May 28, 1963 A. G. LEWIS 3,091,758

SIGNAL APPARATUS INDICATING FLOW THROUGH A PIPE, AVOIDING FALSE ALARMS DURING SURGES

Filed March 3, 1960

FIG. 2

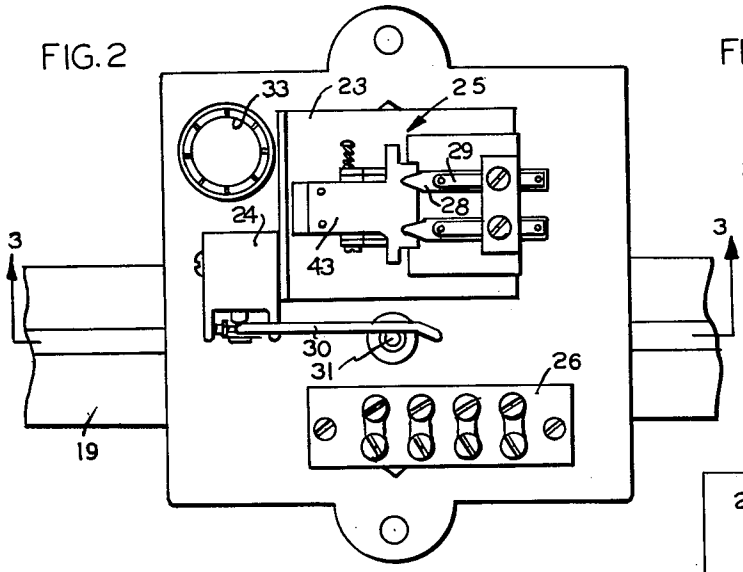


FIG. 1

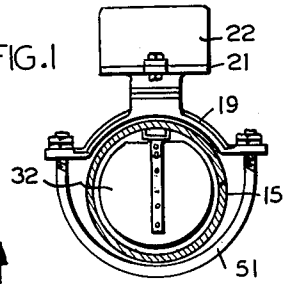


FIG. 5

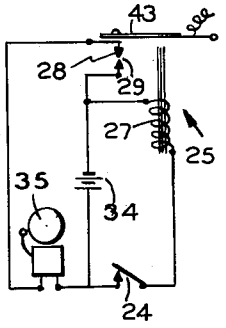


FIG. 3

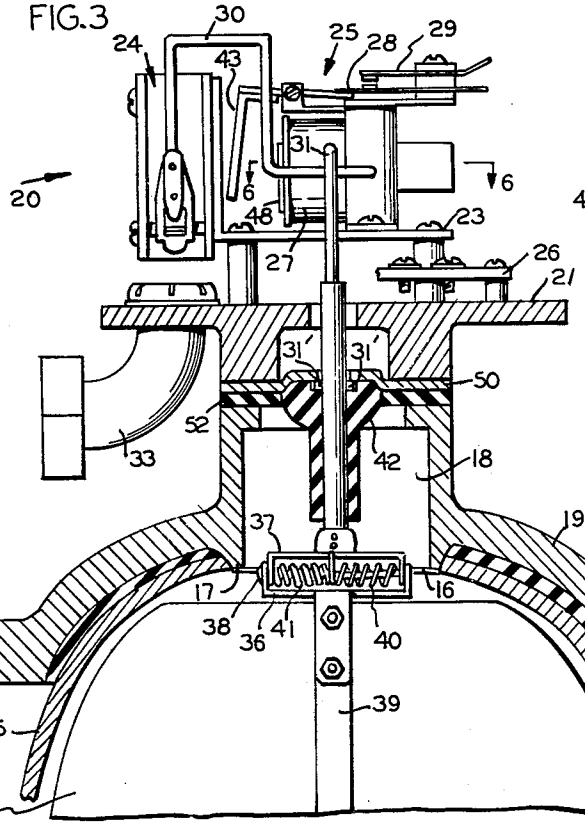


FIG. 6

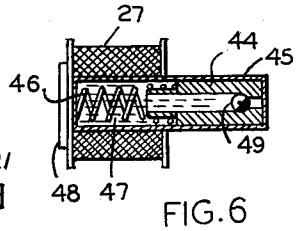
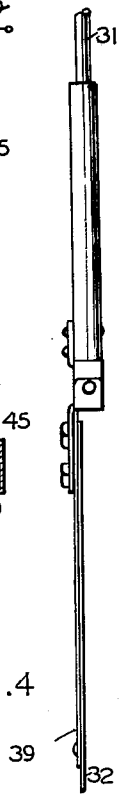


