April 21, 1936. R. M. HOPKINS ET AL 2,038,111

WATER FLOW DETECTOR FOR DUCTS

Filed May 5, 1931 2 Sheets-Sheet 1

Fig. 1.

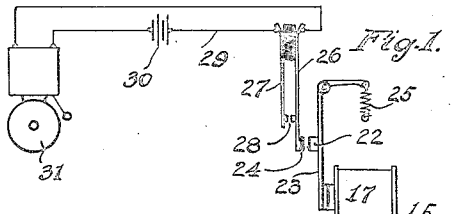


Fig. 3.

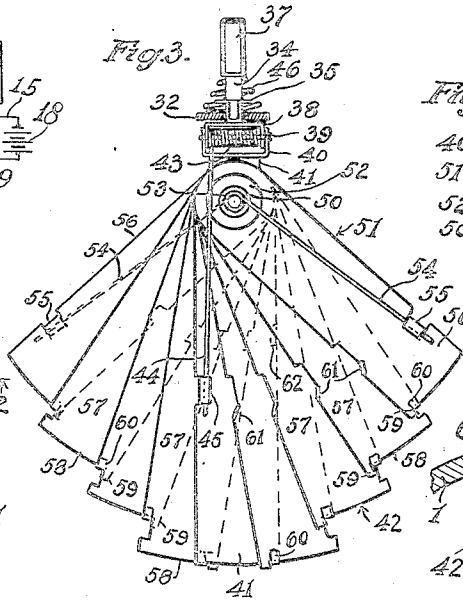
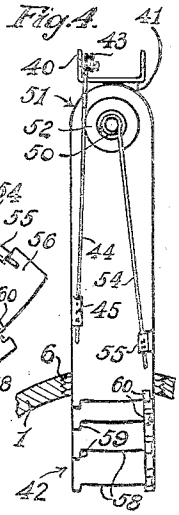


Fig. 4.



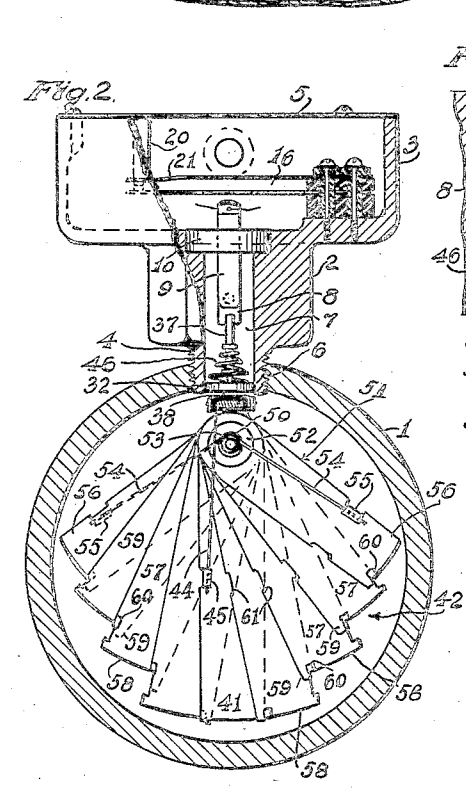


Fig. 2.

Fig. 5.

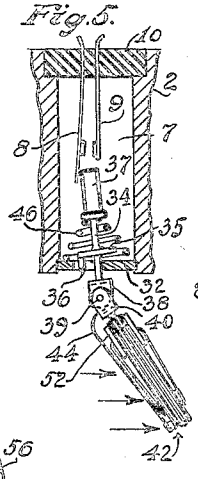


Fig. 6.

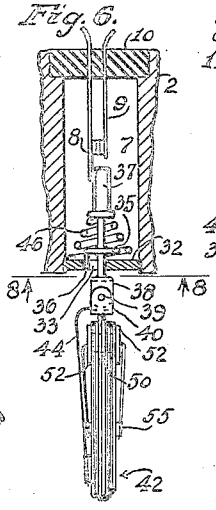


Fig. 7.

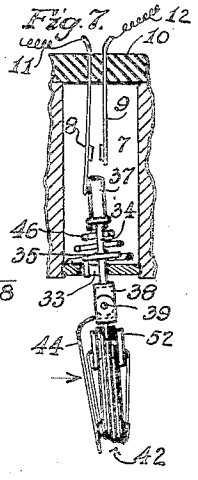
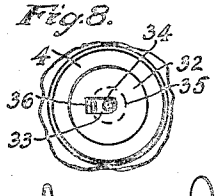


Fig. 8.



