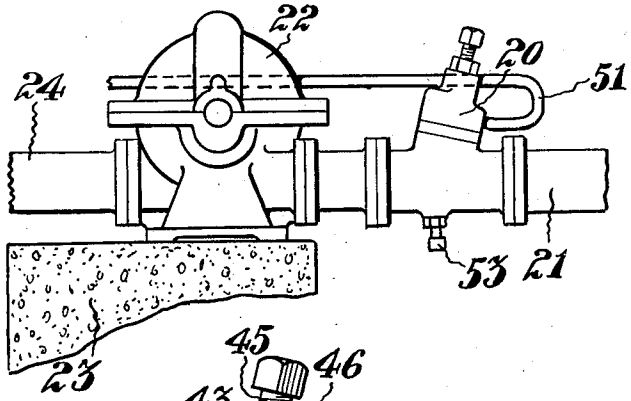
April 4, 1939. H. HORNSCHUCH 2,152,695

CONTROL MECHANISM

Filed Nov. 8, 1935 2 Sheets-Sheet 1

FIG.-1.



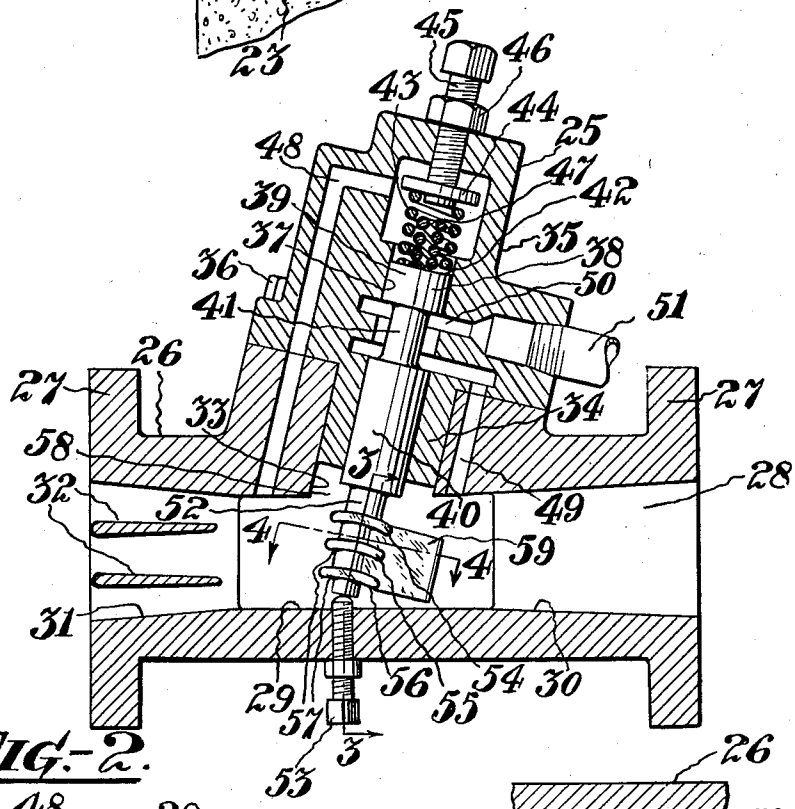


FIG.-2.

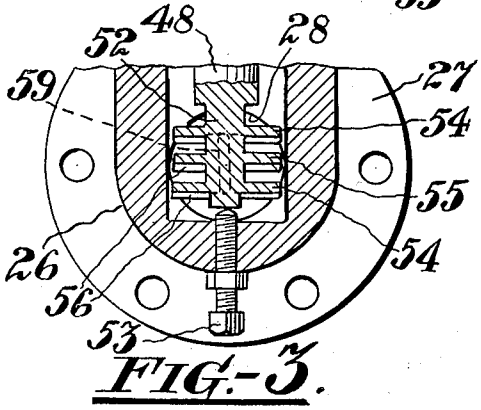


FIG.-3.

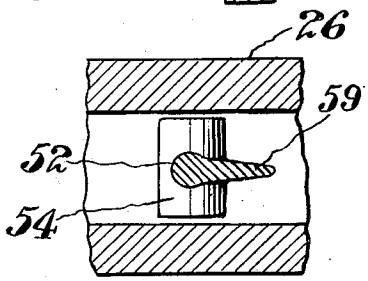


FIG.-4.

