March 10, 1942. E. C. BRISBANE 2,275,608

FLUID CONTROL SYSTEM

Filed July 5, 1940 4 Sheets-Sheet 1

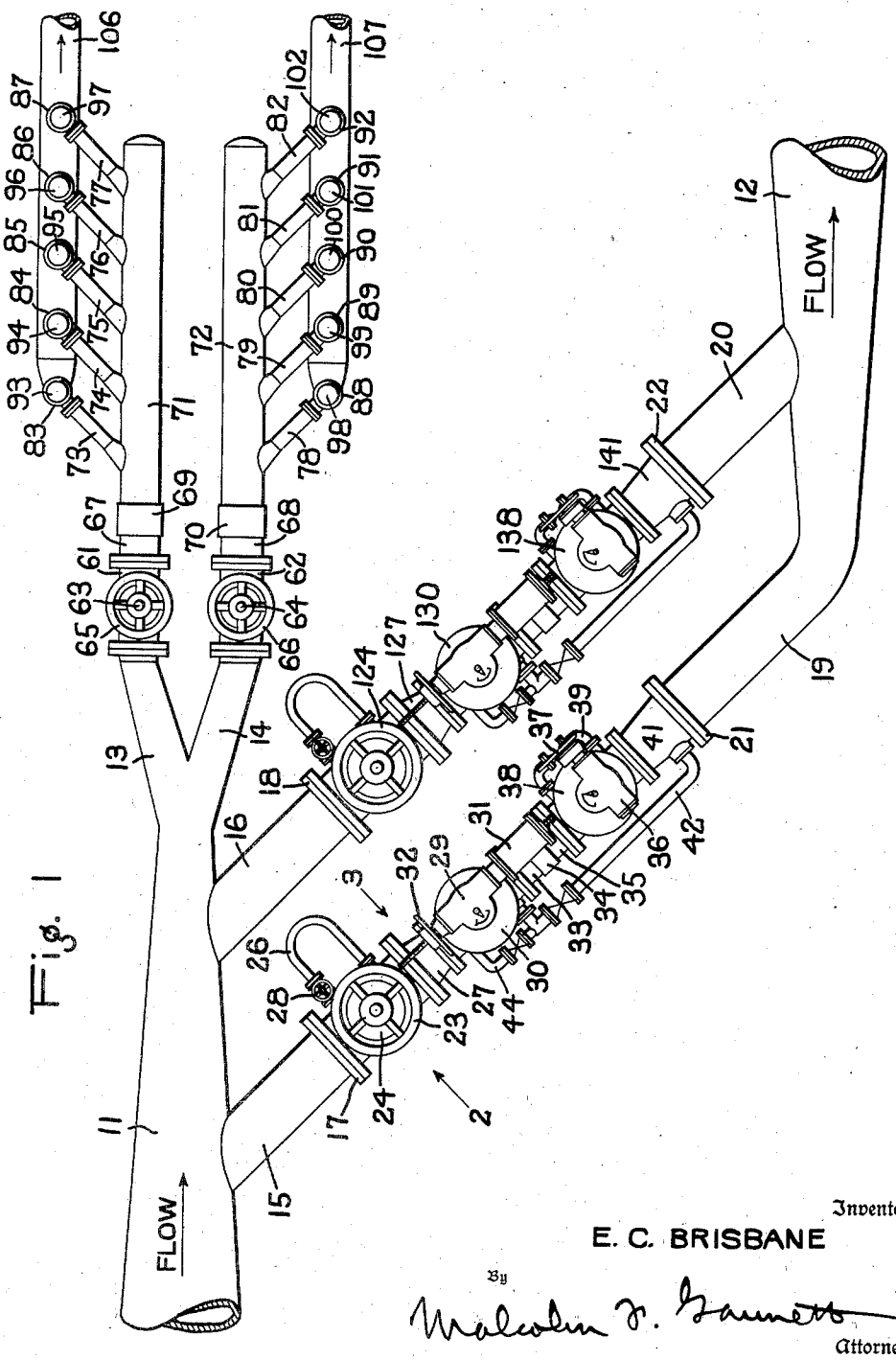


Fig. 1

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Filed July 5, 1940 4 Sheets-Sheet 2

