No. 889,712. PATENTED JUNE 2, 1908.

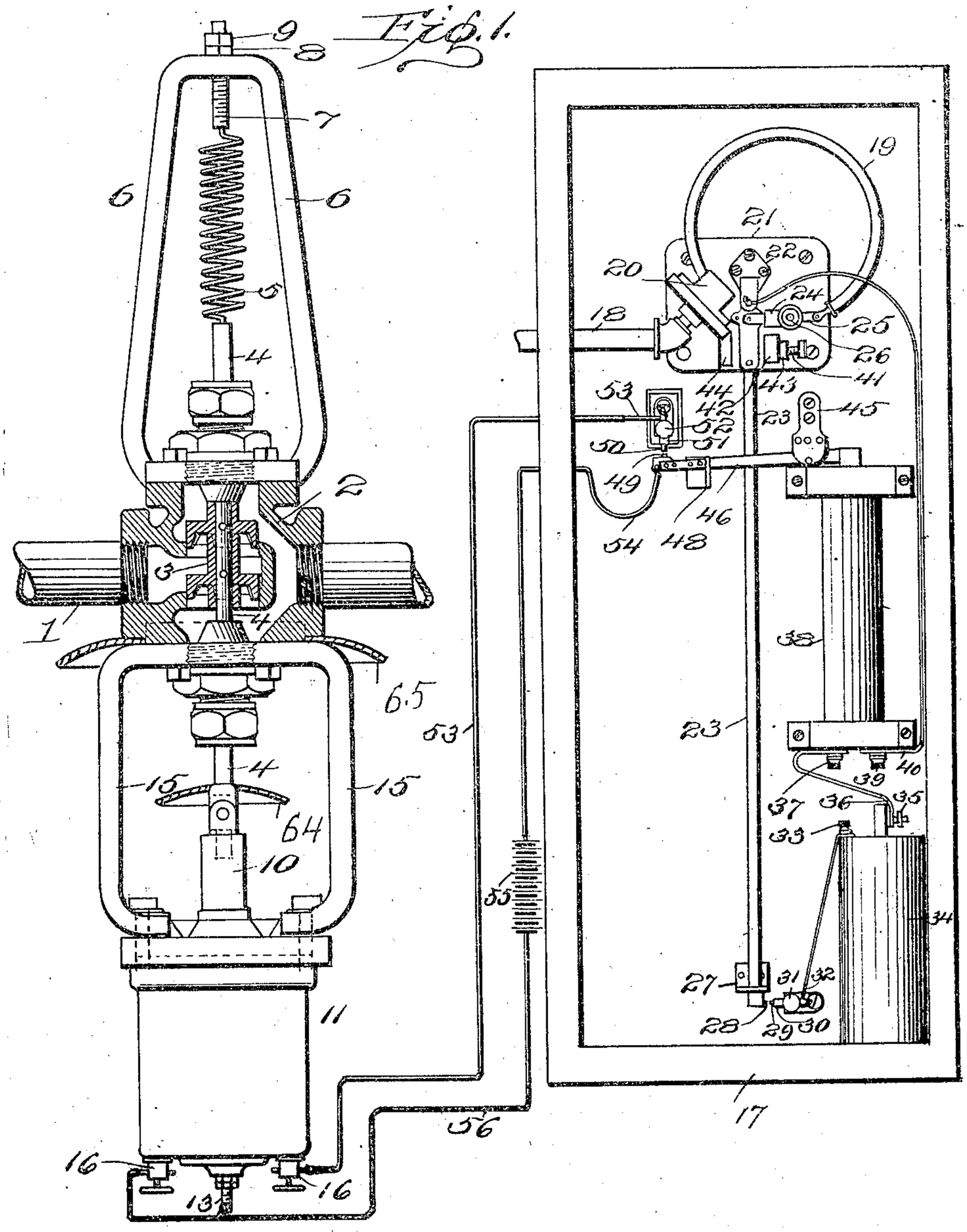
W. McCLAVE.

PRESSURE GOVERNOR.

