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FLUID FLOW RESPONSIVE DEVICE

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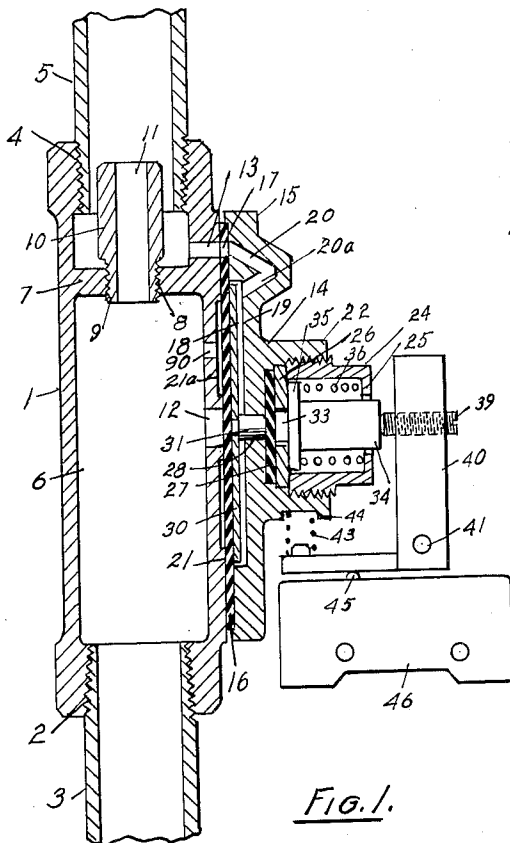


FIG. 1.

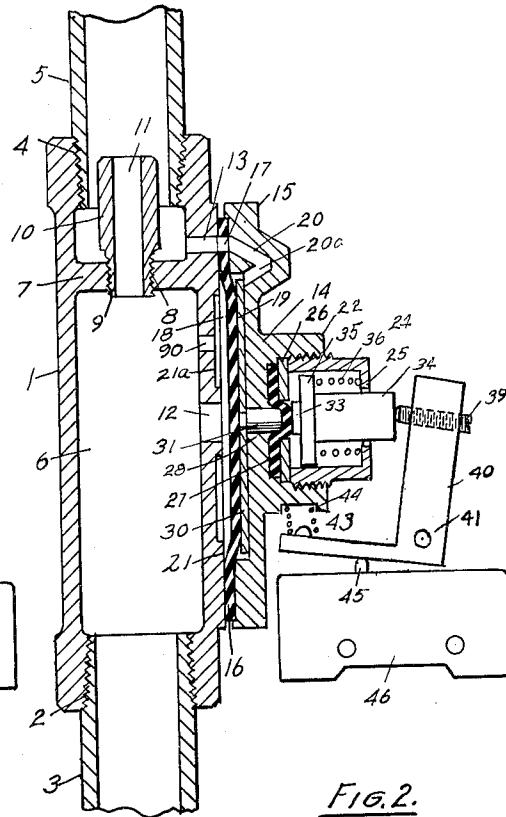


FIG. 2.

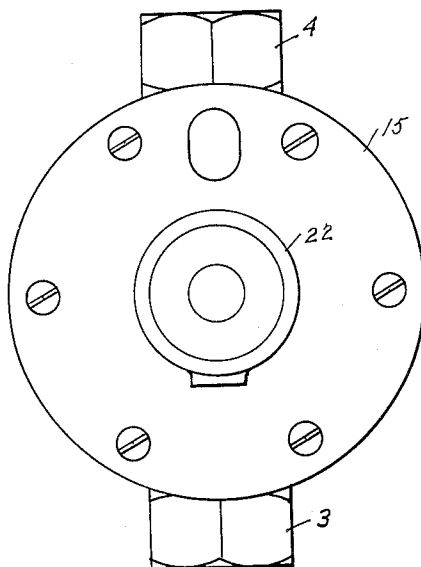


FIG. 3.

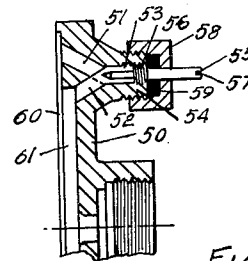


FIG. 4.

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FLUID FLOW RESPONSIVE DEVICE

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9 Claims. (Cl. 200—81.9)

This invention relates generally to a fluid flow responsive device for controlling the operation of control switches and like control devices.