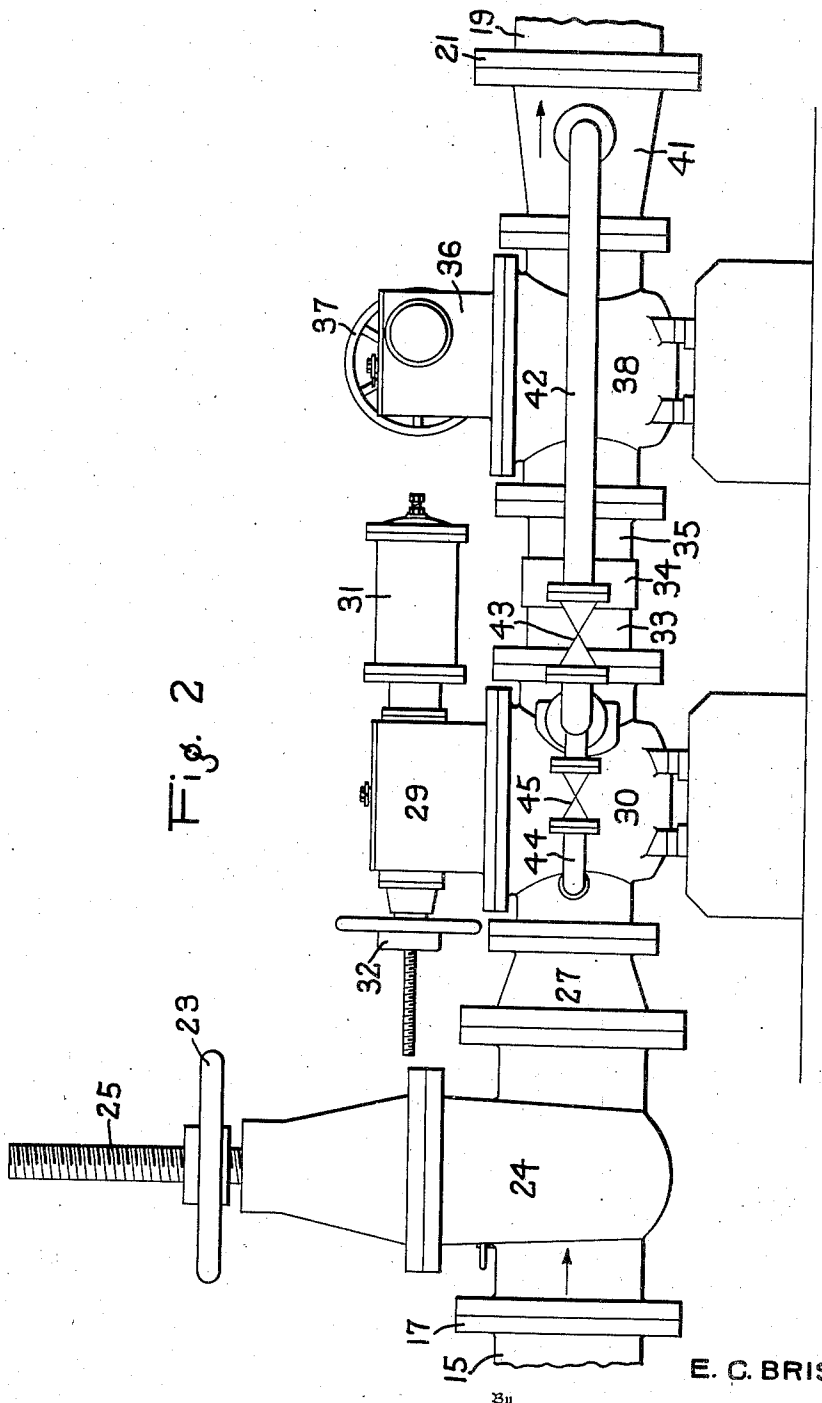


Fig. 2

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FLUID CONTROL SYSTEM

Filed July 5, 1940 4 Sheets-Sheet 3

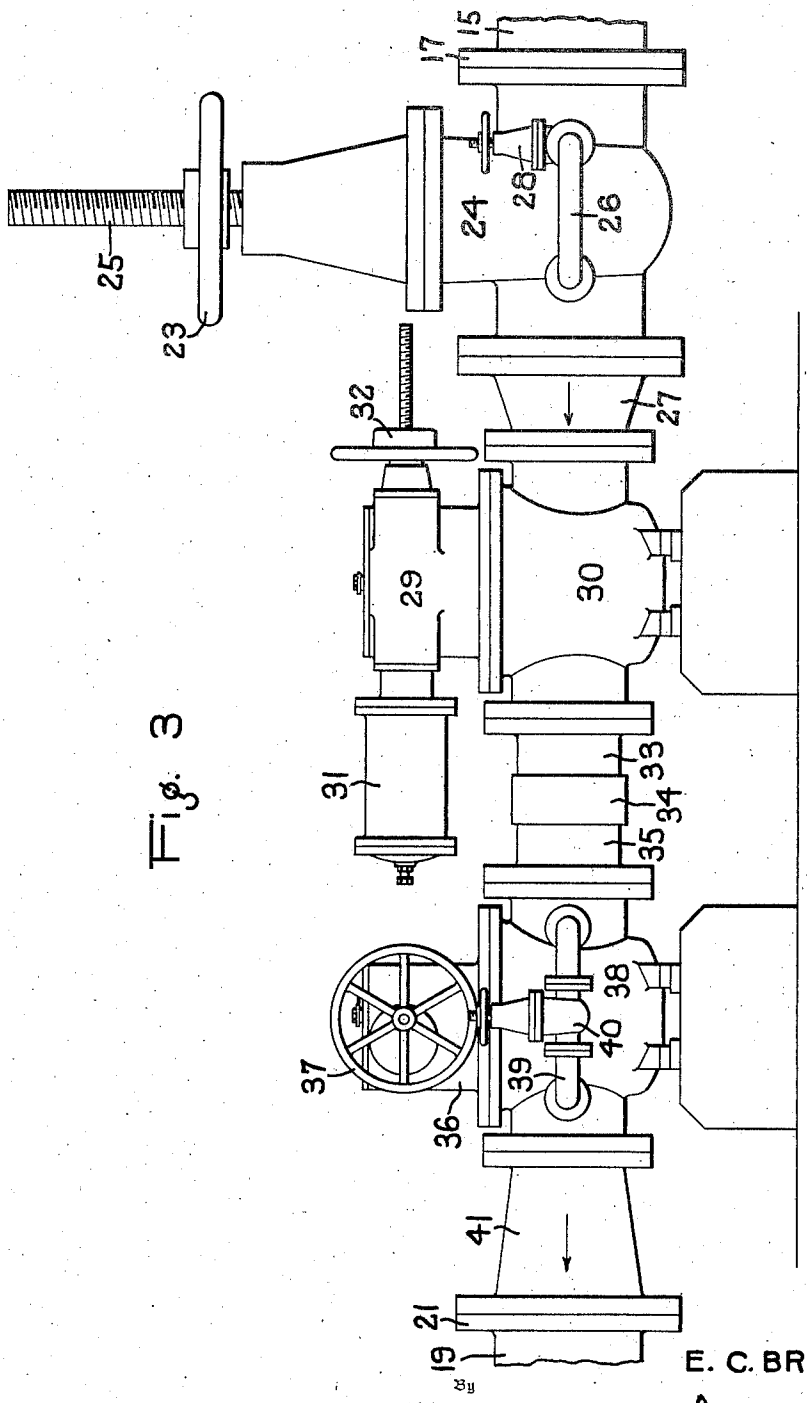


Fig. 3

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FLUID CONTROL SYSTEM

Filed July 5, 1940 4 Sheets-Sheet 4

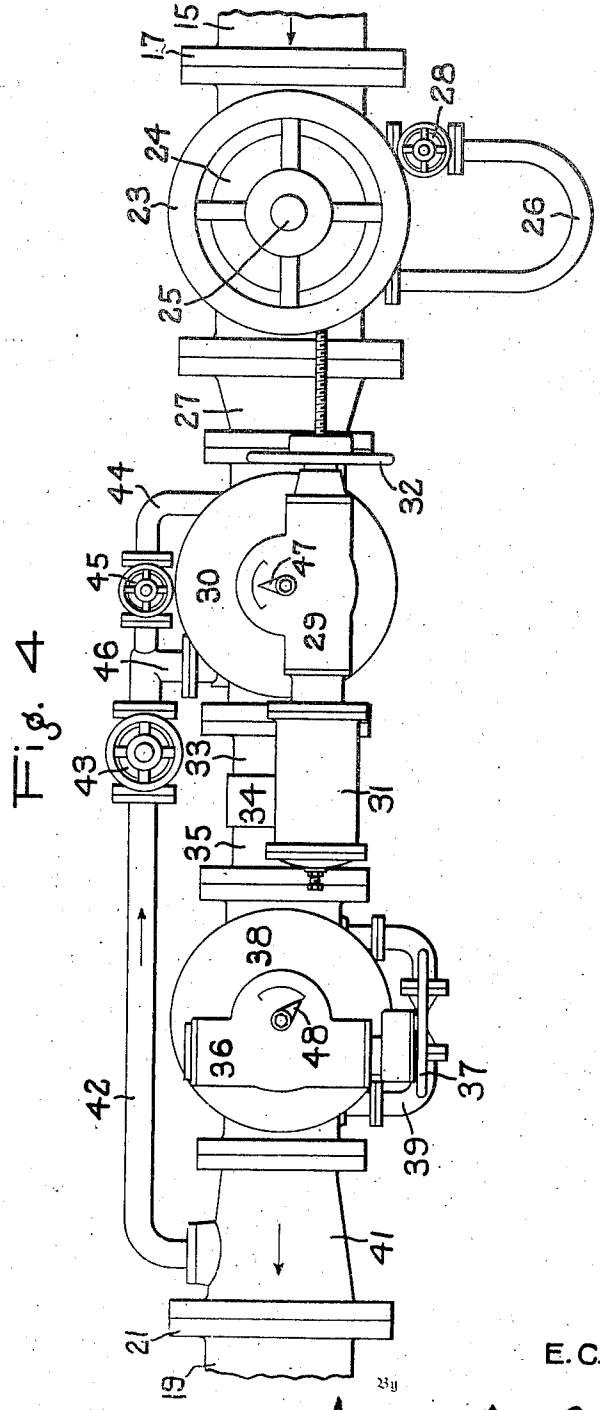


Fig. 4

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FLUID CONTROL SYSTEM

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Application July 5, 1940, Serial No. 343,963

2 Claims. (Cl. 137—78)

This invention relates to fluid control systems.