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WATER FLOW DETECTOR FOR DUCTS

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Fig. 10.

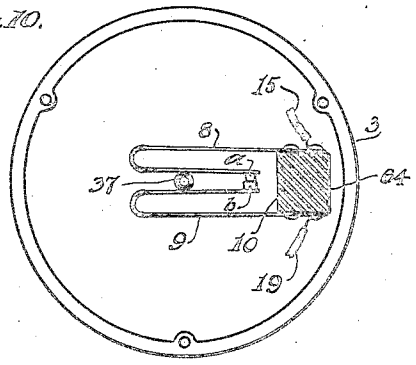


Fig. 9.

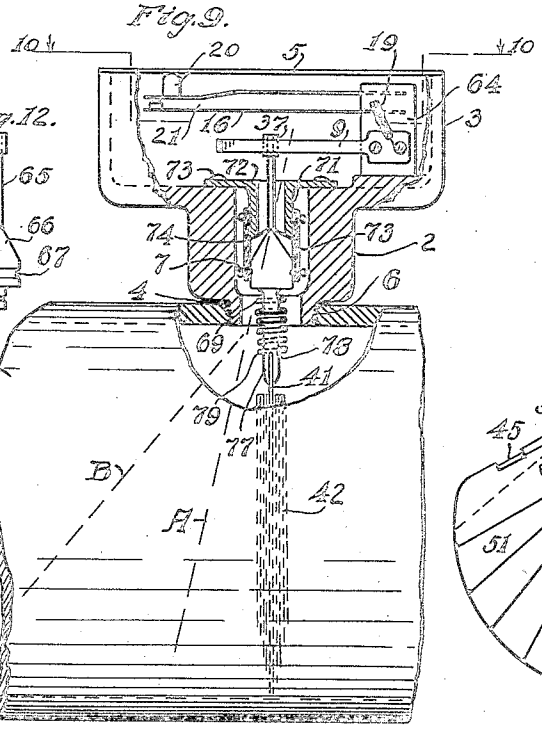


Fig. 11.

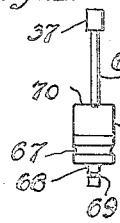
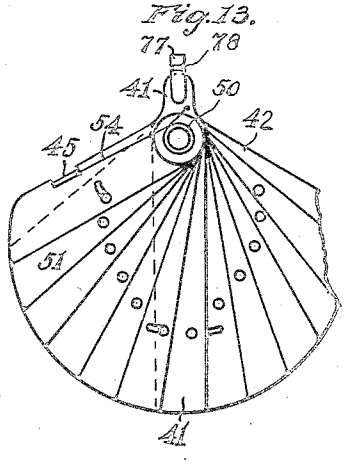


Fig. 12.

Fig. 13.



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UNITED STATES PATENT OFFICE

2,038,111

WATER FLOW DETECTOR FOR DUCTS

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Application May 5, 1931, Serial No. 535,190

14 Claims. (Cl. 200—81)

The present invention relates to an improvement in means for detecting liquid flow movement in ducts or pipes and for either recording such movements or for giving an alarm, upon such liquid flow, which device is provided with a supervisory means to sound an alarm if the apparatus is tampered with.

Such devices are adapted, in one form of use, to be utilized in sprinkler systems such as are usually installed in buildings, to act in case of fire, to throw fire extinguishing fluids thereon.

Another object of the invention is in the manner of constructing the device, so that it may be readily and easily installed in the piping of such sprinkler systems as are already installed, as well as on new systems about to be installed.

Another object is to provide a supervisory means in conjunction with such devices, so that if the device is tampered with, after installation, signals or recording means will be actuated to give indication of such tampering. This device will also act as a fire alarm, in that if a sprinkler system "goes off", the liquid flow will be immediately indicated and will be then accepted as an alarm for fire.

A feature of the construction is to provide air check means for the exclusion of water from electrical contacts controlling initiating alarm means in the apparatus.

The device is simple, easy to install and it is obvious that modifications may be made in the device herein shown without departing from the spirit of the invention nor the scope of the claims.

In the drawings,

Fig. 1 is a fragmentary plan view of the device with the cover partially removed to clearly show the details.

Fig. 2 is a sectional view taken on line 2—2, Fig. 1, looking in the direction of the arrows.