All devices of this character, made in accordance with the teachings of the prior art, and with which I am familiar, have not been very sensitive to changes in the fluid pressure. In these prior devices, movable elements of the fluid flow responsive device to control an outside switch are disposed directly in the fluid passage and in the line of the flow of fluid. They thereby become corroded and scaly after a short period of time and become inoperative. These prior devices also restrict the flow of fluid in the fluid line. The action of these prior devices is too fast for many applications and no adjustment is provided to vary the time of action thereof.

It is, accordingly, an object of my invention to overcome the above and other defects in fluid flow responsive devices and it is more particularly an object of my invention to provide a fluid flow responsive device which is simple in construction, economical in cost, economical in manufacture, and efficient in operation.

Another object of my invention is to provide a fluid flow responsive device which eliminates all movable elements in the fluid flow passage for actuating an outside control switch or the like.

Another object of my invention is to provide adjustable means for delaying or speeding up the action of my novel fluid flow responsive device.

Another object of my invention is to provide a fluid flow responsive device which has no elements which may be scaled or corroded.

Another object of my invention is to provide a fluid flow responsive device with a minimum of parts and which is highly sensitive.

Other objects of my invention will become evident from the following detailed description, taken in conjunction with the accompanying drawings, in which;

Fig. 1 is a vertical sectional view taken through my novel fluid flow responsive device in an inoperative position;

Fig. 2 is a vertical sectional view of my novel fluid flow responsive device in an operative position;

Fig. 3 is a side elevational view of my novel fluid flow responsive device; and

Fig. 4 is a fragmentary view of a modified form of my invention.

Referring now to the drawings, I show in Figs. 1 to 3 inclusive a housing member 1 having a threaded inlet 2 for threadably engaging a threaded inlet pipe 3 and a threaded outlet end 4 in threadable engagement with a threaded outlet pipe 5. The passageway 6 in the member 1 is divided by a wall or baffle 7 with a threaded central aperture 8 for threadably engaging the reduced threaded end 9 of a nozzle 10. The size of the longitudinally extending aperture 11 in the nozzle 10 may be varied. The member 1 has a laterally extending aperture 12 on the inlet side of the nozzle 10 and a laterally extending aperture 13 on the outlet side of the nozzle 10.

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A casing 14 has a cylindrical flanged portion 15 in engagement with the outer marginal edge of a flexible diaphragm 16, preferably made of rubber. The casing 14 has a passageway 20 for registration with the aperture 13 in the member 1 and an aperture 17 in the diaphragm 16. A passageway 20a connects with the passageway 20 and leads to a chamber 18 formed between one side of the diaphragm 16 and the recessed portion 19 of the casing 14. The diaphragm 16 is disposed on a flattened circular face portion 21 on one side of the member 1 and through which the apertures 12 and 13 extend. A circular groove 21a is formed in the face portion 21 on one side of the member 1 and it is connected to the passageway 6 by an aperture 90. The casing 14 has an internally threaded, outwardly extending portion 22 for threadably engaging a flanged threaded sleeve 24 with an inwardly directed flanged portion 25. The sleeve 24 holds a centrally apertured washer 26 against a flexible washer 27 which covers an aperture 28 leading into the chamber 18. A disk 30 has an outwardly projecting, guiding portion 31 thereof journaled in the aperture 28 for longitudinal and rotative movement. The disk 30 is disposed between the diaphragm 16 and the washer 27, the projecting portion 31 thereof being in engagement with the washer 27. The opposite side of the washer 27 is engaged by an outwardly projecting, reduced end 33 of an actuating plunger 34 with an outwardly directed flange 35 engaged by a coil spring 36 disposed between the inwardly directed flange 25 on the sleeve 24 and the flange 35 on the actuating plunger 34 to urge the end 33 of the plunger 34 against the washer 27. The plunger 34 is shown engaging an adjustable threaded pin 39 in a right angled arm 40 pivoted at 41. A spring 43 nested in a recess 44 in the side of the outwardly projecting portion 22 of the casing 14 urges the switch button 45 of a conventional switch 46 to a closed position.

In operation, a nozzle 10 of predetermined size is threadably engaged with the threaded aperture 8 in the wall 7 of the member 1. The pressure of the two sides of the diaphragm 16 is balanced when there is no flow through the nozzle 11 and the pressure in chamber 20a is reduced when there is a flow through nozzle 11. Since the pressure in chamber 20a is less than the pressure in chamber 6 when there is flow through the nozzle 11 when the flow increases to a point where the pressure differential is great enough, the diaphragm 16 will exert a force against the guiding portion 31, the washer 27, and through the member 34 to actuate the switch through lever 40. The spring-urged actuating plunger 34 also urges the diaphragm 16 to a closed position as shown in Fig. 1. As the flow of fluid through the passage 6 of the member 1 increases, the pressure on the outlet side of the nozzle 10 will become less than the pressure on the inlet side thereof in the passage 6 of the member 1, thereby causing the diaphragm 16 to move away from the face portion 21 of the member 1. The outwardly projecting end 31 of the disk 30 is then forced against the center of the flexible washer 27 which in turn engages the end 33 of the actuating plunger 34 to move it against the force of the spring 36 to actuate the arm 40 and the switch button 45.

