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FLUID CONTROLLING MECHANISM

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Fig. 1.

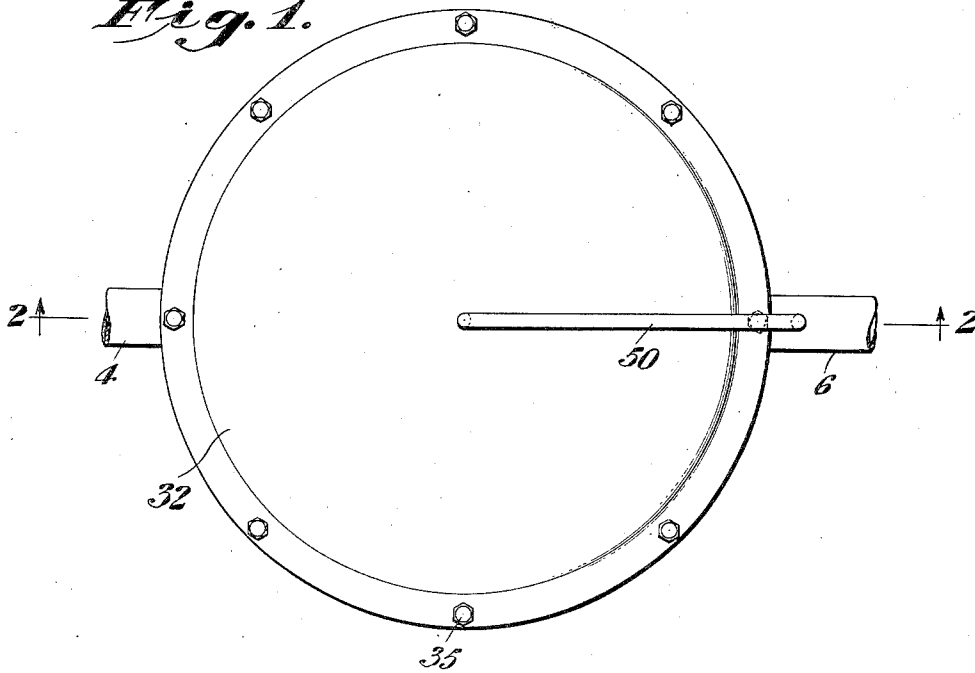
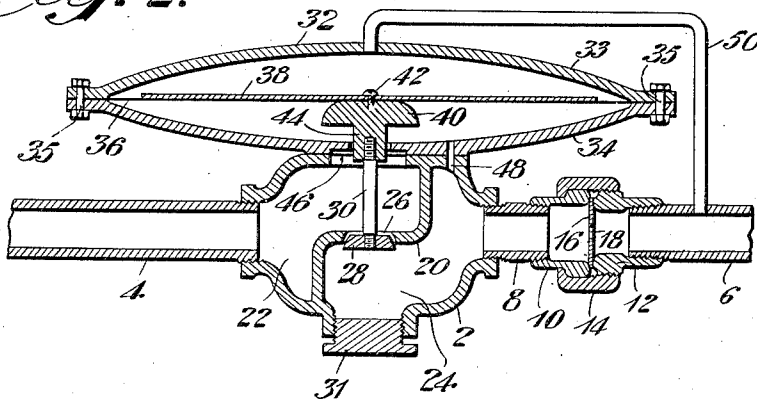


Fig. 2.



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EARL S. RUSH, OF BARTLESVILLE, OKLAHOMA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO DOHERTY RESEARCH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

FLUID-CONTROLLING MECHANISM.

Application filed November 19, 1920. Serial No. 425,196.

This invention relates to fluid controlling mechanism, and the illustrated embodiment of the invention is particularly intended for use in the distribution of natural or artificial gas to limit the quantity of gas which any consumer may take from the supply mains.

