Dec. 23, 1924. 1,520,668

J. T. WILKIN

FLUID GOVERNOR METER

Filed May 7, 1923

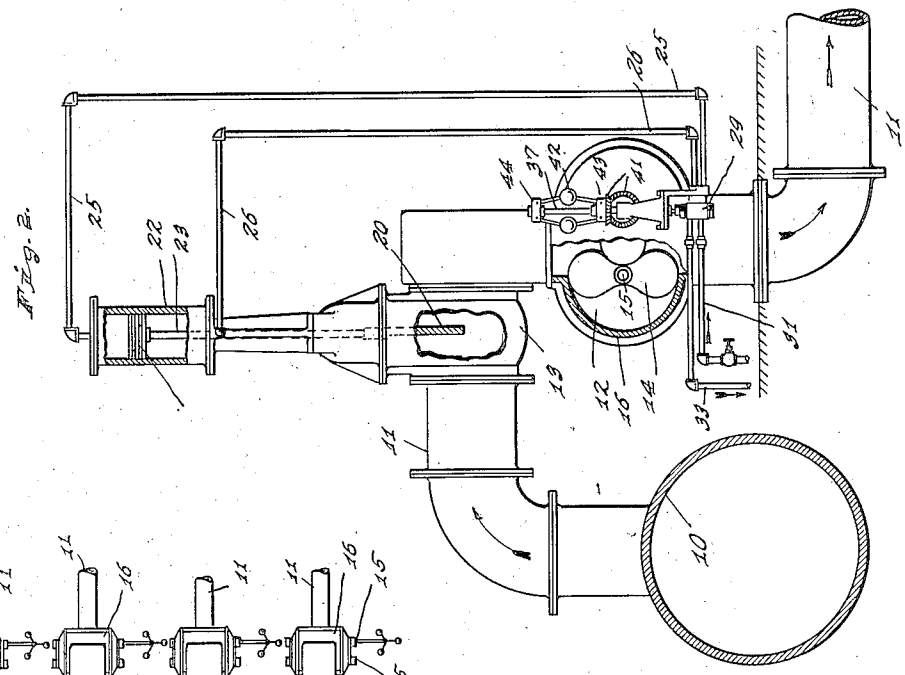


Fig. 2.

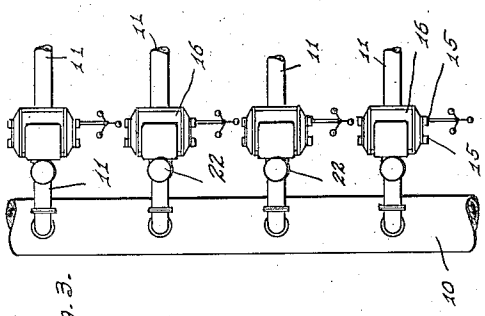


Fig. 3.

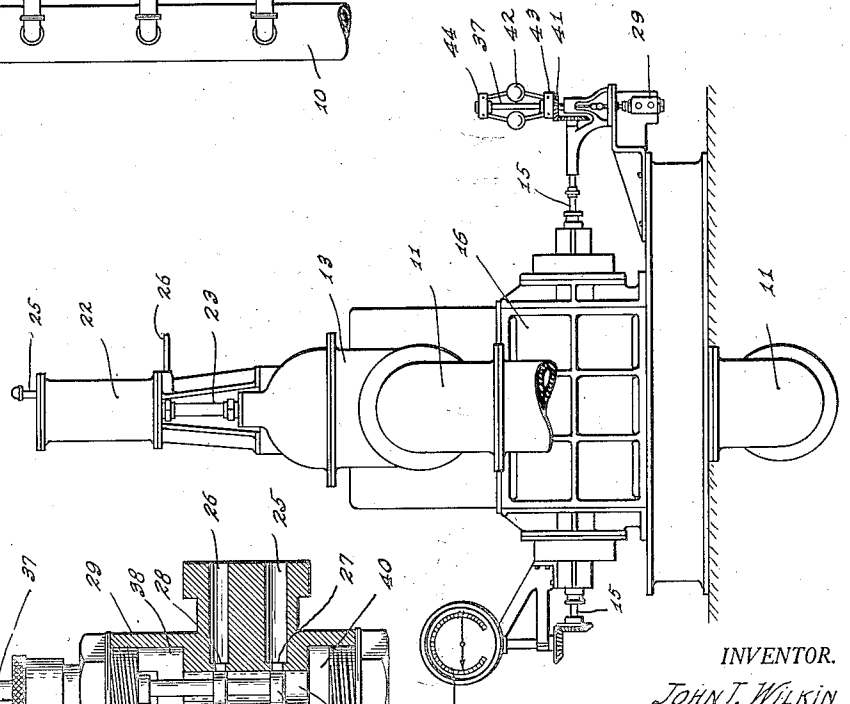


Fig. 1.

