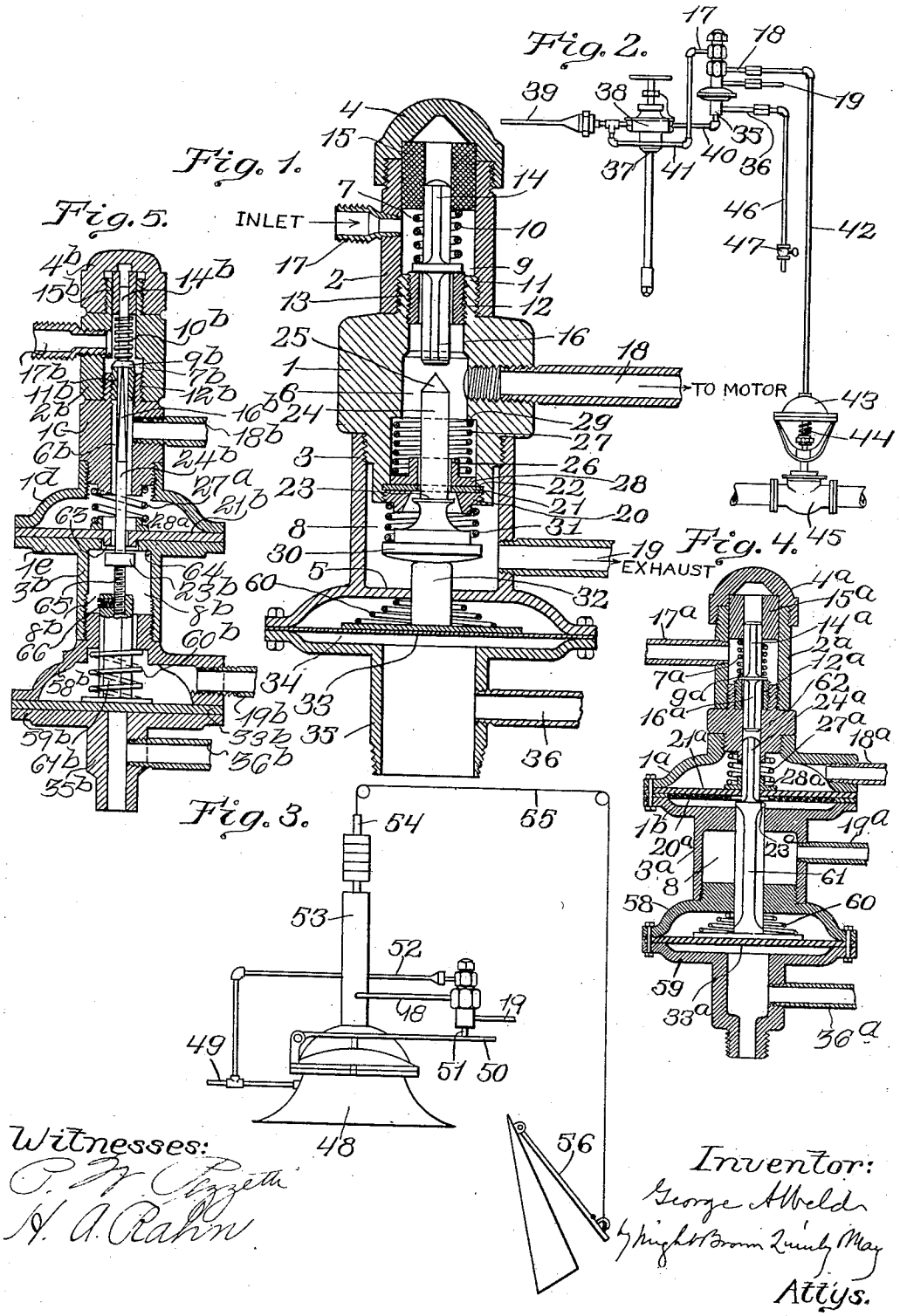
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MOTOR FLUID GOVERNOR.

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UNITED STATES PATENT OFFICE.

GEORGE A. WELD, OF WINCHESTER, MASSACHUSETTS.

MOTOR-FLUID GOVERNOR.

1,245,648. Specification of Letters Patent. Patented Nov. 6, 1917.

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To all whom it may concern:

Be it known that I, GEORGE A. WELD, a citizen of the United States, and resident of Winchester, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Motor-Fluid Governors, of which the following is a specification.

