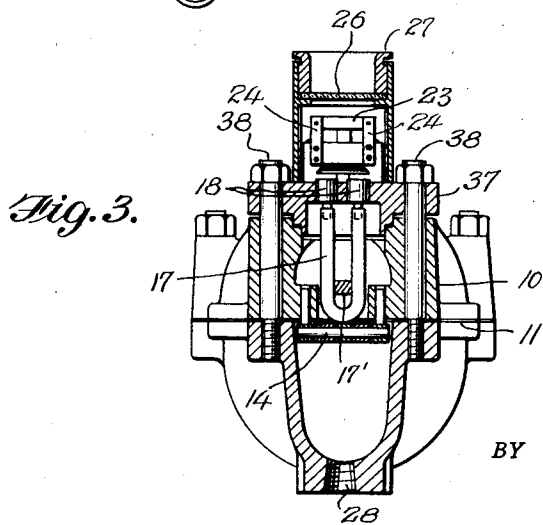
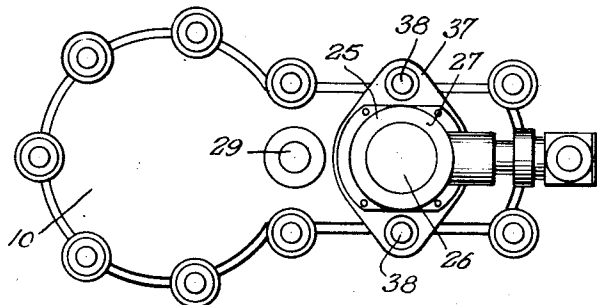
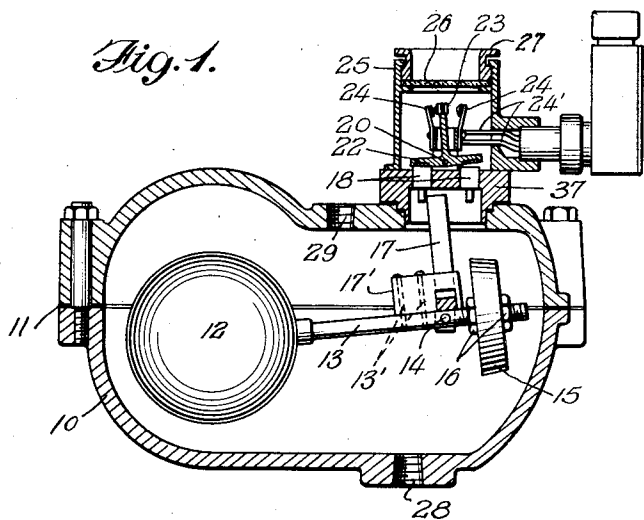


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F. SHENTON
PACKLESS FLOAT SWITCH
Filed April 30, 1935

