June 4, 1940. W. H. HINSCH 2,203,331

FLOW SWITCH

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Fig. 1.

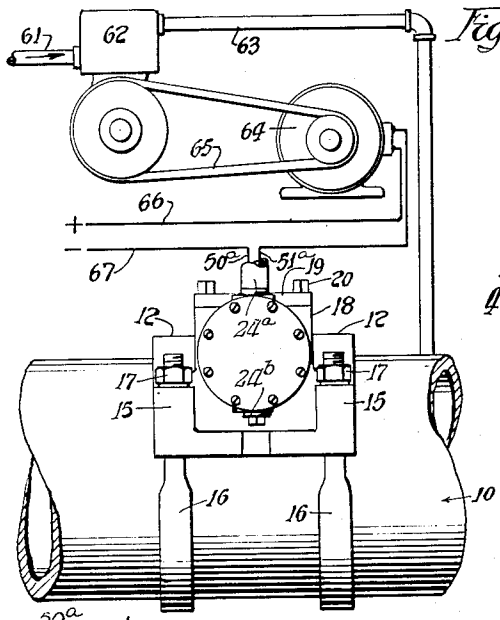


Fig. 2.

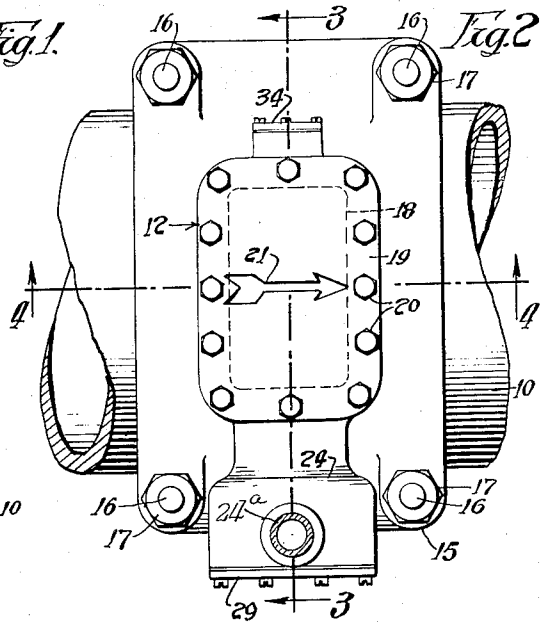
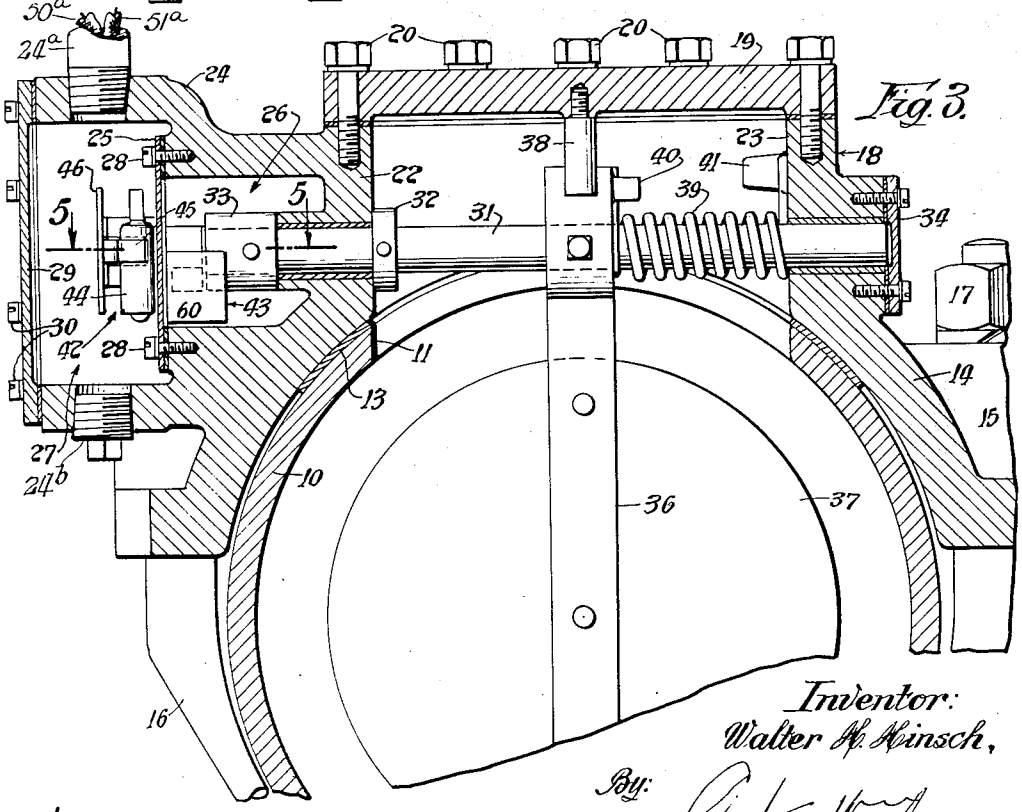


