Nov. 25, 1930. E. BRILLIÉ 1,782,838

APPARATUS FOR SIGNALING CONDITION OF FLUID IN CONDUITS

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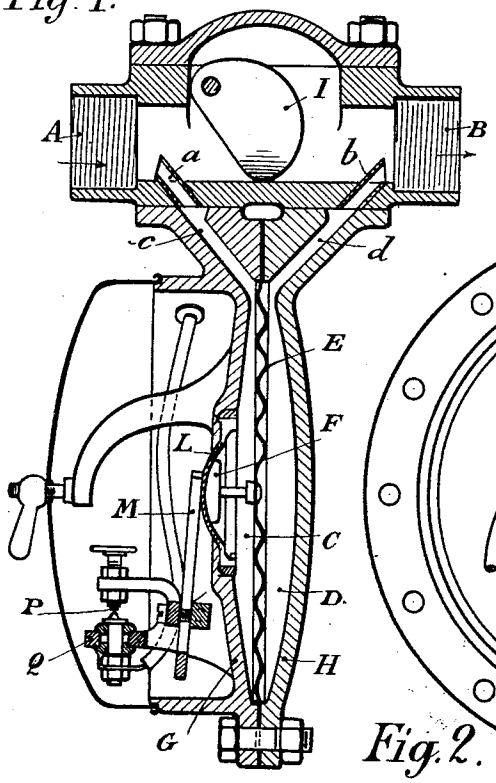
Fig. 1.



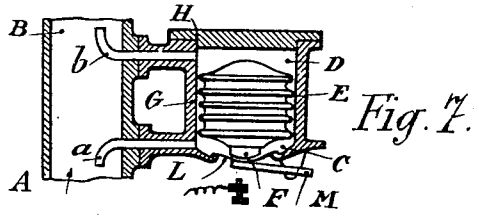


Fig. 7.

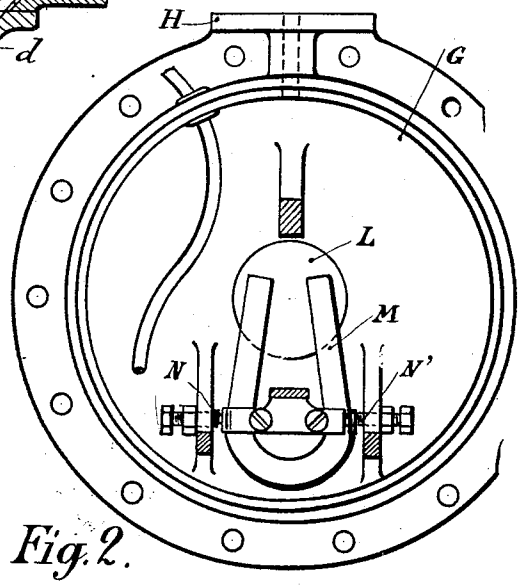


Fig. 2.

Fig. 3.

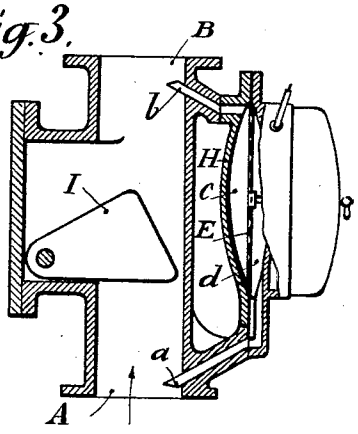


Fig. 4.

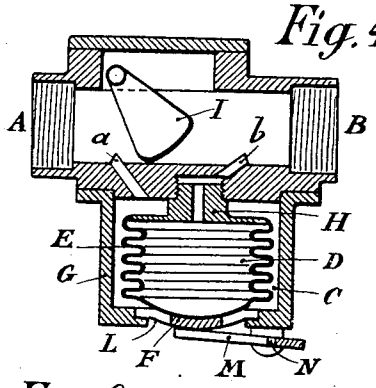


Fig. 5.

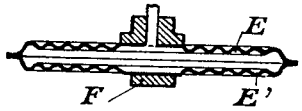


Fig. 6.

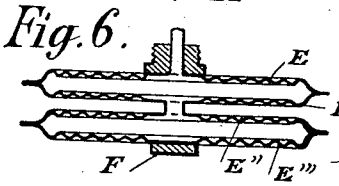


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Fig. 8.

