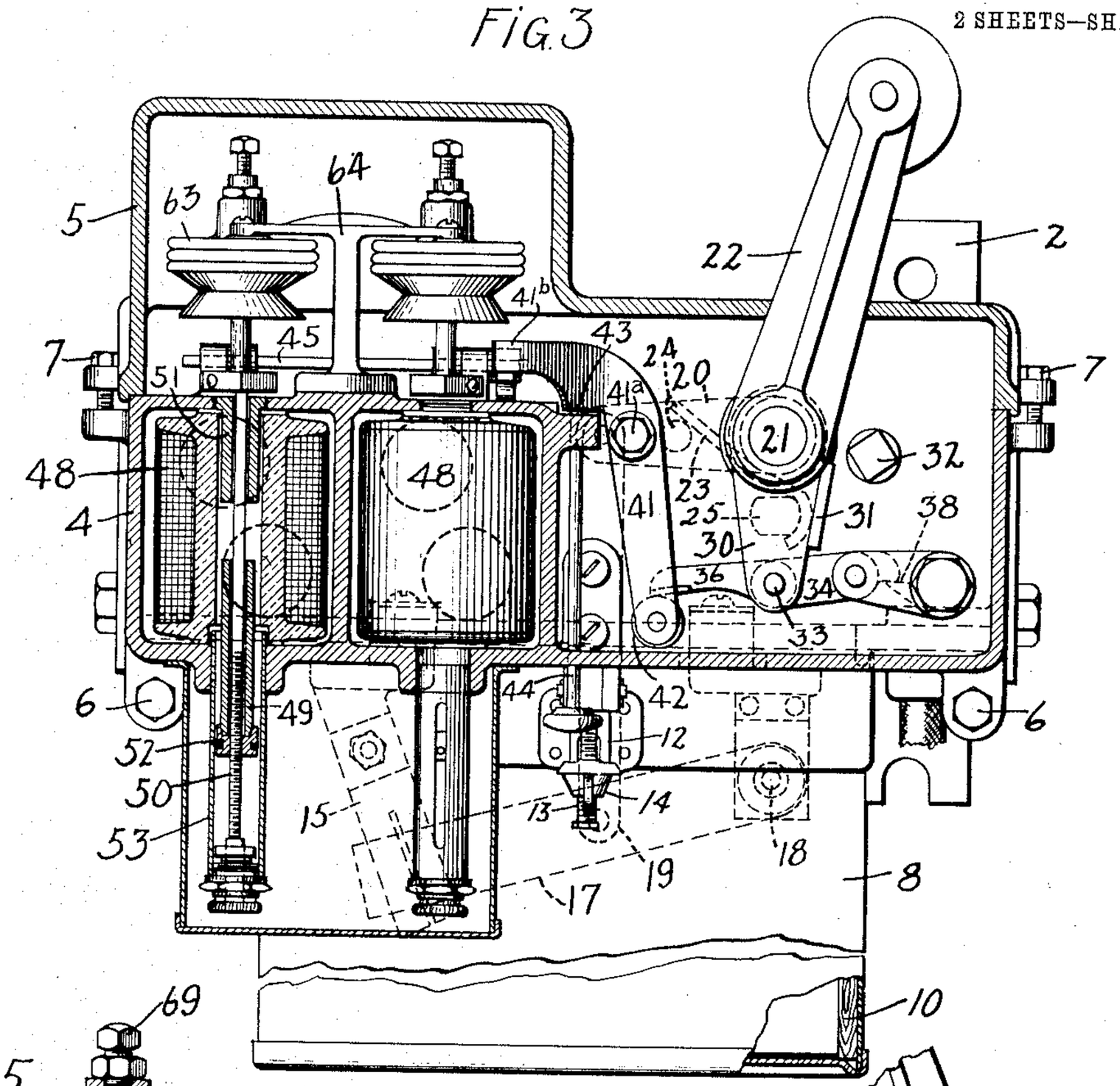


Fig. 5

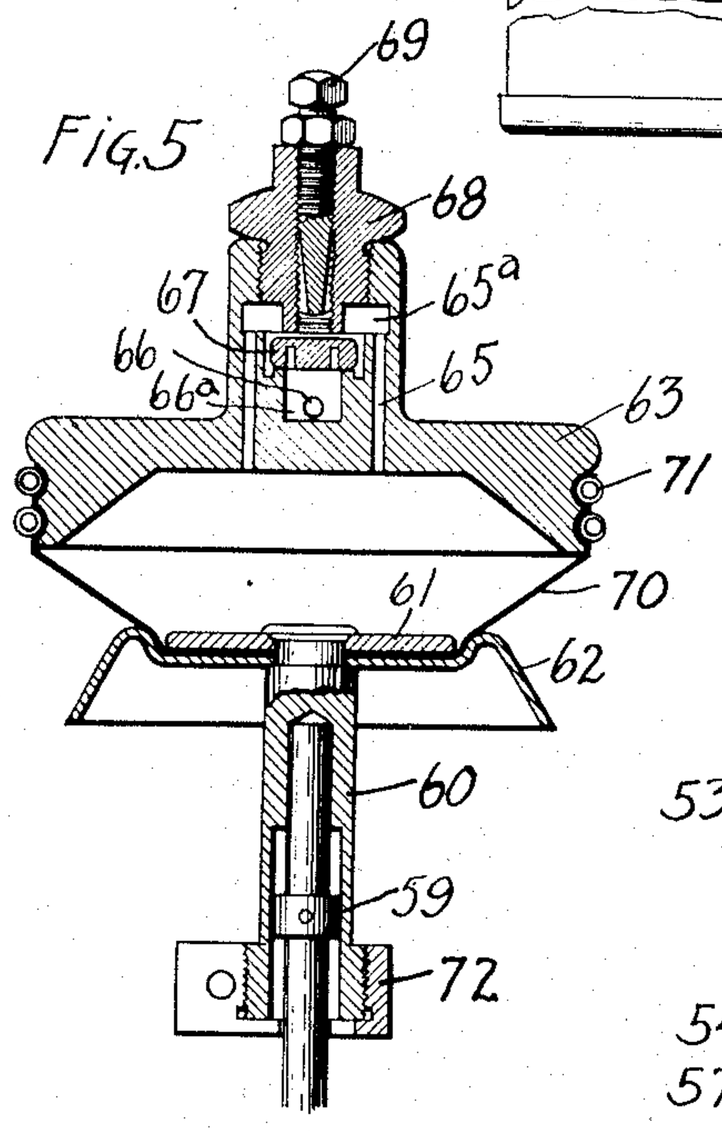