Fig. 3.



Inventor:
Walter H. Hinsch,
By:
Attorney.

Witness:
E. Camporini

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Fig. 4.

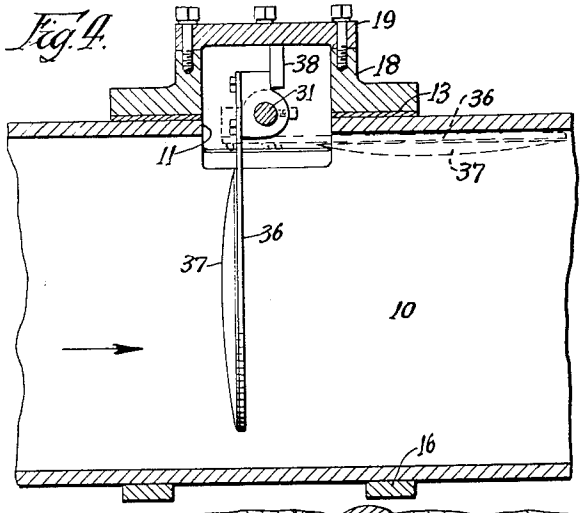


Fig. 8.

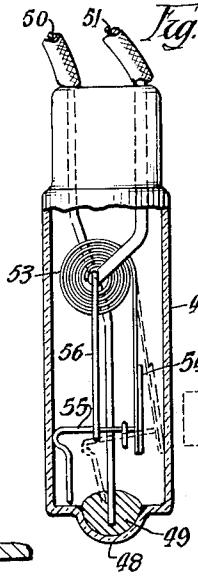


Fig. 9.

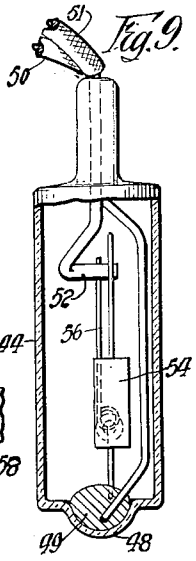


Fig. 5.

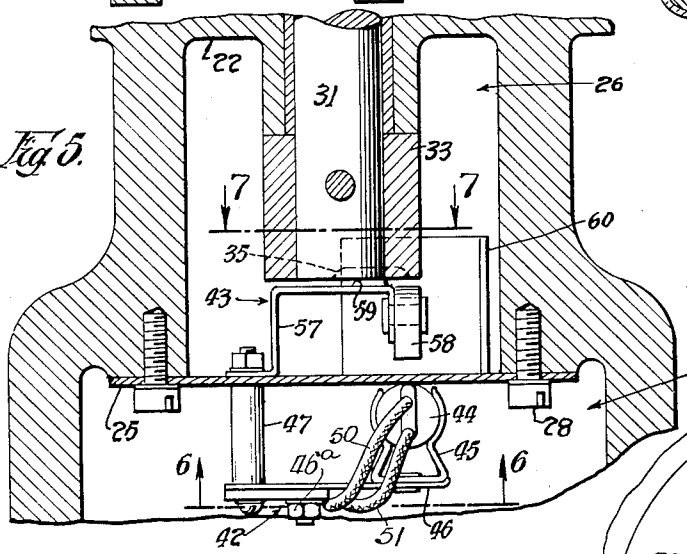


Fig. 6.