An object of the invention is to provide an improved fluid control system embodying control valves arranged in the feed line of a water distribution system so as to maintain a predetermined minimum pressure on the upstream side of the valves and also to cut off the flow when the pressure of the fluid on the downstream side of the valves drops below a predetermined amount.

With the foregoing and other objects and advantages in view, the invention consists in the preferred construction and arrangement of the several parts which will be hereinafter more fully described and claimed.

In the accompanying drawings:

Figure 1 is a plan view of a fluid control system embodying the present invention;

Fig. 2 is a side elevation of a portion of the structure shown in Fig. 1 looking in the direction of the arrow 2, Fig. 1;

Fig. 3 is a view similar to Fig. 2 looking in the direction of the arrow 3, Fig. 1; and

Fig. 4 is a plan of the structure shown in Fig. 3.

Referring to the drawings, and especially to Fig. 1, the feeder line comprises two sections 11 and 12, with the control mechanism installed therebetween in the manner hereinafter more fully described.

From a pipe of desired uniform diameter the pipe 11 is gradually tapered or reduced in diameter, and near its end is formed with two branches 13 and 14. In other words, the reduced end portion of the pipe 11 is constructed in the form of a Y.

Upstream with respect to the Y branches 13 and 14, the pipe 11 is formed with two branch pipes 15 and 16.