Fig. 6

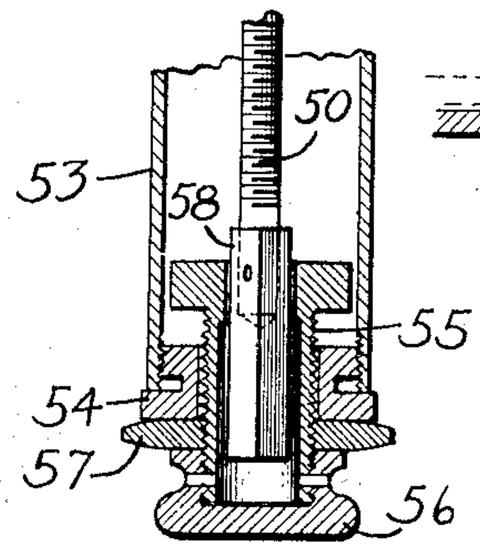
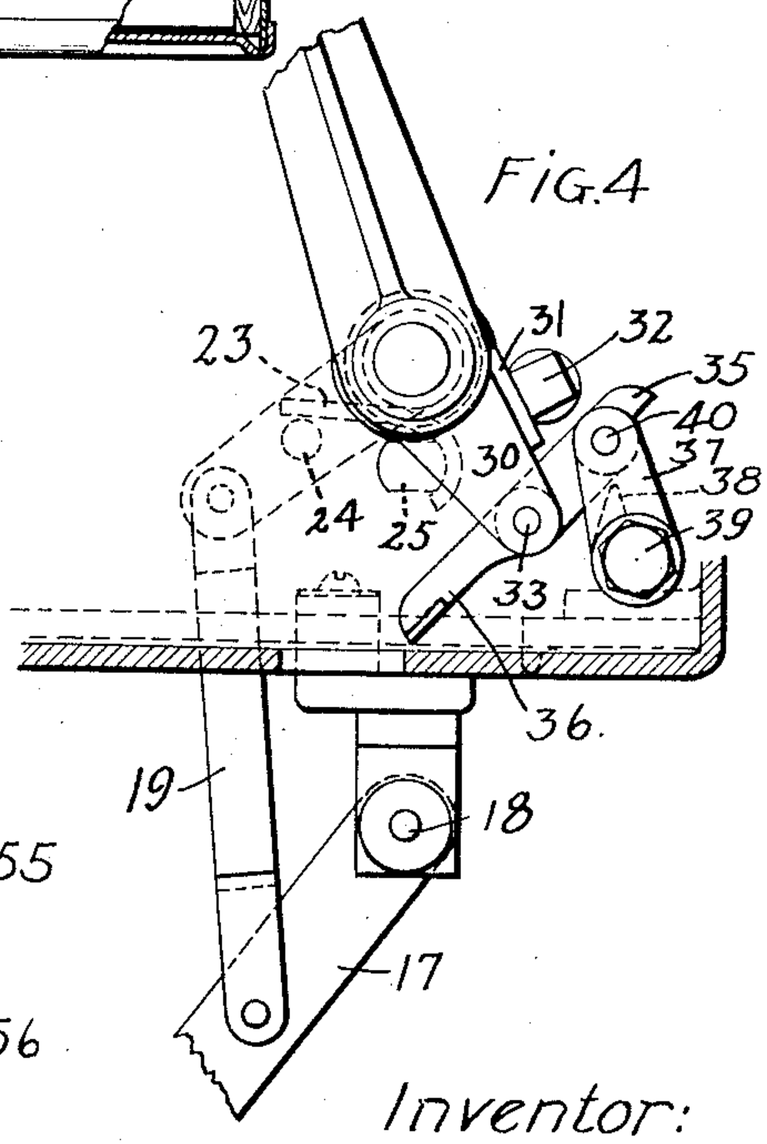


