B. BLÜMEL.

REGULATING VALVE.

APPLICATION FILED MAR. 12, 1906.

939,792. Patented Nov. 9, 1909.

Fig. 6

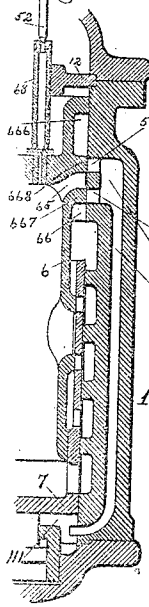


Fig. 7

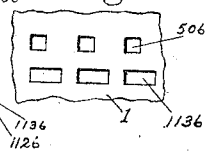


Fig. 1

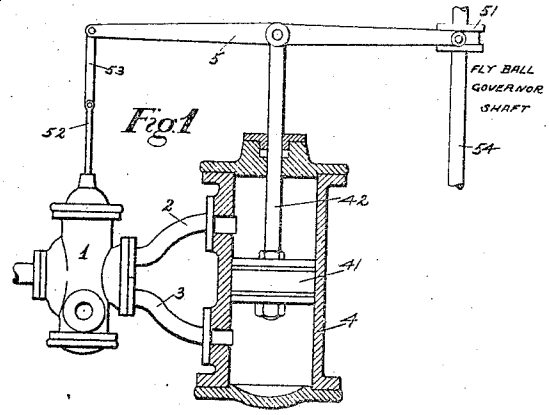


Fig. 5

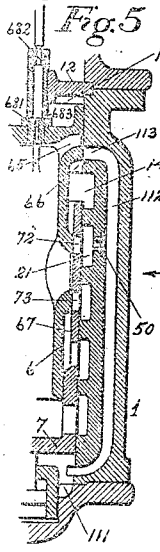


Fig. 2

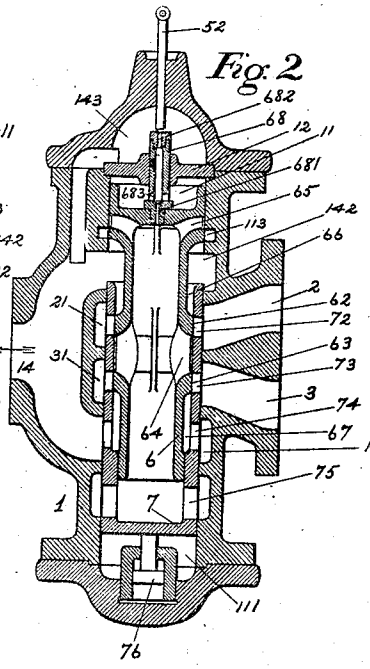


Fig. 3

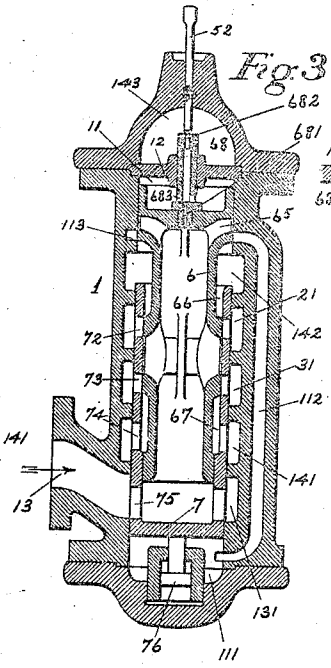
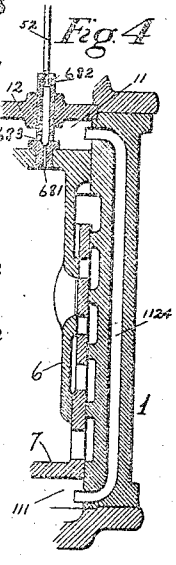


Fig. 4



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UNITED STATES PATENT OFFICE.

BERTHOLD BLÜMEL, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF NEW JERSEY.

REGULATING-VALVE.

939,792. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed March 12, 1906. Serial No. 305,496.

To all whom it may concern:

Be it known that I, BERTHOLD BLÜMEL, a subject of the Emperor of Austria-Hungary, (but having declared my intention of becoming a citizen of the United States), residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Regulating-Valves, of which the following is a specification.