The present invention relates to a device for controlling the opening and closing of valves which are operated by pressure fluids, and for performing analogous offices in admitting and shutting off the working fluid for any sort of motor, whether a diaphragm motor for operating valves, or a motive appliance of any other sort, the device itself being automatic and being under the control of a temperature or pressure operated apparatus. More particularly the invention relates to that class of governor equipped with valves adapted to open and close to permit or prevent passage of the working fluid, and the main object of the invention is to provide the governor with means by which simultaneous opening of both or all of the working valves is made impossible, and it is insured that one of the valves must close before the other can open. This object is accomplished in the present embodiment of the invention by a particular arrangement and construction of mechanical elements, but I declare that I do not limit the invention, at least the broader aspects of the invention, to mechanical elements alone for securing this object. In the accompanying drawings I have illustrated the preferred embodiment of my improved governor in detail and have shown two of the main uses to which it is applicable. In the drawings,

Figure 1 is a vertical central section of the governor.

Fig. 2 is a diagrammatic view of the governor in combination with a thermostat and with a valve of which it controls the operation.

Fig. 3 is a diagrammatic view of the governor used in combination with a pressure-controlled means for effecting its operation.

Fig. 4 is a sectional view of a modified construction of the governor.

Fig. 5 is a similar view of another form of governor.

The same reference characters indicate the same parts in all the figures.

Describing the details of construction of the form of governor shown in Fig. 1, the same comprises first a casing or shell consisting of a central part or body 1, valve casings 2 and 3 which may be called respectively the inlet valve casing and the relief valve casing, because the first contains an inlet valve and the second a relief valve, a cap or end wall 4 detachably secured to the casing 2 and an end wall 5 on the casing 3. These parts are preferably provided with complemental threaded nipples and sockets whereby they may be detachably connected with fluid tight joints. The body 1 incloses a chamber 6, the valve casing 2 incloses chamber 7, and the casing 3 incloses a chamber 8. In the chamber 7 is an inlet valve 9 which is pressed by a spring 10 toward a seat 11 formed on the end of a thimble or tube 12 having a tight fit within the threaded nipple or neck 13 of the body 1. Said valve has a stem 14 having a sliding fit in a sleeve 15 in the end of the casing 2, whereby the valve 9 is guided and positioned with respect to the seat 11. A second stem 16 runs from the valve 9 through the thimble or sleeve 11 into the chamber 1. There is sufficient free space between the stem 16 and the walls of the thimble to allow free flow of working fluid when the valve 9 is unseated. A nipple or pipe connection 17 communicates with the chamber 7, a pipe or pipe connection 18 communicates with the chamber 6, and a third pipe or connection 19 opens from the chamber 8. Connection 17 is an inlet for the working fluid, connection 18 is an outlet for the fluid to the part or motor which it operates, and connection 19 constitutes a waste or drip outlet to permit relief of the operating fluid from the motor when the fluid is shut off.

Threaded into the end of body 1 which projects into the casing 3 is an annular clamp nut 20, which secures the periphery of a flexible diaphragm 21 against a shoulder 22 of the body 1. Said diaphragm constitutes a flexible valve seat with which cooperates a valve 23 having a stem 24 passing through a central aperture of the flexible valve seat into the chamber 1, and provided with a pointed end 25 near the end of valve stem 16. A thimble 26 loosely surrounds the stem 24 and is pressed against the diaphragm 21 by a spring 27 bearing against a lip 28 of the thimble and abutting on a shoulder 29 within the body 1. Valve 23

has a head 30 which is normally pushed away from the flexible seat 21 by a spring 31 abutting on the clamp nut 20 and is held by the spring against an operating stud or rod 32.

Said stud or rod 32 may be operated by any one of a variety of means. In Fig. 1 it is moved against the tension of springs 31, 27, and 10 by a diaphragm 33 contained in a diaphragm chamber 34 which is here made as structurally a part of the casing 3. This diaphragm chamber has a threaded nipple 35 for connection with a pipe or container in which there is a pressure fluid. An exhaust tube 36 leads from the nipple 35.

When the under side of diaphragm 33 is relieved of pressure, the spring 31 opens valve 33 and spring 10 closes valve 9, thereby interrupting the connection between the inlet 17 and outlet 18, and establishing communication between such outlet and the exhaust 19. When pressure is applied to diaphragm 33 on its under side, the actuator stud 32 and valve 23 are raised, first closing the valve against its flexible seat 21 and then bringing end of stem 24 against the stem 16. Continued movement of the diaphragm in the same direction causes the valve 23 to displace the flexible seat 21 and the stem 24 to raise and unseat the valve 9, thereby establishing communication between the inlet 17 and outlet 18 after the communication between outlet 18 and exhaust 19 has been closed. The combined length of the stems 24 and 16 is slightly less than the distance between the valve seat 11 and the valve seat 21, when the latter is in the normal position, whence the valve 23 must seat before valve 9 can open.