Fig. 4



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UNITED STATES PATENT OFFICE.

HENRY L. SMITH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

OIL-SWITCH.

947,860. Specification of Letters Patent. Patented Feb. 1, 1910.

Application filed May 24, 1906. Serial No. 318,441.

To all whom it may concern:

Be it known that I, HENRY L. SMITH, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Oil-Switches, of which the following is a specification.

This invention relates to oil switches, and more particularly to those switches having an automatic trip device controlled by a time limit relay. Switches of this type are usually opened by the action of comparatively strong springs and are held closed by a locking device which resists the strain of the spring. When a time limit relay of the ordinary construction is used to trip the locking device and open the switch, it is necessary to provide sensitive mechanism between the relay and the locking device of the switches by means of which the relay can release the locking device and permit the switch to open since the force exerted by a time limit relay is very slight.

The object of this invention, therefore, is to provide a mechanism for releasing the locking device of a switch of this type which can be operated by the standard time limit relay; to provide a locking means controlled by such mechanism which shall be strong and not liable to get out of order; and in general to improve the construction of switches of this type.

The invention will be best understood by reference to the accompanying drawings in which—

Figure 1 is a sectional view on the line 1 1 of Fig. 2; Fig. 2 is a plan view with the cover of the switch removed to show the connections; Fig. 3 is a sectional view on the line 3 3, of Fig. 2, showing part of the mechanism in elevation; Fig. 4 is a view of the locking device in the position assumed when the switch is opened; Fig. 5 is a sectional view of a part of a time limit relay; and Fig. 6 a sectional view of another part of the relay.

The switch mechanism shown in the drawings is for controlling a three phase circuit, and is supported upon a frame 1 which is secured to brackets 2, by means of bolts 3. The brackets are attached to any suitable support in any convenient way. A protective casing 4, provided with a top 5, is attached to the frame for the purpose of inclosing the operating mechanism and protecting it from the weather. The protective casing 4 is secured to the frame by means of bolts 6, and the top of the protective casing is secured in position by means of the bolts 7, so that the top of the casing can be easily removed for the purpose of examining the operating parts of the device.

An oil can 8, preferably made of metal and provided with partitions 9 and a lining 10 of wood, or similar material, is firmly secured to the frame 1 by means of a hook 11 engaging a lug upon the frame and a lug 12 attached to the cars and having projecting shoulders which embrace a threaded stud 13 secured to the protective casing 4. A thumb-nut 14 upon the threaded stud 13 engages the lug 12 and holds the oil can firmly in position, and by loosening the thumb-nut the oil can may easily be removed from the frame. Fixed contacts 15 are secured to but insulated from the frame 1, and leads 16, one for each phase, are in electrical connection with the fixed contacts. Movable switch-blades 17 are mounted upon pivots 18 which are carried in clips secured to the frame. The blades 17 are swung into and out of engagement with the fixed contacts 15 by means of operating links 19 secured thereto and to operating arms 20 which are firmly secured to an operating shaft 21 suitably journaled in the frame and operated by a handle 22. A spiral spring 23 surrounds the shaft 21 and one end of said spring engages a lug 24 on one of the operating arms, while the other end of the spring engages a lug 25 on the frame. This spring is placed under strain whenever the switch is closed and is strong enough to throw the blades 17 out of engagement with the fixed contacts 15 whenever the shaft 21 is released so as to be free to move. The movable blades 17 are connected through their pivots and supporting clips to leads 26. The circuit, therefore, is from the leads 26, through the switch-blades 17, the fixed contacts 15 and the leads 16. A cover 27, held in place by studs 28, is provided for the purpose of protecting the connections and the operating shaft 21. Packing 29 is placed between the cover 27 and the frame 1 so as to make a water-tight joint and protect the operating parts of the switch from the weather.