This invention relates to a regulating valve in which there are two oppositely movable parts governing or forming a passage.

It is especially applicable for use as a relay valve or any valve where the normal position is central and movement caused by the governor in either of two opposite directions from the central position is followed by corresponding actuation of a controlled mechanism.

The object of the invention is to provide in a single casing a valve means which gives by the travel of one valve a magnified port opening by the travel of another valve. The speed of travel of the second valve may be controlled to any desired extent, or the amount of such travel may be the same as that of the first valve. The port controls passage of fluid for actuating the controlled mechanism.

In the drawings,—Figure 1 is a side elevation in reduced scale of the relay regulating valve system with the main control cylinder in section. Fig. 2 is a central sectional view through the relay valve of Fig. 1. Fig. 3 is a central sectional view of the valve taken at right angles to the views of Figs. 1 and 2. Figs. 4, 5 and 6 are broken sectional views of modifications. Fig. 7 is a development of a portion of the upper inner surface of the valve casing of the modification shown in Fig. 6.

The illustration shows the application of the invention to a relay governor.

A relay cylinder 1 (Figs. 1 and 2) has conduits 2, 3, communicating with the opposite ends of cylinder 4. A piston 41 and rod 42 coact with cylinder 4 and constitute a controlled mechanism which has connection, not shown, to a water gate, a throttle valve, or any other means of control, for regulating the same. The governor connection is shown as by means of a floating lever 5 connected at one end to the fly ball governor ring 51, at its other end to the pin valve 52 through link 53, and at an intermediate point to the piston rod 42. The fly ball governor is not shown complete in Fig. 1, merely its movable ring 51 being shown as sliding upon fixed rod 54. Any form of centrifugal governor may be used.

The internal structure of the preferred form of relay valve 1 is shown in Figs. 2 and 3. It consists essentially of two oppositely moving valves 6, 7, which, as shown, telescope each other; and the areas of the valves subjected to pressure tending to separate the valves is one-half that of the areas subjected to pressure tending to telescope them. The outer valve 7 has ports 72, 73, coacting respectively with conduits 2 and 3, while the inner valve 6 has portions 62, 63, which are coextensive and coact with the ports. A port 64 between the portion 62, 63, allows of communication to either of the ports 72, 73, from the interior of valve 6. The valve 7 also has ports 74, 75, and is closed at the end adjacent ports 75. The valve 7 has connection to a dash pot or stop 76.

One end of the inner valve 6 is closed, except as hereinafter specified, and is provided with ports 65. This end of the valve coacts directly with the valve casing. The valve 6 is formed on its outer surface with channels 66, 67, for a purpose which will hereinafter appear. At the same end of the valve 6 in which are formed the ports 65 the valve is closed and provided axially with a short tube 68. The inner end of this tube 68 has a passage 681 which is one-half the size of the passage 682 in its outer end. This passage 682 is under the control of the pin valve 52. Intermediate the ends of the tube 68 are ports 683 communicating with intermediate pressure chamber 11 formed between the end of the valve 6 and the partition 12 in the casing.

The casing has an inlet port 13 (see Fig. 3) which terminates in annular pressure chamber 131 communicating with the interiors of the valves through ports 75 of valve 7. The casing is provided with annular exhaust chambers 141, 142, and with an end exhaust chamber 143, all in communica-

tion with the exhaust port 14 (see Fig. 2). The casing is also provided with annular chambers 21, 31, communicating respectively with conduits 2, 3, (see Fig. 2). Between the closed end of valve 7 and the casing is formed pressure chamber 111. An annular chamber 113 is formed in the casing and coacts directly with valve 6. A conduit 112 (see Fig. 3) connects chamber 111 with chamber 113.