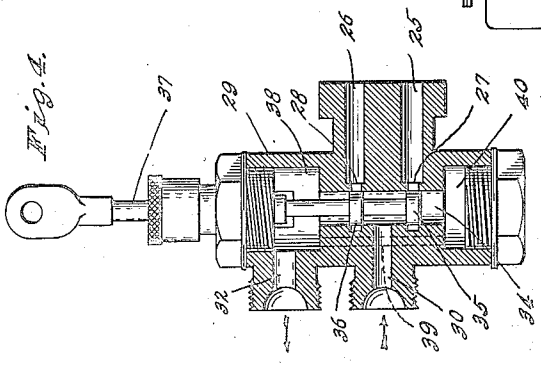


Fig. 4.

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UNITED STATES PATENT OFFICE.

JOHN T. WILKIN, OF CONNERSVILLE, INDIANA, ASSIGNOR TO THE CONNERSVILLE BLOWER CO., OF CONNERSVILLE, INDIANA, A CORPORATION OF INDIANA.

FLUID GOVERNOR METER.

Application filed May 7, 1923. Serial No. 637,381.

To all whom it may concern:

Be it known that I, JOHN T. WILKIN, a citizen of the United States, residing at Connersville, in the county of Fayette and State of Indiana, have invented a new and useful Fluid Governor Meter, of which the following is a specification.

It is the object of my invention to govern and measure the rate of flow of fluid through a pipe, especially in chemical plants; and to reduce to a minimum the loss of power occasioned by the throttling control when such throttling is effective for stabilizing; and from a more specific aspect to govern the division of fluid-flow among a plurality of pipes, all supplied from the same main.

In many chemical processes gases are passed up through washers, mixers, saturators, or aerators containing liquids, and it is desirable that the flow of gas through each unit be at a substantially constant rate and that a proper division of gas flow be maintained among the parallel units, of which there are usually a number in the plant, all supplied from the same main. Unless there is some regulation, the division of gas-flow among the units is unstable; for upon any slight increase in the flow through one unit for any cause, the increased flow of gas serves to reduce the back-pressure from the liquid; by reason of the mixture of a greater quantity of gas with it and the consequent lessening of the weight of the liquid per unit of volume; and because of this there is a tendency to increase further the flow through that unit which already has too large a flow. In other words, with several parallel-connected units there may arise a tendency for one unit to "hog" the gas by taking an increasingly greater part of the total gas, thus overloading itself and robbing the other units of their share, with consequent decrease in effectiveness of operation.

In such processes it has been the practice to control the flow of gas to each unit by means of a throttle valve in the branch pipe leading from the main. If anything like stability and uniform results are obtained by the throttling system, the head pressure in the main must be considerably higher than the pressure required to do the work in the tanks, thus resulting in great loss of power through the throttle valves.

By my invention I obtain practically equal and uniform flow of gas to the several units, and reduce to a minimum the loss of power by throttling. While I have above referred to my invention in connection with chemical plants and in connection with washers, mixers, saturators and aerators, this is merely by way of example, as showing one use of my invention, and is not a limitation of the use to which my invention may be put.

The accompanying drawing illustrates my invention: Fig. 1 is a front elevation of a fluid governor-meter embodying my invention; Fig. 2 is a side elevation of such governor-meter, with some parts broken away and in section, and with the gas-connections diagrammatically indicated; Fig. 3 is a plan of a battery of my governor-meters, in branch lines from a common supply main; and Fig. 4 is a vertical central section through the pilot valve of Figs. 1 and 2.

The main 10 may be a main of a gas plant, or other suitable main, and supplies a fluid such as gas to other pipes 11, of which there may be one or more. In Fig. 3, four such pipes are shown. These pipes, if in a gas plant, may lead respectively to the washers where gas is bubbled through water to remove ammonia and other water-soluble constitutents.

In order to regulate the rate of flow through each pipe 11, both per se and in relation to the rate of flow through other pipes 11, I place in each pipe 11 a rotary displacement meter 12, and a control valve 13 which in accordance with my invention is controlled by the speed of the displacement meter 12 to maintain such speed substantially constant. The valve 13 may be either ahead of or behind the displacement meter 12.

The meter 12 may take various forms, so long as it is of the displacement type; but the type which I prefer is of the two-lobed-impeller type, wherein two impellers 14 mounted on parallel shafts 15 and having lobes which interfit with each other as the shafts 15 rotate in opposite directions are turned by the flow of fluid passing them, the impellers being mounted in the usual casing 16 with the wall of which one lobe of an impeller comes into contact as the other lobe passes out of contact. This type of displacement meter is found to be very accurate in moving in strict proportion to

the volume of fluid passing through it. I prefer to arrange this displacement meter so that the flow through it is downward, by having the pipe 11 enter it from the top and leave it from the bottom. If desired, one of the shafts 15 may be connected to an indicating device 17, indicated diagrammatically in Fig. 1, for indicating either the rate of speed of the meter or for counting the number of revolutions which the meter has made; but this is merely a matter of preference, and is in no way essential to my invention.

