

Feb. 3, 1942.

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2,271,535

WELL FLOWING DEVICE

Filed Aug. 3, 1940

4 Sheets-Sheet 1

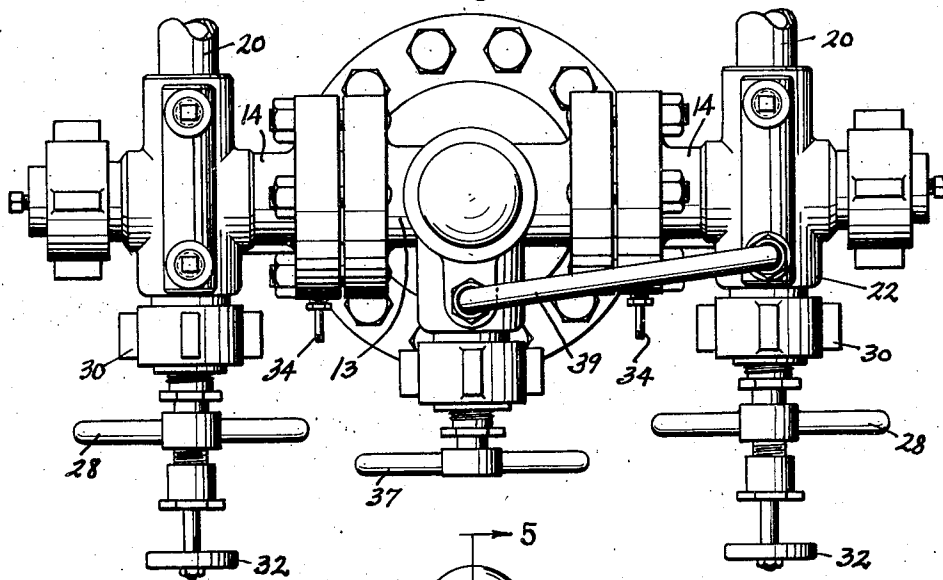


Fig. 2.