2,116,415

2 Sheets-Sheet 1



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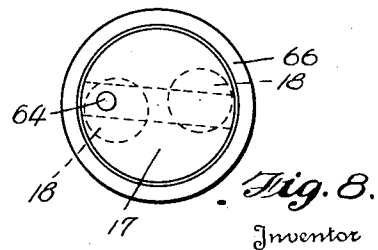
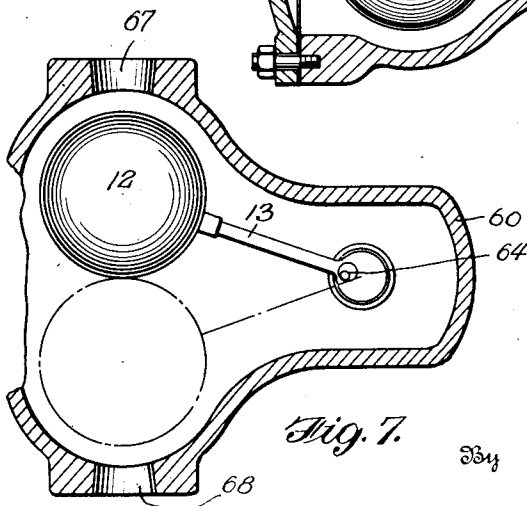
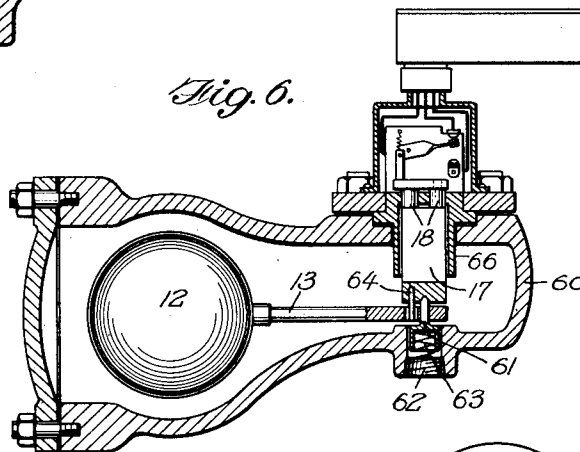
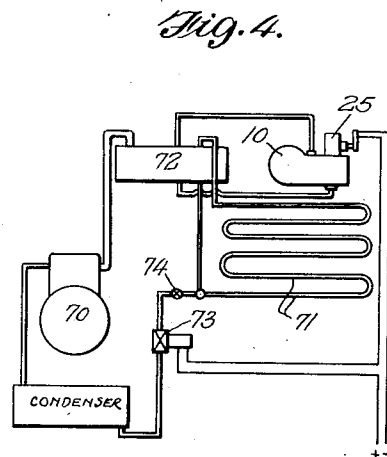
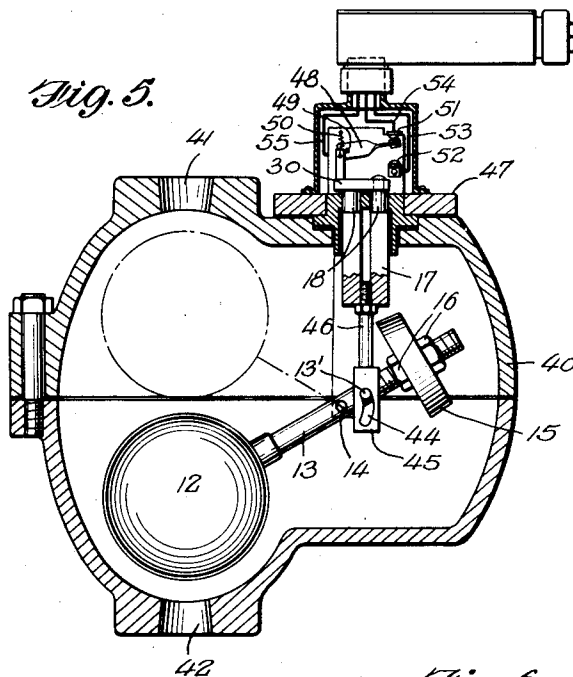
F. SHENTON

2,116,415

PACKLESS FLOAT SWITCH

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2 Sheets-Sheet 2



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PACKLESS FLOAT SWITCH

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Application April 30, 1935, Serial No. 19,081

4 Claims. (Cl. 200—84)

This invention relates to electric switches and more particularly to float-operated switches embodying a float within a fluid-tight casing containing fluid under pressure other than atmospheric.

The invention is particularly applicable where the fluid under pressure is of a volatile character such, for example, as a refrigerant and is adapted for use particularly in steam plants and chemical plants as well as in refrigerating systems.

Heretofore switches of this general character have been made which employed a shaft or rod which extended through the wall of a float chamber wherein it was necessary to seal the joint around such rod or shaft against pressure or leakage either by packing or by constructing the same to operate through a flexible diaphragm or bellows. In other switches of this character, the electrical switch mechanism has been located directly within the sealed casing.

Obviously constructions of the above character possess certain disadvantages, or objectionable characteristics. For example, the packing around the shaft or stems is subjected to wear and resulting leakage and introduces an objectionable uncertainty due to friction between packing and the movable shaft or stem. Such friction impairs the reliability and operation of the device and restrains the free movement of the float. Further the flexible disc and bellows type sealing elements require considerable force to operate, are affected by the pressure in the casing and subject to early failure. Where the switches have been located in the interior of the pressure-type casing there is involved considerable hazard on account of the likelihood of explosion of the volatile substance in case of a short-circuit or the like, or even as a result of arcing at the contacts of the switch.

It is an object of the invention to overcome the objections above enumerated by providing a float-operated switch which requires no packing and in which the hazards are removed due to location of the circuit-controlling contacts exteriorly of the casing providing the chamber in which the float is located.

It is a further object of the invention to provide a simple, inexpensive, commercially feasible, durable and reliable device.

Referring to the accompanying drawings, which are made a part hereof and in which similar reference characters indicate similar parts.