APPLICATION FILED MAR. 13, 1906.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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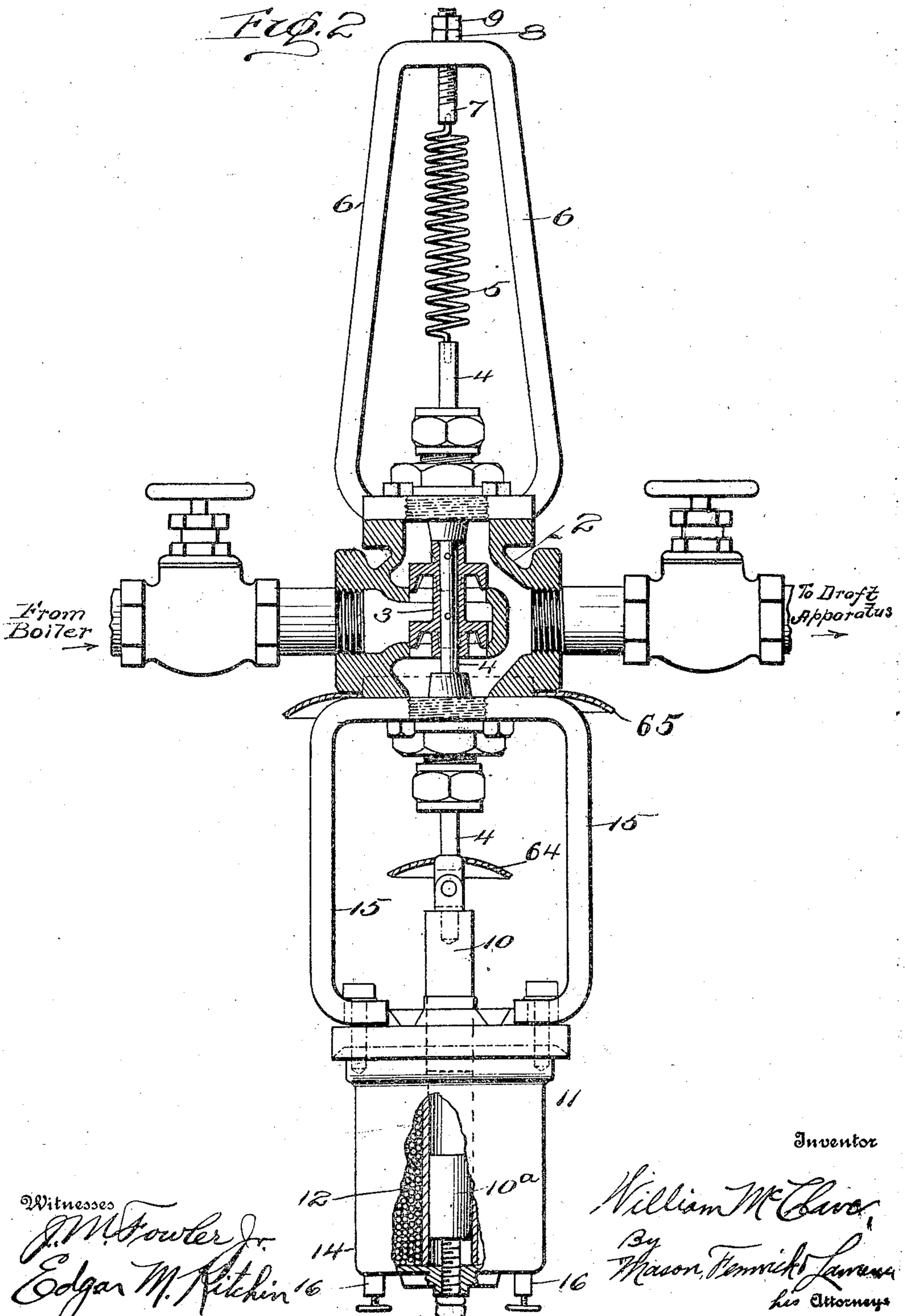
5 SHEETS—SHEET 2.

Fig. 2



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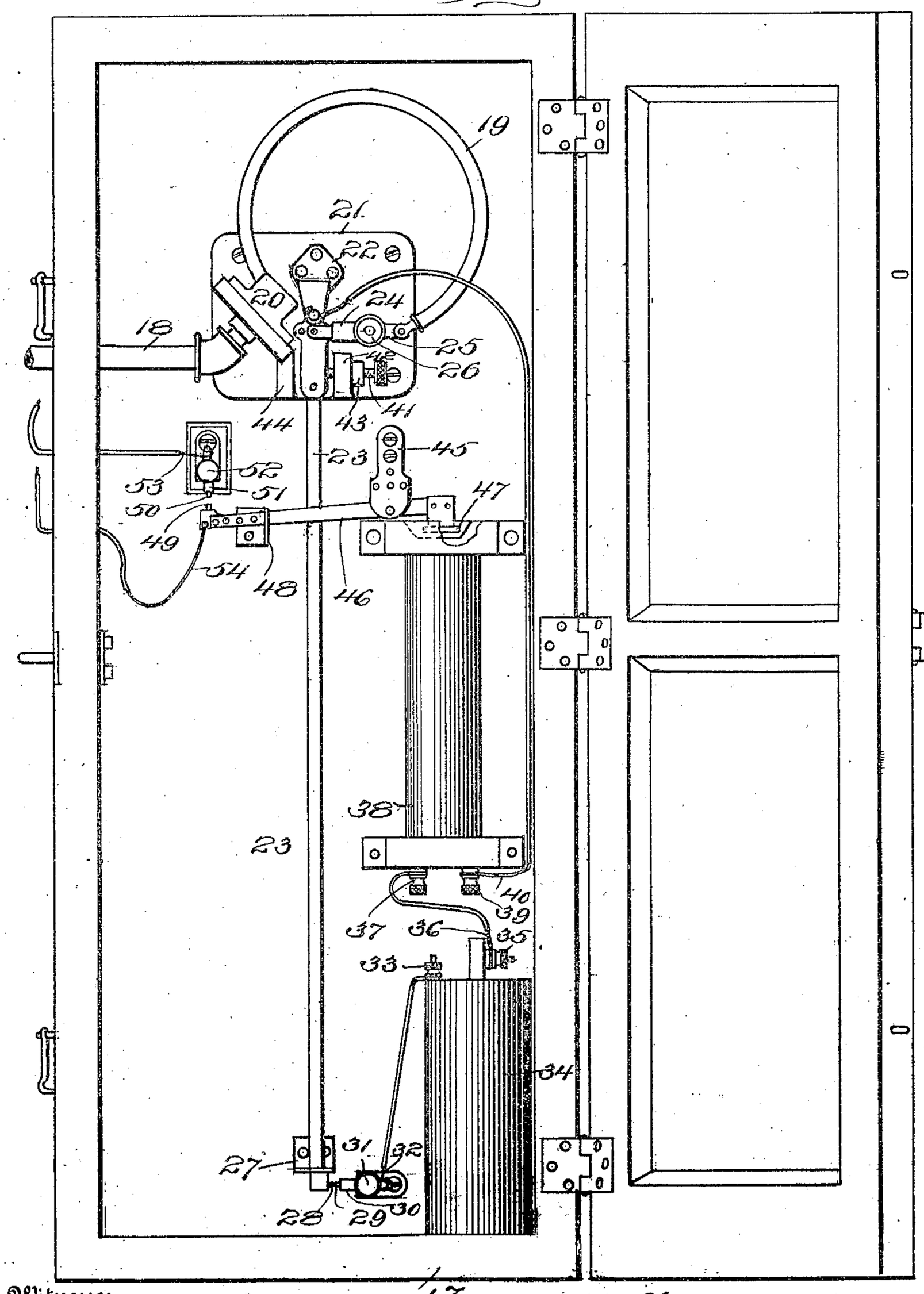
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