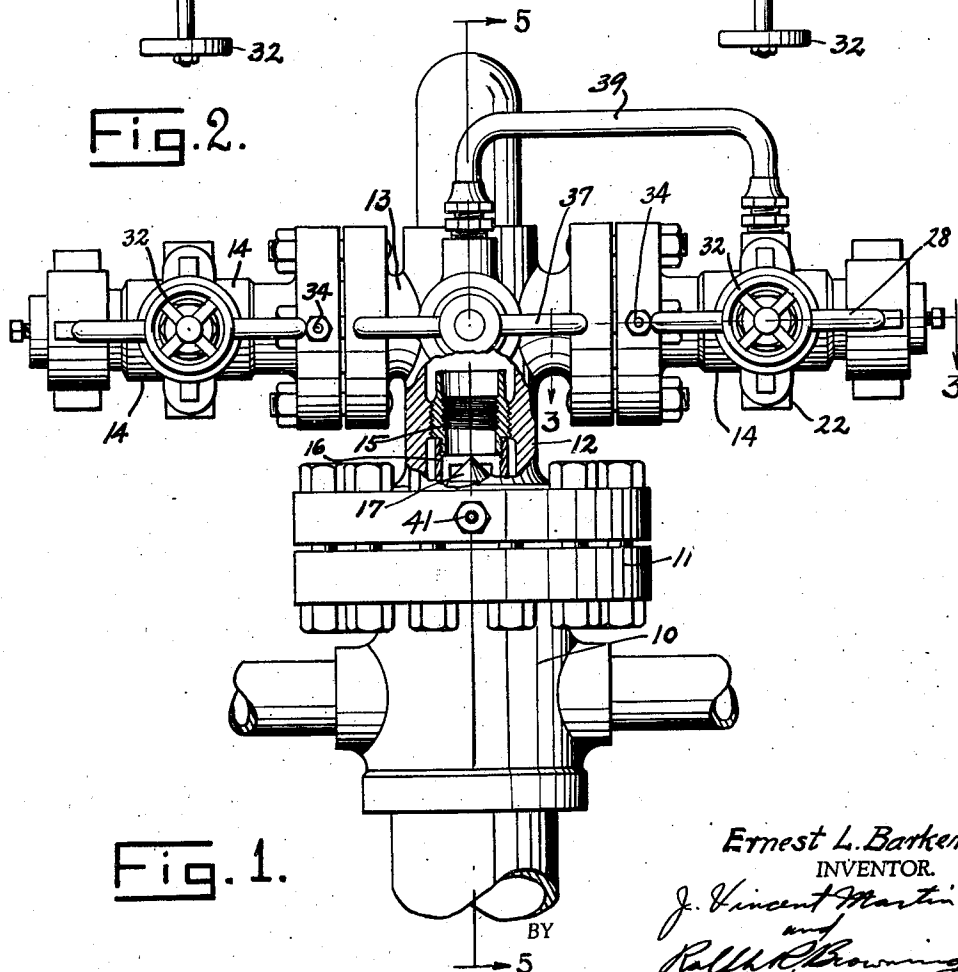


Fig. 1.

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4 Sheets-Sheet 2

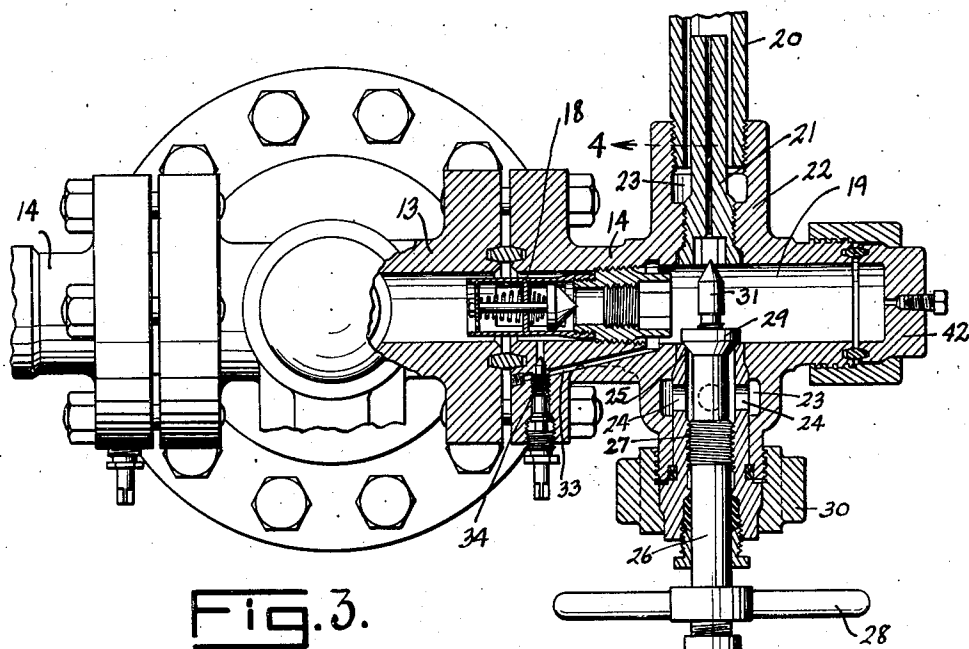


Fig. 3.