The operation of this preferred form of apparatus is as follows: Constant fluid pressure having access to the interior of the valves through port 13, the pressure will leak past port 681 into intermediate pressure chamber 11 and also out through port 682 past pin valve 52 to chamber 143 and the exhaust. The size of port 681 being half that of 682, and the pin valve 52 normally cutting off half of the area of port 682, the pressure in intermediate chamber 11 will be half that of the full pressure. This establishes a hydraulic connection, so to speak, between pin valve 52 and valve 6. As the area of valve 6 in the intermediate chamber 11 is double that of the area of valve 6 subjected to internal full pressure, this will establish the relation of half pressure on full area in one direction, and full pressure on half area in the other direction, and valve 6 will therefore be poised as long as these conditions exist. Valve 7 will also remain poised as long as the fluid is held entrained below it in chamber 111 and in conduit 112. When the pin valve 52 is moved up by the governor, valve 6 will also be moved up by full pressure within the valves because of the drop in pressure in intermediate chamber 11. Conduit 2 (see Fig. 2) will also be opened to full pressure through ports 72. Conduit 3 will be opened to exhaust through ports 73, channel 67, and annular chamber 141. These conditions alone will cause piston 41 (see Fig. 1) in the regulating cylinder to move downwardly and correspondingly actuate the controlled water gate, throttle valve, or device to which it is connected. But the porting is magnified to quicken this action by the quick movement of the valve 7 in the opposite direction to that of 6. This is caused by the pressure being relieved in chamber 111 by the movement of valve 6. Chamber 111 is exhausted (see Fig. 3) through conduit 112, channel 66, and annular exhaust chamber 142. The full pressure within the valve 7 will cause the quick movement of this valve 7 to an extreme position so as to more widely open ports 72 and 73 respectively to pressure and exhaust. The corresponding motion of piston 41 will be a compensating one tending to return pin valve 52 toward its normal mid position. This will cause the pressure in intermediate chamber 11 to increase and to move valve 6 downwardly by reason of the hydraulic connection above described. Until it reaches mid position, the valve 7 will still remain in its extreme lowest position. But when the valve 6 moves very slightly beyond its mid position, the annular chamber 113 is brought into communication with the full pressure through port 65. This will admit full pressure through conduit 112 to chamber 111 underneath valve 7, and the pressure being full pressure upward on the full area, will cause valve 7 to quickly return to its normal mid position, thus restoring the poise. Initial downward motion of pin valve 52 by the governor is followed by a similar sequence of conditions and actions the reverse of those described.

In the modification shown in Fig. 4, conduit 1124, corresponding to conduit 112 of Fig. 3, is placed in communication with the intermediate pressure chamber 11 and is not controlled by valve 6, ports 65 (Fig. 3) being omitted. This structure will insure equal pressure in intermediate pressure chamber 11 and chamber 111 at all times. This construction will therefore cause approximately the same extent of travel of valve 7 as that of valve 6, but, of course, in an opposite direction. Friction is about equal in each. A dash pot or stop is not necessary.

In the modification shown in Fig. 5, conduit 112 is placed in communication through port 50 with annular chamber 21. In other respects this modification is similar to that of Figs. 2 and 3. The operation of this modification differs from that of the modification of Figs. 2 and 3, in causing a somewhat diminished speed of movement of valve 7. This is for the reason that when the valve 7 moves downwardly, some of the fluid exhausted through conduit 112, channel 66, and exhaust chamber 142 is renewed by the entrance of fluid under pressure through port 72, annular chamber 21, and port 50. The speed of valve 7 will be diminished, depending upon the rates at which fluid is thus exhausted and resupplied to conduits 112. It should be noted that in this modification valve 7 does not begin to move until the opening through ports 72 caused by the upward movement of valve 6 is equal in area to that of port 50. This is for the reason that up to this point of travel the exhaust of fluid from conduit 112 through annular chamber 113 is constantly equal to the inlet of pressure through the port 72 because the circumferential lengths of ports 72 and chamber 113 are equal and the flow is not throttled by port 50. When this point of travel of valve 6 has been reached, that is, where the opening through port 72 is equal to the opening through port

50, the flow will be throttled by port 50. The valve 7 will commence to move downwardly because the exhaust of fluid from annular chamber 113 will be greater than the inlet of pressure through ports 72 and 50. It must be remembered, however, that in practice the port 50 is small and valve 7 consequently commences to move almost immediately after valve 6 commences to move.