The pipes 15 and 16 are preferably disposed at an angle of approximately 45° with the longitudinal center line of the pipe 11, said pipes 15 and 16 being arranged in parallel relationship to each other and having flanges 17 and 18 formed on their outer ends, respectively.

From a pipe of desired uniform diameter the section 12 is gradually tapered or reduced in diameter in the direction upstream with the direction of flow.

At its inner end the pipe 12 is formed with two angularly disposed sections 19 and 20, which sections at their ends are formed with flanges 21 and 22, respectively.

The pipe 19 is adapted to be disposed in alinement with the longitudinal center line of the pipe 15, and the pipe 20 is likewise adapted to aline with the longitudinal center line of the pipe 16.

The flanges 21 and 22 are spaced a considerable distance from the flanges 17 and 18, respectively, and interposed in the spaces between the flanges are two valve control mechanisms, respectively, of similar construction.

Arranged end to end between the pipe flanges 17 and 21 is a gate valve 24, a tapered pipe section or reducer 27, an automatically operable type of cone or tapered plug valve 30, a short piece of pipe 33, a union 34, another short piece of pipe 35, a manually operable cone or tapered plug valve 38, and a tapered pipe or increaser 41.

The gate valve 24 may be of well known construction in which the gate is raised and lowered by means of an operating wheel 23 operatively connected with the gate shaft 25. In Figs. 2 and 3 the gate valve 24 is shown in valve open position.

There is a by-pass 26 around the gate of the valve 24, communication through said by-pass being controlled by a valve 28, which in Fig. 3 is shown in closed position.

The automatically operable cone valve 30 may be of well known design, such as the valve shown in United States Patent No. 2,153,885, April 11, 1939, Valve apparatus, invented by D. D. Goldberg and A. R. Kligman.

An automatically operable cone valve of the patented type has plug operating mechanism in a housing 29, a power cylinder 31 for operating the plug operating mechanism, and also manually operable means such as a threaded rod and hand wheel mechanism 32 for also operating the plug operating mechanism.

The manually operable cone valve 38 has an operating mechanism in a housing 36 similar to the operating mechanism of the automatic cone valve 30, said operating mechanism being actuated by manually operable means, such as a hand wheel 37.

There is a by-pass 39 around the plug of the valve 38, communication through said by-pass being controlled by a valve 40, which in Fig. 3 is shown in closed position.

A pipe 42 connected at one end to the valve 30, on the downstream side of said valve, and connected at the other end to the increaser 41 on the downstream side of the valve 38 provides means for breaking vacuum in the pipe line.

Communication through the pipe 42 is controlled by a valve 43.

The construction and function of the pipe 42

and the valve 43 is similar to that shown and described in my Patent No. 2,125,330 of August 2, 1938, Means for breaking vacuum in pipe lines. In the patent, the pipe and the valve are referred to by the reference numerals 26 and 28, respectively.

There is a by-pass 44 around the plug of the valve 30, communication through said by-pass being controlled by a valve 45, which is normally in closed position.

As shown in Figs. 2 and 4 the adjacent ends of the pipes 42 and 44 may be connected together so that a single pipe 46 (Fig. 4) is connected to the downstream side of the valve 30.

In Fig. 4 the valve 30 is shown by indicator 47 in partly opened position, while valve 38 is shown by indicator 48 as being in wide open position.

Arranged end to end between the pipe flanges 18 and 22 is a gate valve 124, a reducer 127, an automatically operable type of cone or tapered plug valve 130, a manually operable cone or tapered plug valve 138, and an increaser 141, said elements corresponding in construction, arrangement and function to the elements 24, 27, 30, 38 and 41 heretofore referred to.

It will be understood that the pair of similar control devices which, in Fig. 1 are shown arranged between the pipes 11 and 12, may be used singly or collectively in the manner to be hereinafter more fully described.

The pipes 13 and 14 function as means by which two sets of relief valves may be connected to the main pipe line 11.

Connected to the pipe 13 is one side of a valve 61, and connected to the pipe 14 is one side of a valve 62.

The valves 61 and 62 may be of any type. In the present instance these valves are shown as being gate valves of the manually operable type.