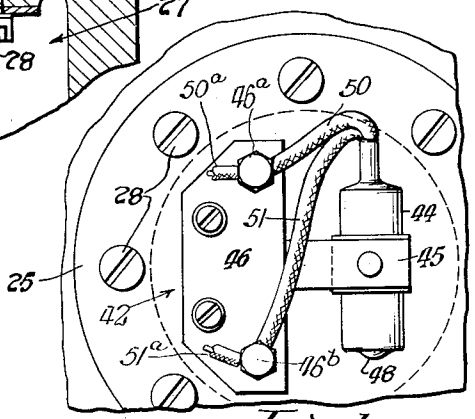
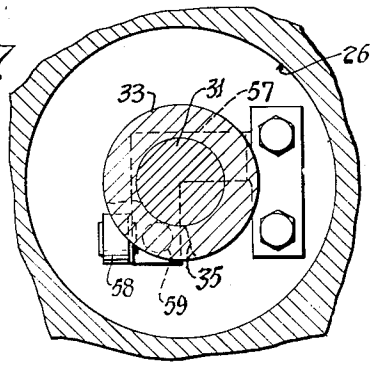


Fig. 7.



Witness:

E. Camporini

Inventor:

Walter H. Hinsch,

By: Arthur W. Hirsch

Attorney.

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UNITED STATES PATENT OFFICE

2,203,331

FLOW SWITCH

Walter H. Hinsch, Chicago, Ill., assignor to Dearborn Chemical Company, Chicago, Ill., a corporation of Illinois

Application May 17, 1937, Serial No. 142,997

9 Claims. (Cl. 200—81)

This invention relates to improvements in flow switches and it consists of the matters hereinafter described and more particularly pointed out in the appended claims.

One of the objects of the present invention is to provide a simple and efficient means for controlling an electric circuit in response to the flow of a stream of liquid.

Another object of the invention is to provide a means of this kind which includes a circuit controlling switch that is isolated in a waterproof manner from the stream of liquid but is responsive to the flow thereof.

A further object of the invention is to provide a means of this kind which includes a circuit controlling switch that is magnetically actuated in response to the flow of the stream of liquid.

Again, it is an object of the invention to provide a means of this kind which is disposed adjacent to but is isolated from the stream of liquid by an imperforate partition and is responsive to the flow of the stream by means which is effective through the partition but does not penetrate the same.

Again, it is another object of the invention to provide a means of this kind which consists of but a minimum of moving parts, is positive in operation and remains trouble-free over a long period of time without requiring service attention.

A further object of the invention is to provide a means of this kind, which is made as a unitary structure for easy application to a conduit for a flowing stream of liquid.

The above mentioned objects of the invention, as well as others, together with the advantages thereof will more fully appear as the specification proceeds.

In the drawing:

Fig. 1 is a view in side elevation of a fragment of a water main or conduit with the improved flow switch connected thereto for controlling the circuit of a motor which drives a pump for feeding measured quantities of a different liquid into the stream flowing through said main or conduit.

Fig. 2 is a top plan view on an enlarged scale of a fragment of the conduit with the improved flow switch thereon.

Fig. 3 is a fragmentary transverse vertical sectional view on a further enlarged scale through the flow switch as taken on the line 3—3 of Fig. 2.

Fig. 4 is a longitudinal vertical sectional view through the improved flow switch structure as taken on the line 4—4 of Fig. 2.

Fig. 5 is a detail horizontal sectional view through a part of the improved flow switch structure on a further enlarged scale as taken on the line 5—5 of Fig. 3.