Fig. 3 is a face view of the expanded impulse delivering member with part of the suspension means in section.

Fig. 4 is a separate side view of an assembled impulse delivering member, showing a mode of inserting it into or removing it from a supply pipe of a sprinkler system.

Figs. 5, 6 and 7 are enlarged views of the jointure and connections of the impulse delivering or paddle member to illustrate the electrical and spring tension means, and showing said member in two circuit breaking positions.

Fig. 8 is a detail section taken on the line 8—8 of Fig. 6.

Fig. 9 discloses a modified form of structure over that shown in Figs. 1 and 2, and is a partially sectioned view to show varied details.

Fig. 10 is a plan view of the housing with parts removed to below the line 10—10, Fig. 9 to show the modified switch.

Fig. 11 is a side view of the switch operating member.

Fig. 12 is a similar view of same member rotated one quarter way around to show the V points thereof.

Fig. 13 is a front view of a modified expanding impulse member.

In Figs. 1 and 2, one of the main liquid distributor pipes 1, of a sprinkler system is fragmentarily shown, and as in Fig. 2, it is drilled and tapped with a standard, tapering pipe thread 6, of suitable size, into which is screwed the threaded nipple 4 of a switch housing 2—3, the shoulder 2 of which is bored to form a central chamber 7 therein and which ends at the threaded end of the nipple 4. An upper preferably circular shell 3, open on its face, and closed by a removable cover plate 5, completes the housing structure. As thus made, this housing may be applied by drilling and tapping any standard distributor pipe of a sprinkler system.

In the center of the bore 7, are arranged a pair of normally closed terminal spring arm contacts 8 and 9 supported in an insulated block 10, which seals the upper end of the bore 7, said sealed bore also forms an air check to prevent water from reaching said contacts 8 and 9; said contacts are extended upward beyond said block, and from which, conductors 11 and 12 lead to conductive pieces 13—13 and 14; the conductive pieces 13—13 being in a circuit portion 15, through a tamper switch 16, and on through a magnet or other electro-magnetic device 17 to a source of energy 18, from which wiring 19 returns to the opposite side of the conductive piece or plate 14.

This circuit 15—19 as will be noted is normally closed and contains therein the closed switch 8—9, and the tamper or supervisory switch 16, which is held closed by the cover 5 bearing on a pin 20 on an upper spring arm 21, of said switch, so that if an unauthorized person removes the plate 5 or breaks the same in an attempt to tamper with the apparatus, the upper arm of the switch 16 with its pin 20 will be free to swing upward and break the alarm initiating circuit 15—19, thus releasing armature 23 of the deenergized coil 17 and permitting the spring 25 to force the said armature to close the contact 28 of the alarm circuit 29.

The normally energized core 17 holds a contact

22, on the armature 23 away from an insulated block 24 and against the pull of a spring 25. The block 24, is insulated from its supporting spring arm 26 forming, with a companion spring arm 27, a normally open alarm switch 28 contained in a normally open alarm circuit 29, in which is a source of electrical energy 30 and an alarm device 31. Thus the normally closed switches 8—9 and 16; the circuits 15 and 19, connections 11 and 12, the coil 17, source 18, and spring thrown armature 23, collectively constitute "alarm initiating means" for closing the normally open alarm circuit.

From the foregoing, it will be clearly evident that if by any means, a switch of the closed alarm initiating means just described, be broken, the core 17 would instantly release its armature 23 and the spring 25 would operate to snap the said armature over, causing the contacts 22—24 to engage, and going further would close the said normally open switch 28, thus closing the alarm circuit 29 to operate the alarm.

Fixedly held by a drive fit or by other means to the walls of the bore 7, and at the lower end thereof, is a disk 32, formed with an elongated opening 33 through which a rock-link or stem 34 operates, said link having a disk or collar 35 midway of its length formed with a downwardly directed integral lug or pin 36, to prevent said rock-link from turning in the opening 33 for the reason hereinafter described.

Formed with the rock-link 34 at its top is an insulated head 37 adapted for operative contact with an extended lower portion of the switch member 8, and at its bottom, the link 34 carries a yoke 38, which is pivoted by a cross pin 39, to a lower yoke 40, through which the foldable laminated fanshaped impulse delivering member or paddle 42 is hingedly, but not revolubly supported, for indicating or detecting liquid flow or movement in the distributor pipe 1, of a sprinkler or other system, as hereinafter described.