When the valves move in the opposite direction the spring 27 causes the valve seat 21 to follow valve 23, remaining in contact with it until the seat brings up against the rigid nut 20, which occurs immediately after the valve 9 has become seated. The closing of the valve 9 by spring 10 and opening of valve 23 by spring 31 are controlled by the recession of the motive diaphragm 33 when the pressure in the chamber 34 is relieved. Thus it is no more possible to open the valve 23 before valve 9 is seated, than it is to open valve 9 before valve 23 is seated.

Valve seat 21 is preferably made of rubber in order to be sufficiently flexible and to make fluid-tight contact with valve 33. The thimble 26 with its flange 28 and spring 27 make a follower or backing or resilient abutment for the valve seat through which the pressure of the spring 27 is applied to said valve seat without injury thereto. If the valve seat could be made sufficiently stiff and at the same time sufficiently yielding for the required purposes, the spring 27 would be unnecessary, but it is impracticable commercially to obtain material for a valve seat having these qualities not subject to deterioration, for which reason it is a practical necessity to provide the spring 27.

Likewise if a sufficiently tight joint could be made between the valve 23 and the follower 26, and if the latter could be made fluid tight with respect to the walls of the body 6, the valve seat 21 in the form of a diaphragm would be unnecessary. But as this is not possible, I have adopted as the best form of seat or packing for the valve the member 21 in the form of a flexible diaphragm tightly clamped at its periphery in contact with the body 1. Functionally the follower 26 could be considered a yielding valve seat and the diaphragm 21 a packing or washer to prevent leakage between the valve and seat.

The end 25 of valve stem 24 is preferably made pointed as shown to obviate possibility of solid matter, such as sediment carried by the motive fluid, lodging between that stem and the stem 16 in such a way as would derange the working of the device.

Fig. 2 illustrates the manner in which the governor is used under the control of a thermostat, or in other words, a temperature-governed controlling device. In this figure a thermostat is represented at 37, such thermostat having a valve chamber 38 to which is attached a connection from a supply pipe 39 carrying the motive fluid, and from which leads a pipe 40 connected with the nipple or inlet 35 of the diaphragm chamber 34. A valve is contained within the chamber 38 of the thremostat adapted to be opened or closed so as to permit or prevent a flow of the fluid through the thermostat. Any thermostat adapted to operate a valve which will govern the admission of fluid to the nipple 35 may be used, since the particular character of thermostat has no connection with the present invention. The thermostat here shown for illustration is substantially that shown in my Patent No. 934,116 granted September 14, 1909 to which reference may be had if desired for an understanding of its construction and operation. 41 represents a by-pass running from the supply pipe 39 to the inlet connection 17 of the governor. The outlet pipe 18 from the governor is connected with a pipe 42 which runs to the fluid operated motor controlled by this governor, which governor may be a diaphragm in a chamber 43 and arranged to act on the stem 44 of a valve contained in a valve casing 45. When the thermostat so acts that the motive fluid acts on the diaphragm 33, the exhaust valve 23 is closed and the inlet valve 9 opened, allowing the motive fluid to flow through the by-pass 41, inlet 17, past the valve 9, out through the outlet 18 and the connection 42 to the motor 43, by which it operates the valve. When the passage through the ther-

mostat chamber 38 is closed, the pressure acting on diaphragm 33 is relieved by escape of the motive fluid through the exhaust outlet 36, whereupon the valves within the governor are moved in the opposite direction by their springs 10 and 13, valve 9 being closed and valve 23 being opened after the closing of valve 9. Then the fluid in the diaphragm chamber or motor 43 may be relieved by escape of some of the fluid in the governor and connecting pipes through the exhaust pipe 19.

The exhaust 36 from the diaphragm chamber 34 is connected with a pipe 46 which has a stop cock 47, whereby a constantly open leak or drip of regulated and limited amount is provided. The constantly open drip allows motive fluid to escape whenever the connection through the thermostat is shut off, but is at the same time so limited and restricted as to make the flow less rapid than the flow through the thermostat, whereby it does not prevent efficient and prompt operation of the governor.