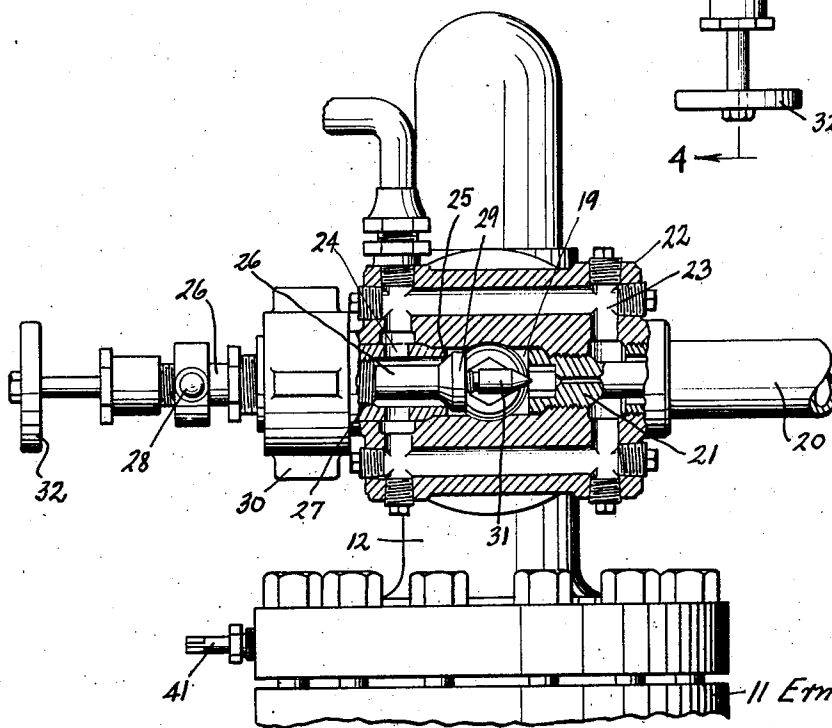


Fig. 4. BY

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4 Sheets-Sheet 3

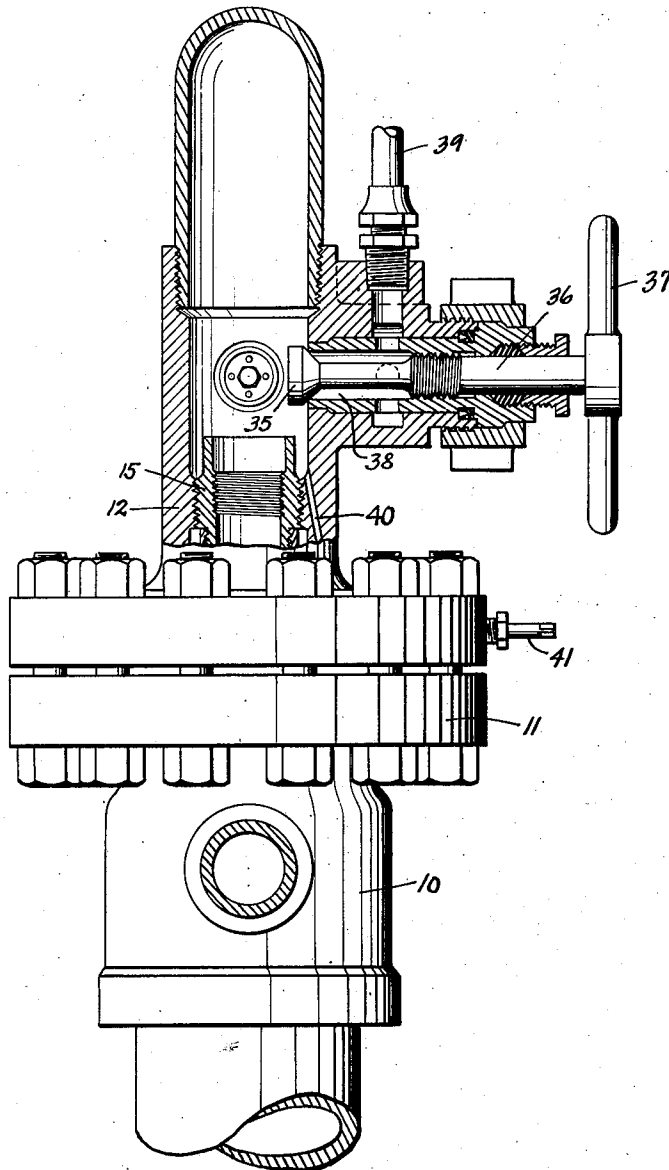


Fig. 5.

