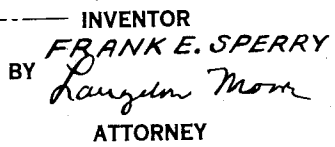


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June 9, 1931.

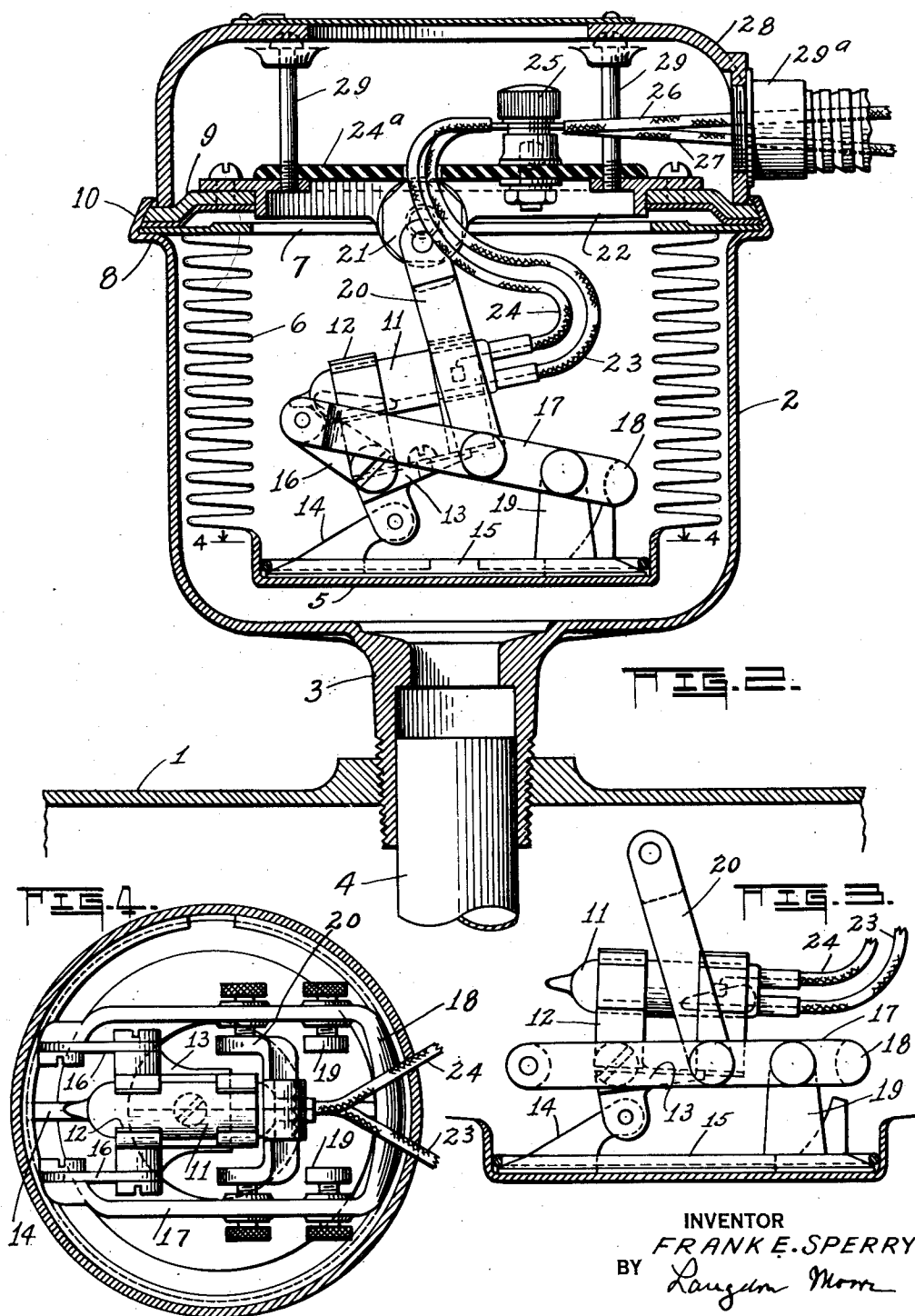
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PRESSURE ACTUATED ELECTRIC SWITCH