It has heretofore been possible for a consumer of gas to take from the supply mains an amount of gas dependent only upon the capacity of the service piping under his control and the pressure of the gas in the mains. Distributors of gas, therefore, have had to take into account the possibility that a number of consumers may simultaneously withdraw from the mains amounts of gas greatly in excess of their normal demands. In order to cope with such an exigency, it has been the practice to maintain the gas in the mains, so far as possible, at a pressure which will permit withdrawal of gas considerably in excess of the amount normally withdrawn from them. In the distribution of gas, however, it is found that leakage from the mains is greatly accelerated by increase in pressure, in consequence of which the maintenance of pressures calculated to provide for the exigency above referred to often entails great loss of gas. Moreover, it sometimes happens, for example, due to the growth of a city, that the normal demand on the supply mains is greater than that which was contemplated at the time they were laid, with the result that it is impossible, even at high pressures, to keep sufficient gas in them to supply all consumers adequately when a considerable number of the consumers are withdrawing gas from the mains in excess of their normal demands. In such an event, consumers close to the source of supply, where the gas pressure is naturally greatest, may be able to draw as much gas from the mains as they may desire, whereas consumers at the other ends of the mains may be unable to obtain enough gas to satisfy their normal needs.

It is an object of this invention to provide a device which may be installed in each of the lines of service piping of a gas distributing system to limit the demand on the line, to the end that each consumer may be assured of a normal supply of gas at all times. The maximum allowed flow of gas through the

service lines so controlled is preferably somewhat greater than the normal demand but is so proportioned to it as to enable sufficient pressure to be maintained in the lines so that a normal supply of gas may always be procured on any of the lines.

It is a well-known principle governing the conductance of fluids that if the flow of a confined fluid is restricted at a point in a fluid conductor, the withdrawal of fluid from the delivery side of the point of restriction will cause the pressure on that side to become less than the pressure on the other side of the point of restriction. Moreover, the extent of the pressure differential of a fluid on opposite sides of a point of restricted flow bears a definite relation to the rapidity of withdrawal of the fluid; that is, the more rapid the withdrawal of the fluid, the greater is the drop in pressure at the point of restriction.

It is a further object of the invention to provide a device in which the principle above enunciated may be utilized to limit the quantity of fluid which may pass thru the device in any given unit of time.

With these objects in view, an important feature of the invention resides in the provision of a fluid conductor having associated therewith means for causing a drop in pressure of fluid passing through the conductor, and means for controlling the passage of fluid through the conductor in accordance with the pressure differential of the fluid on opposite sides of the first-mentioned means without regard to the actual pressure of the fluid. In the illustrated construction, the means for causing a drop in pressure of the fluid comprises an orifice disk disposed in the fluid conductor on the outlet side of a valve casing, and the flow of fluid through the valve casing is controlled by a valve actuated by a diaphragm located outside of the main path of flow of fluid through the conductor the pressure of the fluid on opposite sides of the orifice disk being transmitted to opposite sides of the diaphragm.

The above and other features are illustrated in the accompanying drawings, in which:

Fig. 1 is a view in plan of a demand limiting device embodying the preferred principle of the invention; and

Fig. 2 is a view in elevation of the device taken along the line 2—2 of Fig. 1 and looking in the direction of the arrows.

The illustrated device comprises a fluid conductor adapted for use in connection with a domestic gas meter and including a valve casing 2 and inlet and outlet pipes 4 and 6 respectively.

As shown, the means for causing a drop in pressure of gas passing through the conductor comprises a short pipe 8 screwed into the outlet side of the valve casing 2 and a union composed of sections 10 and 12 held together by a flanged unit 14 and having clamped between them a disk 16 provided with an orifice 18. The sections 10 and 12 of the union are threaded exteriorly on the pipe 8 and the outlet pipe 6 respectively. It is apparent that with this construction, the nut 14 may be screwed off to the left as seen in Fig. 2 and the members 8 and 10 turned slightly away from the member 12, thus enabling the orifice disk 16 to be readily removed and another disk substituted therefor.