The control valve 13 may be of any desired type, but is indicated diagrammatically as having a movable gate 20 which by its vertical movements opens and closes the size of the passage through the valve. This gate 20, or other size-varying member of the valve 13, is connected to be operated by a piston 21 movable in a cylinder 22, the arrangement which I prefer having the gate 20 mounted directly on the lower end of the piston rod 23 which at its upper end carries such piston 21.

The upper and lower ends of cylinder 22 are connected to two pipes 25 and 26, which lead to two ports 27 and 28 respectively of a pilot valve 29. The pilot valve 29 also has a supply port 30, which is supplied through a pipe 31 with fluid under pressure from any suitable source; and a waste port 32 connected with a suitable waste pipe 33. The supply port 30 opens into the central passage 34 of the pilot valve between two collars 35 and 36 on a valve-stem 37, which two collars co-operate respectively with the ports 27 and 28 communicating with the upper and lower ends of the cylinder 22 respectively, and normally close both ports 27 and 28. The port 32 opens into one end space 38 in the pilot valve 29, and this end space communicates by a through passage 39 to the other end space 40, so that both end spaces 38 and 40 communicate with the waste pipe 33 at all times. If the valve-stem 37 is raised, the port 28 is put into communication with the port 30, and the port 27 into communication with the waste pipe 33, so that the fluid supplied under pressure through the pipe 31 may flow through the pipe 26 into the lower end of the cylinder 22, and fluid may escape from the upper end of such cylinder 22 by way of the pipe 25, and the piston 21 will rise to raise the gate 20 and open further the valve 13; while if the valve-stem 37 is lowered, the port 27 is put into communication with the port 30, and the port 28 into communication with the waste pipe 33, so that the reverse action will occur in the cylinder 22 and pipes 25 and 26, and the piston 21 will be pushed downward to close further the valve 13.

The valve-stem 37 is moved upward or downward from normal according as the speed of the displacement meter 12 falls below or rises above normal. To accomplish this, in a simple way, one of the shafts 15 of the displacement meter is connected, through bevel gearing 41, to a fly-ball governor 42, the lower collar 43 of which is vertically fixed while the upper collar 44 thereof is attached to the valve-stem 37 of the pilot valve 29; so that upon an increase in speed, the balls of the fly-ball governor fly out further, to lower the collar 44, and thus to lower the stem 37 of the pilot valve; and vice versa.

In operation, fluid from the main 10 flows into the various pipes 11, and through any apparatus which such pipes 11 supply, such as washers for absorbing ammonia from the gas. As the gas flows through the pipes 11, it flows downward through the respective displacement meters 12, and rotates the impellers 14 of said meters in accordance with the volume of the gas passing. The rotation of the impeller 14 drives the shafts 15 and turns the fly-ball governors 42. Each fly-ball governor is so connected to the valve-stem 37 of its associated pilot valve 29 that for a normal rate of gas-flow the stem 37 is in the position shown in Fig. 4, with both ports 27 and 28 closed by the respective collars 35 and 36, so that the piston 21 and gate 20 will be at rest.

If now, for any reason, there is an increase in the rate of fluid-flow through any pipe 11, there is a corresponding increase in the speed of the displacement meter 12 in that pipe. This causes the balls of the fly-ball governor 42 to fly outward, to lower the valve-stem 37. This connects the port 27 to the supply port 30, and the port 28 to the waste pipe 33, so that fluid under pressure is supplied by the pipe 25 to the upper part of the cylinder 22, and allowed to escape from the lower part of said cylinder to the pipe 26; which produces a downward movement of the piston 21, to close the gate 20 further. This cuts down the rate of fluid flow through the central valve 13, and therefore through the associated pipe 11 and displacement meter 12; which causes such displacement meter to decrease in speed, and the balls of the fly-ball governor to move inward, to raise the valve-stem 37 and stop the flow of fluid under pressure which was producing the movement of the piston 21 and valve 20.

If for any reason the rate of flow through any pipe 11 falls below normal, the resultant decrease in meter speed causes the valve-stem 37 to be raised, to admit fluid under pressure from the pipe 30 through the port 28 and pipe 26 to the lower end of the cylinder 22, and to permit fluid to escape from the upper end of the cylinder through the pipe 25 and port 27, to cause the piston 21

to move upward to raise the gate 20 and permit flow of fluid at a greater rate through the associated pipe 11 and displacement meter 12; until by the return of the speed of such displacement meter to normal, the fly-ball governor has acted to return the valve-stem 37 to normal and stop such upward movement of the piston 21.