Filed Sept. 18, 1929

4 Sheets-Sheet 2



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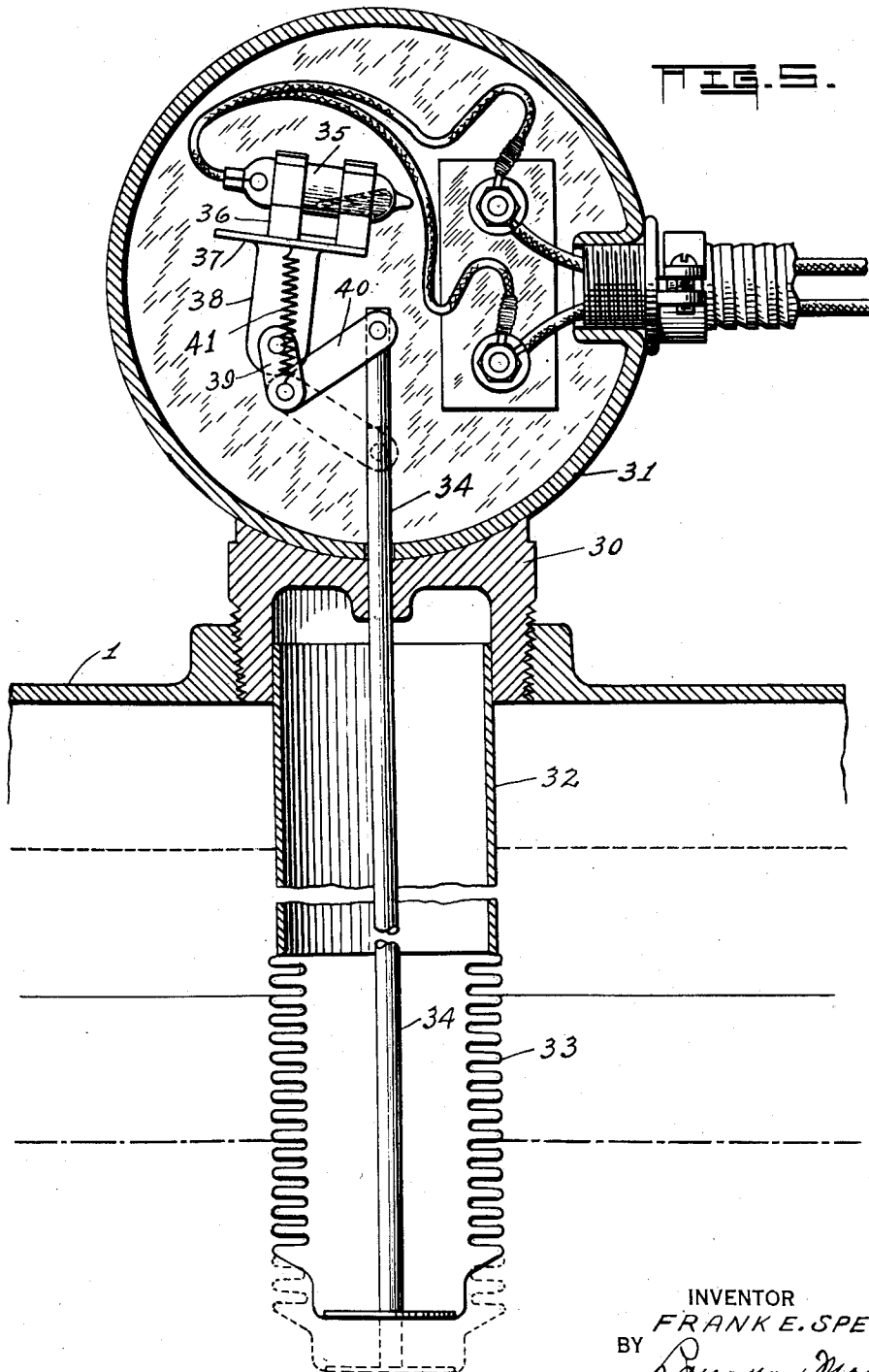
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PRESSURE ACTUATED ELECTRIC SWITCH