The valve casing 2 is divided by a wall 20 into an inlet chamber 22 and an outlet chamber 24, and connecting the chambers 22 and 24 is a port 26. The flow of gas thru the port 26 is controlled by a valve 28 carried on the lower end of a valve stem 30. Access may be had to the chamber 24 and valve 28 by removing a screw plug 31 at the bottom of the valve casing 2.

Mounted on the valve casing 2 is a second casing 32 comprising oppositely disposed meniscus-shaped sections 33 and 34 secured together at their peripheries by bolts 35. Clamped between the sections 33 and 34 is a diaphragm 36 carrying an incubus plate 38 and a diaphragm stop 40 connected to each other and to the diaphragm 36 by a screw 42. The stop 40 is formed with a reduced portion 44 extending thru an opening in the lower section 34 of the diaphragm casing 32 into the valve casing 2 where it is joined to the upper end of the valve stem 30. The passage of gas from the inlet chamber 22 of the valve casing to the diaphragm casing 32 is prevented by a diaphragm 46 surrounding the stop 40 and having an area such that the pressure of the gas in the chamber 22 on the diaphragm substantially balances the pressure on the upper surface of the valve 28.

To the end that the valve 28 may control the flow of gas through the port 26 in accordance with the pressure differential on opposite sides of the orifice disk 16, a port 48 is provided in the outlet chamber 24 of the valve casing 2 and the lower section 34 of the diaphragm casing 32 to enable the pressure in the chamber 24 to be imparted to the under side of the diaphragm 36, and a pipe 50 is tapped into the outlet pipe 6 and the upper section 33 of the casing 32 to transmit the

pressure of the gas in the outlet pipe 6 to the upper side of the diaphragm 36.

The manner of operation of the illustrated device will now be described. Assuming that there is no flow of gas through the device, the pressures on opposite sides of the orifice disk 16 and diaphragm 36 will be equal, and the weight of the plate 38, diaphragm stop 40, valve stem 30, and valve 28 will maintain the valve 28 in fully opened position. Upon withdrawal of gas from the outlet pipe 6, the pressure in the pipe 6 will decrease more rapidly than that in the outlet chamber 24 of the valve casing 2, in consequence of which the pressure on the upper side of the diaphragm 36 will become less than that on the under side of the diaphragm. So long, however, as only a relatively small flow of gas is set up in the outlet pipe 6, the pressures on the opposite sides of the diaphragm 36 will vary to a relatively small extent only, so that the weight of the valve 28 and its associated parts will still maintain the valve in open position. If, however, gas is withdrawn rapidly from the outlet pipe 6, the pressure on the upper side of the diaphragm 36 will be so reduced that the greater pressure of the gas against the under side of the diaphragm will cause it, and, consequently, the valve 28 to be raised. When the valve 28 is raised, the flow of gas from the inlet chamber 22 to the outlet chamber 24 is reduced or discontinued, with the result that the pressure in the outlet chamber 24 gradually approaches that in the outlet pipe 6 until a point is reached where the weight of the valve 28 and its associated parts more than counter-balances the difference in pressure on the sides of the diaphragm. At such time, of course, the diaphragm 36 is again depressed, thereby opening the valve and permitting more gas to flow through the valve casing.

When the maximum allowed quantity of gas is being withdrawn from the outlet pipe 6, a condition of equilibrium is established in the demand limiting device wherein the pressure differential of the gas on opposite sides of the diaphragm 36 equals the combined weight of the plate 38, stop 40, valve stem 30 and valve 28. It is apparent, therefore, that if the combined weight of the above-mentioned parts is increased or decreased, while the size of the orifice 18 remains unchanged, the maximum allowed flow of gas through the device will be increased or decreased respectively.

Inasmuch as an increased flow of gas may be obtained with a given pressure differential by increasing the size of the orifice 18 in the orifice disk 16, it is manifest that the maximum allowed flow of gas may be increased by substituting for the orifice disk 16 a disk having a larger orifice. Conversely, if a disk having an orifice of less size is substituted for the

disk previously in use, the maximum allowed flow of gas is decreased. Accordingly, a convenient method of varying the maximum allowed flow of gas through the device is to substitute orifice disks having orifices of different sizes, without otherwise modifying the device.

