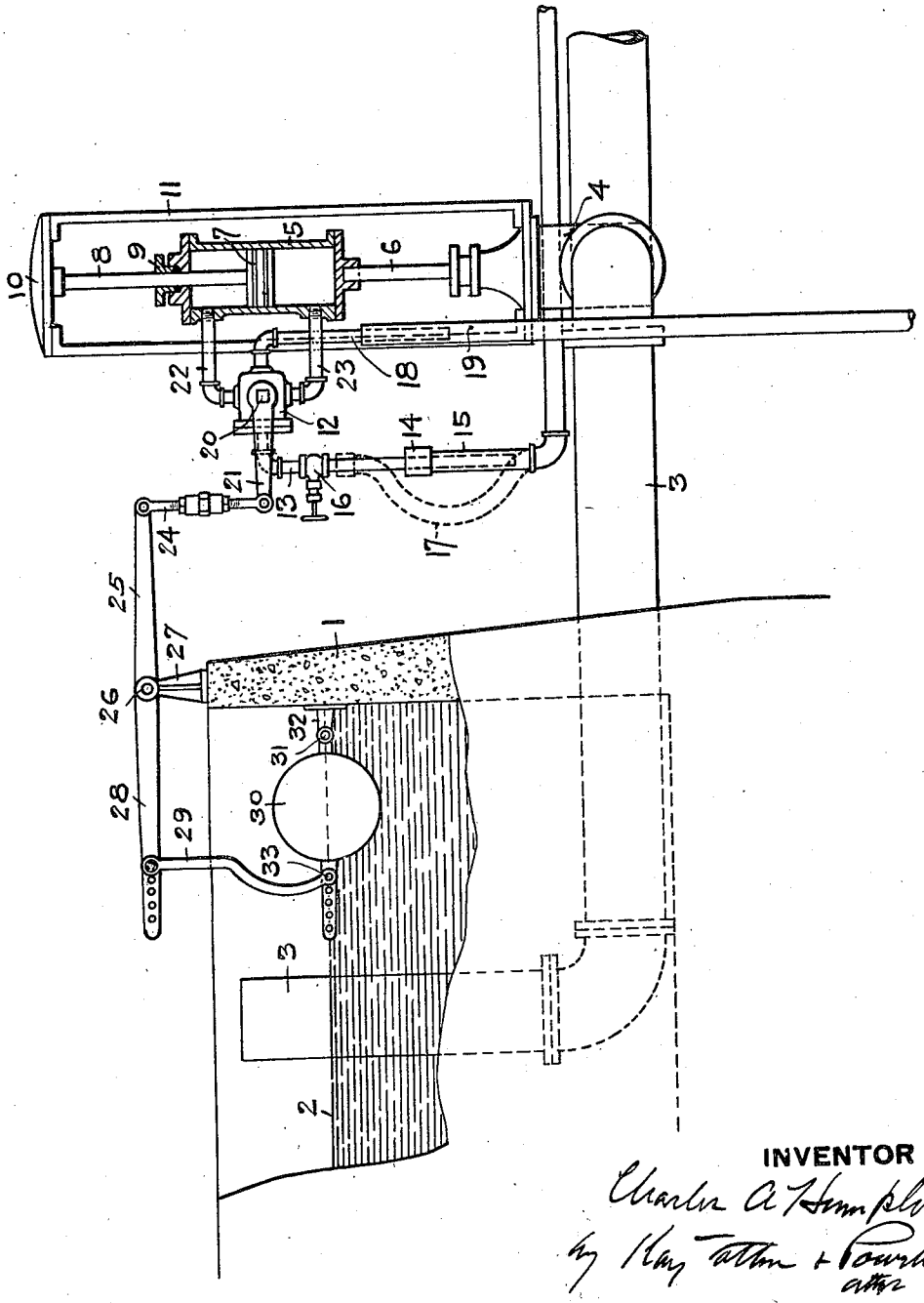
C. A. HUMPHREYS.

CONTROLLING DEVICE.

APPLICATION FILED JULY 5, 1918.

1,428,375. Patented Sept. 5, 1922.