Rigidly attached to the lower yoke or cross head 40, is the main blade or member 41, of the impulse devise 42, and a tension spring 43 is coiled about the cross pin 39 with one end bearing against the upper wall of the upper yoke 38; the free end 44 of said spring being slidably received in a keeper 45, struck up from the material of the said main blade 41. The purpose of this spring which is comparatively heavy is to maintain the impulse delivering device in normal alignment with the link 34 and its head 37, and to maintain this relative position when a low pressure flow of water is present in the pipe and the head 37 of the link 34 is slightly tilted to break the switch 8—9 thus actuating the alarm initiating means for closing the alarm circuit to sound an alarm indicating water movement in the said pipe as shown in Fig. 7. The impulse delivering device 42 and the attached link 34 and insulated head 37 are returned to the normal position when the water flow ceases, by a bee hive or conical spring 46; but should a high pressure water flow be present in the pipe, the impulse delivering device 42 with its coacting parts would assume the position of Fig. 5, in which the disk 35 will be tilted to cause its edge to contact with or bottom on the disk 32, thus preventing the insulated head 37 from moving the contact arm 8, too far from arm 9, beyond its yield, to retain its resiliency, and as the said disk can tilt no farther, the joint formed by the pin 39, will break against the action or urge of the spring arm 44, and when the high pressure ceases, the springs 44 and 46 will restore the impulse delivering device and its associated parts to the normal position of Fig. 6, with the switch 8—9 closed.

The spring arm 44 serves a further function by permitting the impulse delivering device or paddle 42 to either bend forwardly in a "down stream" position in case of a fire condition when several sprinkler heads are open, or, to bend backward should there be a back rush of water when the system is being drained.

We will now proceed to further describe the construction of the impulse delivering or paddle device against which the water flow impinges and the means whereby it may be folded into compact form for insertion into operative position through a threaded bore in a sprinkler or other pipe.

Immediately below its supporting yoke or cross head 40, the main blade or member 41 of the impulse delivering or paddle device 42 has a drilled hole (not shown) through which a sleeve, tube or bushing 50 is passed and on which a plurality of swingable plates or blades 51 are mounted and held in place by retaining washers 52. In practice, about four plates or blades on either side of the main blade are found satisfactory but more or less may be employed if desired.

A spring coil 53, may be disposed within the sleeve, tube or bushing 50, and it has extended spring terminals or arms 54, their ends being connected in sliding relation with loops 55, struck up from the material of the outer blades 56 of the fan-like impulse delivering device to normally urge the blade members to the operative unfolded or extended position when passed within the pipe, as shown in Figs. 2 and 3 so as to have the device occupy a large cross sectional area of the inner confines of said pipe, said device being maintained at a lateral plane by the lug 36, engaging the slot 33 of the disk 32 as shown in Figs. 5, 6 and 7.

Each of the other or intermediate blades 57 going to make up the impulse delivering device, are similar in structure except as to length which in this characteristic, the blades are progressively longer from the sides of the device toward the center and each has an arcuate end 58 and a side extension 59 for engagement with a turned back hook 60, carried by its neighbor blade, thus interlocking the ends of the blades laterally and circumferentially.

Short wings 61 are also struck up from the blades 56 and 57 to provide limiting stops when the blades are folded for inserting the device through the hole 6 of the pipe 1, said wings 61 abutting the shank of the loop 45 on one side of the device, and a stop 62 struck up from an edge of the main blade 41 at the opposite side, thus the blades may be folded in registration or alinement as in Fig. 4, to pass through the hole 6 of the pipe 1.

In the alternate form, shown in Figs. 10 to 13 inclusive, the function is exactly like that described for Figs. 1 to 9 inclusive. Modification of the structure in this alternate form is made for the purpose of providing a means between the impulse delivering paddle, and the switch means and casing whereby to permit of desired flexibility of the said paddle and connection, but to so construct said connections as to positively exclude the entry of liquid from the distributor pipe to the interior of the switch casing.

In describing the details of this later modification, like parts are given the same indices as for those of similar function as described in the prior described structure.

To this end the distributor pipe 1 has a threaded bore 6, to receive the threaded nipple 4 of the switch housing 2—3. The central chamber 7 in the shoulder 2 joins the chamber of the shell or casing 3, which is closed with a cap plate 5.