The smaller the aperture provided in the nozzle 10, the less will be the volume passing through the passageway 6 of the member 1 and the greater will be the pressure drop between the inlet and outlet sides of the nozzle 10. Conversely, the larger the aperture in the nozzle 10, the greater will be the volume and the pressure drop will be lower. Also, the longer the nozzle 10 that is provided, the greater will be the pressure drop. The action of this pressure drop is the well known Venturi effect. Because of the many possibilities of varying the

pressure drop between the inlet and the outlet sides of my novel flow responsive device, it may be adapted for use in practically any installation. Several types of nozzles 10 may be tried until best results are obtained.

In many installations where a fluid flow responsive device is used, the action of the device is too fast. In these installations, there may be a temporary cessation of flow and reduction of pressure whereby the switch is actuated immediately and the machinery used in conjunction with the flow control device is shut off. Where these prior fluid flow responsive devices have been used to control the flow of cooling fluid to a welding unit, the quick action thereof has been particularly bad because these units are made to stay inoperative for five minutes or more to protect the resistance and other elements used in conjunction therewith. It will be evident that where the fluid flow responsive device shuts off the machine several times an hour, a great loss in production occurs. To overcome these difficulties, I have shown in Fig. 4 a means for delaying the opening action of the diaphragm of my novel device and therefore the opening or the closing of the switch actuated thereby. The casing 50 shown in Fig. 4 is the same as the casing 14 shown in Figs. 1 and 2 except that a needle valve 55 is disposed in the passage leading to the chamber 60 on the back side of the diaphragm 61. Fig. 4 shows passageways 51 and 52 the same as passageways 20 and 20a in Figs. 1 and 2. At the apex of the passageways 51 and 52, I provide a threaded, outwardly extending aperture 53 in an externally threaded bossed portion 54. The needle valve 55 has a threaded portion 56 for threadable engagement with the threaded aperture 53 of the bossed portion 54 on the casing 50. A cross slot 57 on the end of the needle valve 55 is provided to rotate the valve for adjustment thereof. A threaded gland nut 58 threadably engages the threaded bossed portion 54 of the casing 50 and it engages a washer 59 which sealingly engages the stem of the valve 55.

In the operation of my modified form of fluid flow responsive device shown in Fig. 4, the valve 55 is rotated inwardly a predetermined amount thereby causing bleeding of the fluid to and from the chamber 60 behind the diaphragm 61. Rather than reduce the pressure quickly behind the diaphragm 61 where the passages 51 and 52 leading thereto are open, the pressure in my modified device behind the diaphragm 61 is reduced slowly thereby delaying the action of the opening of the diaphragm 61. Thus, if there is only a temporary drop in pressure of the fluid passing through my novel fluid flow responsive device, the switch 46 will not be actuated until the passage of a predetermined amount of time. If the pressure in the line builds up during a predetermined time, my modified device will not actuate the switch and a machine such as a welding machine may continue to operate.

It will be evident from the foregoing description that I have provided a novel fluid flow responsive device which has no movable element in the passageway for the flow of fluid to impede the flow or one which may be corroded or scaled and become inoperative. My device has a high degree of sensitivity, it is highly responsive to the changes of the rate of flow of fluid through the passageway therein, it has a minimum number of moving parts, it is durable and extremely efficient, and it has means for changing the pressure drop of the fluid passing there-through thereby making it adaptable for use in a wide variety of installations. Furthermore, I have provided adjustable means for delaying the action of my novel fluid flow responsive device.

Various changes may be made in the specific embodiment of my invention without departing from the spirit thereof or from the scope of the appended claims.

What I claim is:

1. A fluid flow responsive device comprising a housing member having a flow passage with an inlet and an out-

let, a transverse wall intermediate said inlet and said outlet, a nozzle detachably engaged with said wall, a casing defining a chamber adjacent said flow passage and attached thereto, a flat diaphragm disposed in said chamber adjacent the passages in said member on the inlet side of said wall, said housing member having two laterally extending passages on the inlet side of said transverse wall connected to one side of said diaphragm and a passage on the outlet side of said transverse wall leading to the side of the diaphragm opposite the side of the diaphragm connected to the inlet side passages, said casing being interconnected with said flow passage by said passage on the outlet side of said housing member, a spring urged actuating means engaging an electrical actuating means and further engaging said diaphragm and movable by said diaphragm upon an increase of the rate of flow of fluid through said flow passage whereby said electrical control is actuated when the flow reaches a predetermined value.