INVENTOR

Charles A Humphreys

by Kay Tatton & Powell

attys

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UNITED STATES PATENT OFFICE.

CHARLES A. HUMPHREYS, OF BLUEFIELD, WEST VIRGINIA.

CONTROLLING DEVICE.

Application filed July 5, 1918. Serial No. 243,335.

To all whom it may concern:

Be it known that I, CHARLES A. HUMPHREYS, a citizen of the United States, and resident of Bluefield, in the county of Mercer and State of West Virginia, have invented a new and useful Improvement in Controlling Devices; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to mechanism for maintaining a substantially constant level of water in a tank or reservoir. The purpose thereof is to maintain the liquid level as nearly without fluctuations as possible and I accomplish this purpose by the employment of a movable member connected with the source of liquid for the reservior, which movable member is sensitively controlled in its movements by means of a controlling member influenced by the level of the liquid in the reservior.

While maintaining the liquid level, as described is a primary object contemplated in my invention at the present time, it is obvious that the invention may be applied to a number of different uses, such as the control of pressures, the control either of the water level in a filter above the filter bed, or the outlet flow of a filter, and in many other connections where sensitive, regulated control is desired.

With these objects in view, the invention consists in a construction and arrangement of parts, and in a mode of operation, a preferred form and arrangement of which is illustrated, for example, in the accomanying drawing, in which the figure shows a tank partly in section and the improved controlling mechanism therewith.

In the embodiment of my invention, which has been herein selected for the purpose of illustration, 1 indicates a tank or container for water or other liquids; 2 indicates the water level therein, and 3 indicates the inlet or supply-pipe for said tank. Said inlet pipe is provided with a suitable gate or other form of control valve 4.

In the construction here illustrated, there is mounted, preferably above the valve 4, a movable controlling member or cylinder 5. It is to be understood that this cylinder may be of any desired size and weight to be sensitive to the controlling means. It may be in the form of a pipe of brass or other metal of comparatively small diameter, or it may be a cylinder of considerable diameter, according to the use for which it is intended.

To the lower end of this cylinder 5, as here illustrated, is attached or fixed a rod 6 which rod, in turn, controls the gate or valve 4. But it is to be understood that the device to be controlled by the cylinder 5 and rod 6 may be varied for different purposes. Within the cylinder 5 is mounted a piston 7 having a piston rod 8 passing out of the cylinder through a stuffing box 9. The upper end of the piston rod, as shown in this case, is fixed to the cross-piece or yoke 10 of a stationary frame 11 which is also mounted just above the valve 4, as here shown.

It will be seen, therefore, that the piston 7 is at all times stationary, and that any movement relatively between the piston and cylinder must be accomplished by the cylinder.

A pilot or controlling valve 12 is connected to move with the cylinder 5. This valve has a fluid inlet pipe 13 which may have a sliding engagement, as at 14, with a fixed section of the pipe 15, and this cylinder supply pipe 13 may also be provided with an ordinary shut-off valve 16. In some cases, it may be preferable to provide a flexible pipe such, for example, as a flexible hose 17 for connecting the control valve 12 with the supply pipe 13. An exhaust pipe 18 leads from the chamber of the controlling valve 12 and, like the inlet pipe 13, may have a sliding or flexible connection with an exhaust extension 19 leading off to any suitable point. The valve chamber is provided with any suitable form of valve member which valve member has an extension 20 to the outside of the valve for engagement with an operating lever 21. The valve chamber at one side of the valve is connected by a pipe 22 with one end (the upper end in this case) of the cylinder 5, a pipe 23 connecting the valve chamber on the opposite side of the valve with the opposite end or lower end of the cylinder 5, as here shown, the pipe 22 connecting with the cylinder at one side of the piston 7 and the other pipe 23 connecting with the cylinder at the opposite side of the piston 7.

In order automatically to control the opening and closing of this pilot valve 12 in response to variations in the conditions of the thing to be controlled,—in this instance, the level of the water 2 in the tank 1, the valve lever 21 is connected by means of a link 24 with one arm 25 of a rocking lever,

pivoted at 26 on a suitable bracket 27. The opposite arm 28 of this rocking lever is connected by a link 29 with a float 30 mounted within the tank 1 and pivoted at 31 to a bracket 32 extending from the side wall of the tank, as here shown.