Figs. 6 and 7 are vertical detail sectional views as taken on the lines 6—6 and 7—7 respectively of Fig. 5.

Fig. 8 is a view partly in side elevation and partly in section of a certain circuit controlling switch embodied in the improved flow switch structure.

Fig. 9 is a view similar to Fig. 8, but with the switch turned through about 90° from the position shown in Fig. 8.

The improved switch structure is herein illustrated and described as embodied in a water treating system for controlling the circuit of a motor that drives a pump for feeding measured quantities of a reagent or chemical into the flowing stream of water being treated, the switch being operative in response to the flow of said stream. This, however, is not to be taken in a limiting sense, because as is apparent, the improved flow switch may be used for controlling other circuits, when the peculiar characteristics of the invention make it of advantage to do so.

Referring now in detail to that embodiment of the invention illustrated in the accompanying drawings: 10 indicates a main or conduit of a relatively large diameter through which a stream of water may periodically flow in the direction indicated by the arrow in Fig. 4. In the top side of said main or conduit is a rectangular opening 11 having its greatest dimension arranged transversely of the main and considerably less than 180° in extent. A saddle 12 engages upon the top side of said main about parts of said main defining said opening. A gasket 13 is employed between said saddle and said main to provide an effective water-tight seal about said opening as will later appear.

The saddle includes a saddle plate 14 that is curved transversely to fit upon the top side of the main and its opposite sides are formed as eyes 15. These eyes receive the threaded ends of a pair of saddle clamping straps 16 that are spaced longitudinally of the main. Nuts 17 are threaded on said ends of the straps. When these nuts are drawn up tight, the saddle plate 14 is drawn downwardly toward the top side of the main. This compresses the gasket 13 to provide a water-tight seal for the saddle about the opening 11 in the main.

An open top, hollow housing 18 rises from the central top portion of the saddle plate about the

opening 11 in the main. The open top of said housing is closed by a cover plate 19 removably secured in place by cap screws 20, a suitable gasket being arranged between said housing and cover plate to provide a water-tight seal therebetween. An arrow 21 (see Fig. 2) is formed on the cover plate to indicate the direction of the flow of the stream in the main.

The hollow housing 18 has opposite side walls 22—23. The side wall 22 is formed with a laterally extending hollow boss 24 divided by a partition 25 into a smaller inner and a larger outer compartment, 26 and 27 respectively. The partition 25 is of non-magnetic metal and is secured in place by cap screws 28 in a water-tight manner so as to isolate the outer compartment from the inner one. The outer compartment is closed by a cover plate 29 secured in place by cap screws 30.

A conduit 24a is secured in the top of the boss for the passage of certain electrical conductors, as will later appear and a plug 24b is secured in the bottom of said boss, as appears in Fig. 3. If desired, said conduit and said plug may be reversed in position, should the same be more convenient for running in the conductors mentioned.

31 indicates a transverse rock shaft that is journalled at its ends in the side walls 22—23 of the housing and one end of said shaft extends into compartment 26. Collars 32—33 are secured to the last mentioned end of the shaft on opposite sides of the wall 22 to secure the shaft against endwise movement. The bearing opening for the other end of the shaft in the side wall 23 is sealed by a cover plate and gasket 34. In the outer end of the collar 32 is a flat bottomed recess, one end 35 (see Fig. 5) of which forms a cam, the purpose of which will later appear.

An arm 36 is fixed to the shaft 31 in the plane of the axis of the main and a paddle 37 of a thin sheet metal is fixed to said that side of the arm facing away from the direction of flow of the stream of water in the main. The paddle is preferably circular in shape and of a diameter somewhat less than the inside diameter of the main. However, the diameter of the paddle is greater than that of the opening 11 in the main and it is preferably arched or bent transversely so that when it is in its wide open position in the main, it closely approaches and approximately conforms to the top internal surface of the main as appears in dotted lines in Fig. 4.