A thermostat is only one type of device for operating the governor. Fig. 3 represents diagrammatically the use of another form of primary control device which is actuated by pressure. In this figure the pressure actuated device is a chamber 48 to which pressure fluid passes through a pipe 49 and in which there is a movable member such as a diaphragm or piston acting on a lever 50, which in turn acts through a stem 51 corresponding to the stud 32, already described, and arranged to operate the valves in the governor. A by-pass 52 goes from the pipe 49 to the inlet of the governor, while the outlet 18 from the governor extends to a motor 53 in which there is a piston or other traveler carrying weights and having a rod 54, which is joined by a wire or other flexible connector 55 with a damper or the like 56, which is operated by the motor. The governor or controller affords a means for effecting a more rapid admission of working fluid to the motor and a more rapid and sensitive actuation of the motor than could be effected by the thermostat or the primary control device alone. The by-pass from the motive fluid supply conducts the motive fluid in full volume and undiminished pressure directly to the governor, ready to pass through the latter to the motor whenever the governor is operated.

Fig. 4 indicates how the essential principles of the device may be embodied in a specifically different construction. In this figure the part corresponding to the body or central portion 1 is made as a diaphragm chamber, with a dished disk 1^a attached to the flange 1^b of a tubular casing 3^a which incloses the exhaust chamber 8. The edges of the disk 1^a and flanges 1^b are clamped together and between them is gripped the edge of a diaphragm 21^a which forms a yielding valve seat, and also a rigid disk 20^a which supports the diaphragm when the coöperating valve is separated from it, and limits the movement which may be given to the diaphragm by the spring 27^a acting through the washer or thimble 28^a. The tubular casing 3^a is detachably screwed upon the hub of a disk 58 which forms one wall of a diaphragm chamber and is secured to a complemental disk 59 forming the other wall of such chamber, which contains a diaphragm 33^a corresponding to the diaphragm 33 in Fig. 1. The diaphragm in each form of the invention is pressed upon by a spring 60, which assists in expelling the motive fluid from the diaphragm chamber when the latter is inoperative.

The stem 61 which is pressed upon by diaphragm 33^a is also the exhaust valve, and is formed with a shoulder 23^a which constitutes the exhaust valve proper and is arranged to pass through a central aperture in the support plate 20^a and to seat against the diaphragm valve seat 21^a. The upper end of the stem 61 is continued to form a stem 24^a corresponding to the stem 24 in Fig. 1, by which the inlet valve is controlled.

There is one further difference between the construction of this form of the invention and that shown in Fig. 1, which consists in a connector 62 having threaded nipples, one of which is screwed into the central part of disk 1^a and the other of which is screwed into the inlet valve casing 2^a and carries the valve seat thimble 12^a. In all other respects this form of the device is identical with that shown in Fig. 1, and the corresponding parts are designated by similar reference characters, which are respectively modified by the exponent "a".

The form of governor illustrated in Fig. 5 exhibits slight modifications in the construction from the form illustrated in Fig. 4, the most important of which are provisions for adjusting the escape or exhaust valve and a construction of the seat for said valve which resists wear and destruction of the seat. The exhaust valve 23^b corresponds in function to the valve 23 of Fig. 1 and 23^a of Fig. 1. It coöperates with a flexible seat composed of a diaphragm having a central aperture and clamped between the rims of a disk 1^d and flange 1^e. The rim of the aperture in the diaphragm 21^b through which the stem 24^b of the valve passes, is reinforced and strengthened by a bead 63 which takes the thrust of the valve 23^b and greatly diminishes the tendency of the diaphragm to tear at the margin of the aperture. The diaphragm is supported by the flange 1^e of the casing 3^b, and by an inwardly projecting flange 64 which surrounds the valve 23^b, leaving a central opening large enough to permit the valve and the fluid to pass freely.

This flange 64 performs the function of the disk 20^a, and being formed as a part of the casing permits the elimination of one part and the simplification of the device to that extent.

The valve 23^b instead of being formed as a part of the stem 61^b, is adjustably mounted thereon, being provided with a threaded stem 65 which enters a threaded socket in the end of the stem 61^b whereby the valve is adjusted, and the adjustments are made permanent by a set screw 66. Evidently the adjustments thus permitted to the valve determine the sensitiveness of the device. The stems 61^b, 24^b, and 16^b are made of non-circular outline so as not to obstruct the passages through which they extend, whereby they permit free flow of the fluid.

Except for the particulars above noted the construction and arrangement of the parts shown in Fig. 5 are equivalent and substantially identical with the construction and arrangement of corresponding parts in Figs. 1 and 4. The reference characters applied in Fig. 5 with the exponent "b" annexed designate the parts in this figure which correspond with parts designated by the same numerals in the other figures. The fundamental principle present in all forms of the device herein illustrated and described is the same.