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CONTROL MECHANISM

Filed Nov. 8, 1935 2 Sheets-Sheet 2

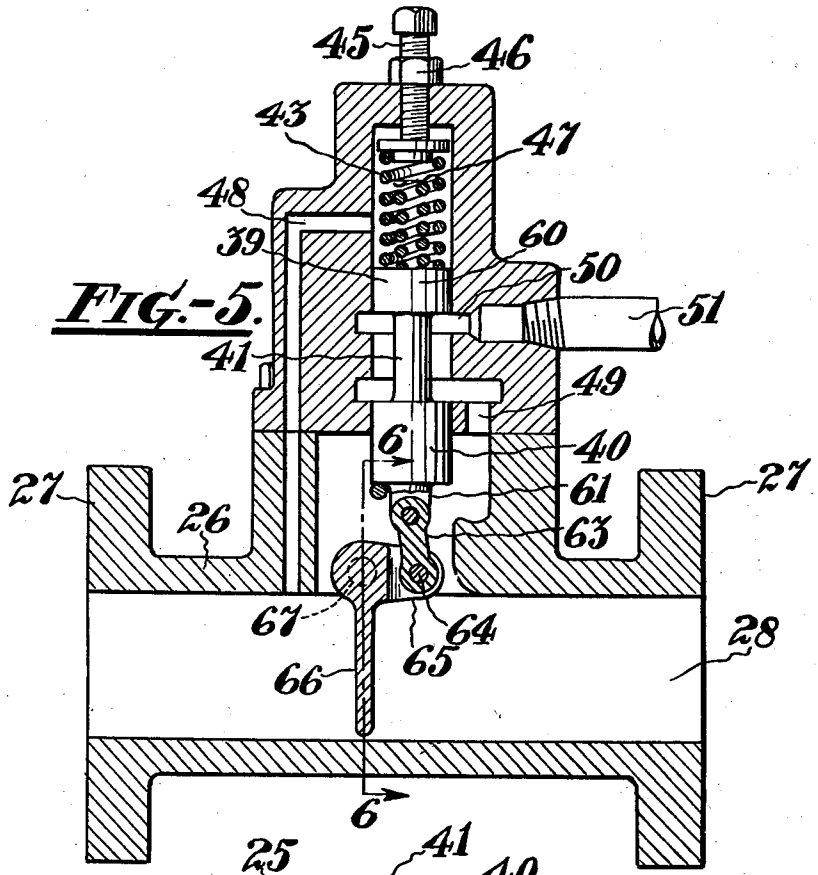


FIG.-5.

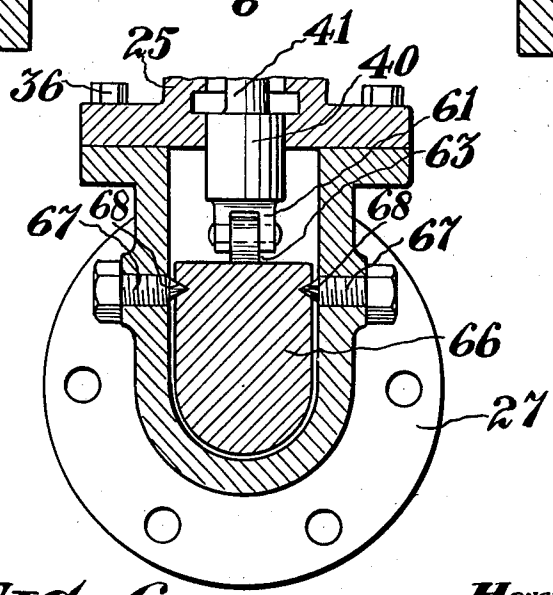


FIG.-6.

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CONTROL MECHANISM

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Application November 8, 1935, Serial No. 48,808

11 Claims. (Cl. 137—152)

This invention relates to control mechanisms, and more particularly to a fluid actuated control mechanism.

As an example of use, the control mechanism may be incorporated in a pumping system in which a pump is operated continuously for moving feed water at temperatures normally close to the vaporizing value and in which means are embodied in the system for cutting off communication between the pump and the point of delivery. When operating under these conditions and when the discharge line is closed the liquid merely recirculates within the pump and its temperature speedily rises to the vaporizing point. The pump then becomes vapor bound, and if operated under this condition its interior parts are subjected to very rapid wear. This causes excessive clearances throughout the pump so that it cannot meet the requirements of the system. In order, therefore, to again bring the pump to its former efficient state it is necessary to make extensive repairs and quite frequently to replace costly elements of its organization.