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4 Sheets-Sheet 3



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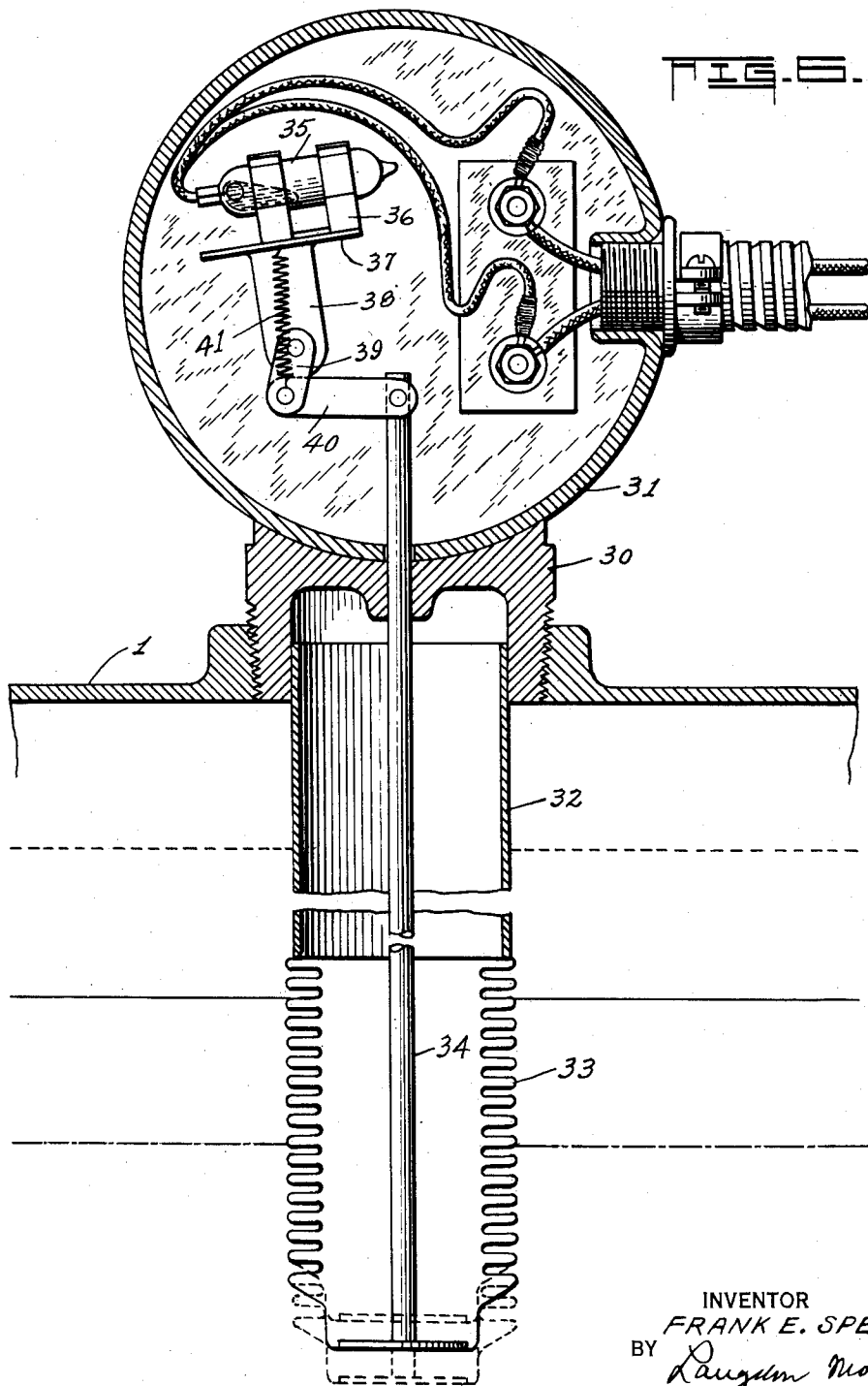
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PRESSURE ACTUATED ELECTRIC SWITCH