When no stream is flowing through the main, the arm 36 stands in its normal position wherein it is arranged transversely of the main with the center of the paddle substantially coincident with the axis of the main, as shown in Fig. 3. This leaves an annular space between the internal surface of the main and the edge of said paddle. This position of the arm and its paddle is determined by a stop pin 38 depending from the cover plate and engaged by a part of said arm. A torsion spring 39 surrounds the shaft 31 between the arm 36 and housing wall 23 and its ends engage stops 40 and 41 respectively on said arm and wall, see Fig. 3. This spring acts to urge the arm and its paddle into the normal position before mentioned. When a stream of water is flowing through the main, and has gained a velocity of such magnitude as to overcome the action of the spring, the arm and its paddle swing upwardly under the top internal surface of the main as appears in dotted lines in Fig. 4.

The partition 25 carries a suitable switch mechanism 42 on that side thereof facing the chamber 27 and carries a suitable actuating mechanism 43 on that side thereof facing the chamber 26. The switch mechanism and the actuating mechanism are isolated from and independent of each other. The switch mechanism is preferably of the kind known as a "Mercoid" type of switch and includes a normally upright sealed glass tube or container 44. This container normaly stands in a vertical position and is removably engaged in a spring clip 45. Said spring clip is carried by a plate 46 arranged parallel with the partition 25 and supported in spaced relation with respect thereto by a pair of posts 47. In the central portion of the bottom end of the container is a well 48 for holding a globule of mercury 49, see Figs. 8 and 9.

A pair of conductors 50 and 51 are sealed in the opposite end of the tube. The conductor 50 extends down along one side of the tube and its bottom end is offset so as to extend into the well 48 and be immersed in the globule of mercury 49 therein. The other conductor 51, which is of relatively heavy stock has a bottom end portion bent at a right angle to the axis of the tube as at 52. The innermost convolution of a spiral hair spring 53 is secured to said bent portion 52. The other end of said spring is straightened out to extend downwardly of the tube and carries an armature plate 54 susceptible to magnetic forces. A contact member 55 is carried by said plate to extend transversely of the tube and its free end is bent downwardly to terminate near the bottom of the tube and at a point below the top of the mercury globule 49 but normally spaced laterally therefrom. A guide 56 depends from the bottom end portion 52 of the conductor 53 and the bottom end of said guide is formed as a loop and through which the contact 55 has sliding bearing in a manner removing the weight of the contact 55 and armature plate 54 from the spiral spring 53.

The conductors 50—21 are secured to binding posts 46a—46b on the plate and other conductors 50a and 51a respectively lead off from said posts, out through the conduit 24a for connection in the circuit which the switch mechanism 42 controls.

When a magnet is moved into a position adjacent that side of the tube 44 near and in line with the armature 54, so that its force attracts the armature 54, said force causes the armature to swing toward said magnet. As the contact 55 is carried by the armature plate 54, it moves therewith toward and into engagement with the top portion of the mercury globule. This electrically connects the conductors 50—51 together in circuit. When the magnet is moved away from the tube to a point wherein its magnetc force is insufficient to hold the armature plate in its last mentioned position, the spring 53 operates to restore the parts to their normal position wherein the circuit is broken between said conductors 50 and 51.

A flexible spring arm 57 (see Fig. 5) is secured at one end to the partition 25 so as to be disposed in the compartment 26. The other end of said spring arm carries a magnet 58 which as shown herein, is of the permanent horse shoe type. This magnet is disposed in line with the tube 44. A projection or button 59 is carred by the spring arm in such a manner that it rides against the end of the cam collar 33. When this button is normally in the low portion or recess of the cam, the arm 57 has so flexed itself that the magnet 58 is spaced from the tube a distance that makes its magnetic force ineffective to attract the armature plate 54 of the switch mechanism

42. Thus, said switch and its associated circuit are both open.

When the cam collar has been turned into such a position that the end surface 35 engages the button 59, this flexes the arm 57 so that the magnet is moved toward the partition 25. In this position its magnetic force is effective through said partition, to attract the armature plate 54 and close the switch and associated circuit. Thus, it is apparent that while the switch is isolated from the chamber 26 by the partition 25, the magnet 58, in one position is operative or effective through the partition, to actuate the switch. From the above, it is apparent the means which is effective through the partition to actuate the switch does not penetrate said partition. Thus, even though there be a leakage of water from the main, through the bearing in the wall 22 for the shaft 31 and into the chamber 26 so that said chamber fills with water, the switch remains unaffected by such water. If desired, an arcuate flange 60 is provided on that side of the partition facing the chamber 26 to shield the magnet 58 from any disturbing forces, occasioned by the metal of which the saddle may be made.