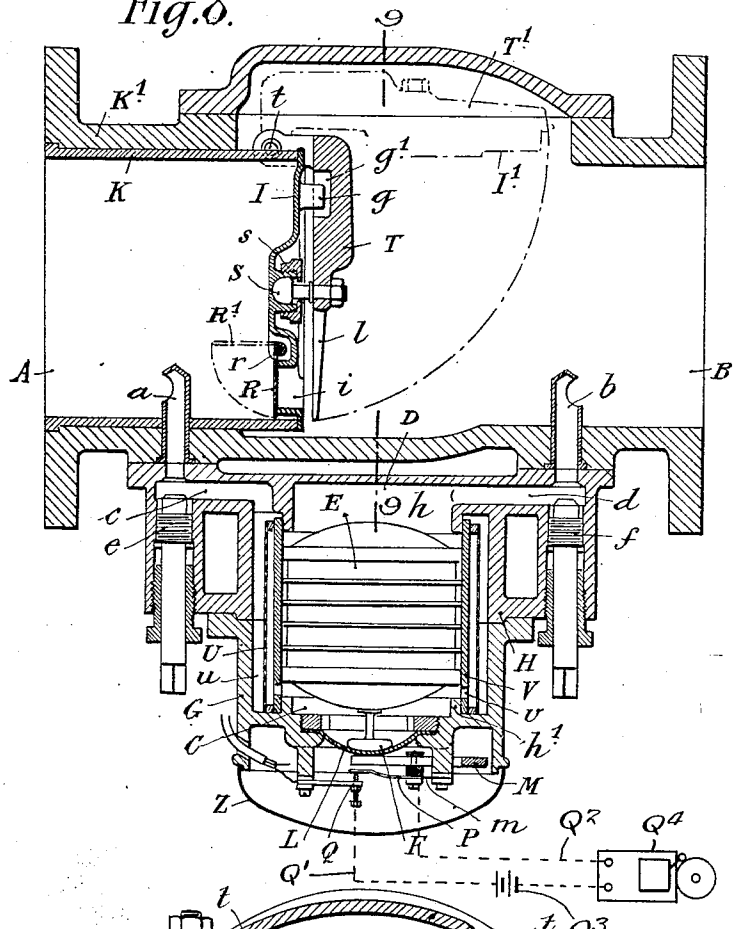
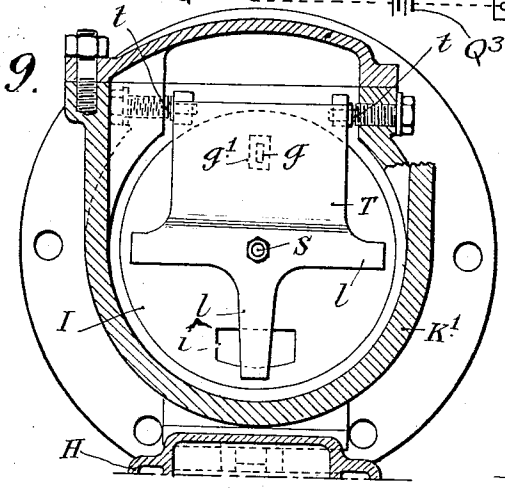


Fig. 9.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR SIGNALING CONDITION OF FLUID IN CONDUITS

Application filed February 17, 1928, Serial No. 255,141, and in France March 21, 1927.

The present invention relates to apparatus for indicating or signaling the change of condition of a fluid in a conduit, more particularly the change from the normal condition of rest into a condition of flow for example in conduits used in installation for protection against fires, by means of sprinklers.

It is already well known that apparatus of the class to which the present invention pertains, and which include a magnetic body, susceptible of being displaced under the action of a flowing liquid, influences the action of a magnet for the opening or closing of an electric current.

In such known apparatus the movable metallic magnetic organ is a sphere which is displaced by a column of water in a tubular vertical cylinder of non-magnetic metal of a thickness sufficient to resent pressure.

In this construction there is a certain necessary amount of play between the magnetic sphere and the wall of the tubular column, by which the interval between the sphere and magnet is variable, thus rendering the attraction of the magnet variable and at times feeble and uncertain.