Each gate valve 61, 62, has a valve element or gate, an operating stem 63, 64, respectively, for said gate, and a hand wheel 65, 66, respectively, for operating the stems 63, 64.

The side of the valve 61 opposite to the side to which the pipe 13 is connected is connected to a pipe 67, and the side of the valve 62 opposite to the side to which is connected the pipe 14, is connected to a pipe 68.

The pipes 67 and 68 are respectively connected by unions 69 and 70, to manifolds 71 and 72, respectively.

The manifold 71, which is closed at its outer end, has a series of pipes 73, 74, 75, 76 and 77 projecting laterally therefrom, and the manifold 72 is correspondingly formed with branch pipes 78, 79, 80, 81 and 82.

Connected to the branch pipes 73 to 82 inclusive, are relief valves designated by the reference numerals 83 to 92 inclusive.

While each manifold 71, 72 is shown as having five relief valves connected thereto, it will be understood that any number of relief valves may be used, depending upon actual operating conditions of the fluid control system.

Any type of relief valve may be used. In the present instance the relief valves are shown as being of the type described in United States Letters Patent No. 2,104,934, granted January 11, 1938, to Arthur G. Smith.

Relief valves of the Smith type have characteristics which lend them applicable for use with the present invention, since these valves operate to quickly establish communication by which the pressure of fluid is immediately relieved when the pressure increases above a predetermined amount. Such valves also operate to shut down or cut off communication therethrough gradually or slowly after the pressure of the fluid has reduced a predetermined amount, thereby preventing sudden changes in the pipe line pressure, which sudden changes usually cause water hammer, surges, and the like.

Each relief valve 83 to 92 inclusive is similar in construction and as said relief valves are fully described in the above referred to Smith patent, no detailed description thereof is deemed necessary herein.

Associated with each relief valve is a counterweight which controls the operation of the valve in accordance with variations in fluid pressure. The counter-weights of the relief valves are indicated at 93 to 102 inclusive, respectively, in Fig. 1.

The relief valves 83 to 87 inclusive, are connected to a sewer or free discharge 106, and the relief valves 88 to 92 inclusive are connected to a sewer or free discharge 107.

Since the relief valves are adapted to operate successively upon a predetermined increase in pressure of the fluid in the main pipe line, the respective counterweights thereof are so constructed that the relief valves operate successively at different pressure levels.

Under ordinary operating conditions fluid flows through both of the pipes 15, 19 and 16, 20, from the main pipe 11 to the main pipe 12, the rate of flow being controlled by the automatic cone valves 30 and 130, respectively. Also, the gate valves 61 and 62 are opened wide so that fluid under pressure from the pipe 11 is in the manifolds 71 and 72, respectively.

The dual arrangement of the valves 30 and 130 enables communication through either of the lines 15, 19 or 16, 20 connecting the pipes 11 and 12 to be individually controlled, and in case of emergency or other instances, communication through either of the connecting lines can be entirely cut off by the manual operation of either of the gate valves 24 and 124, respectively, without affecting the flow of the other connecting line.

During the operation of the fluid control system, when it is desired to cut off communication through either the line 15, 19, or the line 16, 20, the gate valves 24 or 124 are closed.

For instance, should it be desired to cut off communication through the line 15, 19 the gate valve 24 is closed. Since the cone valve 30 is operated by fluid flow conditions, the closing of the gate valve 24, with the resultant cutting off of fluid pressure in the line on the downstream side of the gate valve 24, automatically effects closing of the cone valve 30. With the cone valve 30 thus closed, if desired, the valve 38 can be manually operated to closed position. On the other hand, should for any reason the cone valve 30 fail to operate automatically in response to variations in flow conditions, the valve 38 can be manually closed and the operating mechanism of the cone valve 30 can be manually closed by operating the hand wheel 32.

Assuming that the three main valves 24, 30 and 38 are closed and it is desired to establish communication through the line 15, 19, the valve 28 is opened so as to admit fluid from pipe 15 into pipe 27. When the valve 24 is then opened, since the pipe 27 will contain fluid there will be no rush of fluid through the valve 24. Valve 38 can also be opened, and valve 30 will open automatically in well known manner.