FIG. 4



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SIGNAL APPARATUS INDICATING FLOW THROUGH A PIPE, AVOIDING FALSE ALARMS DURING SURGES

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1 Claim. (Cl. 340—239)

The present invention relates to a signaling apparatus to indicate that a liquid is flowing through a pipe and more particularly to the type avoiding false alarms when there occurs mere surges in the pipe line. One extensive use of this apparatus is in connection with a sprinkler system installed in a building, adapted to automatically come into operation upon the occurrence of a fire. The alarm system is electrically operated and employs a paddle or vane-operated, retarded-action switch to control the alarm circuit.

Various attempts have been made heretofore along these lines, but they have proven faulty in that they did not avoid false alarms. When electrical thermostat switches were used, continuous surges would cause a cumulative heating effect which set the switches into operative condition though none of the sprinklers were in operation. Various uses of pneumatically-operated delayed action switches are incident to similar cumulative effect, and here again false alarms are not avoided.

It is therefore the principal object of this invention to provide a novel and improved alarm system which absolutely prevents the operation of the switch controlling the alarm circuit execpt when there is a continuous flow of liquid in one direction, thereby avoiding false alarms.

Another object of this invention is to provide a novel and improved false-alarm-avoiding signaling system of the character mentioned in which the retarding mechanism need not be at the paddle-operated apparatus, but at any accessible point remote therefrom so that when any adjustments need be made you do not have to go to a basement where the paddle-operated component is usually located.

A further object is to provide novel and improved spring mechanism to offer the paddle its required movements during continuous flow and surge flow in the pipe line.

Another object thereof is to provide a novel and improved apparatus having the attributes mentioned, which is reasonable in cost to manufacture, easy to install, positive in action and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For one practice of this invention, it includes a spring-biased vane set across the interior of the pipe line and free to swing with a rod extending upwardly from said vane to operate a micro-switch when the vane is moved in the direction of normal flow of liquid through said pipe. Said vane has swinging movement independent of said rod, whereupon the vane's associated springs act thereon to tend to return it to normal position across the pipe's interior. The vane is connected to said rod by a knuckle structure comprising two U-shaped members on an axis pin through the distal ends of their legs. A right-hand and a left-hand coil spring about said axis pin, co-act with the vane.

For the electrical alarm system, said micro-switch controls the circuit of the electro-magnet coil of a retarded action relay. The switch operated by said electromagnet controls the alarm circuit. The relay I employ is of the type where the core which is magnetized upon actuation of the electro-magnet, is movable, but restrained in a manner hereinafter described by spring, hydraulic and magnetic action so that a predetermined time interval need pass before said core moves to a position where the armature of the relay is moved to operate the switch means offered by the relay. This relay is an article of commerce and one of its manufacturers is the Heinemann Electric Company of Trenton, New Jersey, who markets it under the designation "Silic-O-Netic Relays" a time delay relay, their type A.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is a section through the pipe which supplies water to a sprinkler system. A device which is the subject of this invention, is shown associated with such pipe. Such device's components which are exterior the pipe, being housed in a casing.

FIG. 2 is a top plan view of said device. Here, the casing is omitted to expose the mechanism.

FIG. 3 is a section taken at line 3—3 in FIG. 2. In parts, this view is fragmentary.

FIG. 4 is a fragmentary side view of the vane and of some elements associated therewith.

FIG. 5 is an electrical circuit diagram which includes the alarm and its controls.

FIG. 6 is a section taken at line 6—6 in FIG. 3.