The operating shaft 21 has a locking arm 30 firmly secured thereto, the locking arm

being provided with a buffer-plate 31 which engages a stop 32 on the frame when the switch is open, thereby preventing the contact-blades from striking the bottom of the oil can. The locking arm 30 is also provided at the free end thereof, with a pivot 33 upon which is mounted a toggle link 34 having a shoulder 35 and a heel 36. Another toggle link 37 having a shoulder 38, is mounted upon a fixed stud 39 carried by the frame and is secured to the toggle link 34 by means of a pin 40. A latch lever 41 in the form of a bell-crank and carrying a roller 42 in one end thereof, is mounted upon a pivot 41[a] carried by the frame. The latch lever is provided with a shoulder 43 engaged by a push-pin 44, loosely mounted in the protective casing 4. When the push-pin is actuated, the end thereof engages the shoulder 43 and swings the latch lever upon its pivot. A rock-shaft 45 is suitably mounted upon the protective casing 4 and carries a trip-arm 46 which engages the end 41[b] of the latch lever which is on the same side of the pivot as the shoulder 43. Actuating arms 47 are also attached to the rock-shaft for the purpose of rotating it in its bearings and thereby, through the trip-arm 46 engaging the end 41[b] of the latch lever, causing the latch lever to swing about its pivot.

The switch is opened automatically upon the occurrence of an overload in the circuit in which it is connected by means of a time limit relay having tripping coils 48, one of which is shown in section in Fig. 3. Each coil is provided with a hollow core 49 through which passes a rod 50, the upper end of the rod passing through a guide 51 supported by the protective casing 4. The end of the core carries a threaded cap 52 which fits loosely in a calibrating tube 53 secured to the protective casing 4 having a longitudinal slot into which a pin on the cap 52 projects to prevent rotation of the cap. The lower end of the calibrating tube is closed by a plug 54, through which passes a threaded sleeve 55 having a knob 56 by means of which the sleeve may be rotated. A lock-nut 57 is provided by means of which the sleeve may be locked in any position. On one end of the rod 50 is rigidly mounted a head 58, preferably square in cross-section, which passes through an opening of similar shape in the sleeve 55. As a result of this construction, when the sleeve 55 is turned, by means of the knob 56, the rod 50 is also rotated and, since the cap 52 upon the core is prevented by a pin from rotating in the calibrating tube 53, the rotation of the rod 50 causes the hollow core 49 to be moved up and down upon the rod 50. In this way the relation of the core to the coil 48 is altered, thereby altering the amount of current required to draw the core into the coil. On the other end of the rod 50, a collar 59 (fitting loosely in a recess in a cylinder 60) is keyed; the end of the rod loosely fitting in a guide recess in the cylinder. When the rod is pushed upward, the upper end of the rod strikes the bottom of the guide recess, forming a positive connection between the rod and the cylinder. The upper end of the cylinder carries a disk 61 and a plate 62. A base 63 is secured by means of studs to a T-shaped standard 64 carried upon the protective casing 4. The base is provided with ports 65 leading into a chamber 65[a], and also with a port 66 leading from the atmosphere to a chamber 66[a]. A check-valve 67, normally closed, controls communication between the chamber 66[a] and the chamber 65[a]. One wall of the chamber 65[a] is formed by a stud 68 which carries a screw-plug 69 having a groove in one side and loosely fitting in the screw threads of the stud 68. The base 63 and the cylinder 60 are connected together by means of flexible walls 70 secured to the base by means of ring springs 71, and to the cylinder by the disk 61 and the plate 62. This construction forms a collapsible chamber, the inlet to which is controlled by the check-valve 67 and the outlet from which is controlled by the screw-plug 69. Altering the position of the screw-plug 69 in the stud 68 varies the rate at which air can escape from the collapsible chamber. The lower end of the cylinder 60 is threaded and carries a threaded collar 72, the position of which with relation to the cylinder 60 may be varied. The collar engages the end of an actuating arm 47 mounted upon the rock-shaft, so that when the collar moves upward the rock-shaft is partially rotated.