When used in connection with a pumping system of the nature described the control mechanism is disposed on the discharge side of the pump and acts responsively to the velocity of the discharge fluid to perform its function which, in the example illustrated in the drawings, is that of by-passing fluid from the discharge line whenever the velocity of the discharge fluid drops below a predetermined rate or ceases altogether. The control mechanism operates to discharge a sufficient amount of fluid from the discharge line to assure the constant circulation of fluid through the pump, thereby preventing the objectionable condition hereinbefore outlined.

The liquid by-passed in this manner need be of only sufficient volume to prevent an undue temperature rise within the pump and may again be returned to the suction side of the pump.

One object of the invention is to effect actuation of the control mechanism in response to the rate of flow of the actuating fluid.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is a side elevation of a pumping system equipped with a valve mechanism constructed in accordance with the practice of the invention,

Figure 2 is a longitudinal sectional elevation of the valve mechanism,

Figure 3 is a transverse view taken through Figure 2 on the line 3—3,

Figure 4 is a plan view, in section, taken through Figure 2 on the line 4—4,

Figure 5 is a view similar to Figure 2 showing a modified form of the invention, and

Figure 6 is a transverse view taken through Figure 5 on the line 6—6.

Referring to the drawings, and at first more particularly to Figure 1, 20 designates a valve mechanism constructed in accordance with the practice of the invention and is shown, for illustrative purposes, as being interposed in the discharge line 21 of a pump 22.

The pump shown is of the centrifugal type. It is mounted upon a foundation 23 and its suction line or pipe 24 may be connected to the outlet opening of a condenser (not shown) or other vessel constituting a source of liquid of a temperature slightly below the vaporizing point.

The discharge line 21 of the pump may be provided with the usual regulating device (not shown) such as is usually provided in systems of this type to cut off the discharge line from the destination of the liquid, for example, a boiler.

The valve mechanism illustrated in Figures 2 to 4 inclusive, comprises a casing 25 consisting of a tubular member or sleeve 26 having lateral flanges 27 at its extremities to seat against similar flanges on the discharge line 21 of which the sleeve 26 constitutes a part. The passageway 28 in the sleeve 26 affords communication between the adjacent sections of the discharge conduit 21.

The passageway has, in the present instance, an intermediate rectangular portion 29 and coniform portions 30 and 31 on opposite sides thereof. In order to assure the flow of the fluid through the intermediate portion of the passageway along a substantially straight line, guide vanes 32 are arranged in the portion 31 of the passageway 28. The vanes 32 preferably extend entirely across the passageway 28. They are spaced with respect to each other and are in parallelism with the longitudinal axis of the passageway. Arranged in this manner, the vanes serve to effect a stream line flow of the liquid through the portion 29.

In the side of the sleeve 26 and opening into the portion 29 of the passageway is an aperture 33 to accommodate a stem 34 of a valve chest 35 seated on the side of the sleeve 26 to which it is secured by bolts 36. The valve chest has a longitudinal bore constituting a valve chamber 37 which also communicates at one end with the portion 29, and contains a reciprocatory valve 38 having a pair of heads 39 and 40 which are joined together by a reduced stem 41.

The heads 39 and 40 may, as shown, be of the same diameter and the outer surface 42 of the head 39 constitutes a seat for an end of a spring 43 of which the other end seats against a plate 44 carried by a screw 45 threaded into the end of the valve chest 35. The screw 45 which serves to adjust the tension of the spring 43 may be provided with a lock nut 46 for locking it securely in position. As second spring 47 of shorter length and less responsive to pressure than the spring 43 is disposed within the latter spring to serve as

a yieldable stop for the valve 38.

The outer end of the valve chamber 37 is in constant communication with the passageway 28 through a passage 48 to subject the surface 42 of the valve to the same pressure as that existing in the passageway.

Leading from the passageway 28 is a passage 49 which opens into the intermediate portion of the valve chamber 47 at a point where it may be conveniently overrun by the head 40 of the valve. A second passage 50 in the valve chest opens into the same portion of the valve chamber 37 and is so located with respect to the passage 49 that when the valve occupies the limiting position to which it may be actuated and held by the spring 43 both passages 49 and 50 will communicate with the space between the heads 39 and 40 of the valve. A conduit 51 threaded into the valve chest 38 communicates with the passage 50 at one end and may be connected with its other end to a point in the suction side of the pump 22, as for example a heater or a surge tank, (not shown).

