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CONTROL SYSTEM

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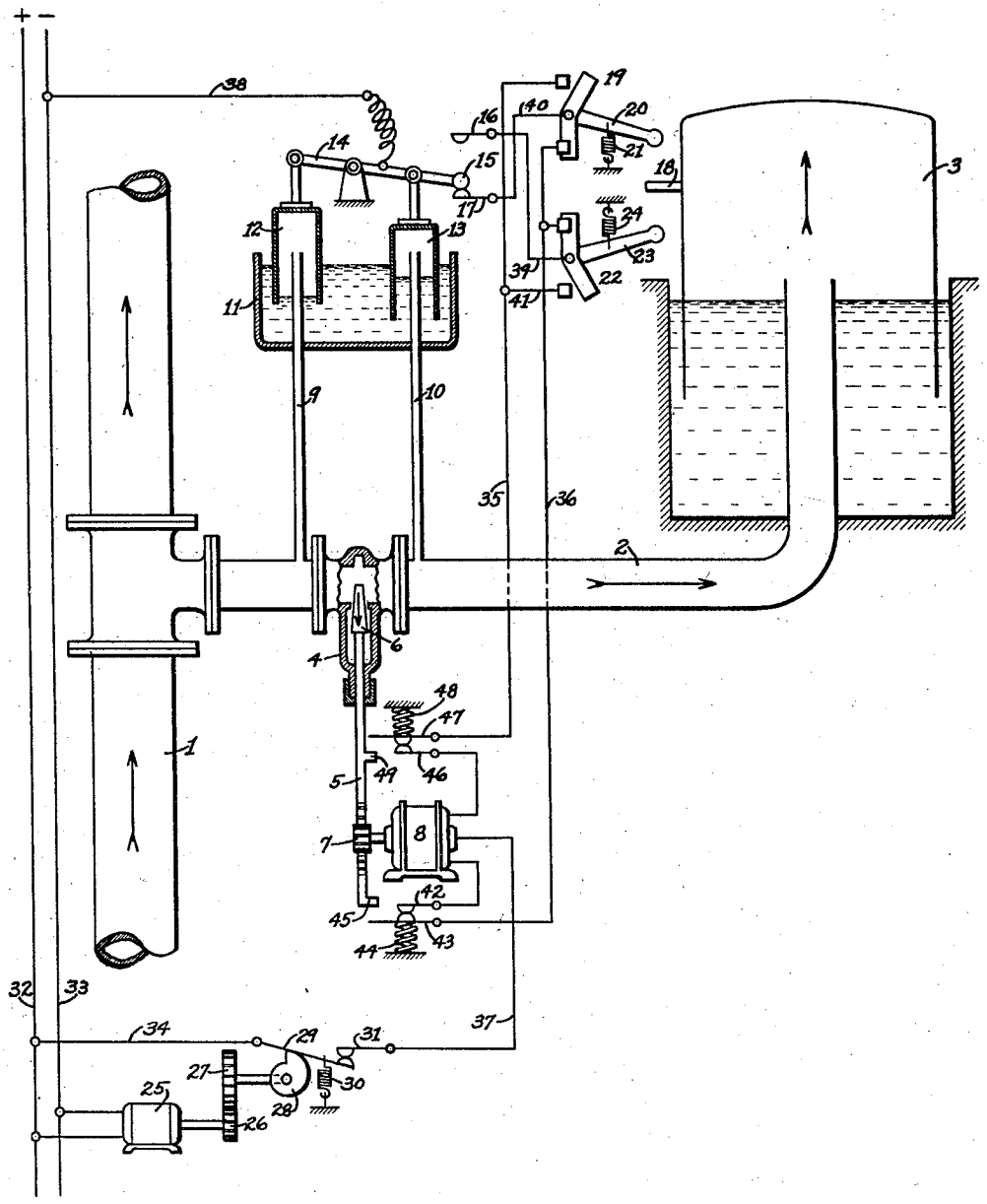

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CONTROL SYSTEM

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6 Claims. (Cl. 48—190)

In connection with fluid transmission systems wherein a conduit is used to convey fluid from a source of variable supply to a point or points of variable consumption it is known to provide a storage chamber, holder or accumulator in connection with the conduit which functions to store fluid at times of excess supply and to feed fluid to the system at times of deficiency in the supply.