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4 Sheets-Sheet 4



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PRESSURE ACTUATED ELECTRIC SWITCH

Application filed September 18, 1929. Serial No. 393,400.

This invention relates to improvements in electric switches and more particularly to a pressure actuated electric switch for controlling the operation of an electric motor.

It is an object of this invention to provide a switch in the electric circuit controlling an electric motor for operating a pump for filling and automatically maintaining full a tank or other receptacle and controlling the operation of the switch by the level of the liquid in the tank or receptacle, so that when the desired level is reached the motor circuit will be broken and pump will be automatically operated whenever this level descends.

It is a further object of this invention to provide means which will automatically break the motor circuit if the level of the liquid in the tank descends below a certain pre-determined mark which would only be caused by the tank becoming defective so as to be unable to retain the liquid pumped into it, thus preventing a loss of the liquid and the unnecessary operation of the motor.

With these and other objects in view reference is made to the accompanying sheets of drawings which illustrate the preferred forms of this invention with the understanding that minor detail changes may be made without departing from the scope thereof.

In the drawings:

Figure 1 is a vertical central sectional view taken through the casing inclosing the improved switch mechanism in normal off position, the connection between the casing and the tank and the means of communication between the interior of the casing and the interior of the tank, with parts illustrated in side elevation, and with the upper or full liquid level indicated in the solid black line, the level causing the normal operation of the switch in dotted lines, and the lowermost level causing the actuation of the switch to break the motor circuit in dot and dash lines.

Figure 2 is a fragmentary view similar to Figure 1 illustrating the switch mechanism in the abnormal off position.

Figure 3 is a fragmentary view illustrating the switch mechanism in the normal on position.

Figure 4 is a top plan view of the switch

actuating mechanism, with the surrounding bellows shown in section on the line 4—4 Figure 2, looking in the direction of the arrows.

Figure 5 is a vertical sectional view taken through the switch mechanism casing, its connection to tank, and the pressure responsive actuating member of a modified form, illustrating the normal high level of the liquid in a solid black line and the abnormal low level liquid in a dot and dash line, and illustrating the switch and switch operating mechanism in the normal off position.

Figure 6 is a view similar to Figure 5, illustrating the switch and switch mechanism in the normal on position.

In the embodiment of this invention as illustrated in Figure 1, only a fragmentary portion of that part of the tank 1 is shown which supports the casing 2 containing this improved switch. The casing 2 is preferably cylindrical in shape and is supported upon the tank body 1, by the centrally depending externally screw threaded portion 3 engaging a similarly screw threaded aperture in the tank wall. The interior of the portion 3 is hollow and communicates with the interior of the casing 2, and supports a pipe 4 depending from the interior thereof which extends within the tank to a point in proximity with the lowest portion there, so that as the level of the liquid within the tank ascends and descends corresponding variations in pressure will be transmitted through the column of air above the liquid in the pipe 4 to the interior of the casing 2.

The switch operating mechanism is supported upon the flat cylindrical bottom 5 of an expansible and contractable member preferably in the form of a bellows 6, the upper corrugation of which is secured to an annular plate 7, which in turn is secured to the upper portion of the casing 2 by engagement with a shoulder 8 of the casing over which a cover plate 9 is held by contracting the upper edge 10 of the casing thereabout, which forms an air tight closure in the casing between the interior thereof and the exterior of the contractable and expansible member so that as the level of the liquid in the tank rises and

falls a corresponding upward and downward movement will be imparted to the cylindrical bottom 5 of the bellows 6.