As before stated, the improved switch is illustrated herein as embodied in a water treating system wherein measured quantities of a liquid reagent are pumped into the water flowing through the main. As shown in Fig. 1, 61 indicates a line leading from a source of liquid reagent supply to a pump 62. A line 63 leads from the outlet side of said pump into the flowing stream in the main 10. An electric motor 64 drives the pump by means of a belt 65. One side of the motor 64 is connected to the positive side 66 of a source of current and the other side of the motor is connected to one of the conductors 50a and 51a of the switch mechanism 42. The other of said conductors is connected to the other side 67 of the source of current. It is apparent that when the switch mechanism 42 is open, the motor 64 is deenergized. When the said switch mechanism is closed, the motor is energized to drive the pump.

When no water is flowing through the main 10, the paddle arm 36 stands in substantially a vertical position in the main. So soon as a flow is established in the main that is sufficient to overcome the action of the spring 39, the paddle 37 is swung upwardly against the action of the spring 39. As the paddle so swings upwardly, the shaft 31 turns on its axis and the cam collar 32 turns therewith. The recess in the end of the cam collar is of such arcuate length that the collar must turn through the desired number of degrees before the cam-like end 35 engages the button 59 to flex the arm 57 into a position wherein the magnet 58 carried thereby is effective to close the switch mechanism 42. When said switch mechanism is closed, this closes the circuit for the motor 64 which becomes energized to drive the pump 62. Said pump then draws reagent liquid from the line 61 and discharges it under a relatively high pressure through the line 63 into the water in the main 10.

When the flow of water ceases in the main, the spring 39 operates to return the paddle 37 and its arm 36 to its normal position. In this position, the button 59 is disposed in the recess in the end of the cam collar so that the arm 57 flexes back to its normal position. This moves the magnet 58 away from the partition so as to make it ineffective in its attraction of the armature 54 in the tube 44. The hair spring 53 then operates to return said armature to its normal position so that the contact 55 is removed from circuit closing engagement with respect to the mercury globule 49. This opens the circuit for the motor 64 which now stops.

It is apparent that there are no openings in the partition 25 through which water may leak into the compartment 27. Thus, even though there be a leakage of water into the compartment 26, such water cannot work its way into the compartment 27 so that there is no danger of a short circuit between the conductors 50 and 51 by reason of water. Another advantage in this respect is that the cover plate 29 may be removed to give access to the switch mechanism therein for inspection, repair or switch parts replacement, without requiring a stoppage of the stream of water in the main.

All of the mechanism may be assembled upon the saddle, before the same is placed in position upon the main and this makes the assembly possible at a bench wherein the mechanism may be tested in the open, before application to the main. It is pointed out that when the paddle is of a diameter greater than the greatest dimension of the opening 11 in the main 10, said paddle, due to being made of a relatively thin, curved disk, may be further curved to a dimension which permits its insertion or passage through said opening 11 to permit proper application of the saddle to the main. Thereafter, the saddle straps 16 and nuts 17 may be applied securely to clamp the saddle in water-tight relation with respect to the main.

While in describing the invention I have referred in detail to the form, arrangement and construction of the various parts, the same is to be considered only in an illustrative sense so that I do not wish to be limited thereto except as may be specifically set forth in the appended claims.