The operation of the device is as follows: When the switch is closed, as shown in Fig. 1, by means of the handle 22, the spring 23 is put under strain and at the same time the toggle 34, 37 is straightened out. The toggle, however, remains slightly under-set as the shoulders 35 and 38 engage before the pivots 33, 39, and 40 form a straight line. The roller 42 on the end of the latch lever 41 swings under the heel 36, and although the toggle 34, 37 tends to collapse and move to the position shown in Fig. 4, this tendency is resisted by the latch lever 41 which prevents the collapse of the toggle, and thereby locks the switch in its closed position. The strain upon the latch lever, however, is in a line at right angles to the surface of the heel 36 and therefore the resistance to the movement of the latch lever about its axis is very slight, so that practically the only resistance to be overcome when the latch lever is moved is that due to the friction of the roller 42 upon its pivot. The same result is attained by any construction which causes the end of the latch lever and its roller to move parallel to the contact surface of the heel 36. It is evident that the

degree of force required to move the latch lever can be varied by altering the position of the pivot 41ª, since if this pivot were moved to a position to the left of that shown in Fig. 3, the pressure exerted by the heel 36 upon the roller 42 might be sufficient to swing the latch lever upon its pivot. It is therefore possible by altering the position of the pivot 41ª to make the releasing mechanism as delicate as may be desired. If an overload should come upon the line when the switch is set and the parts are in the position shown in Fig. 3, the core 49 would be attracted by the coil 48, the rod 50 would engage the cylinder 60 and move it toward the base 63, thereby compressing the air in the collapsible chamber. The only escape for this air is through the opening controlled by the screw-plug 69 and hence some time must elapse before the chamber completely collapses and allows the core to reach its highest position. As the core reaches the limit of its movement the threaded collar 72 engages the actuating arm 47 and partially rotates the rock-shaft, bringing the trip-arm 46 into engagement with the shoulder 41ᵇ of the trip lever and causing the trip lever to swing about its pivot to move the roller 42 from under the heel 46 and permit the toggle 34, 37 to collapse and assume the position shown in Fig. 4. The collapse of the toggle permits the spring 23 to throw the movable contacts 17 out of engagement with the fixed contacts 15 and open the circuit, the parts then assuming the position shown in Fig. 4.

It is apparent that if it is desired to trip the switch by hand, the push-pin 44 may be moved into engagement with the shoulder 43 and thereby the latch lever is swung about its pivot out of engagement with the heel 36.

Changes may be made in the form in which my invention is embodied and I therefore do not wish to be restricted to the precise form herein shown and described, but intend to cover by the appended claims all changes and modifications which are within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an electric switch, the combination with a base and an operating lever mounted on said base, of a locking toggle for said lever comprising a link pivoted on said base, a second link pivotally connected at a point near the middle thereof to said operating lever, one end of said second link being pivoted to the first link and the other end being free, and a latch on said base for engaging the free end of said second link to prevent collapse of said toggle when the switch is closed.

2. In an electric switch, the combination of a base and an operating lever pivoted on said base, of a locking toggle for said lever comprising a link pivoted on said base at a point on one side of said operating lever, a second link pivotally connected at a point near the middle thereof to said operating lever, one end of said second link being pivoted to the first link and the other end being free to extend beyond said operating lever and a latch on said base on the other side of said lever for engaging the other end of said second link to prevent collapse of said toggle.

3. In an electric switch, the combination with an operating lever, of a locking toggle for said lever comprising a link mounted on a stationary pivot on one side of said lever, a second link pivotally connected at a point near the middle thereof to said operating lever, one end of said second link being pivoted to the first link and the other end being free and provided with a contact surface extending beyond said operating lever, and locking means on the other side of said operating lever for locking the toggle against collapse when the switch is closed, said locking means having a disengaging movement parallel to said contact surfaces.

4. In an electric switch, the combination with a base and an operating lever pivoted on said base, of a locking toggle for said lever comprising a link pivoted to said base at a point on one side of said lever, a second link pivoted near the middle thereof to said lever, one end of said second link being pivoted to the first link and the other end being provided with a contact surface on the other side of said operating lever, a latch pivoted on the other side of said operating lever and having a roller on the end for engaging said contact surfaces, the pivot of said latch and said contact surface being so related that the roller is movable parallel to said contact surface when in engagement therewith.

In witness whereof, I have hereunto set my hand this 22nd day of May, 1906.

HENRY L. SMITH.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.