The switch mechanism comprises preferably an electric mercury tube switch 11, supported in clamps 12 extending upward from a plate 13 which plate is pivoted at the lower left hand edge to a bracket 14 extending upward from a circular plate 15 secured upon the circular bottom 5 of the bellows 6. The upper left hand edge of the plate 13 is pivoted on each opposite corner thereof to links 16 which in turn are pivoted to the free ends of the arms of a U shaped member 17. These arms are each pivoted adjacent the connecting portion 18 to brackets 19 supported upon the plate 15, resting on the bottom of the circular member 5 of the bellows 6. The arms of the U shaped member 17 are pivotally connected intermediate the pivot points of brackets 14 and 19 to the free ends of a wishbone member 20, which in turn is pivoted to a bracket 21 depending from a removable cover plate 22, supported by and secured to the cover 9 of the casing 2. The leads 23 and 24 from the mercury tube switch are flexible and pass through an opening above the bracket 21 in a plate of insulation material 24^a mounted upon and secured to an aperture in the cover plate 22, which leads are connected to the binding post 25, upon the plate 24^a which binding posts in turn are connected to the circuit wires 26 and 27. A cover 28, as shown, resting upon the outer edges of the cover 9 is preferably secured by means of screws 29 passing through the plate 24^a and engaging the cover plate 22. This cover 28 is provided with outlets 29^a for the circuit wires 26 and 27.

The proportions of the pivoted wishbone member 20, the U shaped member 17 pivoted thereto, the links 16, pivoted to the U shaped member, as well as the pivotal points of the U shaped member 17 and of plate 13 are such that when the liquid in the tank has ascended as high as desired the pressure within the pipe 4 will cause the bellows 6 to contract raising the cylindrical bottom 5 to the position indicated in full lines in Figure 1, and in this position the plate 13 is tilted about the bracket 14, to throw the mercury tube switch into its off position. Since the switch 11 is in the motor circuit which operates the pump, when sufficient liquid has been pumped into the tank until the desired level is reached the motor circuit will be broken. As the level of the liquid in the tank descends the pressure within the pipe 4 will decrease and the bellows 6 will expand causing the plate 5 to descend. This movement through the pivotal connections of the wishbone member 20 to the U shaped member 17 will impart a swinging of the U shaped member about its pivots which in turn will impart through links 16 a pivotal movement to the plate 13, causing

the same to tilt the mercury tube switch into the closed position as shown in Figure 3. This closing of the switch 11 closes the circuit to the motor and the pump will operate until the tank is sufficiently full to break the motor circuit.

Should the tank leak or otherwise become defective so that it will not retain the liquid pumped into it, if the motor operates continuously the liquid pumped into the tank would be lost. To prevent such an occurrence the pipe 4, and casing 2 are so proportioned that if the liquid in the tank descends below a predetermined level the bellows 6 will continue to expand until the circular bottom 5 assumes the position shown on dotted lines in Figure 1. This movement of the bottom plate 5 will cause the operating members of the switch mechanism to assume the position shown in Figure 2 and thereby tilt the plate 13, to throw the mercury tube switch 11 to the off position and thereby break the motor circuit and cause the pump to cease to operate.

Figures 5 and 6 illustrate a modified form of this invention in which the depending member 30 of the casing 31 is similarly screw threaded into an aperture provided therefor in the top of the tank which end supports a tubular member 32 extending into the interior of the tank. To the lower end of this member 32 the upper portion of a bellows 33 is attached, the lower portion of the bellows being closed and the closure attached to an operating shaft 34 which passes axially through the tubular member 32 and through an aperture provided therefore in member 30 and casing 21 and is mounted to reciprocate therethrough when the bellows is caused to contract and expand as the level of the water in the tank ascends and descends.