In the upper portion of the casing 3 is mounted the supervisory or tamper indicating switch 21 held closed by the cover 5 bearing upon the pin 20, for the same purposes as described for Figs. 1 and 2. The two members forming the supervisory switch 21 are mounted upon the insulating block 64, and are in turn connected in series to the lower switch members 8—9, Fig. 9 by connections not shown but of similar nature to that described and shown for Figs. 1 and 2.

The switches 8—9 shown in plan in Fig. 10 comprises a pair of U shaped members, the outer leg of each of which is longer than the inner legs and are attached to the opposite sides of the block 64 and have lead wires 15—19 leading therefrom to an alarm system 18 to 31, as described and shown for Fig. 1. In normal conditions the inner shorter legs of the switch members 8—9 approach each other at a decreasing angle and bear separate contact points *a—b* respectively, that are normally closed.

An operating member comprising an insulated sleeve 37 is carried on the end of a stem 65 which is fixedly mounted upon the V shaped end of a cylindrical block 66, the upper end of which is cut to a taper or knife edge 70, Figs. 11—12. The lower end of this cylindrical piece is provided with a groove 67, a smaller cylindrical extension 68 having a coil spring engaging groove 69 therein.

As in Fig. 9, the chamber 7 of nipple 2 is closed at its upper face by an affixed tubular member having a downwardly depending tubular extension 71 with an integral flange 72 affixed in a water-tight manner to the bottom wall of the casing by rivets or screws 73. The lower end of the tube 71 is cut with an upwardly transverse tapering seat, as shown, into which the knife blade edge 70 of the block 66 is seated.

Over the outer cylindrical faces of the tube 71 and the block 66 is slipped a flexible rubber tubing 74, around the ends of which are twisted wire fasteners, as clearly shown in Fig. 9. Both the tube and the block are grooved as shown immediately under these wires, as at 67, and the tube 74 is therefore compressed into these grooves in a water tight but flexible manner. The rubber tube may also be vulcanized on to the associate parts, 71 and 66, if desired.

The resiliently collapsible fan like paddle member 42, Fig. 13, is constructed along the same lines as that described for Figs. 3—4, in that it comprises a plurality of separate, stopped blades 51 pivotally attached to a main connection 50, is provided with spring opening means 54 all about as described for Figs. 3—4.

There are only slight differences of construction herein involved. The main difference relates to the manner of attaching the fan or impulse delivering member to the block 66 to operate the switch end 37 to open the switches 7—8, upon the flow of liquid through pipe 1.

For this purpose, the main plate or blade 41, Fig. 13, of the paddle has rigidly affixed at its upper end an upstanding stem 77, grooved as at 78. When this complete paddle is assembled to the block 66, as in Fig. 9, it is connected by its stem 77 to the lower extension 68 of the block 66, by means of a coiled spring 79, Fig. 9. The outer opposite ends of the coiled spring 79 are caught in the grooves 69 and 78 of the members described and is thereby locked in operative position, thus holding the paddle 42 in resilient assembly to the knife blade block 66.

In the structure thus described, the paddle assembly 42 thus connected to the switch opening means 37, to operate the same, by a double resilient connection, comprising spring 79 and rubber tube 74. Thus two joints are formed, one by the knife edge assembly 70—73 and the spring 79. In action a flow of liquid through the pipe 1 would move the paddle to any position A—B shown dotted Fig. 9, thereby to open the switches 8—9 by separating them due to the inclination of the both arms thereof, and give an alarm. If a back surge occurs, it would be in the opposite direction and therefore, due to the tapering arrangement of the inner legs of the switches 8—9, a back movement would leave them unaffected and no alarm would be initiated.

As thus constructed the knife edge joint permits actuation of switch at the proper time, while the coil spring 79, which is fairly rigid, permits the paddle to swing upwardly to clear the pipe as much as possible so as to leave as little obstruction as is necessary to a substantially full flow of liquid thereby.

Thus, the modified form just described permits of flow action to initiate an alarm, allows the impulse delivering or paddle member to move freely out of the way of the moving stream to allow substantially free unobstructed flow of liquid therethrough and does not send an alarm upon back surges or water hammer in the distributor pipes. Owing to the manner of housing and mounting the movable members of this latter structure, water cannot reach the interior of the switch casing 3, while allowing of great freedom of action of the operative parts.

It will further be apparent from the foregoing description, that we evolved an unfailing signal apparatus for detecting liquid flow movement which is quickly attachable to determined pipes in sprinkler systems or in other installations where sensitive alarm devices are required, and supervisory means whereby tampering with the signal device is instantly detected and an alarm actuated.