It is to be noted that the pivotal connection of the link 29 with the float 30, as at the point 33, is at a considerable distance from the pivot 31 of the float on the tank, so that slight changes in the level of the liquid in the tank will result in augumented or multiplied movement of the control connections from the float 30 to the pilot or control valve 12. Also, if desired, the link 29 may have adjustable connections with the lever arm 28, and with the float 30, as shown, for the purpose of varying the throw of the controlling or pilot valve 12. This enables the operator to change the condition or level of the liquid in the tank 1, at which the float will be operated, or in other words, to alter the liquid level, for instance.

In the operation of my improved control mechanism, as here illustrated, when the level of the liquid 2 in the tank 1 falls, the float 30 will drop or turn on its pivot 31, thereby rocking the lever arm 28 down and the lever arm 25 up. Consequently, through the link 24, the valve lever arm 21 operates the pilot valve 12, which in the present instance may be normally closed. Such operation of the pilot valve will serve to let water or fluid under pressure, from the inlet pipe 13, into the valve chamber and thence, through the connecting pipe 22, into the upper end of the cylinder 5, which fluid, operating against the stationary piston 7 and the upper head of the cylinder, will serve to elevate the cylinder slightly and consequently open the gate valve 4 of the tank supply pipe 3.

Conversely, if the liquid 2 in the tank 1 rises above the normal or desired level in the tank, then the upward movement of the float 30 will reverse the operation of the control valve 12 to permit the pressure fluid from inlet pipe 13 to be admitted through the valve chamber and the connecting pipe 23, to the lower end of the cylinder 5, thus depressing the cylinder and closing the gate valve 4.

As the cylinder 5 above and below the stationary piston 7 is always filled with liquid, it is necessary to connect one or the other of the pipes 22, 23 with the exhaust or outlet pipe 18, when liquid under pressure is to be admitted to the cylinder from pipe 13.

Therefore in the present instance, the pilot valve 12 when rotated to connect the fluid in pressure pipe 13 with the connecting pipe 22 leading to the upper end of the cylinder, simultaneously connects the pipe 23 between the lower end of the cylinder 5 and valve chamber with the exhaust pipe 18, to enable an amount of liquid to drain out of the lower end of the cylinder, equal to the amount admitted to the upper end of the cylinder.

When the pressure pipe 13 is connected through the valve 12 and pipe 23 to the lower end of the cylinder, the pipe 22 between the upper end of the cylinder and the valve chamber, is connected with the exhaust pipe 18.

It will be further noted that when fluid is admitted by the pilot valve 12, either to the upper or lower end of the cylinder 5, the resulting movement of the cylinder is communicated to the valve 12 itself, so that said controlling valve will rise and fall with the cylinder. Now, inasmuch as the control valve lever 21 of said valve is attached by means of the link 24 to the lever 25—28, and inasmuch as the movements of the lever 25—28 are controlled entirely by the float 30, it will be obvious that movements of the control valve 12 either upward or downward, serves to reverse the operation of the pilot valve caused by movement of the float. Therefore, the opening and closing of communication from the pilot valve to the upper or the lower end of the cylinder 5 will be at all times compensated for by movement of the cylinder and of the pilot valve carried thereby.

In other words, for example, assuming that the float 30 has dropped owing to a decent of the liquid level 2 in the tank 1, the arm 21 of the valve 12 will be swung upwardly from the horizontal position shown to turn the valve in a clockwise direction relatively to the valve chamber, and cause the valve to connect the pressure pipe 13 with the upper pipe 22, to raise the cylinder 5.

Because of the rigid connection between the controlling valve 12 and cylinder 5, afforded by the pipes 22 and 23, the cylinder, as it rises, carries the valve chamber and valve 12 along, and the arm 21 being still held upwardly by the weight of the float, the upward movement of the valve chamber and valve will operate to close the valve, which closing action is facilitated and assisted by the float 30, as the liquid level rises in the tank 1.