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4 Sheets-Sheet 4

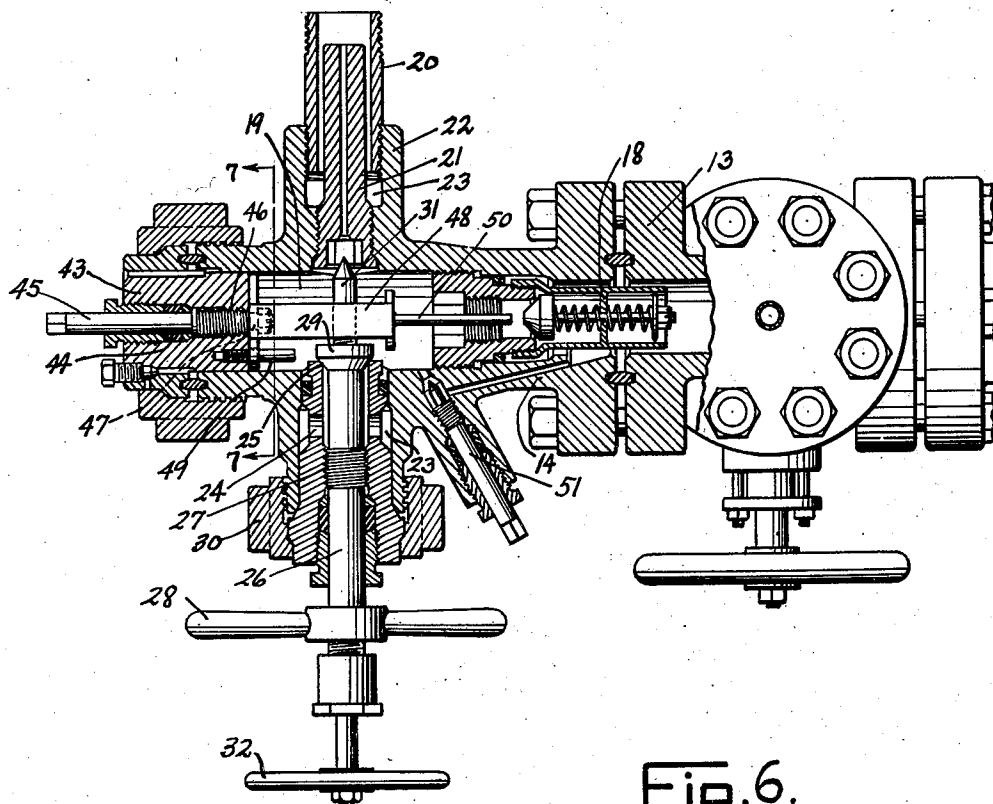


Fig. 6.

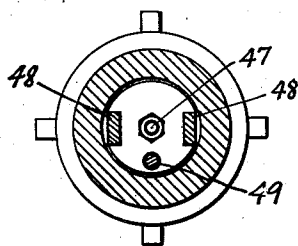


Fig. 7.

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UNITED STATES PATENT OFFICE

2,271,535

WELL FLOWING DEVICE

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Application August 3, 1940, Serial No. 350,325

11 Claims. (Cl. 166—2)

This invention relates to well flowing devices, and more particularly to devices which may be used on oil or gas wells and which are operable to cut off the flow when said flow exceeds a predetermined velocity. In my previously filed application, Serial No. 234,128, filed October 10, 1938, now Patent No. 2,233,077 granted I described a cut-off device which, broadly, performs this function, and the present invention concerns an improvement on said device.

Where the cut-off device described in my previous application is used in above ground or well head connections, such as the structure commonly referred to as a Christmas tree, it is obviously desirable to provide some means for closing off the flow through the main line or through any of the branches at will. This is necessary to permit replacement or repairing of connections, etc. The gate valves customarily employed for this purpose are cumbersome and involve a multiplicity of connections in addition to being expensive.

Accordingly, it is an object of this invention to provide a means whereby the gate valves or the like customarily employed may be dispensed with.

It is a further object to provide a means for controlling my automatic cut-off valve, so that it can be caused to open or close at the will of the operator.

Another object of this invention is to facilitate the use and operation of oil well connections utilizing my automatic cut-off valves.

Another object is to provide a control means for causing such an automatic cut-off valve to open and close at the will of the operator, thereby starting or stopping the flow of fluid through the line when desired.

Further objects and features will become evident from the following disclosure when taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation, partly in section, of a Christmas tree embodying my invention;

Fig. 2 is a plan view of the device shown in Fig. 1;

Fig. 3 is a cross-section taken along line 3—3 of Fig. 1;

Fig. 4 is a cross-section taken along line 4—4 of Fig. 3;

Fig. 5 is a cross-section taken along line 5—5 of Fig. 1;

Fig. 6 is a view similar to Fig. 3 showing a slight modification; and

Fig. 7 is a section taken along the line 7—7 of Fig. 6.

Referring to the drawings in detail, a casing head 10 has a flange coupling 11 which supports the Christmas tree organization. This comprises an upright portion 12 and an integral cross 13 which is coupled to the two lead-off connections 14. Referring to Figs. 1 and 5, the upright portion 12 is threaded internally to receive a bushing 15 which carries a valve housing 16 and an automatic valve structure similar to that set out in my aforementioned previous application, the valve plunger being shown at 17.