The modification shown in Figs. 6 and 7 differs from that shown in Fig. 5 in proportionally controlling the size of port 50 by valve 6 itself. The conduit 112 terminates in annular chamber 1126, which communicates with the interior of the casing or valve seat surface through two series of ports 1136, 506. The total circumferential length of ports 506 is a fraction of the total circumferential length of ports 1136, and some of the ports 506 may be plugged to reduce this fraction. The proper ratio is found by test and the ports are left in diametric balance, that is, the ports are arranged in diametric pairs. The ports 1136, 506, are controlled by corresponding walls 667 and 668 of the valve 6. Between these are ports 65, as before. Beyond the wall 668 in the valve 6 is formed annular channel 666 which is in communication with the exhaust. This communication is not shown, but it may easily be accomplished by forming an additional conduit in the valve casing so that this conduit connects channel 666 to the connection (see Fig. 2) between the end chamber 143 and the exhaust 14. In operation, as the valve 6 is moved upwardly through the governor connection, communication will be established through ports 506 between the interior of the valve and chamber 1126, while at the same time the chamber 1126 is placed in communication with the exhaust through ports 1136 and channel 66. If the sizes of the passages formed in these two communications were constantly equal, then there would be as much pressure entering the chamber 1126 as is exhausted therefrom. This would give the same conditions as the modification shown in Fig. 4. In other words, the chamber 1126 would be maintained under half pressure. But, as shown clearly in Fig. 7, the size of the communication with the full pressure within the valves is a fraction of the size of the communication with the exhaust, so that the pressure in chamber 1126 will gradually fall. This will give a slower downward motion of the valve 7. It will be seen by reason of the peculiar construction of the ports 506, 1136, in the casing and the coacting valve 6, that for a given travel of the valve 6, the total opening of port 506 will always be a constant fraction of the total opening of port 1136. The valve 6 will then control the passages 506, 1136, at a constant ratio of opening for pressure actuation of valve 7. This will insure the prompt action of the valve 7 as soon as the valve 6 is moved. It will also insure that the inlet to conduit 112 bears a constant ratio to the outlet therefrom. This is in contradistinction to modification of Fig. 5 in which the valve 7 is subjected to upward half pressure until the opening past port 72 becomes equal to port 50; also, where the area of inlet to conduit 112 bears no constant ratio to the area of outlet.

In accordance with the provisions of the patent statutes, the principle of operation of the invention has been described, together with the means which is now considered to represent the best embodiment thereof; but it is desired to be understood that the means shown is merely illustrative and that the invention can be carried out by other means.

What is claimed and it is desired to have secured by Letters Patent is,—

1. A casing, a plurality of oppositely movable valves therein, passages in the casing, one of the valves controlling a plurality of said passages and by moving in either direction allowing pressure actuation of another of the valves in the opposite direction.

2. A casing, a plurality of valves therein, and sets of passages in the casing, one of the valves controlling the sets of passages at a constant ratio of opening for pressure actuation of another of the valves.

3. The combination with a casing provided with ports, of a valve provided with ports seated in said casing and movable therein under the influence of a fluid under pressure admitted to said casing, a second valve also provided with ports adapted to register with the ports of said first mentioned valve and the ports of said casing, said second mentioned valve being also movably seated in said casing and being adapted to be actuated by the fluid under pressure admitted to said casing.

4. The combination with a casing provided with ports, of a valve provided with ports seated in said casing, a second valve provided with ports also seated in said casing, the ports in said valves and casing being adapted to register, and each of said valves being provided with opposed pressure surfaces whereby differences of pressure of the fluid upon said surfaces are adapted to actuate said valves.

5. The combination with a casing provided with ports, of a valve provided with ports seated in said casing, a second valve provided with ports also seated in said casing, the ports in said valves and casing being adapted to register, and each of said valves

being provided with opposed pressure surfaces whereby differences of pressure of the fluid upon said surfaces are adapted to actuate said valves, and means to vary the pressures exerted upon said pressure surfaces of said valves by the fluid.

6. The combination with a casing, of a movable valve therein, and a second valve in said casing the valve being pressure actuated, both said valves coacting to establish the same passage through said casing and moving in opposite directions.

In testimony whereof I affix my signature in presence of two witnesses.

BERTHOLD BLÜMEL.

Witnesses:
JOHN DAY, Jr.,
G. F. DE WEIN.