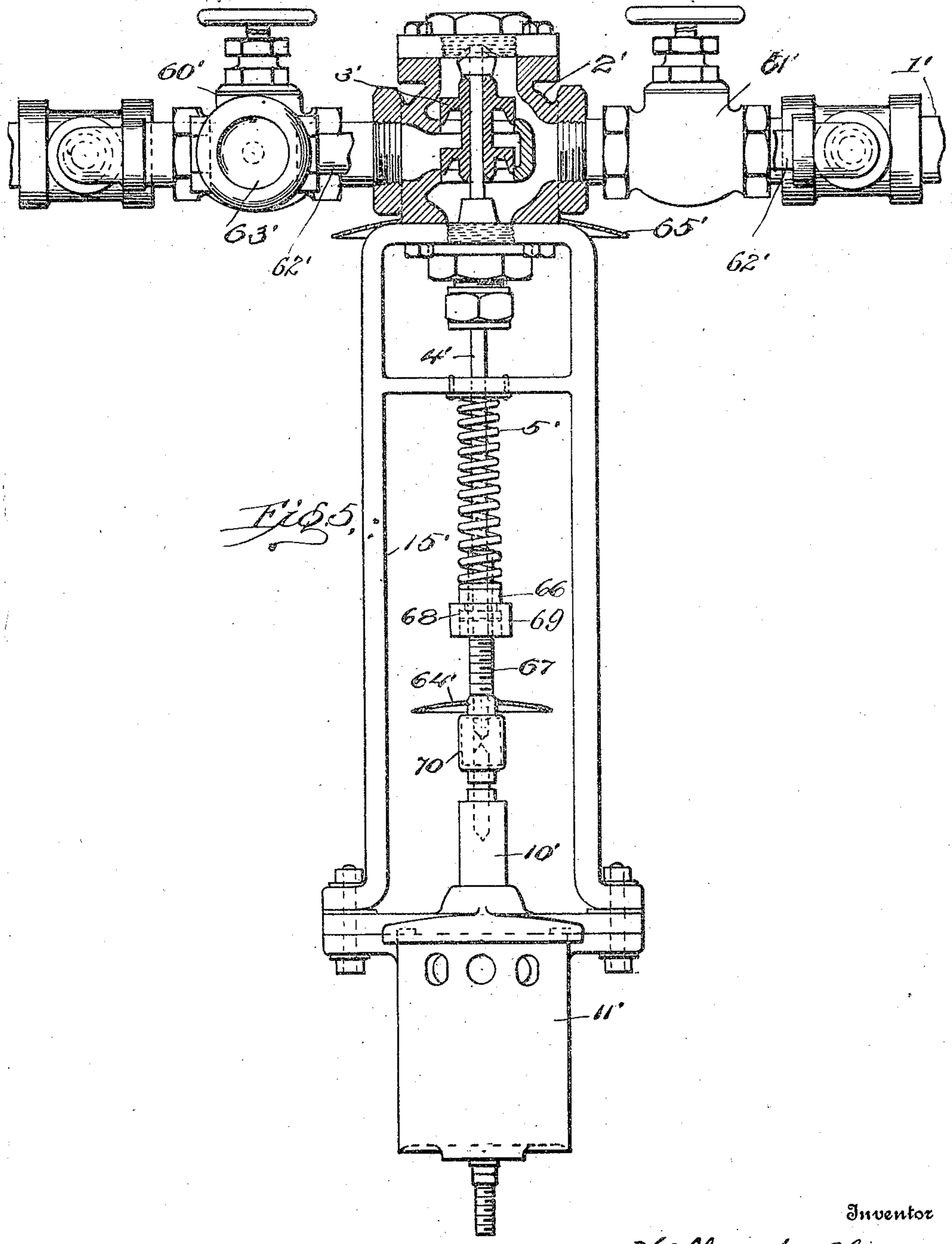

Fig. 5.