Again, such apparatus is particularly intended and adapted for application to vertical conduits, and is not effectively applicable to horizontal conduits.

The accompanying drawings show by way of example several constructions embodying the features of the invention.

Fig. 1 shows in sectional elevation a construction of the apparatus as applied to a horizontal fluid conduit.

Fig. 2 is an end view corresponding to Fig. 1 certain parts being removed and in which the fluid operated member consists of a flexible or extensible diaphragm.

Fig. 3 shows in sectional elevation a construction of the invention as applied to a vertical fluid conduit.

Fig. 4 shows in sectional elevation a construction of the apparatus in which an expansible hollow body is used as the fluid-operated member.

Fig. 5 shows a modified construction of a fluid-operated member constituted by a hollow body or cushion.

Fig. 6 shows a third construction of the fluid operated hollow body or cushion.

Fig. 7 shows a construction in which the fluid-operated member is constituted by a piston.

Fig. 8 shows in sectional elevation the preferred construction of the invention as applied to fire-extinguishing apparatus.

Fig. 9 is a section on line 9—9 of Fig. 8.

The signaling apparatus comprises a movable fluid-operated member which in the constructions shown in Figs. 1, 2 and 3 is constituted by a diaphragm E which separates from one another two fluid chambers C and D which communicate through passages *a* and *b* respectively with a part A—B of the conduit through which the fluid, say water, may pass. The port *b* is in front of the port *a* in the direction of the flow of the liquid which is indicated by arrows. When the fluid in the conduit A—B is at rest, the fluid pressure at the ports *a* and *b* is equal and consequently the fluid pressures in the chambers C and D are also equal. As soon as the fluid commences to flow the pressure at the port *a* must be higher than the pressure at the port *b* and this difference or drop of pressure may be artificially increased by providing at a suitable point between the ports *a* and *b* a pressure reducing device, for instance, a flap valve I, which in its normal position entirely closes the conduit between *a* and *b*. The member E carries within the chamber C an armature F of magnetic material. Normally this armature bears with slight pressure against a non-magnetic very thin wall portion L inserted into one side G of the casing, the other side of the casing being constituted by a similar dished disc H. The two discs are bolted together so as to clamp the diaphragm E upon its periphery. The non-magnetic wall portion L is preferably made concave for the purpose of increasing its resistance to the pressure of the fluid.

Against the outer surface of the non-magnetic wall L bear the two ends of a horse-shoe shaped magnet M which is turnably mounted upon two pins or needles N, N′ (Fig. 2). The arrangement is such that the weight of the magnet M tends to move same

away from the wall L and that normally the magnet is held in contact with the wall L by the magnetic force acting between the magnet and the armature F. This normal position of the magnet corresponds to the normal position of rest of the fluid in the conduit A—B. As soon as the fluid commences flowing from A to B, the equilibrium of pressure in the chambers C and D is destroyed, the movable member E moves towards and into the chamber D, the armature F moving together with the movable member moves away from the wall L, the magnetic attraction decreases or ceases to act, and consequently the magnet moves under the action of its own weight. The magnet is shown as carrying an electric contact P adapted to cooperate with another insulated contact Q, whereby upon movement of the magnet an electric alarm circuit may be closed. The connection of these contacts with an alarm is shown diagrammatically in Fig. 8, in which Q^1, Q^2, designate the conductors from P and Q, in circuit with a battery Q^3, and a magneto-electric alarm Q^4. The distance between the contacts P and Q may be so chosen that a very small movement of the magnet may suffice to close the contact. Such an arrangement has the advantage that the magnet M may be quickly returned to its normal position as soon as the flow of liquid ceases.

Figs. 1 and 2 show a construction with a movable member, consisting of a hollow piston as applied to a vertical conduit.

Fig. 3 shows a similar construction as applied to a vertically extending conduit.

Fig. 4 shows a construction in which the movable fluid-operated member E is constituted by a hollow expansible body or cushion. The interior of this body constitutes in this case the chamber D and communicates with the port *b*. The chamber C enclosing the member E communicates with the port *a*. The casing G is again provided with a non-magnetic wall portion L against which bear from the outer side magnets M and from the inner side an armature F connected to the member E. As soon as the difference of pressures occurs between the ports *a* and *b* the member E is compressed by the higher pressure in the chamber C and the armature F is moved away from the magnet M.