Fig. 1 is a vertical longitudinal section through

a float switch illustrating one application of the invention;

Fig. 2, a top plan view of the casing of Fig. 1;
Fig. 3, a vertical transverse section taken at right angles to Fig. 1;

Fig. 4, a diagrammatic view of a refrigerating system embodying the invention;

Fig. 5, a vertical longitudinal section of a modified type of float switch;

Fig. 6 is a horizontal section of a second modified form of float switch;

Fig. 7, a vertical longitudinal section of the switch of Fig. 5 and

Fig. 8, a detail illustrating the relationship of the magnetic plugs of the valve shown in Figs. 6 and 7.

Referring to Figs. 1, 2 and 3 of the drawings a two-part casing 10 provides a suitable container for float mechanism. The casing 10 is preferably provided with a horizontal division 11 to permit assembly and to afford access to the interior of the casing. The joint 11 is made pressure tight in any desired manner, for example, by means of a gasket or other sealing element. Within the casing 10 is located a float 12 mounted upon an arm or beam 13 pivotally supported on a pin or shaft 14. If the float 12 when used with certain liquids whose level is to be controlled is not sufficiently buoyant, a counterweight 15 may be provided on the end of the beam opposite the float 12, such counterweight being adjustable on the beam and being secured in a fixed relation by lock nuts 16.

In the preferred form of the invention as illustrated in Figs. 1, 2 and 3, a horse-shoe magnet 17 is rigidly mounted upon the beam 13 in a manner to swing with the beam around the pivot 14, the arc described by the magnet when it is swung being dependent upon the amount of raising and lowering of the float 12. The horse-shoe magnet 17 is clamped in place by a clamping block 17' rigidly fastened to the beam 13 by screws 13'. For cooperation with the poles of the horse-shoe magnet 17 at each extremity of its swing, two pairs of plugs 18 of low reluctance and negligible residual magnetism are provided by means of which a pendulum switch element pivoted at 20 is oscillated for making and breaking contacts at each extremity of its swing. This pendulum switch element comprises a body of nonmagnetic material formed with a relatively large flat base and a narrow upstanding neck located centrally at the base. At each side of the pivot 20 the base is provided at its underside with magnetic keeper strips 22 so that when one set of plugs is magnetized by the horse-shoe magnet

engaging the same the adjacent keeper strip 22 is attracted, swinging the pendulum in one direction and when the magnet engages the opposite set of plugs the pendulum is swung in the opposite direction. On the upper end of the pendulum is carried a bracket with contacts 23 which close a circuit through two pairs of spaced contacts 24 from which extend conductors 24'.

The switch mechanism is enclosed within a housing or casing 25 located exteriorly of the housing or casing 10 and provided with a cover glass 26 and is held in place by jam nut 27. The casing 25 has interposed between it and the casing 10, a nonmagnetic member 37 in which the plugs 18 are mounted, the casings 25 and 10 being fastened together by means of bolts or other fastening elements 38 which extend through the nonmagnetic member 37. The above-described construction is susceptible to use in varied relationships as for example, in a refrigerating system in which a valve or other element is operated in accordance with liquid level within a chamber such for example, as an accumulator, such chamber being in communication with the casing 10 by means of passages 28 and 29 to permit free flow of fluid into and from the casing 10.

In the operation of the switch it will be noted that as magnet 17 approaches plugs 18, as on an increase in fluid level, the magnet will reach a certain point and then snap into engagement with the plugs which is caused by the magnetic attraction, which is due to the fact that the magnet is carried in a balanced state by the float members and the magnetic attraction causes a slight unbalancing thereof as will be apparent. When the poles of the magnet so engage the plugs the keeper strip 22 is attracted in the same manner so that the switch contacts are closed with a snap action. Again when the fluid level lowers the magnetic attraction tends to maintain the magnet in engagement with these plugs so that the switch will remain closed until the fluid level has lowered sufficiently so that the weight of the float members in the unbalanced state is sufficient to separate the magnet from the plugs. At this time the magnetic attraction transmitted through the plugs to the keeper of the switch is removed and the switch member is free to open its contacts. In the arrangement shown in Figs. 1 to 3, when the fluid level decreases magnet 17 will cooperate with the other magnetic keeper through the other set of plugs 18 in a similar manner.

It will thus be seen that this retarded action permitted by the float is such that a positive closing action and maintenance of engagement of the switch contacts is afforded which may be relied upon for the operation of the control circuits affected thereby.

A system of this character is shown in Fig. 4 wherein a compressor 70 is arranged to supply refrigerant to an evaporator 71 from which liquid and gaseous refrigerant flow to an accumulator or separator 72. The float switch 10 is arranged to be responsive to the liquid level in the accumulator 72 and may be connected to electro-responsive valve 73 in the supply line adjacent expansion valve 74 for shutting off the supply of refrigerant from the compressor or condenser to the evaporator 71.