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5 SHEETS—SHEET 5.

Fig. 6

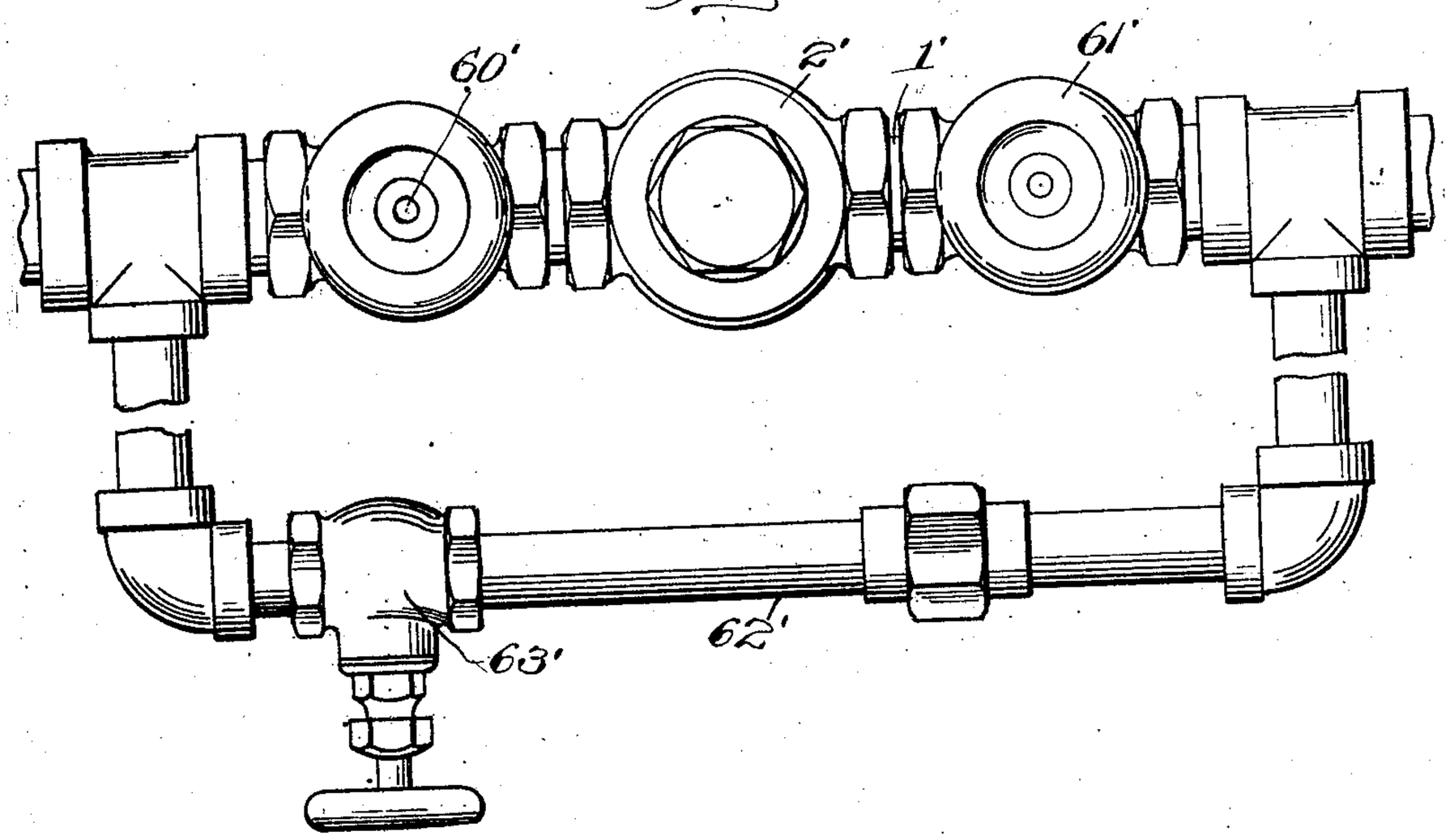
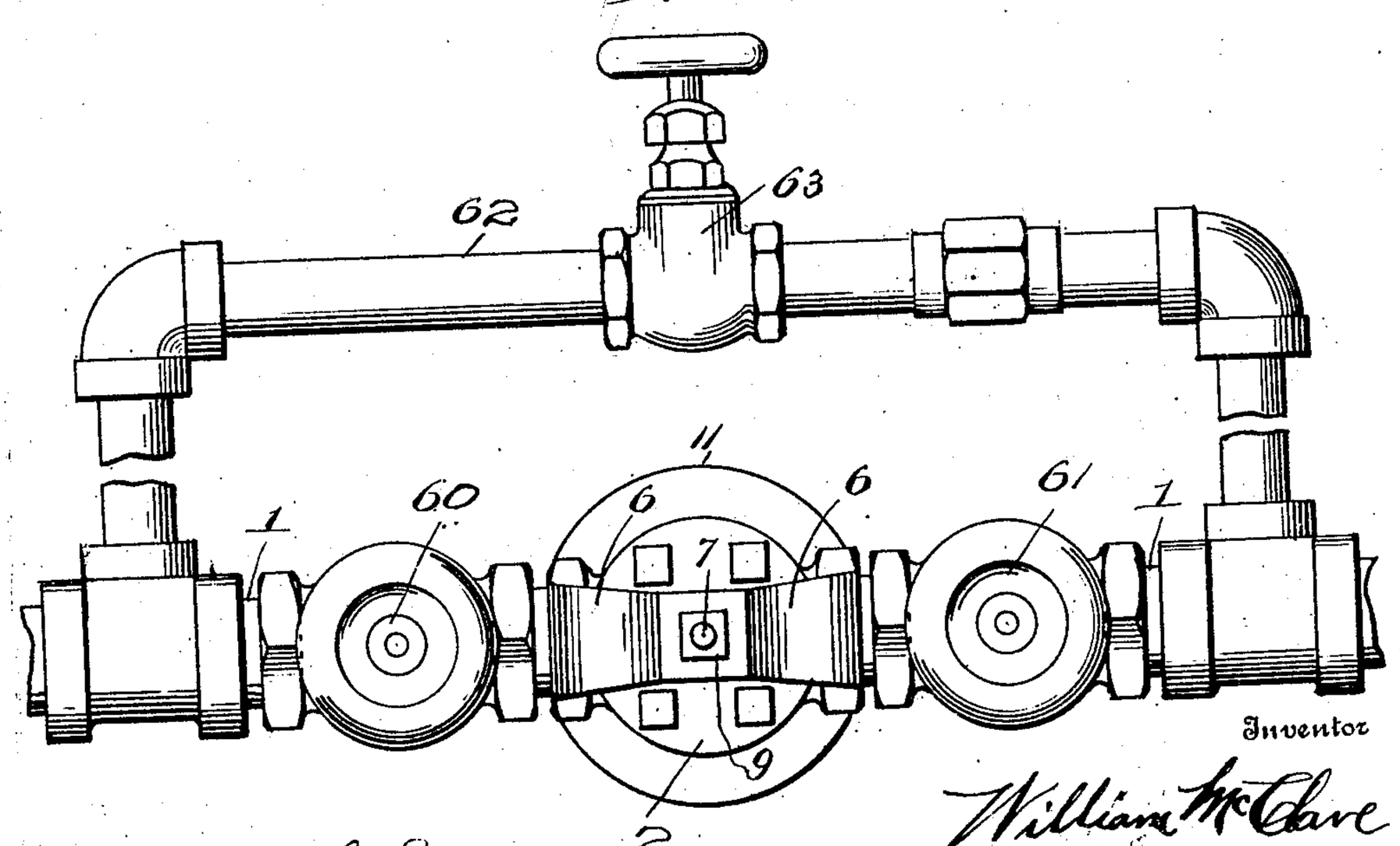