My invention relates to an improved system for controlling the flow of fluid to and from such a storage chamber, holder or accumulator.

The primary object of my invention is to provide a control system which will effectively and automatically take care of an excess or deficiency of supply of fluid relative to demand.

Another object is to provide a control system for an accumulator in which an excess of fluid may be stored and from which fluid may be returned to the supply conduit when an otherwise deficiency would exist in the supply conduit.

A further object is to provide a control system which will prevent possible over-filling or under-filling of such an accumulator.

Still further objects will become apparent from the description hereinafter.

In the drawing, the figure is a diagrammatic view of an apparatus embodying the invention.

Referring to the drawing, 1 indicates a conduit through which a fluid, such for example as coke oven gas or blast furnace gas, flows from a source of supply (not shown) to a point or points of usage (not shown). Connected to conduit 1 by a branch conduit 2 is a gasometer or holder 3, in its simplest form being an inverted bell, liquid sealed, which rises in the liquid seal upon the application of pressure to its inner surfaces. In the branch conduit 2 is located a valve means 4 which controls the flow of gas through the conduit 2 either to or from the holder 3.

According to my invention I provide an improved automatic means for controlling the valve 4 in accordance with operating conditions so that an excess of gas supplied to the conduit 1 will be passed to the holder 3 where it will be stored until a deficiency exists in the conduit 1, when the stored gas will be returned to the conduit 1. I have also provided means for operating the valve 4 from limit switches on the holder so as to minimize the possibility of damage or disarrangement to the holder that might result from over or under filling.

For operation of the valve 4, I provide a reversible means shown as the reversible motor 8, which through the medium of the pinion 7, meshed with a rack cut on the stem 5, operates to position a gate 6 relative to its seats in the valve body. I protect the mechanism from jamming the gate against its seats by the addition to the stem 5 of the projections 45 and 49 cooperating at desired extremes of travel, with the contact arms 43 and 47, respectively, to open the electrical circuit to the motor 8, the contact arm 43 being normally urged to contact with the contact arm 42 by the spring 44 and the contact arm 47 being normally urged to contact with the contact arm 46 by the spring 48.

I have found that it is desirable to periodically interrupt the electric circuit of the motor 8 to allow the advantage of gradually opening or closing the valve 4, rather than allowing the sudden surging of pressures to or from the holder 3, that might result from a very rapid opening or closing of the valve. For accomplishing the periodic circuit interruption there is provided a continuously running motor 25 connected to the power conductors 32 and 33 and driving through the gears 26 and 27, a cam 28 against which a contact arm 29 is urged by a spring 30. The contact arm is connected to the power conductor 32 by a conductor 34 and is periodically brought into engagement with the contact arm 31 which through the conductor 37 is connected to the motor 8. The frequency and/or duration of closures may be varied by changing the ratio of the gears 26 and 27 or the shape of the cam 28.

Energization of the motor 8 for opening the valve, is accomplished by a means responsive to gas pressure relation between that in the conduit 1 and that in the gas holder 3, while energization of the motor for closing the valve is accomplished by a means responsive to holder position, that is, when the holder is filled or is empty.

The pressure relation device consists generally of a casing 11 containing a sealing fluid into which depend two inverted bells 12 and 13, suspended at opposites sides of a fulcrum from a beam 14. To the underside of the bell 12 is transmitted by a pipe 9 a pressure indicative of that in the conduit 1 while to the underside of the bell 13 is transmitted by a pipe 10 a pressure indicative of that in the holder 3.