What I claim and desire to secure by Letters Patent is:—

1. A governor comprising a casing having an inlet, an outlet and an exhaust arranged in the order named longitudinally of the casing, a valve seat between the inlet and the outlet, a second valve seat between the outlet and the exhaust, the outlet being between the two valve seats, two valves each co-acting with one of said valve seats and one of them having a stem projecting toward the other and adapted to be engaged therewith, yielding means tending to hold the valve between the inlet and the outlet against its seat, yielding means tending to hold the other valve away from its seat, and an actuator for placing the latter valve against its seat, the seat for the latter valve being yieldable in the closing direction whereby to permit continued movement of the coöperating valve sufficient to open the first valve.

2. A governor comprising a casing having an inlet, an outlet and an exhaust arranged in the order named longitudinally of the casing, a valve seat between the inlet and the outlet, a second valve seat between the outlet and the exhaust, the outlet being between the two valve seats, two valves each co-acting with one of said valve seats and one of them having a stem projecting toward the other and adapted to be engaged therewith, yielding means tending to hold the valve between the inlet and the outlet against its seat, yielding means tending to hold the other valve away from its seat, and an actuator for placing the latter valve against its seat, the seat for the latter valve being yieldable in the closing direction whereby to permit continued movement of the coöperating valve sufficient to open the first valve, there being sufficient lost motion between the engaging points of the two valves to permit seating of the one valve against its yielding seat before the other valve is unseated.

3. A governor comprising a casing having an inlet, an outlet and an exhaust arranged longitudinally in the order named, an inlet valve and a seat coöperating therewith between the inlet and the outlet, a spring tending to hold said valve against its seat, an exhaust valve and a complemental seat arranged between the outlet and the exhaust in such manner that the closing movement thereof is in the same direction as the opening movement of the admission valve, said valves having stems projecting toward one another and of a combined length equal approximately to the distance between the valve seats, the exhaust valve being normally open and its seat being yieldable toward the admission valve, and an actuator arranged and operable to close the exhaust valve and thereafter open the admission valve by continuing to move the exhaust valve with its seat after the same has become seated.

4. A governor comprising a casing, two valve seats in said casing spaced apart and facing in opposite directions, and an admission valve co-acting with one of said valve seats, an exhaust valve co-acting with the other valve seat, the casing having ports on opposite sides of both valve seats, the valves having stems projecting toward one another of such length as to come into contact when both valves are seated, an actuator arranged to act upon one of the valves in the valve closing direction, and springs associated with both valves tending to move them in the opposite directions, one of the valve seats being movable against a yielding resistance with its complemental valve in the closing direction.

5. A governor comprising a casing, two valve seats in said casing spaced apart and facing in opposite directions, and an admission valve co-acting with one of said valve seats, an exhaust valve co-acting with the other valve seat, the casing having ports on opposite sides of both valve seats, the valves having stems projecting toward one another of such length as to come into contact when both the valves are seated, an actuator arranged to act upon one of the valves in the valve closing direction, and springs associated with both valves tending to move them in the opposite directions, one of the

valve seats being movable against a yielding resistance with its complemental valve in the closing direction, the movable valve seat being a flexible diaphragm secured at its periphery in a fluid tight manner to the casing and having an aperture through which the stem of the complemental valve passes, the face of the diaphragm adjacent to said aperture being that part of the seat which co-acts with the valve.

6. A governor for motive fluid comprising a valve casing, a diaphragm crossing said casing, connections for external communication with said casing at opposite sides of said diaphragm, a valve arranged to seat against such diaphragm and having a stem passing through the diaphragm, a second valve having a stem extending toward and engageable by the stem of the first named valve, a seat with which said second valve co-acts located between the second valve and the diaphragm, and a third connection for external communication with the casing arranged on the other side of the second valve from the connections previously mentioned, such diaphragm being yielding and adapted to follow the valve with which it co-acts during part of the movements of that valve.

7. In a governor having inlet and outlet openings and a valve between such openings, a flexible valve seat arranged to coöperate with said valve and being movable with the valve, said seat being a diaphragm having an aperture and said valve being arranged to lie over such aperture, the diaphragm having a bead surrounding the aperture and providing the seating surface for the valve.

8. A governor comprising a casing having an inlet, outlet, and an exhaust, a valve seat and a valve interposed between the inlet and the outlet, a second valve seat and a second valve interposed between the outlet and the exhaust, said valves being movable in approximately the same line and one of them having a stem extending toward the other and adapted to transmit movement from one valve to the other, the valve seats being on relatively opposite sides of the valve with which they respectively coöperate, and one of the valve seats being yieldingly movable in the closing direction with the coöperating valve, and means for limiting the movement of said valve seat in the opening direction of movement of the said coöperating valve.

In testimony whereof I have affixed my signature, in presence of two witnesses.

GEORGE A. WELD.

Witnesses:
ARTHUR H. BROWN,
P. W. PEZZETTI.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."