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM McCLAVE, OF SCRANTON, PENNSYLVANIA, ASSIGNOR TO McCLAVE-BROOKS COMPANY, OF SCRANTON, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PRESSURE-GOVERNOR.

No. 889,712. Specification of Letters Patent. Patented June 2, 1908.

Application filed March 13, 1906. Serial No. 305,899.

To all whom it may concern:

Be it known that I, WILLIAM McCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Pressure-Governors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in pressure governors, and more particularly to apparatus designed for controlling the condition of combustion within a furnace for governing the pressure of steam within a boiler heated by said furnace.

The object in view is the control of the pressure within a boiler, such control being accomplished by governing the blast or draft of the furnace employed for heating the boiler. This and other objects are attained largely by the employment of the combination of a steam supply pipe leading directly or indirectly from a boiler or boilers (not illustrated) to fan engines, steam blowers, etc., (not illustrated) arranged for furnishing forced draft or blast for a furnace, a valve interposed in the length of said pipe for controlling the flow within the pipe, an electro-magnet acting directly upon said valve for governing the position of the same, a gage controlled by the pressure of the boiler or boilers being heated by the furnace whose draft apparatus is operated by the steam supplied through the said pipe, an electrical circuit, means controlled by said gage for closing said circuit, an electro-magnet interposed in said circuit, and a relay circuit adapted to be closed by said last-mentioned magnet, the said relay circuit including the electro-magnet acting upon the valve.

The invention further comprises certain other novel constructions, combinations and arrangements of parts as will be hereinafter fully described and claimed.

In the accompanying drawings: Figure 1 is a general view partially in elevation and partially in section of a pressure governor embodying the features of the present invention. Fig. 2 is a longitudinal, vertical, central section through the valve, some of the connected parts being shown in elevation, part of the solenoid being broken away for disclosing interior structure. Fig. 3 is a detail view in elevation of the circuit closing mechanism. Fig. 4 is a top plan view of the valve and surrounding parts. Fig. 5 is a view partially in section and partially in elevation of a modified form of valve actuating mechanism. Fig. 6 is a top plan view thereof.