Figs. 5 and 6 show two further constructions in which the fluid-operated member E is composed of two joint diaphragms E, E′ or four diaphragms E, E′, E″, E‴. Expansible members of this kind are known per se and are for instance used in the construction of barometers.

Fig. 7 shows a construction with a movable member consisting of a hollow piston E which is adapted to move freely in a casing G. The lower space C of the casing communicates with the port *a* whilst the upper space D communicates with the port *b*. The movable member E carries again an armature F resting on the non-magnetic wall portion L. Normally the member E rests with the armature upon the non-magnetic wall L. As soon as the fluid starts to flow in the direction of the arrow in the conduit A—B, the hollow piston E is raised owing to the pressure in the chamber C exceeding that in the chamber D and the magnet F closes the electric alarm circuit.

It will be understood that the above described apparatus instead of being located in the immediate neighbourhood of the conduit may be placed at any suitable distance therefrom, it being sufficient to connect the apparatus with the fluid conduit by suitable communication passages C, D of appropriate length.

In practice and particularly when the invention is applied to conduits of automatic fire extinguishers, it is important to provide means for separating entirely the fluid conduit from the detector apparatus proper in order to enable the latter to be dismounted and replaced without the necessity of emptying the main fluid conduit. On the other hand the pivoted flap valve which serves for increasing the difference of pressure to a degree which ensures proper functioning of the detector apparatus, must be very sensitive and must be so arranged as to enable the conduit to be emptied by a flow of the liquid in the rearward direction, that is, from *b* to *a*.

A construction comprising these additional means is shown in Figs. 8 and 9. In this construction the movable fluid-operated member E is in the form of a hollow piston as described with reference to Fig. 7 and may, of course, be also in the form of a diaphragm or expansible hollow body or cushion. As in the previously described constructions the conduit A—B communicates through ports *a* and *b* with the casing of the detector apparatus. The casing of the detector apparatus consists of the lower half G containing the non-magnetic wall portion L and the upper half H containing the communication passages *c* and *d* leading to the ports *a* and *b* respectively. A needle valve *e* controls communication between the passage *c* and the port *a*, whilst a needle valve *f* controls the passage between the passage *d* and the port *b*. By means of these valves *e* and *f* communication between the detector casing and the main conduit A—B may be closed when it is desired to dismount the detector apparatus. The pressure reducing device I which is in the form of a pivoted valve comprises an opening *i* which is normally closed by a flap valve R which opens towards the port *a*, that is, in the rearward direction, into the position indicated by R^1, turning about a pivot *r* and thus enabling discharge of the

liquid from the conduit pipe in the direction from B towards A.

The pressure reducing device consists of a valve I which is pressed upon its seat by the weight of a flap T pivoted at t, t. The pivots of the flap T are arranged in rear of the valve seat, or the weight of the flap T is so arranged as to tend to hold the valve I in the closed position. The flap T is connected to the valve I by a ball joint S, a screw cap s limiting relative movement of T and I. The seat of the valve I is preferably constituted by a sleeve K inserted into the end K^1 of the conduit A—B whereby easily workable and non-oxidizable contact surfaces are obtained between the valve and the seat.

In order to prevent the valve I from turning around the joint S whereby the position of the opening i might be changed, the valve I is provided with a projection g engaging a cavity g^1 in the flap T. The flap T is also provided with arms l which limit the relative movement of the valve I with regard to the flap, particularly when the parts assume the position I′ and T′ indicated by dotted lines or some intermediate position.

In order to facilitate inspection of the parts constituting the detector apparatus proper, the cylinder in which the movable member E works is constituted by a sleeve V which engages at the upper end a flange h of the casing H and at its lower end a flange h^1 of the casing portion G, the parts H and G constituting together the casing of the apparatus. Openings v in the lower part of the sleeve V establish communication between the lower space C of the cylinder with an annular space u which communicates with the passage c leading to the port a. The upper space D communicates through the passage d with the forward port b. In the annular space u is arranged an annular filter U to prevent access of foreign matter.

In order to dismount the lower portion G from the upper portion H, the valves e and f are closed so as to interrupt communication with the conduit A—B. The inner parts E, V and U may then be removed.