Referring to Fig. 5 a two part float casing 40 similar to the casing of the preceding figures is provided with fluid inlet and outlet openings 41 and 42. Within the casing 40 is a float 12 mounted upon the beam 13 pivoted at 14, said beam being provided with a counter-weight 15 held be-

tween lock nuts 16 as previously described. A horse-shoe magnet 17 is mounted upon the beam 13 by means of a pin and slot connection, the pin 13' being carried by the beam and the slot 44 being formed in a plate 45 carried by a rod 46 which connects the plate with the horse-shoe magnet 17. With this construction the horse-shoe magnet is caused to reciprocate vertically and is adapted to contact two magnetic plugs 18 when the magnet is in its uppermost position. The plugs 18 are mounted in a nonmagnetic member 47 upon which is mounted a keeper beam 30 which is attracted by the magnet to oscillate a switch element 48 pivoted at 49 against the action of a spring 50 which tends to hold the switch element on the free end of the switch arm in its lowermost position. The switch element engages contacts 51 and 52 from which extend conductors 53 and 54 through one of which and the conductor 55 extending to the switch arm 49, the circuit is completed. The pin and slot connection provides a connection to permit variations in the float operation due to difference in liquid levels.

In Figs. 6 and 7 is illustrated a construction similar to that shown in Fig. 5 except that instead of the horse-shoe magnet being reciprocal vertically or endwise it is rotated to bring its extremities into engagement with plugs 18 which causes a keeper bar to be attracted to oscillate the switch arm as in Fig. 5. In this embodiment of the invention a casing 60 is provided in which the float 12 is mounted upon a beam 13 pivoted upon a supporting member 61 accessible through an opening in the casing closed by a plug 62 pressing against a spring 63 by means of which the member 61 is held against the end of the magnet 17. The magnet is provided with a pin 64 which extends into an opening in the beam 13 so that when the beam raises or lowers the magnet will be oscillated about the member 61. The magnet is supported in a bearing member 66 of nonmagnetic material. The housing or casing of the float is provided with openings 67 and 68 for the inlet and discharge of fluid as previously described.

In each of the embodiments of the invention it will be readily apparent that the magnetic attraction of the movable switch element will cause it to operate with a snap action.

In operation the horse-shoe magnet 17 is rotated by the float 12 and when the ends of the magnet are in contiguous relation to the magnetic plugs 18, the magnetic circuit is completed through the plugs and the keeper is drawn towards the plugs and the switch is snapped into one position. When rotated away from such a position the switch is snapped to the opposite position by means of the spring.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and the invention is therefore not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

I claim:—

1. In a float operated switch for use with an electrically operated valve, means for controlling the flow of a fluid in response to liquid level, said means comprising a float chamber, a float in said float chamber, a horse-shoe magnet movable by said float within said casing, two pairs of magnetic low reluctance plugs extending through said casing as stops between which the poles of said horse-shoe magnet reciprocate and with which

they cooperate, said plugs also limiting both the up and down movements of the float, and movable switch elements without said casing operating through said plugs by the magnetic field created by the horse-shoe magnet when in a predetermined position.

2. For use with an electrically operated valve, a float-operated switch for controlling the operation of said valve, said float-operated switch comprising a casing, a float within said casing, a sensitized magnetic member in said casing operated by said float, spaced elements of low magnetic reluctance extending through the casing as stops limiting the movement of the magnetic member within the casing, and both the up and down movement of the float, and a magnetic member without said casing operated by said sensitized magnetic member through the last said element.

3. A float switch and operating means therefor comprising a casing, a float within said casing, magnetic means moved by said float, a switch located exteriorly of said casing, said switch having spaced magnetic elements adapted to be

alternately attracted by said magnetic means for shifting the switch, and spaced elements of low reluctance extending through said casing and projecting inwardly thereof as stops adapted to be alternately engaged by said magnetic means, limiting both up and down movement of the float, and correspondingly cooperating with said magnetic elements for effecting positive operations of the switch.

4. In an electric float switch, an operating means therefor comprising a fluid chamber, a float in said chamber and an electric switch located exteriorly of said chamber and comprising a fixed contact, a movable contact pivotally mounted and swingable into and out of engagement with the fixed contact for making and breaking an electrical circuit, said movable contact being arranged to be normally influenced by gravity to open circuit position or closed circuit position, and a magnet for operating said movable contact in accordance with the level of the liquid.

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