Referring to the drawing by numerals, 1, indicates a pipe adapted to supply steam or other suitable agent under pressure, to a suitable draft or blast apparatus for a furnace.

Interposed in the length of the pipe 1, is a valve casing 2, provided with a valve 3, preferably of the balanced type. The valve 3 is provided with a centrally arranged valve stem 4, which extends axially of the valve and projects beyond the valve at each end thereof, one end of said stem extending through any suitable packing, carried by casing 3, to a point above the casing, and being engaged by a retractile spring 5. Any suitable bracket 6 is carried by the casing 2, and extends beyond the upper end of the spring 5, and a bolt 7 is supported on the bracket 6, by an adjusting nut 8. The nut 8 is preferably normally retained against movement by any suitable lock nut 9. The spring 5 may have its tension increased or decreased by longitudinal movement of the bolt 7, and in practice I preferably adjust the bolt 7 for giving the required tension to the spring 5 for normally maintaining the valve 3 in an open condition. The opposite end of the stem 4 projects through a packing carried by the lower side of the casing 2, and preferably pivotally engages the core 10 of a solenoid 11. The solenoid 11 may be of any suitable type, but by preference consists of the usual winding 12, surrounding core 10. Core 10 is longitudinally movably mounted within the winding, and is preferably substantially one-half the length of the helix, the other half of the space within the helix, or winding 12, being taken up by a core section 10^a. The core section 10^a is adjustable within the helix and is engaged by an adjusting screw 13, adapted to move the said core section longitudinally within the

helix for increasing or decreasing the reluctance of the path of the magnetic flux. For the sake of centralizing the lines of force, a preferably soft iron casting 14 incloses the helix or winding 12. The solenoid 11 is preferably supported by brackets 15, fixed and depending from the casing 2. The opposite terminals of the helix 12 are preferably connected with binding posts 16—16.

From the foregoing it will be observed that when the solenoid 11 is not supplied with current, the spring 5 will maintain the valve 3 in an open condition, and when current is supplied to the solenoid the valve will be moved to a closed condition. The adjusting means shown and described for varying the tension of the spring 5, together with adjusting means for the core section 10^a, makes it possible to carefully balance the solenoid against the spring, the adjustment of the core section 10^a, varying the reluctance of the path for the magnetic flux, and thereby varying the degree of pull upon the core 10. In practice of course, the solenoid must be capable of exerting a pull on its core 10, equal to approximately twice the pull on the spring 5, and, as the parts are in exact alinement and are in line with the longitudinal axis of the valve 3, the said valve will readily respond to the solenoid, or to the spring, according to the presence or absence of current in the solenoid helix.

In practice I find that the solenoid 11 requires a current of sufficiently high potential for producing an objectionable amount of sparking, if the switch employed for making and breaking the circuit is operated slowly. The prior art includes apparatus involving a gage for moving an electrode into contact with a second electrode, but I find that such apparatus is undesirable for use in connection with a solenoid designed to act directly upon the pressure controlling valve for the reason that so much sparking is produced by the slow making and breaking of the circuit as to burn and destroy the electrodes.

By the apparatus best seen in Fig. 3, I obviate the objections above noted and eliminate substantially all sparking. The apparatus is preferably arranged in any suitable cabinet 17. A pipe 18 is employed and leads from the boiler being heated by the furnace whose draft apparatus is supplied with pressure through pipe 1. The pipe 18 communicates with any ordinary type of pressure gage 19, which gage is supported in position by a block 20, fixed to one end thereof. The block 20 is preferably hollow and constitutes the means of communication between the pipe 18 and the gage, the said block being fixed to a bracket, not illustrated, which projects from plate 21 and which is preferably integral therewith. A bracket 22 is carried by plate 21, and pivotally carries a depending arm 23. The arm 23 is preferably of non-magnetic material, but is a good electrical conductor. The said arm is, as illustrated, preferably of relatively great length, and normally hangs in the line of gravitation. At a comparatively short distance from the pivot of the arm 23, said arm is pivotally engaged by one end of a sleeve 24. The sleeve 24 telescopically incloses a rod 25, and carries a set screw 26, adapted to engage the rod 25 at various points of longitudinal adjustment of said rod for locking the rod against movement independently of the sleeve. The free end of the rod 25 pivotally engages the free end of the gage 19. A right angle bracket 27 is fixed to the cabinet 17 near the lower end of the arm 23, and is provided with a horizontal slot inclosing the lower end of the arm for guiding same in its movement. The said lower end is provided with a contact point 28, preferably of platinum, said point being disposed contiguous to a similar point 29, carried by a suitable adjustable bar or rod 30, said rod 30 being engaged by an adjusting set screw 31 for retaining same at various points of longitudinal adjustment. The rod is also engaged by a wire 32 or other suitable electrical conductor, which extends to the binding post 33 of any ordinary type of electrical cell 34. The opposite binding post 35 of said cell is engaged by a wire or other suitable conductor 36, which extend to a binding post 37 of an electro-magnet 38, the opposite binding post 39 of said magnet being engaged by a wire or other suitable electrical conductor 40, which extends to and engages with the pivot of the arm 23. The adjusting screw 41 is threaded through a bracket 42, arranged on the plate 21, contiguous to the arm 23, and the said screw 41 preferably carries a lock nut 43, for retaining the screw at various points of adjustment. At the opposite side of that arm 23, a lug 44, projects laterally from the plate 21, and prevents the arm from swinging too far rearwardly.