There is no fixed relation between the speed of the displacement meter 12 and the position of the piston 21 and gate 20. Whenever the speed of the displacement meter departs from the normal value for which the apparatus is set, whether by rising above or falling below such normal, fluid under pressure is supplied to move the piston 21 and gate 20; and the supply of such fluid under pressure is continued, and the movement of the gate 20 is also continued, until there has been a sufficient change in the rate of fluid flow through the pipe 11 and valve 13 to produce a return of the speed of the meter 12 to normal. This may occur with only a slight movement of the piston 21, or it may occur only after a rather long-continued movement of such piston.

As a result of this control, the flow of fluid through each pipe 11 is accurately governed, and maintained at a substantially uniform rate, and "hogging" of the gas by any of the pipes 11 is effectively prevented.

I claim as my invention:—

1. In combination, a pipe through which there is a flow of fluid, a displacement meter in said pipe, a valve controlling the rate of fluid-flow through said pipe, and means for governing said valve by the speed of said displacement meter.

2. In combination, a pipe through which there is a flow of fluid, a displacement meter associated with said pipe so that its speed varies with the rate of fluid-flow through said pipe, a valve controlling the rate of fluid-flow through said pipe, and means for governing said valve by the speed of said displacement meter.

3. In combination, a pipe through which there is a flow of fluid, a displacement meter in said pipe, a valve controlling the rate of fluid-flow through said pipe, power-operated means for opening and closing said valve, and pilot means controlled by the speed of said displacement meter for controlling the supply of power to said power-operated means.

4. In combination, a pipe through which there is a flow of fluid, a displacement meter associated with said pipe so that its speed varies with the rate of fluid-flow through said pipe, a valve controlling the rate of fluid-flow through said pipe, power-operated means for opening and closing said valve, and pilot means controlled by the speed of said displacement meter for controlling the supply of power to said power-operated means.

5. In combination, a pipe through which there is a flow of fluid, a displacement meter in said pipe, a valve controlling the rate of fluid-flow through said pipe, power-operated means for moving said valve toward and from closed position to vary the size of the passage through the valve, and pilot means controlled by the speed of said displacement meter for controlling the supply of power to said power-operated means to move the valve toward and from closed position upon increase and decrease respectively in the speed of said displacement meter from normal and shutting off the supply of power to said power-operated means when the speed of said displacement meter returns to normal.

6. In combination, a pipe through which there is a flow of fluid, a displacement meter associated with said pipe so that its speed varies with the rate of fluid-flow through said pipe, a valve controlling the rate of fluid-flow through said pipe, power-operated means for moving said valve toward and from closed position to vary the size of the passage through the valve, and pilot means controlled by the speed of said displacement meter for controlling the supply of power to said power-operated means to move the valve toward and from closed position upon increase and decrease respectively in the speed of said displacement meter from normal and shutting off the supply of power to said power-operated means when the speed of said displacement meter returns to normal.

7. In combination, a pipe through which there is a flow of fluid, a displacement meter in said pipe, a valve controlling the rate of fluid-flow through said pipe, power-operated means for moving said valve toward and from closed position to vary the size of the passage through the valve, and pilot means controlled by the speed of said displacement meter for controlling the supply of power to said power-operated means to move the valve toward and from closed position upon increase and decrease respectively in the speed of said displacement meter from normal.

8. In combination, a pipe through which there is a flow of fluid, a displacement meter associated with said pipe so that its speed varies with the rate of fluid-flow through said pipe, a valve controlling the rate of fluid-flow through said pipe, power-operated means for moving said valve toward and from closed position to vary the size of the passage through the valve, and pilot means controlled by the speed of said displacement meter for controlling the supply of power to said power-operated means to move the valve toward and from closed posi-

tion upon increase and decrease respectively in the speed of said displacement meter from normal.

9. In combination, a pipe through which there is a flow of fluid, a displacement meter in said pipe, a valve controlling the rate of fluid-flow through said pipe, a fluid-pressure motor for operating said valve in opposite directions, a pilot valve controlled by the speed of said displacement meter, and connections controlled by said pilot valve and varying the supply of fluid pressure to said fluid-pressure motor.

10. In combination, a pipe through which there is a flow of fluid, a displacement meter associated with said pipe so that its speed varies with the rate of fluid-flow through said pipe, a valve controlling the rate of fluid-flow through said pipe, a fluid-pressure motor for operating said valve in opposite directions, a pilot valve controlled by the speed of said displacement meter, and connections controlled by said pilot valve and varying the supply of fluid pressure to said fluid-pressure motor.

In witness whereof, I have hereunto set my hand at Connersville, Indiana, this 2nd day of May, A. D. one thousand nine hundred and twenty three.

JOHN T. WILKIN.