The reason for the sliding engagement or slip connection between the pressure pipe 13 and the fixed section 15, as well as the similar connection between the exhaust pipe 18 and its fixed extension 19 is now apparent.

It is to be particularly noted that owing to the considerable movement of the control float 30, due to more or less slight change of level in the liquid in the tank 1, the pilot or control valve 12 will be instantly operated to a sufficient extent to positively operate the gate valve 4 in one or the other di-

rection. But it is to be borne in mind that when this device is in operation the cylinder 5 on both sides of the piston 7 is constantly filled with liquid from the cylinder supply pipe 13. Consequently, any slight operation of the pilot or control valve 12 will admit a correspondingly slight amount of liquid to the cylinder at one side of the piston, and will exhaust a corresponding small amount of liquid from the cylinder at the opposite side of the piston, and since the controlling ports or pipes 22 and 23 to the cylinder are of comparatively small diameter relatively to the capacity of the cylinder, it will be understood that the controlling movements of the cylinder 5 either up or down, will be but slight and consequently the control of the liquid level in the tank 1 will approximate very closely a constant level at all times.

It will be further observed that inasmuch as the upward or downward movements of the cylinder 5 serve to reverse the operations of the control valve 12 caused by movements of the float 30, there will be a mutual compensating action between the movements of the cylinder 5 and the movements of the float 30, which will make the operation of the control valve the more sensitive to changes in the level of the liquid in the tank 1. In other words, this construction does not permit of violent or extensive fluctuation of the level of the liquid in the tank 1. It maintains that level at so close an approximation to a constant level that the change in level will be almost imperceptible.

While I have herein described a particular embodiment of the invention and a particular arrangement of parts, and have specified the control of the level of liquid in a tank by the device, it is to be understood that the construction and relative arrangement of parts here shown may be varied to any desired degree, and also that a great variety of devices may be controlled by this mechanism other than that herein shown, and numerous other changes and variations in the invention may be made within the scope of the appended claims.

What I claim is:

1. In a control device, the combination with apparatus to be controlled, of a movable cylinder, a stationary piston mounted in said cylinder, means for controlling the condition of the mechanism to be controlled, a connection between said cylinder and said controlling means, a movable member mounted in said mechanism to be controlled, a controlling valve for said cylinder and connections between said last movable member and said controlling valve whereby the movements of said cylinder may be controlled.

2. In a control device, the combination with a liquid containing tank, of a float mounted therein, a movable cylinder and a connection between said cylinder and the means which controls the inlet supply for said tank, a fixed piston mounted in said cylinder, a controlling valve for said cylinder having connections therewith on opposite sides of said piston, connections between said float and the operating lever of said valve whereby movements of said float will control the operation of said valve, and consequently will control the movements of said cylinder, said parts being so constructed and arranged that the movements of said cylinder will reverse the operation of said controlling valve caused by movements of said float, so that the movements of the cylinder will cause compensating movements of the control valve tending to reverse the movements of said cylinder.

3. In a control device, the combination with a liquid containing tank or container, the level of the liquid in which is to be maintained constant, a float pivotally mounted in said tank and arranged to be moved by changes in the level of the liquid in said tank, a supply pipe for said tank, a valve for said pipe, a movable cylinder, connections between said cylinder and said supply valve, a fixed piston mounted in said cylinder, a control valve for said cylinder having communication therewith at the opposite sides of said piston, an operating lever for said valve, connections between said operating lever and said float, whereby movements of said float caused by changes of level in the liquid in said tank will operate said controlling valve to admit liquid to said cylinder at one side of said piston, and simultaneously to exhaust the liquid from the said cylinder at the opposite side of said piston whereby said cylinder will be moved in one or the opposite direction to control the movements of the inlet valve for said tank, said controlling valve for said cylinder being arranged to partake of the movements of the cylinder, said parts being so constructed and arranged that the movements of said cylinder when communicated to said controlling valve will serve to reverse the operations of said controlling valve caused by the movements of said float.

In testimony whereof I, the said CHARLES A. HUMPHREYS, have hereunto set my hand.

CHARLES A. HUMPHREYS.

Witnesses:

JOHN F. WILL,

S. F. ARMSTRONG.