The beam 14 is connected by the conductor 38 to the power conductor 33 and has an extension illustrated as a contact arm 15 which may make contact with either the contact finger

16 or 17 according to whether the pressure effective upon the bell 12 predominates that effective upon bell 13, or vice versa, the bell-beam assembly being generally responsive to the relation between the pressure in the conduit 1 and the pressure in the holder 3.

The contact finger 16 with which the contact arm 15 may contact, is joined by a conductor 39 to a limit switch 22, while the contact finger 17 is joined by a conductor 40 to a limit switch 19. The blade seats of both limit switches are connected to the conductors 35 and 36 of the reversible motor 8.

A projection 18 on the holder 3 cooperates at one extreme of the holder's travel with the arm 20 of the limit switch 19 to overcome the resistance of the spring 21 and move the limit switch until circuit is broken between conductors 36 and 40 and completed between conductors 35 and 40. At the other extreme of the holder's travel, the projection 18 engages the arm 23 of the limit switch 22 and overcomes the resistance of spring 24 to the end that circuit is broken between conductors 36 and 39 and completed between conductors 39 and 35.

The operation of the above described arrangement is as follows. Assuming an excess of gas in the conduit 1, as illustrated, the pressure in the conduit 1 effective through the pipe 9 on the bell 12 is greater than the pressure in the holder 3 effective through the pipe 10 on the bell 13, causing the beam 14 to assume the position wherein the contact arm 15 is in contact with the contact arm 17. A circuit is thus completed from the power conductor 33 through the conductor 38, the contact arms 15 and 17, conductor 40, the limit switch 19, conductor 36, to the motor 8, from which conductor 37 joins power conductor 32 through the periodic interrupting means. Periodically then through rotation of the cam 28, a circuit is completed and the motor 8 by increments moves the gate 6 of the valve 4 to an open position, allowing gas to flow from the conduit 1 to the holder 3. As the holder is filled and rises in its liquid seal, the limit switch actuator 18 moves toward engagement with the arm 20 of the limit switch 19, overcoming the resistance of the spring 21 and finally causing an opening of circuit between conductors 40 and 36 and a closing of circuit between conductors 40 and 35. A circuit is thus completed from power conductor 33 through conductor 38, contact arms 15 and 17, conductor 40, limit switch 19 and conductor 35 to the motor 8 and through the conductor 37 and the interrupting means to the power conductor 32, for operation of the motor 8 in a direction to close the gate 6 of the valve means 4 and prevent over-filling of the holder 3, which might cause blowing of its liquid seal and damage or disarrangement of parts.

If now at a later time, the supply of gas to the conduit 1 is insufficient for the demand, and the pressure in the conduit 1 decreases to a value lower than that in the holder 3, then these pressures, effective respectively upon bells 12 and 13, will cause a rotation of the bell-beam assembly around its fulcrum and the contact arm 15 will leave engagement with contact arm 17 and will contact with the contact arm 16, completing a circuit through the limit switch 22 and the conductor 36 to cause operation of the motor 8 in a direction to open the gate 6 of the valve 4 and allow passage of gas from the holder 3 to the conduit 1 and make up for the deficiency.

When sufficient gas has left the holder to cause it to reach a predetermined low position, the limit switch 22 will be operated and the motor 8 will close the gate 6 across the conduit 2 and prevent a movement of the holder lower than desired.

It is possible that when the holder is being filled or emptied, it will not be completely filled or emptied and may, for example, be half-filled when relation between supply and demand in the conduit 1 reaches an equilibrium. The gate 6 has been opened wide to allow gas to pass to the holder, and remains open. Gas may flow to or from the holder and no further positioning of the gate 6 by the motor 8 will result until the holder is eventually filled or emptied to a predetermined amount and one of the limit switches functions to close the passage through the valve means 4 and protect the holder against over or under-filling.