In the drawing, the numeral 15 designates a water supply pipe of a sprinkler system (not shown) in which when any of the sprinklers are in operation, the direction of flow of the water in said pipe 15, would be towards an observer of FIG. 1 when the drawing herein is held vertical. This pipe is provided with a hole 16 to receive the neck ring 17 which is around the mouth of a socket 18. This socket is part of a saddle member 19 which carries the electrical switch mechanism indicated generally by the numeral 20 which is on a platform 21 and covered by a removable casing 22. This platform carries a bracket 23 on which is mounted the micro-switch denoted generally as 24 and a relay designated generally as 25, which has special characteristics as will be explained. A terminal connection block 26 is mounted on the platform 21 to receive the terminal wires (not shown) of the micro-switch 24, the solenoid coil 27 and of the alarm circuit control switch comprising the normally separated springy contact arms 28, 29, which latter are brought together upon a determined actuation of the solenoid coil 27. The operating element 30 of the micro-switch 24, is adapted to close such micro-switch which is normally in open condition, when said element is moved by the finger element 31 which is associated with the paddle or vane 32 which is suspended within and across the pipe 15. Conductors (not shown) leading from the connection block 26, are positioned through the tubular member 33, which in the instance shown is of elbow-shape, to extend to the current supply 34 and the alarm device which may be the bell 35.

A knuckle structure is comprised of two U-shaped

members 36, 37 which are hingedly related by the axis pin 38 positioned through the distal ends of their arms. The vane 32 is of thin tempered Monel or other suitable springy sheet metal secured by a central stiffener element 39 to the U-member 36. The finger element 31 is secured to the U-member 37. Said axis pin 38 has two coil springs thereon, one right-hand 40 and one left-hand 41, each adapted to act in torsion when the vane 32 is moved from its normal position across the interior of the pipe 15. The finger element 31 is swingably mounted by its lateral pintles 31' and extends through the elastic rubber member 42 which is secured to the plate 50, a wall of the socket 18, to attain water-tight assembly and to hold the finger element 31 from turning.

Although the relay 25 illustrated as shown is of the double-pole, single-throw type, I have utilized only its contacts 28, 29 for I only need a single-pole, single-throw switch for the circuit shown in FIG. 5 where the electrical connections may be described as follows: The contact point 28 is connected to one terminal of a signal bell 35. One terminal of the micro-switch 24 is connected to one terminal of the relay's electro-magnet 27. One terminal of the electrical energy supply 34 is connected to the other terminal of the electro-magnet 27 and to the contact point 29. The other terminal of the supply 34 is connected to the other terminal of the bell 35 and to the other terminal of the micro-switch 24. In normal condition, when no water is flowing continuously through the pipe 15 and when no surges occur in such pipe, meaning when the water is at rest therein, the condition of the apparatus will be as shown in FIG. 3, where the vane 23 hangs vertical, the points 28, 29 are out of contact and the micro-switch 24 is open as further seen in FIG. 5. Should there occur a continuous flow in the pipe 15 as when any sprinkler head is operating, the vane 32 would move towards the observer about axis pin 38 after it has moved somewhat in such direction whereupon the finger element 31 did move the element 30 to close the micro-switch 24. Thereupon current would continuously flow through the magnet coil 27 causing attraction of the armature 43 towards the magnet core 44 which has moved fully into said coil. Such movement of the armature will bring contact 28 into contact with the contact point 29, whereupon the circuit of the bell 35 would be closed and said bell actuated. It is to be noted that the relay's armature will be attracted to the core 44 only when said core has moved fully into the coil 27. I will now explain the manner how said core is delayed in its movement into the coil, so that it would be necessary for the micro-switch 24 to be in closed condition a prescribed period of time to actuate the magnet coil 27 long enough to allow core travel to be sufficient to cause movement of the armature 43; it being evident if full core travel is not permitted, that the armature will remain at rest.