The armature F which is made of magnetic material and is fixed to the lower end of the member E, rests normally upon the non-magnetic wall portion L which is made concave and has a very small thickness. The magnet M is pivotally mounted upon a flexible spring m. The magnet when released by the armature F, establishes contacts between the parts P and Q whereby an electric signaling circuit is closed. The magnet and the switch actuated thereby are enclosed by a cover Z.

To enable the proper functioning of the apparatus to be tested from time to time as required, a branch pipe may be provided at a suitable point in front of the port b. This branch pipe is provided with a suitable valve so that by opening the valve liquid in the conduit A—B may be caused to flow in the required direction thus bringing the detector apparatus into action.

I claim:—

1. In apparatus for indicating the change of condition of a fluid from rest to flow, the combination of: a conduit; a fluid-operated member; a casing containing said fluid-operated member; means for connecting one side of said fluid-operated member with one point in the said conduit so as to transmit the fluid pressure occurring at said point to said side of the member; means for connecting the other side of said member to another point of the conduit lying in front of the first mentioned point in the direction of the flow of the fluid so as to transmit the fluid pressure occurring at said second point to said other side of the said member; a pressure reducing means arranged within the said conduit between the said two points for the purpose of increasing the pressure drop; a control member arranged outside the casing of the fluid operated member; and magnetic means for operatively connecting said control member with the said movable fluid-controlled member, substantially as described.

2. In apparatus for indicating the change of condition of a fluid from rest to flow, the combination of: a conduit for the fluid; a casing; a movable member within said casing; a passage leading from the space in said casing on one side of said member to a point in the said conduit; a second passage leading from the space in the casing on the other side of said member to a second point in the said conduit lying in front of the first mentioned point; a magnetic circuit arranged partly inside the said casing and partly outside the said casing; a signaling device; means operatively connected with said magnetic circuit for controlling the signaling device; a pressure reducing means arranged between the said two points in the said conduit, said means comprising a flap valve adapted to open in the direction of the flow of the fluid in the conduit, means for normally holding the said flap valve in its closed condition, and a second flap valve mounted on said first flap valve in such a manner as to open in the opposite direction so as to allow fluid to pass in the opposite direction through the first flap valve, substantially as described.

3. In apparatus for indicating the change of condition of a fluid from rest to flow, the combination of: a conduit for the fluid; a casing; a movable member within said casing; a passage leading from the space in said casing on one side of said member to a point in the said conduit; a second passage leading from the space in the casing on the other side of said member to a second point in the said conduit lying in front of the first-mentioned point; a magnetic circuit arranged partly inside the said casing and partly outside the said

casing; a signaling device; means operatively connected with said magnetic circuit for controlling the signaling device; a pressure reducing means arranged between the said two points in the said conduit said means comprising: a valve member, a pivoted weighted member connected to said valve member by a ball joint, the pivots of said weighted member being arranged at the rear of said valve member; means for limiting rotary movement of the valve relatively to said weighted member in the plane of the valve; and means for limiting relative movement of the valve relatively to said weighted member at right angles to the plane of the valve, substantially as described.

4. In apparatus for indicating the change of condition of a fluid from rest to flow, the combination of: a conduit for the fluid; a casing; a movable member within said casing; a passage leading from the space in said casing on one side of said member to a point in the said conduit; a second passage leading from the space in the casing on the other side of said member to a second point in the said conduit lying in front of the first-mentioned point; a magnetic circuit arranged partly inside the said casing and partly outside the said casing; a signaling device; means operatively connected with said magnetic circuit for controlling the signaling device; and a pressure reducing means arranged between the said two points in the said conduit, said means comprising a flap valve and a sleeve inserted into one end of the conduit, the end of said sleeeve constituting the seat of the said flap valve.

5. In apparatus for indicating the change of condition of a fluid from rest to flow, the combination of: a conduit; a movable member adapted to be operated differentially by oppositely acting fluid pressures occurring at different points of flow of the fluid in said conduit; a casing containing said movable member, said casing being divided into two halves transversely to its axis, each half being provided with a circular flange and a sleeve engaging said two flanges of said two halves and forming a cylinder within which said movable member works; and a magnetic circuit associated with said movable member, part of the said magnetic circuit being located outside of said casing and another part of said magnetic circuit being located inside said casing and being connected directly with the movable member, substantially as described.

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