A mercury tube switch 35 is supported by clamps 36 upon a plate 37 having a depending portion 38 from the under side thereof which is pivoted at its lower end to the casing. One end of a link 39 is pivotally mounted upon the same to a longer link 40 which in turn is pivoted to the upper end of the operating shaft 34. A coil spring 45 is secured centrally to the under side of the plate 37 and at the other end to the pivot between the links 39 and 40. As this pivot point is swung from side to side of the vertical plane passing through the pivot of the plate 37, the spring 45 will cause the said plate to tilt in the direction of the movement of the lower end of the spring as it passes the dead center to make or break the electric circuit through the switch 35.

As the level of the liquid in the tank 1 ascends the bellows 33 will be compressed and the relation of the upper end of the operating shaft 34 and the two links 39 and 40 is such that when the liquid has reached a predetermined high level the mercury tube switch

35 will be tilted to the off position to break the motor circuit as shown in Figure 5. As the liquid is drawn from the tank the level will descend allowing the bellows 33 to expand which movement will be imparted by the operating shaft 34 to the links 39 and 40 moving the lower end of the spring 41 over the dead center and causing the plate 37 to tilt the mercury tube switch 35 to close the motor circuit as shown in Figure 6. Should the tank become deformed or leak causing the level of the liquid to descend below the normal operating level the bellows will continue to expand causing the shaft 34 to continue to descend and this movement will cause the links 39 and 40 to move the lower end of the spring 45 across the dead center to tilt the mercury tube switch to the off position and break the motor circuit so that the pump will cease operating. The relation of the parts under the latter condition is illustrated in dotted lines in Figure 1.

It is therefore seen that by this invention the operation of the pump can be controlled through the parts depending from the switch casing and all of the parts may be inserted through the single aperture in the tank 1 required for connecting the casing to the tank. This obviates the arrangement of floats and other mechanism requiring other holes to be made in the tank walls in order that such parts may be connected to operate a switch mechanism.

What I claim is:

1. In a device of the character described, the combination of a closed casing with an expansible and contractable bellows member closed at the lower end and secured to the casing closure at the other end, said casing having a tubular projection adapted to be passed through and be secured to the wall of a tank and terminating adjacent the bottom of said tank affording a communication between the space in the casing surrounding the bellows and the air confined in the tubular member above the level of the liquid therein, whereby variations of said liquid level impart a vertical movement to the closed bottom of the bellows, a mercury tube switch adapted to be connected in the motor circuit of a pump for supplying liquid to said tank, a support for said switch having a depending ear pivoted to a support carried upon the interior of the bellows closure, a short link pivoted at one end to said support above its pivoted point and at the other end to a lever pivoted at its opposite end to a support also carried upon the interior of the bellows closure, said lever intermediate its length pivotally connected to one end of a link pivoted at its opposite end to the casing closure all so proportioned that extreme contraction or expansion of the bellows through the pivoted links and lever imparts a movement to the mercury tube switch about its

supporting pivot to break the circuit there-through and at intermediate positions of the bellows to close the circuit through said switch.

2. A pressure operated switch actuating mechanism including a closed casing with an expansible and contractible bellows member closed at the lower end secured to the case enclosure at the other end, said casing having a communication between the space in the casing surrounding the bellows and a source of varying pressure, whereby variations of said pressure impart a vertical movement to the closed bottom of the bellows, a switch adapted to be connected in an electric circuit, a support for said switch having a depending ear pivoted to a support carried upon the interior of the bellows closure, a short link pivoted at one end to said support above its pivoted point and at the other end to a lever pivoted at its opposite end to a support also carried upon the interior of the bellows closure, said lever intermediate its length pivotally connected to one end of a link pivoted at its opposite end to the casing closure all so proportioned that extreme contraction or expansion of the bellows through the pivoted links and lever imparts a movement to the switch about its supporting pivot to break the circuit there-through and at intermediate positions of the bellows to close the circuit through said switch.

FRANK EARL SPERRY.