It will be clear from the foregoing that a supply of gas may always be withdrawn from the device and that the gas can pass through it in a given quantity only, such quantity being predetermined by the area of the diaphragm 36, the weight of the valve 28 and associated parts, and the size of the orifice in the orifice disk.

An important advantage of the device is that the valve-actuating element, namely, the diaphragm 36, is located outside of the main path of flow of the gas through the device so that it is substantially unaffected by the dynamic force of the gas passing through the device and is governed only by the pressure differential of the gas on opposite sides of the orifice disk 16. Consequently, the device does not have to be calibrated for differences in the actual pressure of gas in the mains, and devices of like standard construction may be used in gas distributing systems or portions of the same system where the actual pressure of the gas varies.

Another advantage of the device is that orifice disks having orifices of different sizes may be used without modifying the effective area of the diaphragm 36. Consequently, the capacity of the device may be changed without affecting the pressure differential necessary to cause the valve to be actuated. The fact that the maximum differential across the orifice disk is thus maintained constant tends toward uniformity in the operation of the device.

A still further advantage of the device of this invention is that the proper operation of the diaphragm 36 and valve 28 is not interfered with by the presence of dirt or other foreign material in the gas, as is likely to occur in a device in which the valve-actuating member moves bodily in close juxtaposition to other parts of the device.

The invention having been described, what is desired to be secured by Letters Patent of the United States is:

1. A fluid controlling mechanism comprising a fluid conductor, an orifice disk for causing a drop in pressure of fluid passing through the conductor, a valve for controlling the passage of fluid through the conductor, a valve actuating element responsive to the pressure differential of the fluid on opposite sides of the orifice disk and movable independently of the orifice disk so that orifice disks having orifices of greater or less size may be used without affecting the pressure

differential necessary to cause the valve to be actuated, and means for transmitting the pressure of the fluid on opposite sides of the orifice disk to opposite sides of the valve actuating element.

2. A fluid controlling mechanism comprising a fluid conductor having a tubular fluid passage, a disk extending transversely of the passage of the conductor and formed with a single opening of less area than a transverse section of the passage of the conductor to restrict the flow of fluid through the conductor and thereby to cause a drop in pressure of the fluid, a valve for controlling the passage of fluid through the conductor, and means for actuating the valve in accordance with the differential pressure of the fluid on opposite sides of the disc.

3. In a fluid controlling mechanism, a fluid conductor comprising a valve casing, a valve in the valve casing, a diaphragm casing connected to the valve casing; a diaphragm in the diaphragm casing operatively connected to the valve, a fluid connection between the valve casing and the adjacent side of the diaphragm casing on the outlet side of the valve, an orifice disk in the fluid conductor at the delivery side of the valve casing for causing a drop in the pressure of fluid passing through the conductor, and a fluid connection between the fluid conductor at the outlet side of the orifice disk and the side of the diaphragm casing remote from the valve casing, the construction being such that the pressures of the fluid in the valve casing and the fluid conductor on opposite sides of the orifice disk are transmitted to opposite sides of the diaphragm so that the valve is actuated in accordance with the differential between such pressures.

4. A maximum demand fluid regulator, comprising a valve, and means for actuating the valve upon an abnormal increase in flow beyond a predetermined maximum including a restricted orifice through which the fluid flows, a flexible diaphragm operatively connected with the valve and weighted with a removable weight so as to normally maintain the valve wide open, and passages from the upper and lower sides of the diaphragm to the outlet and inlet sides, respectively, of the orifice, substantially as described.

5. A maximum demand fluid regulator, comprising a valve normally wide open, means for actuating the valve upon an abnormal increase in flow beyond a predetermined maximum, including a removable restricted orifice not accessible to the user, and a diaphragm subject to the differential pressure between the two sides of the orifice, substantially as described.

In testimony whereof I affix my signature.
EARL S. RUSH.