The operation of this automatic valve is such that, when the velocity of the fluid therethrough reaches a certain point, the plunger 17 closes against its seat on the bushing 15 to cut off the flow. On the other hand, when the pressure which holds the plunger closed drops to a predetermined value, the plunger is forced by a spring to open position.

As may be seen more clearly in Fig. 3, each of the lead-off connections 14 carries an automatic valve organization 18, as described above, therein. These valves are set to close on a smaller velocity than the valve in the upright portion, because the flow, being divided among a plurality of lines, is smaller in the lead off connections, but in contraction the valves may be identical.

The lead off connections include a pressure chamber 19 (see Fig. 3) and a flow pipe 20, with a choke 21 therebetween. The flow pipe is connected to the pressure chamber by being threaded into an enlarged portion 22, and said enlarged portion is formed with ducts 23 which lead to the space between the choke 21 and the flow pipe 20. The ducts also communicate, by means of apertures 24, with a valve seat 25 in the pressure chamber 19. Thus, when the valve seat is unobstructed, fluid may flow from the chamber 19 through the ducts 23 and into the flow pipe 20, by-passing the small bore of the choke 21, and greatly increasing the velocity of flow past the valve 18, thus closing this valve.

In order to provide manually operable means for causing this operation to take place, there is a hollow valve stem 26 threaded into a bushing in the enlarged portion as at 27, having a handle 28 and a valve head 29. It will be seen that rotation of the handle 28 will cause the valve head 29 to unseat from the seat 25, permitting the fluid to by-pass the choke 21 and increasing its velocity. This increase in velocity will cause the automatic valve 18 to close and shut off the flow entirely.

While the flow is thus stopped, connections may be replaced or repaired, etc. or any desired operation may be performed at any point downstream from the valve 18. In order to provide access to the chamber 19, the manually operable valve 26 may be removed by unscrewing a collar 30. This will permit ready removal and replacement of the choke 21 if desired.

When it is desired to cause the automatic valve 18 to open and permit the flow of the fluid through the lead-off again, a needle valve 31, screw-threaded inside the hollow valve stem 26 and operated by a hand wheel 32, is utilized. By turning the hand wheel 32, the needle valve 31 is caused to enter and close the bore of the choke. When the valve head 29 is also closed, this completely closes off the pressure chamber 19. A bleeder duct 33 is formed in the wall of the lead off connection connecting the downstream side of the valve 18 with the chamber 19, and this bleeder can be opened or closed by a needle valve 34. Therefore, when the pressure on the downstream side is permitted by these means to bleed into the chamber 19 until it reduces the differential on the two sides of the valve to a predetermined value, the spring of the valve 18 will cause it to open. Then the wheel 32 may be turned to open the bore of the choke 21, and the bleeder 33 closed by needle valve 34 to place the device in operation.

In order to effect the closing of the main line automatic valve 17, there is provided a valve head 35 operated through a threaded stem 36 by handle 37 (see Fig. 5). This valve head controls the opening of a duct 38 which leads to a pipe 39 connected to one of the ducts 23, to increase the flow past the valve 17 and thereby cause automatic valve 17 to close when handle 37 is turned. In the wall of the upright portion 12 there is formed a bleeder duct 40, which is similar in structure and operation to bleeder 33, and is controlled by needle valve 41. Automatic valve 17 can therefore be opened by closing off both chambers 19, as explained above, and permitting pressure to bleed from the downstream side of the valve 17 into the space above.

It will be seen that I have produced an efficient manually operable means for opening or closing my automatic valves in an oil well structure such as a Christmas tree. By means of this invention, any one of the lead off lines, or the well itself, may be closed off at will to permit repairs, replacements, etc., and at the same time the automatic valves are left in condition to be rendered operative whenever desired. I do not wish to be limited to the specific form described herein, but only by the scope of the appended claims.

In the modification shown in Fig. 6, the respective parts are all in substantially the same relation in the structure just described, and have been given corresponding numerals. The bull plug 42, however, which appears at the right in Fig. 3, has in Fig. 6 been replaced with a plug 43 which carries a stuffing box 44 through which extends a stem 45. The stem 45 is threaded into the plug 43 at 46 and at its inner end is connected by a swivel connection 47 to the yoke 48. This yoke 48 straddles the valve member 31 and is kept from rotating about its axis by a pin 49 set in the inner end of the plug 43. At its end remote from the stem 45 the yoke 48 has a valve unseating projection 50.