It is thought that the operation and utility of the device will be apparent without further description and while in the drawings there is illustrated what we now consider the best forms of the device, it is to be understood that the structural elements thereof are susceptible to such variations and modifications as fall within the scope of the invention claimed.

What we claim as new is:

1. In combination, a pipe having an opening therein; a housing having a nipple in said opening having a bore; an insulated block in and sealing said bore; a detector switch comprising members passing through said block and having contact portions between the block and the interior of said pipe; a flow detector in the pipe engaging said detector switch; a fulcrum member in said bore between said contact portions and the interior of the pipe, and partially closing the bore; said block sealing the bore and effecting the function of pocketing air therein and cooperating with the fulcrum member to prevent the passage of water from the pipe to the contact portions.

2. In combination, a pipe having an opening therein; a housing having a nipple in said opening having a bore; an insulated block in said bore; a detector switch comprising members pass-

ing through said block; a flow detector in the pipe engaging said detector switch; a fulcrum member in said bore between said contact portions and the interior of the pipe, and partially closing the bore; said block and fulcrum member cooperating to pocket air in the bore and cooperating with the fulcrum member to prevent the passage of water from the pipe to the switch members.

3. A flow detector comprising fulcrum means adapted to be inserted in a bore; a stem rockably connected to the fulcrum means; a paddle pivotally supported by the stem for movement relative to the stem transverse to the plane of the paddle; and yieldable means to yieldably hold said paddle substantially in a plane of the stem thereby to allow yieldable relative movement between said stem and paddle; said stem being adapted to be removed from said bore, the stem then having the function of carrying and supporting the fulcrum means, the yieldable means and the paddle as a unitary assembly to facilitate easy insertion and removal of said assembly.

4. A flow detector comprising a stem adapted to be fulcrumed; a plurality of blades pivoted at one end on said stem on the same pivotal axis for movement in approximately the same plane with each other and the pin; yieldable means holding said blades yieldably normally diverged to form a paddle pointed toward the outer end of the stem; said means and blade cooperating to result in the function that said paddle will automatically collapse when drawn, in the direction of said pivoted end, through a narrow opening.

5. A flow detector comprising a stem adapted to be intermediately fulcrumed; a plurality of blades pivoted at one end on said stem and converging in the direction of one end of the stem, the free ends of the blades being diverged in a direction away from said end and lying flatwise in a plane of the stem; means holding said blades yieldably diverged; said blades when diverged forming a tapered paddle having a narrow end at the pivoted ends of the blade whereby when the paddle is drawn, with said narrow end first, through a narrow opening, the edges of said opening will engage the outer edges of the paddle and automatically collapse the paddle to facilitate passage of said paddle through the opening.

6. In combination, a flow pipe; a housing having a narrow opening communicating with the side of the pipe; a flow detector comprising a stem intermediately fulcrumed in said housing, and a plurality of blades in said pipe, pivoted at one end on said stem, and converging in the direction of the outer end of the stem, the free ends of the blades being diverged in a direction away from said end and lying flatwise in a plane of the stem and transverse to the pipe; means holding said blades yieldably diverged; said blades when diverged forming a tapered paddle having a narrow end at the pivoted ends of the blade whereby when the paddle is drawn, with said narrow end first, from the pipe through said narrow opening, the edges of said opening will engage the outer edges of the paddle and automatically collapse the paddle to facilitate passage of said paddle from the pipe; said blade having the function of easy collapse by a single hand for insertion through the narrow opening into the pipe.

7. In combination, a flow pipe having an opening therein; a housing having a nipple in said opening having a bore; an insulated block in and sealing said bore remote from the pipe; a detector switch comprising spring members rigidly held in, and passing fluid tight through said block and having contact spring portions between the block and the interior of said pipe; a fulcrum member in said bore between said contact portions and the interior of the pipe, and almost completely closing the bore and provided with a small bore; a flow detector in the flow pipe engaging said detector switch and passing loosely through said small opening; said block sealing the bore fluid-tight and pocketing air therein between said block and fulcrum member and cooperating with the fulcrum member to prevent the passage of water from the pipe through the loose connection at said small opening to the contact portions.