To the end that the valve may be automatically actuated to and held in position to cut off communication between the passages 49 and 50 during the normal operation of the pump, the valve is provided with a stem 52 which extends into the passageway 28 and may, in a limiting position, seat upon a set screw 53 threaded into the sleeve 26. On the stem 52 and on the down stream side of the passageway 28 are a plurality of wings or foils 54 which extend across the passageway and, in the present instance, have curved portions 55 presenting surfaces 56 against which the fluid flowing through the passageway 28 strikes to move the valve 38 to a position for closing the passage 49.

Any suitable number of foils 54 may be provided and the portions 57 of the foils confronting the vanes 32 may lie in parallelism with the longitudinal axis of the passageway so that the fluid stream flowing through the portion 29 will be gradually guided to the surfaces 56 with a minimum degree of turbulence or eddying of the fluid.

The valve 38 may, as shown, be freely rotatable within the valve chamber 37, and in order that side thrust of the valve against the wall of the valve chamber may be reduced to a minimum the valve 38 is inclined with respect to the passageway 28, as for instance, in a position corresponding to the resultant of the lift and drag forces of the fluid stream. Owing to this arrangement the drag of the water passing over the surfaces 56 will not interfere with the free reciprocatory movement of the valve in the valve chamber.

The foils 54 lie in the portion 29 of the passageway and sufficient clearance exists between the ends of the foils and the walls of the passageway to prevent interference with the movement of the valve. It is, however, desirable that the valve be prevented from rotating to a position in which the foils may contact the wall of the passageway and the stem 52 of the valve is accordingly provided with a rudder 59 adjacent the curved portions 55 so that the fluid flowing through the passageway will act against the sides of the rudder 59 to maintain it in coincidence with the direction of fluid flow.

The operation of the device is as follows: With the pump 22 operating at normal capacity the liquid passing through the discharge line 21 acts against the surfaces 56 of the foils 54 and moves the valve outwardly, either fast or slowly, in accordance with the rate of flow of liquid in the passageway until, at a predetermined velocity, the valve reaches a position in which the head 40 overlies the passage 49. Communication will then be cut off between the passageway and the passage 50.

The valve will be held in this position until resistance to discharge flow occurs, as when the discharge line is partly or fully closed between the valve mechanism 20 and the destination of the liquid, and in consequence of which liquid flow through the discharge line decreases or ceases altogether. The spring 43 will then shift the valve in the direction of the passageway 28 to gradually uncover the passage 49, in the one instance, or to establish full communication between the passages 49 and 50, it being, of course, understood that, inasmuch as the different controlling positions assumed by the valve are determined by the rate of flow of liquid through the passageway, the valve may also assume and be maintained stable in various intermediate controlling positions to partly uncover the passage 49 at different sustained intermediate velocities.

When the valve is open fluid flows from the passageway 28 through the passage 49, the valve chamber 37, the passage 50 and the conduit 51 to the suction side of the pump, thus assuring a constant circulation of liquid through the pump and preventing the formation of vapor therein which would cause the pump to become vapor bound and damaged, as a result.

In the modified form of the invention illustrated in Figures 5 and 6 the valve, designated 60, lies normal to the passageway 28 and is provided, on the free end of the head 40, with a lug or stem 61 carrying a pivot 62 to which is connected a link 63. In the other end of the link 63 is a pivot 64 which is seated in lugs 65 formed integral with and lying at a right angle to a vane 66 in the passageway 28. The vane 66 is of a shape conforming substantially to the shape of the passageway 28 and is mounted upon a pair of pivots 67 threaded into opposite sides of the sleeve 26 and extending into sockets 68 in the sides of the vane.

In the operation of this form of the invention, the fluid flowing through the passageway 28 tilts the vane 66 in the direction of fluid flow. This movement of the vane may take place gradually or rapidly in accordance with the rate of flow of fluid through the passageway and is transmitted through the link 63 to the valve 60 for covering the passage 49 during the normal operation of the pump. All the fluid pumped flows to the point of delivery until communication between the pump and the fluid destination is interrupted. The spring 43 will then move the valve in the direction of the passageway 28 and uncover the passage 49. Fluid then flows through the valve chamber, the passage 50 and the conduit 51 to assure a constant circulation of fluid through the pump.

When communication is again restored between the discharge line of the pump and the point of application the velocity of the fluid flowing through the passageway 28 again increases and, owing to this fact, the vane 66 will be tilted and actuate the valve to prevent the by-passing of fluid through the valve chamber and the connecting passages.