I claim as my invention:

1. In combination with means providing a conduit through which a stream of liquid may flow, means providing a saddle on said conduit and in communication therewith, said saddle having a chamber therein, means for isolating said chamber from said liquid in said conduit, circuit controlling means in said chamber, a shaft journalled in said saddle and rockable in response to the flow of liquid through said conduit, and means movable by and endwise of said shaft and effective through said isolating means for controlling said circuit controlling means.

2. In combination with means providing a conduit through which a stream of liquid may flow, means providing a saddle on said conduit, said saddle having a chamber therein, means for isolating said chamber from the liquid in the conduit, magnetic circuit controlling means in said chamber, a shaft journalled in said saddle and rockable in response to the flow of liquid therethrough, and a magnet movable by and endwise of said shaft into position to be effective through said isolating means for actuating said circuit controlling means.

3. In combination with means providing a conduit through which a stream of liquid may flow, means providing a saddle on said conduit, said saddle having a chamber therein, means for isolating said chamber from the liquid in the conduit, magnetic circuit controlling means in said chamber, a rock shaft journalled in said saddle, means secured to said shaft and operable

in response to the flow of liquid in said conduit for turning said shaft in one direction, a magnet mounted on said isolating means for movement toward and away from the same and means movable by said rock shaft as it turns in one direction, for moving said magnet toward said isolating means to be effective therethrough for actuating said circuit controlling means.

4. In combination with means providing a conduit through which a stream of liquid may flow, means providing a saddle on said conduit, said saddle having a chamber therein, means for isolating said chamber from the liquid in the conduit, magnetic circuit controlling means in said chamber, means mounted on said isolating means for movement toward and away from the same, into and out of position for actuating said magnetic circuit controlling means, and means in said conduit and movable in response to the flow of liquid therethrough for moving said means mounted on said isolating means into a position to be effective on said circuit controlling means.

5. In combination with means providing a conduit through which a stream of liquid may flow, means providing a saddle on said conduit, said saddle having a chamber therein, means for isolating said chamber from the liquid in the conduit, magnetic circuit controlling means in said chamber and supported by said isolating means, a magnet mounted on said isolating means for movement toward and away from the same into and out of effective position with respect to said circuit controlling means, and means in said conduit and movable in response to the flow of liquid therethrough for moving said magnet into said effective position with respect to said circuit controlling means for actuating the same.

6. In combination with means providing a conduit through which a stream of liquid may flow, means for providing a saddle on the conduit and in communication therewith, a circuit controlling means associated with the saddle, means for isolating said circuit controlling means from the liquid in said conduit, a rock shaft journalled in the saddle and rockable in response to the flow of liquid in said conduit, a cam on said shaft, and means engageable by said cam for movement toward and away from said isolating means and effective through the latter for controlling said circuit controlling means.

7. In combination with means providing a conduit through which a stream of liquid may flow, means providing a saddle on the conduit and in communication therewith, magnetic circuit controlling means associated with the saddle, means for isolating said circuit controlling means from the liquid in said conduit, a rock shaft journalled in the saddle and rockable in response to the flow of liquid in said conduit, a cam on said shaft, a magnet, and means for mounting said magnet for movement toward and away from said isolating means and actuatable in at least one direction by said cam.

8. An assembly for a flow switch of the kind described, a supporting element, a magnetically operable member mounted on one side of the supporting element, means providing a magnetic member mounted on the other side of said supporting element, means for connecting said magnetically operable member to the associated side of said element, means connecting said magnetic member to its associated side of said element, one of said connecting means being capable of permitting a movement of its associated member toward and away from the supporting element into and out of position to be effected by the attraction of the other member.

9. In combination with means providing a conduit through which a stream of liquid may flow, means providing a chamber associated with said conduit, a plate separating said chamber from the interior of said conduit, a magnetically operable means for changing the condition of an associated electric circuit and which means is disposed in said chamber and mounted on one side of said plate, magnetic means mounted on the other side of said plate and capable of movement toward and away from said plate into and out of effective position with respect to said magnetically operable means, and means in said conduit and operable in response to the flow of liquid therethrough for controlling the movement of said magnetic means.

WALTER H. HINSCH.