When the valve **30** is closed, the pressure of the fluid in pipe **33** will be lower than the pressure of the fluid in pipe **27**. Consequently when the plug of valve **30** is being turned towards its open position, there will be an onrush of fluid from pipe **27** through the valve **30** to the pipe **33**. This onrush of fluid through the valve **30** is apt to produce a vacuum in the upstream portion of the pipe **33**. This vacuum is due to the fact that insufficient fluid flows through the valve **30** while the plug of said valve is being turned to open position. In order to destroy the vacuum, the valve **43** is opened. The static pressure of the fluid in the pipe **41**, that is to say, the pressure of the fluid in the pipe beyond the point in the pipe line in which the vacuum pocket is formed, is considerable. Therefore, due to the difference in the fluid pressure at opposite ends of the pipe **42**, there is a tendency for the fluid to flow through the pipe **42** in the opposite direction to the direction in which the fluid flows through the main pipe line when the valve **30** is open. Consequently when fluid under pressure is introduced into the vacuum pocket the pressure will be increased, with the result that the vacuum is destroyed. When the vacuum is destroyed the flow through the pipe **42** in the direction of the arrow, Fig. 4, will cease. The valve **43** can then be closed.

After the plug of the valve **30** has opened the desired amount the flow through the pipe line **15**, **19** will be automatically controlled by the valve **30** in well known manner.

The control elements for the pipe line **16**, **20** function in the same manner as has been described for the control elements of the pipe line **15**, **19**.

Where a multiplicity of small size relief valves is employed, and each relief valve is adapted to operate only at a predetermined pressure level, when there is a small surge or slight increase of pressure of the fluid in the main pipe line **11**, only one or two of the relief valves will be actuated to relieve the pressure. In case of a large surge or perceptible increase in the pressure of the fluid in the main pipe line **11**, additional relief valves are actuated.

By providing a plurality of relief valves adapted to successively operate, only the number of relief valves will be actuated for a predetermined load condition which will instantly relieve such condition. In this way the flow of fluid from the pipe line **11** to the pipe line **12** is limited to the predetermined maximum pressure desired, and since the valves **30** and **130** control the flow of fluid from the pipe line **11** to the pipe line **12**, the desired volume of fluid in pipe line **12** will remain substantially constant.

Having thus described my invention, what I claim is:

1. A fluid flow control system comprising a series of three valves arranged end to end in the space between the ends of two pipes, a by-pass around the gate of said first valve having means for controlling fluid flow from one side of the gate to the other side thereof when the gate is closed so as to build up a predetermined amount of pressure on the downstream side of the first valve prior to the opening of its gate, said second valve having a plug operable by fluid pressure actuated mechanism responsive to the pressure of fluid in the conduit between the first and the second valves, a by-pass around the plug of the second valve having means therein for controlling the fluid flow therein, a by-pass around the plug of the third valve having means for controlling the fluid flow therein, a pipe connected at one end to the downstream side of the second valve and connected to the conduit at the downstream side of said third valve for conducting fluid from the pipe on the downstream side of the third valve backwardly to the second valve for breaking vacuum in the conduit on the downstream side of the second valve when the plug of the second valve is moved from closed towards open position.

2. A fluid flow control system comprising a pipe leading from a source of fluid supply, a valve connected on one side to the main pipe and connected on the other side to one end of a reducer, a second valve connected on one side to the other end of the reducer and connected on the opposite side to one side of a third valve, the opposite side of the third valve being connected to one end of an increaser having its opposite end connected to a second main pipe, a by-pass around the gate of said first valve having means for controlling fluid flow therein, a by-pass around the gate of said first valve having means for controlling fluid flow therein, a by-pass around the plug of the second valve having means for controlling the fluid flow therein, a by-pass around the plug of the third valve having means for controlling the fluid flow therein, a pipe connected at one end to the downstream side of the second valve and connected at the other end to the increaser on the downstream side of said third valve for conducting fluid from the second main pipe backwardly to the second valve for breaking vacuum in the line between said second and said third valves.

EUGENE C. BRISBANE.