It will be seen that when the valve 18 is closed it may be quickly and positively opened by ro-

tating the stem 45 until the projection 50 contacts the valve and unseats it.

In Fig. 6 also, the needle valve 51, instead of being set in the flange of the fitting as shown in Fig. 3, is set in the main body portion of the fitting and at an angle to the axis of the incoming line. This makes for a more convenient and compact construction, although the function of the needle valve remains the same.

I claim:

1. In a device of the class described, a flow pipe, an automatic cut-off valve responsive to fluid velocity in said pipe, manually operative means for effecting an increase in fluid velocity to close said valve, and additional manually operative means to equalize the pressure on the upstream and downstream sides of said valve to open the valve.

2. In a device of the class described, a flow pipe, an automatic cut-off valve responsive to fluid velocity in said pipe, an obstruction in the pipe on the downstream side of the valve, and manually operative means for effecting closure of said valve, said means comprising ducts for bypassing said obstruction.

3. In a device of the class described, a flow pipe, an automatic cut-off valve responsive to fluid velocity in said pipe, an obstruction in the pipe on the downstream side of the valve, and manually operative means for effecting closure of said valve, said means comprising ducts for bypassing said obstruction, and additional means for causing said valve to open, said means comprising a bleeder duct to equalize pressure between the upstream and downstream sides of the valve.

4. In a device of the class described, a flow pipe, an automatic cut-off valve responsive to fluid velocity in said pipe, a choke in said pipe on the downstream side of said valve, a duct bypassing the choke, a manually operative valve controlling said duct and with said duct constituting means to increase the fluid velocity through and thereby close said valve, and additional means to open said velocity-responsive valve, comprising a bleeder duct with a manually operative valve to equalize pressure between the downstream and the upstream side of said velocity-responsive valve.

5. In a device of the class described, a flow pipe, an automatic cut-off valve responsive to fluid velocity in said pipe, a choke in said pipe on the downstream side of said valve, a duct bypassing said choke, a manually operative valve in said duct and with said duct constituting means for increasing the velocity through and thereby closing said velocity-responsive valve, additional means for causing said velocity-responsive valve to open comprising a needle valve for closing said choke which forms when closed and when the duct valve is closed a closed compartment on the downstream side of the velocity-responsive valve, and a valved bleeder between the downstream side of said valve and its upstream side to equalize the pressure.

6. In combination with a flowing well, a main flow pipe, an automatic cut-off valve responsive to velocity of flow in said pipe, a plurality of lead-off flow pipes from said main pipe, similar valves in each of said lead-off pipes, said last-mentioned valves being set to close under less velocity than said first-mentioned valve, separate manually operative means on each pipe to cause its valve to close by increasing the flow therethrough, and additional manually operative

means on each pipe to cause its valve to open by equalizing the pressure on the downstream and the upstream side.

7. In combination, a main supply conduit, branch conduits leading therefrom, a normally open valve in each of said conduits adapted to be closed by an excessive velocity of flow in said respective conduits, and means for effecting an increase in velocity of flow through any one of said valves to cause it to close without closing any of the other of said valves.

8. In combination, a main supply conduit, branch conduits leading therefrom, a normally open valve in each of said conduits adapted to be closed by an excessive velocity of flow in said respective conduits, the valve in said main conduit being adapted to permit a greater flow than the other valves without closing, and means for effecting an increase in velocity of flow through said main conduit valve to cause it to close without causing an increase in flow through any of said other valves.

9. In combination, a main supply conduit, branch conduits leading therefrom, a normally open valve in each of said conduits adapted to

be closed by an excessive velocity of flow in said respective conduits, the valve in said main conduit being adapted to permit a greater flow than the other valves without closing, and means for effecting an increase in the velocity of flow through one of said other valves to cause such other valve to close without closing the valve in the main conduit.

10. In a device of the class described, a flow pipe, an automatic cutoff valve responsive to fluid velocity in said pipe to close when said fluid velocity exceeds a predetermined value, and mechanical means for positively engaging said valve when in closed position and moving it to open position.

11. In a device of the class described, a flow pipe, an automatic cutoff valve responsive to fluid velocity in said pipe to close when said fluid velocity exceeds a predetermined value, manually operative means for effecting an increase in fluid velocity to close said valve, and mechanical means for positively engaging said valve when in closed position and moving it to open position.

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