2. A fluid flow responsive device as set forth in claim 1 wherein a flexible washer is disposed in said casing spaced from said diaphragm and a connecting member is disposed in an aperture in said housing wall between said washer and said diaphragm and in engagement with the center of said diaphragm, a spring-urged actuating member being engaged by the opposite side of said washer for movement thereof upon movement of said diaphragm, said washer sealingly covering said aperture in said housing.

3. A fluid flow responsive device as set forth in claim 1 wherein adjustable valve means are provided to restrict the flow of fluid to and from said chamber defined by said casing.

4. A fluid flow responsive device comprising a housing member having a passageway with an inlet and an outlet, a transverse wall with a threaded aperture intermediate said inlet and said outlet, said housing member having laterally extending apertures in one side thereof on the inlet and outlet sides of said wall, a nozzle of predetermined size threadably engaged with the threaded aperture in said transverse wall, a flanged casing engaging the apertured side of said housing member having a passageway registering with the aperture in the outlet side of said wall and defining a chamber, a diaphragm secured by said casing and disposed over said aperture in said housing member on the inlet side of said wall, a flexible washer secured in said casing spaced from said diaphragm, a connecting member disposed between said diaphragm and said washer, and a spring-urged actuating member engaging the opposite side of said washer, said diaphragm being movable away from said housing member upon a predetermined increase in the rate of flow of fluid through said passageway thereby moving said connecting member between said diaphragm and said washer, and said actuating member.

5. A fluid flow responsive device as set forth in claim 4 wherein valve means are provided to restrict the flow of fluid between said chamber defined by said casing and said passageway.

6. A fluid flow responsive device comprising a housing member having an elongated passageway with an inlet and an outlet, a nozzle intermediate said inlet and said outlet, said passageway having laterally extending apertures on one side thereof on the inlet and outlet sides of said nozzle, a flexible diaphragm disposed on the outer side of said laterally extending aperture on the inlet side of said nozzle, a flanged member for securing said diaphragm to said housing member defining a chamber in communication with the aperture in said passageway on the outlet side of said nozzle, a flexible washer in said flanged member spaced from said diaphragm, a member intermediate said diaphragm and said washer, and a spring-urged actuating plunger engaging said washer, said diaphragm being adapted to move said intermediate member, washer, and actuating plunger upon

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a predetermined increase in the rate of flow of fluid through said passageway.

7. A fluid flow responsive device as set forth in claim 6 wherein valve means are provided to restrict the flow of fluid between said elongated passageway and said chamber defined by said casing.

8. In combination, a fluid flow responsive operating means and an electrical control and actuating means comprising a housing member having a flow passage with an inlet and an outlet, a transverse apertured wall intermediate thereof, a chamber adjacent said flow passage, a flexible diaphragm in said chamber, said housing member having laterally extending apertures on the inlet and outlet sides of said wall, said inlet side aperture connecting said flow passage and said chamber on one side of said diaphragm and said outlet side aperture connecting said passage to said diaphragm, control means actuated by said diaphragm upon increase in the rate of flow of fluid through said apertured wall to operate the electrical actuating means, and a nozzle having an elongated aperture therein of predetermined size disposed in said aperture of said transverse wall, said nozzle having a substantial length whereby a substantial pressure drop is accomplished in said nozzle whereby a differential pressure is exerted on opposite sides of said diaphragm.

9. In combination, a fluid flow responsive operating means and an electrical control and actuating means comprising a housing member having a flow passage with an inlet and an outlet, a transverse apertured wall intermediate thereof, a chamber adjacent said flow passage,

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said housing member having laterally extending apertures on the inlet and outlet sides of said wall, said inlet side aperture connecting said flow passage and said chamber and said outlet side aperture connecting said passage to a flexible diaphragm in said chamber, control means actuated by said diaphragm upon increase in the rate of flow of fluid through said passageway to operate the electrical actuating means, a flexible washer disposed over an aperture in the side of said housing member sealing said aperture and laterally spaced from said diaphragm, a connecting member engaging said washer and said diaphragm and disposed therebetween, a spring urged actuating plunger engaging the opposite side of said washer adapted to be moved thereby upon movement of said diaphragm, and control means actuated by said plunger.

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