Although the invention is illustrated in only two forms and one example of application, it will be readily apparent to those skilled in the art that it is susceptible of various other changes and modifications, without departing

from the spirit thereof. It is to be understood, moreover, that it is not intended that its use shall be limited to the service described, but that a control member actuated in the manner described may, for example, serve to control the admission of fluid into the passageway, or to control the action of a medium in a conduit disunited from that containing the medium whereby the control member is actuated.

I claim:

1. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve to control the passage and having its opposite ends exposed to the pressure of the fluid in the passageway, and a surface on the valve extending at an angle to the direction of flow of fluid through the passageway and being exposed to such fluid for actuating the valve in response to the velocity of the fluid.

2. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve chamber in the casing, a valve to control the passage and having a plurality of heads of equal diameter slidable in the valve chamber, a foil on the valve inclined with respect to the axis of the passageway and being subjected to the fluid flowing through the passageway to actuate the valve in response to an increasing velocity of the fluid for closing the passage, and a spring to shift the valve in response to a decreasing velocity of the fluid for opening the passage.

3. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve to control the passage and being freely rotatable in the casing, a foil on the valve subjected to the fluid flowing through the passageway to actuate the valve in response to the velocity of the fluid for closing the passage, a spring to actuate the valve for opening the passage, and a rudder on the valve exposed to the fluid flowing through the passageway for maintaining the foil in the correct operative relationship with the passageway.

4. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve chamber in the casing, a valve slidable in the valve chamber to control the passage and having opposed ends of equal area exposed to the pressure of the fluid in the passageway, said valve being inclined with respect to the passageway, means for preventing rotary movement of the valve, means on the valve subjected to the fluid flowing through the passageway to actuate the valve in response to the velocity of such fluid for closing the passage, and a spring to actuate the valve for opening the passage.

5. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve chamber in the casing, a valve slidable in the valve chamber to control the passage and having opposed ends of equal area exposed to the pressure of the fluid in the passageway, means arranged pivotally in the casing and extending into the passageway into the path of flow of the fluid through the passageway, means for transmitting the movement of the said means to the valve for closing the passage, and a spring for actuating the valve to open the passage.

6. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve reciprocable in the casing to control the passage and having opposed ends of equal area exposed to the pressure of the fluid in the passageway, said valve being inclined with respect to the passageway, means for preventing rotary movement of the valve, means on the valve subjected to the fluid flowing through the passageway to actuate the valve in response to the velocity of such fluid for closing the passage, a vane pivotally mounted in the casing and extending into the passageway across the path of flow of the fluid through the passageway, a link pivotally connected to the vane and the valve to transmit the movement of the vane to the valve for closing the passage, and a spring to actuate the valve for opening the passage.

7. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening thereinto, a valve slidably mounted in the casing to control the said passage, said valve having a stem extending obliquely into the passageway, and a transverse fin immovably attached to the stem whereby the valve is moved upwardly in response to increased velocity of the flow of fluid in the passageway.

8. A control mechanism, comprising a casing having a main passageway and a connecting passage, a slidable valve in the casing to control the connecting passage, an extension of said valve projecting obliquely into the main passageway, a fin affixed transversely to the axis of the extension to lift the valve in response to increased velocity of the fluid in the passageway, and means to prevent rotation of the valve.

9. A control mechanism, comprising a casing having a main passageway for fluid and a passage, a valve in the casing reciprocable laterally of the passageway to control the passage, and means in the passageway reciprocable with the valve and subjected to the fluid flowing through the passageway for actuating the valve in response to the velocity of such fluid.

10. A control mechanism, comprising a casing having a main passageway for fluid and a passage, a reciprocatory valve to control the passage and being inclined with respect to the passageway, means reciprocable with the valve, subjected to fluid flowing through the passageway for actuating the valve in one direction in response to an increasing velocity of such fluid, and a spring to actuate the valve in an opposite direction in response to a decreasing velocity of the fluid.

11. A control mechanism, comprising a casing having a main passageway for fluid and a passage opening into the passageway, a valve chamber in the casing, a valve slidable in the valve chamber to control the passage and having opposed end of equal area exposed to the pressure of the fluid in the passageway, said valve being inclined with respect to the passageway, means for preventing rotary movement of the valve, an extension on the valve extending into the passageway and reciprocable with the valve, and a surface on the extension extending in a plane disposed at an angle to the direction of reciprocation subjected to the fluid flowing through the passageway to actuate the valve in response to the velocity of such fluid.

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