It is understood that while I have illustrated and described a preferred embodiment of my invention, other types of apparatus and arrangements may be used. For instance, other pressure-responsive contacting devices than those employing liquid sealed bells may be used. Other types of valve means, and reversible means other than a motor may be used equally well. Various types of storage chambers may be employed, and other fluids than gas may be under control.

I obtain through my invention an advantage of storing and saving the surplus fluid when an excess exists in a system and feeding this stored fluid back to the system at times when it is needed. There is a further advantage through the use of my invention in that it protects against detrimental effects of forcing too great a quantity of the liquid into the storage chamber or of attempting to take more from the storage chamber than there is present.

While I have described and illustrated a preferred embodiment of my invention, it is expressly understood that I have not limited the invention other than as covered in the claims in view of prior art.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. In combination, a conduit for gas flow, a storage chamber, a second conduit connecting the storage chamber with the first-named conduit, valve means in said second-named conduit, reversible means for positioning said valve means, control means for said reversible means, differential pressure sensitive means responsive to variations in the difference between the pressure in the first-named conduit and the pressure in the storage chamber, and means responsive to variations in the quantity of gas in said storage chamber, said control means responsive to the last two named means.

2. In combination, a conduit for gas flow, a storage chamber, a second conduit connecting the storage chamber with the first-named conduit, valve means in said second-named conduit, reversible means for positioning said valve means, control means for said reversible means, differential pressure sensitive means responsive to variations in the difference between the pressure in the first-named conduit and the pressure in the storage chamber, and means responsive to variations in the quantity of gas in said storage chamber, said control means re-

sponsive to the differential pressure means for operating the valve means in an opening direction and to the quantity responsive means for operating said valve means in a closing direction.

3. In combination, a conduit for gas flow, a gas holder, a second conduit connecting the gas holder with the first-named conduit, valve means in said second-named conduit, a reversible electric motor for positioning said valve means, control means for said reversible electric means, said control means responsive to variations in the difference between the pressure in the first-named conduit and the pressure in the gas holder, limiting means of the positioning of said valve means, and intermittently actuated circuit-opening means for the electric motor.

4. In combination, a conduit for gas flow, a gas holder, a second conduit connecting the gas holder with the first-named conduit, valve means in said second-named conduit, a reversible electric motor for positioning said valve means, limit switches in the circuit of the electric motor actuated at predetermined extremes of travel of said valve means, intermittent interrupting means in the circuit of the electric motor, and pressure actuated circuit-closing means for the motor, said pressure actuated means responsive to pressure in the first-named conduit and to pressure in the gas holder.

5. In combination, a conduit for gas flow, a gas holder, a second conduit connecting the gas holder with the first-named conduit, valve means in said second-named conduit, a reversible electric motor for positioning said valve means, limit switches in the circuit of the electric motor actuated at predetermined extremes of travel of the said valve means, intermittent interrupting means in the circuit of the electric motor, pressure actuated circuit-closing means for the motor, said pressure actuated means responsive to pressure in the first-named conduit and to pressure in the gas holder, and selective means for selecting the direction of rotation of said motor, said selective means positioned responsive to the amount of gas in the gas holder.

6. In combination, a conduit for gas flow, a gas holder, a second conduit connecting the gas holder with the first-named conduit, valve means in said second-named conduit, a reversible electric motor for positioning said valve means, control means for said reversible electric motor, means responsive to the amount of gas in the gas holder, pressure actuated means responsive to pressure in the first-named conduit and to pressure in the gas holder, said last two named means effective for positioning the control means, said control means adapted to cause an operation of said motor in a direction to open said valve means when the gas holder is not filled and when the pressure in the first-named conduit is greater than the pressure in the gas holder and further adapted to cause an operation of the motor for closing the valve means when the gas holder is not empty and when the pressure in the gas holder is greater than that in the first-named conduit, limit switches in the circuit of the electric motor actuated at predetermined extremes of travel of the said valve means, and intermittent interrupting means in the circuit of the electric motor.

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