I will now quote from the literature of the mentioned Heinemann Electric Company, as to how the relay operates, using the reference numerals of my drawing herein to identify components. "Instead of a fixed, solid core characteristic of conventional relays, Silic-O-Netic relays have a hermetically sealed, non-magnetic metal tube 45 which extends through and beyond the solenoid coil 27. The tube, in turn, contains a movable iron core 44, a core-return spring 46, and a silicone liquid fill 47. When the coil 27 is energized the movable iron core 44 is drawn into the magnetic field. But the silicone liquid slows down this travel. This provides the time delay. As the core moves into the coil, it reduces the "air" gap, lowering the reluctance in the magnetic field. When the core 44 touches the pole piece 48, the magnetic circuit is completed, creating a considerable increase in magnetic flux. The magnetic flux is sufficient to attract the armature 43 and actuate the relay contacts 28, 29. When the relay 25 is de-energized, the movable core 44 returns quickly under spring pressure to its original position. On the return, a tiny ball-type check valve 49 within the movable

core opens, allowing the silicone liquid 47 to pass through the center of the core 44. As a result, the relay 25 is quickly reset for the next operation."

Upon the occurrence of surges in the pipe 15, those flowing in the direction towards the observer, will cause the finger element 31 to close the micro-switch, while, upon the occurrence of surges in which the direction of flow is in reverse, there will be no effect on the normally closed micro-switch 24. Of course, every time switch 24 is closed, current will pass through the relay's magnet coil 27, but the time such current flows is not sufficient to exceed or equal the time required for the core 44 to move its entire course towards the pole piece 48, because upon the quicker movement of the finger element 31, the micro-switch is opened whereupon the core 44 is quickly returned to its initial rest position as shown in FIG. 6. So although the micro-switch closes and opens, closes and opens ad infinitum while the surges occur, there will never be an alarm, that is the bell 35 will not be actuated and hence there could be no false alarm.

It is to be noted that upon flow in any direction in the pipe 15, the vane 32 will swing up in the direction it is forced by the flow and may even reach limit horizontal positions along the upper portion of the pipe wall. The vane 32 being thin and flexible will become concavo-convex and back again to substantially plano-plano. The springs 40 and 41 act to bring the vane to vertical position when the water in the pipe 15 is at rest.

Although elements 30 and 31 are shown separate, they co-operate and may be deemed the means to operate the micro-switch 24.

The device may be mounted onto the pipe 15 by means of a U-bolt 51 as shown in FIG. 1. The numeral 52 denotes a rubber gasket.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiment herein shall be deemed merely illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claim rather than to the specific description herein to indicate the scope of this invention.

I claim:

In a signalling apparatus of the character described, a frame adapted to be mounted on a pipe, a vane swingably mounted on the frame and extending into the pipe to be acted on by a fluid which may flow through said pipe, a finger element swingably mounted on the frame, a knuckle made of two U-shaped elements pivotally connected by an axis pin through the distal ends of said U-shaped elements; one of said U-shaped elements being attached to said vane and the other of said U-shaped elements being attached to said finger element, spring means for biasing said knuckle comprising a right hand and a left hand coil spring about said axis pin; each coil spring associated with said knuckle being stressable in torsion upon swinging movement of said vane whereby said vane is free to swing to a position substantially along the pipe without moving said finger element beyond a prescribed scope, a first switch carried on the frame; said first switch including an operating member to be moved by said finger to close said switch when said finger is moved by the movement of the vane in a predetermined direction; said switch being normally in open condition, an electrical relay, a source of electrical energy and an electrical signal device; said relay consisting of a second switch which is normally in open condition, a solenoid coil, a closed tubular casing of non-magnetic material extending through said coil and outwardly thereof in one direction, a magnetizable pole piece fixed to one end of said casing, a magnetizable tubular core slidably mounted in said casing, spring means within said casing, biasing said slidable core towards the outwardly extending end of said casing, a check valve within said tubular core, a liquid medium filling said casing; said check valve being closed when the slidable core

is moved towards the pole piece, a spring biased armature normally spaced from said pole piece and adapted to be attracted thereto upon actuation of said solenoid coil when the slidable core is adjacent said pole piece; said second switch being adapted to be closed by the armature when the latter is attracted to said pole piece, and a circuit including said switches, solenoid coil, energy source and signal device, so connected that the first switch controls the actuation of the solenoid coil and the second switch controls the actuation of said signalling device; said liquid and spring within said casing having the character to delay the movement of the slidable core towards the pole piece a sufficient time to allow for any surges occuring in the pipe, thereby avoiding the closing of said second switch while the first switch is closed by such surges.

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