It is to be especially noted that in practice the pivotal connection of the sleeve 24, with the arm 23, is as close to the pivotal support as it is practical to make the same, as that the slightest movement of the sleeve 24, and connected parts, will produce a relatively great movement of the lower end of the arm 23, the set screw 41, being employed for controlling to a nicety the amount of movement permitted, so that the electrode 28 will not be permitted to strike electrode 29 with sufficient force to do injury to either. Thus any fluctuation in pressure in the gage 19 will quickly produce operation of the parts. If the pressure rises above the desired point the expansion of the gage 19, even to a very slight degree, will swing the arm 23 out of the line of gravital force sufficiently for producing contact of electrodes 28 and 29, and clos-

ing the circuit of the electro-magnet 38. When the pressure is reduced to normal, a retraction of the gage 19 will permit the arm 23 to have its free end drop by gravity away from electrode 29, and the contact is thus broken. A quick acting contact making and breaking apparatus is thus provided, but the action is not sufficiently quick to justify the employment of such apparatus for controlling the circuit of solenoid 11, and the said apparatus is therefore employed as indicated for governing the local circuit, and, as will be hereinafter fully specified, for controlling the solenoid circuit by controlling of the local circuit.

Fixed to the cabinet 17, above and at one side of the electro-magnet 38, is a suitable bracket 45, which pivotally supports a lever 46, the said lever being provided at one end with the armature 47, suspended above and contiguous to one end of the core of magnet 38. The lever 46 is guided in its movement by a suitable guide bracket 48, constructed similar to bracket 27, but disposed vertically instead of horizontal. The end of the lever 46 beyond the bracket is provided with an electrode 49, preferably of platinum, arranged contiguous to a similar electrode 50, carried by a rod or bar 51, adjustably engaged by a set screw 52 of any ordinary type. The rod 51 is engaged by a wire or other suitable electrical conductor 53, which extends to one of the binding posts 16. Electric wire, or other suitable conductor, 54, engages the arm 46 near the electrode 49, and extends to one pole or any suitable battery, or other source of electric energy 55, the other pole of the battery or other source of electric energy being engaged by a wire, or other suitable conductor, 56, extending to the other binding post 16.

The operation of the parts will be largely obvious, but it may be pointed out that when the local circuit is closed by the swinging of the arm 23, through the expansion of the gage 19, the magnetizing of the core of magnet 38 will produce downward movement of the armature 47, which produce a sharp, decisive movement of the electrode 49 into contact with the electrode 50. As soon as the contact is made, current flows from battery 55, to conductor 56, to helix 12, to conductor 53, and to rod 51, through the contacting electrodes to conductor 54, and back to battery. The core 10 will be drawn downwardly with sufficient force for pulling the valve 3 to a closed condition, and the valve will remain closed until the reduction in draft will sufficiently reduce the temperature of the furnace for lowering the pressure in the boiler to normal, at which time the gage 19, will return to its former condition and the contact between the electrodes 28 and 29 will be broken. The armature 47 will thus be released and the contact between the electrodes 49 and 50 will be broken, releasing the core 10, and permitting the spring to lift the valve to its open condition.

It will be observed that the magnet 38 is provided with a helix of low resistance, and that the helix of the solenoid 11 is of comparatively high resistance so that the electro motive force from cell 34 may be of low potential, while that of battery 55 must be of comparatively high potential. The quick operation of the lever 46 shortens the duration of the spark between the contacts regardless of the potential of the current in the circuit closed thereby: and the comparatively low amperage of the current from a single cell in the circuit closed by the arm 23 insures that there will be but little sparking at the point of the electrodes or contacts 28 and 29.

As seen in Figs. 2 and 4, I provide valves 60 and 61 which are adapted to positively control the steam pressure of pipe 1. In Fig. 4 it will be seen that a by-pass 62 leads from the pipe 1 at one side of the valve 60 and extends to and communicates with the pipe 1 at a point beyond the valve 61. The by-pass 62 is provided with a valve 63 similar in construction and arrangement to valves 60 and 61, and adapted to control the passage of steam pressure through the by-pass. The by-pass may be made of any preferred size and is illustrated as being slightly smaller than the pipe 1, but said by-pass may, of course, if desired, be made of the same size as pipe 1 so as to be able to permit the passage of the full head of steam when the valves 60 and 61 are closed and the valve 63 is open. In practice, I ordinarily open the valve 63 only to a sufficient extent for insuring the passage of sufficient steam for slowly operating the fan engines or blowers without materially affecting the draft or blast, when the valve 3 is closed. Should anything occur to the valve 3 which makes repairs necessary, the valves 60 and 61 may be closed and the valve 63 opened to the full extent and the parts left in this condition while the repairs are being made with respect to the valve 3 or the connected parts. While the repairs are being made, of course, the valve 63 may be manually operated for governing the draft apparatus for controlling fluctuations in the pressure of the boiler being heated by the furnace whose draft is controlled by the pressure in pipe 1.