8. A flow detector comprising a support adapted to be fixedly inserted in a hole in the side of a pipe and having a bore; a fulcrum means rockably connected to said support, for movement relative thereto; a stem therein rockably connected to the fulcrum means for movement therewith; a vane pivotally connected to the stem for movement relative to the stem and fulcrum means transverse to the plane of the vane and substantially longitudinally of the pipe; and yieldable means to yieldably hold said vane substantially in alinement with the stem thereby to allow yieldable relative movement between said stem and vane; said stem, fulcrum means, vane and yieldable means being connected together and adapted to be removed outwardly from said bore as a unitary assembly while the support is in the hole.

9. A flow detector comprising a support having a bore and adapted to be inserted in a bore in the side of a pipe; fulcrum means yieldably connected to the support; a stem connected to the fulcrum means; a vane pivotally connected to the stem for movement relative to the stem transverse to the plane of the vane longitudinally of the pipe in either direction; yieldable means to yieldably hold said vane substantially in alinement with the stem thereby to yieldably move the stem and allow yieldable relative movement between said stem and vane and a switch controlled by the stem when moved in one direction.

10. A flow detector comprising a support adapted to be inserted liquid tight in a hole in the side of a pipe, said support having a bore; a stem in said bore; a fulcrum means rockably mounting said stem in the bore; a vane; a pivot means for pivotally connecting the vane to the stem for angular movement relative to the stem transverse to the plane of the vane and supporting the vane; and yieldable means to yieldably hold said vane against said angular movement relative to the stem thereby to allow yieldable relative movement between said stem and vane; said pivot means being movable in a direction substantially longitudinal to the pipe.

11. A flow detector comprising a stem adapted to be disposed in a bore in the side of a pipe; means for rockably supporting said stem in said bore for relative movement of the inner end of the stem longitudinally of the pipe; a vane; pivot means mounted on the inner end of the stem for movement longitudinally of the pipe with the stem and pivotally connecting the vane to said inner end of the stem in and transverse to the pipe for movement relative to the stem transverse to the plane of the vane and longitudinal to the pipe; and yieldable means to yieldably hold said vane substantially in alinement with

the stem thereby to allow yieldable relative movement between said stem and vane.

12. In combination, a flow pipe; a housing having a narrow opening removably communicating with the side of the pipe; a flow detector comprising a stem fulcrumed to said housing; and a vane in said pipe connected at one end on said stem, and having its side edges adjacent to said stem converging in the direction of the stem; said vane being yieldably extended transverse to the pipe and forming a tapered vane having a narrow end at the stem-end of the vane; means so connecting the side portions of said vane to the intra-marginal part of the vane that when they are in normal extended position pressure on the side edges directly toward each other will collapse the vane; the taper of the vane toward the stem being so gradual that when the housing, stem and vane drawn from the pipe through said narrow opening, the edges of said opening will engage the outer edges of the vane and automatically collapse the vane to allow the passage of said vane from the pipe.

13. In combination, a flow pipe; a housing having a narrow opening removably communicating with the side of the pipe; a flow detector comprising a stem fulcrumed to said housing, and a vane in said pipe, connected at one end on said stem, and disposed transverse to the pipe, in part substantially in the axis of the stem; said vane being yieldably extended transverse to the pipe; means so connecting the side portions of said vane to the intra-marginal part of the vane that when they are in normal extended position pressure on the side edges directly toward each other will collapse the vane, whereby the vane has the function of easy collapse by a single hand for insertion through the narrow opening into the pipe.

14. A flow detector comprising a housing adapted to be inserted in a bore in the side of a pipe; an elongated yieldable fulcrum means; mounting means securing one end of the fulcrum means to said housing with the fulcrum means disposed longitudinally of said bore, leaving the other end of the fulcrum means free and movable transverse to the bore and longitudinal to the pipe; a stem disposed longitudinally in the fulcrum means and having one end part secured to said free end and movable therewith, said stem being movable angularly of said bore; a pivot means secured to the inner end of said stem and supported by the stem and the yieldable fulcrum means and movable longitudinally of the pipe as the pin and fulcrum means move; a collapsible vane pivotally supported by the pivot means for movement angularly relative to the stem and for movement longitudinal to the pipe and transverse to the plane of the vane; and yieldable means carried by the pivot means and vane to yieldably hold said vane substantially in alinement with the stem thereby to allow yieldable relative movement between said stem and vane; said fulcrum means and mounting means being adapted to be removed outwardly from said pipe; the yieldable fulcrum means then having the function of carrying and supporting the mounting means, the stem, the yieldable means and the vane as a unitary assembly.

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