In order to prevent the moisture of condensation from falling upon parts of the solenoid 11 and injuring the same, I preferably provide suitable baffles 64 and 65, arranged above the solenoid and disposed for receiving drippings and directing the same beyond the parts of the solenoid which may be injured thereby.

In Figs. 5 and 6, I have illustrated a modified form of the valve controlling mechanism, in the said figures the pipe 1′ is provided with a valve casing 2′ containing a valve 3′, said parts being constructed and arranged similar to the corresponding parts of the structure shown in Fig. 2. Valves 60′ and 61′ are also employed for the reason stated with respect to valves 60 and 61, and the by-pass 62′ is arranged and adapted to operate in a manner similar to by-pass 62, a suitable hand valve 63′ being provided for controlling the steam passing through by-pass 62′. A valve stem 4′ engages the valve 3′ and extends through any suitable packing gland. A bracket or supporting frame 15′ is connected with valve casing 3′, and the stem 4′ extends through the cross braces of the frame 15′ and is surrounded by a spring 5′ which is fixed at one end of said cross brace and extends downwardly to and fixedly engages a swivel block 66 which is apertured for permitting free passage therethrough of the tube 67 which tube is fixed to stem 4′. The block 66 is formed with a suitable annular flange or bead 68, seen in dots in Fig. 5, which bead engages a suitable undercut annular groove in a nut 69, which is threaded on to the tube 67. The stem 4′ extends throughout the length of the spring 5, and projects into the pipe 67, the said stem by preference extending through the pipe and engaging a coupling 70 suitably connected with the core 10′ of a solenoid 11′. The solenoid 11′ is supported by the arms of the bracket of frames 15′, the said solenoid being constructed and arranged similarly to the solenoid 11. The pipe 67 is fixed at its end opposite that engaged by the nut 69 to the coupling 70, and it is thus apparent that when the nut 69 is rotated the block 66 will be moved longitudinally of stem 4′ and the tension of spring 5′ varied. Suitable shields 64′ and 65′ are arranged to protect the solenoid 11′ from drippings.

Thus it is obvious that it is not absolutely necessary to have the spring and solenoid disposed on opposite sides of the valve, as it is possible to arrange both on the same side of the valve, the advantage of this invention being present in any embodiment employing a spring and solenoid acting against each other and being arranged in axial alinement with the valve.

The modified structure has the advantage of obviating the use of one of the packing glands, and eliminating the friction occasioned thereby, but the balanced action in the modified structure is not as perfect as that in the structure having the spring and solenoid on opposite sides of the valve.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a pressure governor, the combination with a steam supply pipe and a balanced valve for governing the flow therein, of an electro magnet connected with and adapted to actuate said valve, a main circuit for said magnet, a pivoted arm interposed in said circuit and disposed substantially horizontally and overbalanced on its pivot for retaining the circuit normally open, an electro magnet for swinging said arm upon its pivot for closing said circuit, a local circuit for said second mentioned electro magnet, a relatively long pendent arm interposed in the local circuit and pivoted at its upper end in position for hanging normally in the line of gravitation and adapted to swing upon its pivot out of such line for making the said local circuit and to swing back to said line for breaking said circuit, and a gage connected to said pendent arm substantially at its upper end and adapted for swinging the arm out of the line of gravitation relative to the pressure in said steam pipe supply.

2. In a pressure governor, the combination with a pressure supply pipe and a valve for governing the flow therein, of a spring connected with said valve for retaining the same normally in an open condition, means adjustably supporting said spring for varying the tension thereof, a solenoid for moving said valve in a direction opposing the pressure of the spring, the core of said solenoid being formed in sections, means for adjusting one of said sections for varying the degree of pull of the solenoid independently of the spring, and a gage for controlling the circuit of the solenoid.

3. In a pressure governor, the combination with a steam supply pipe and a valve for governing the flow therein, of an electro magnet of relatively high resistance for actuating said valve, a main circuit for said magnet, a pivoted arm interposed in said circuit and disposed substantially horizontal and adapted to have one of its ends swung vertically for opening and closing the said main circuit, an armature connected with said arm, an electro magnet adapted to operate said armature for swinging said arm for closing the said main circuit, a local circuit for said second mentioned electro magnet, a relatively long pendent arm pivoted at its upper end and adapted to be swung upon its pivot for breaking and making the said local circuit at its lower end, the said relatively long pendent arm being suspended normally in the line of gravitation and when so suspended retaining the local circuit in a broken condition, and a gage connected with the said pendent arm contiguous to the pivot thereof for swinging the arm relative to the pressure in said steam supply pipe.

4. In a pressure governor, the combination with a steam pipe and a valve for gov-

erning the flow therein, of a spring connected with said valve for normally retaining the same in an open condition, a solenoid having its helix fixed with respect to the valve and its core connected to the valve, means for varying the tension of said spring independently of the solenoid, means independent of the spring adjustable within the helix for varying the pull of said core, and a gage for governing the circuit of said helix.

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

WILLIAM McCLAVE.

Witnesses:
C. P. SMITH,
E. WHITMORE.