No. 715,551. Patented Dec. 9, 1902.

D. S. COLE.

AUTOMATIC VALVE FOR WATER HEATERS.

(Application filed Feb. 6, 1902.)

(No Model.)

Fig. 1.

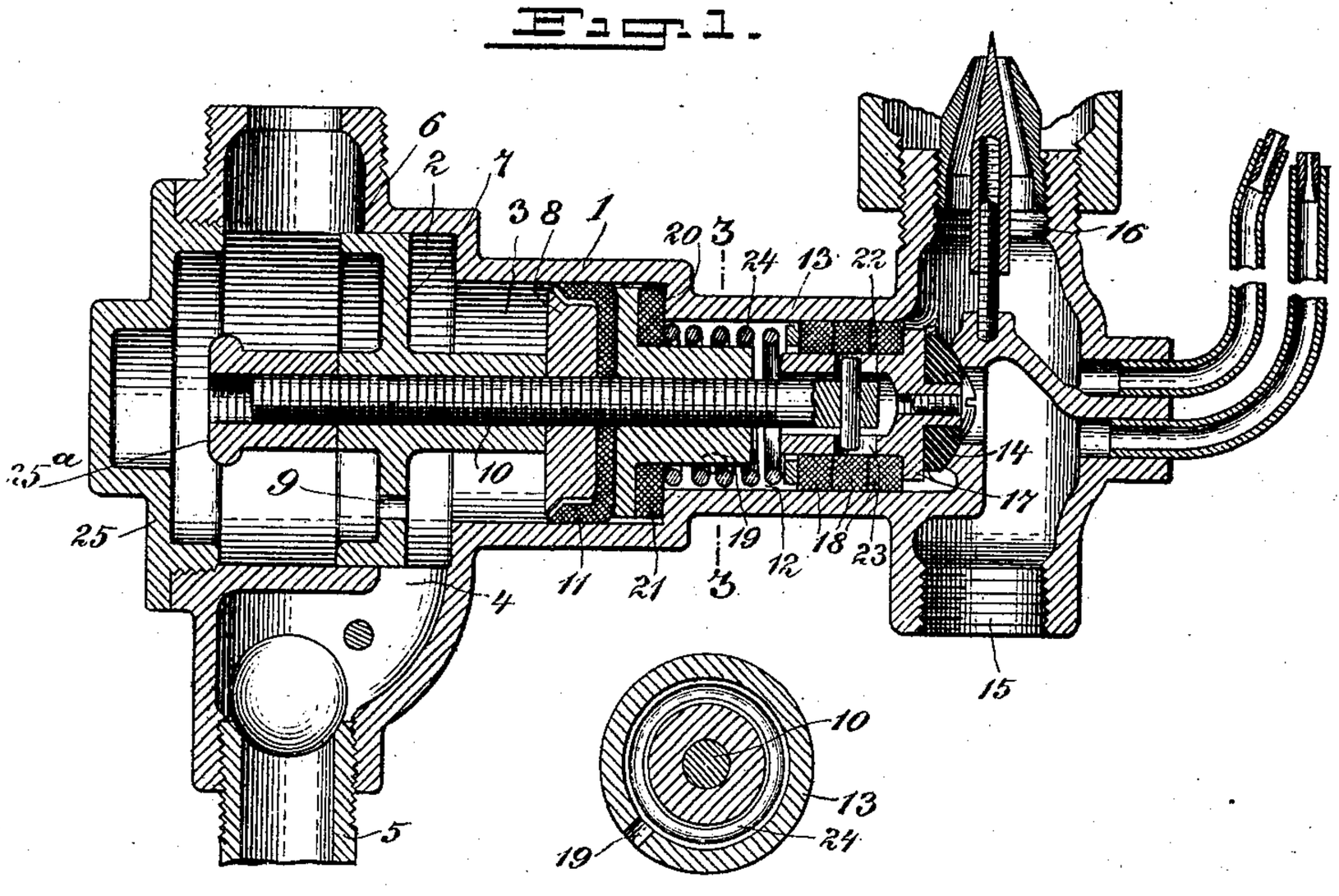

Fig. 3.

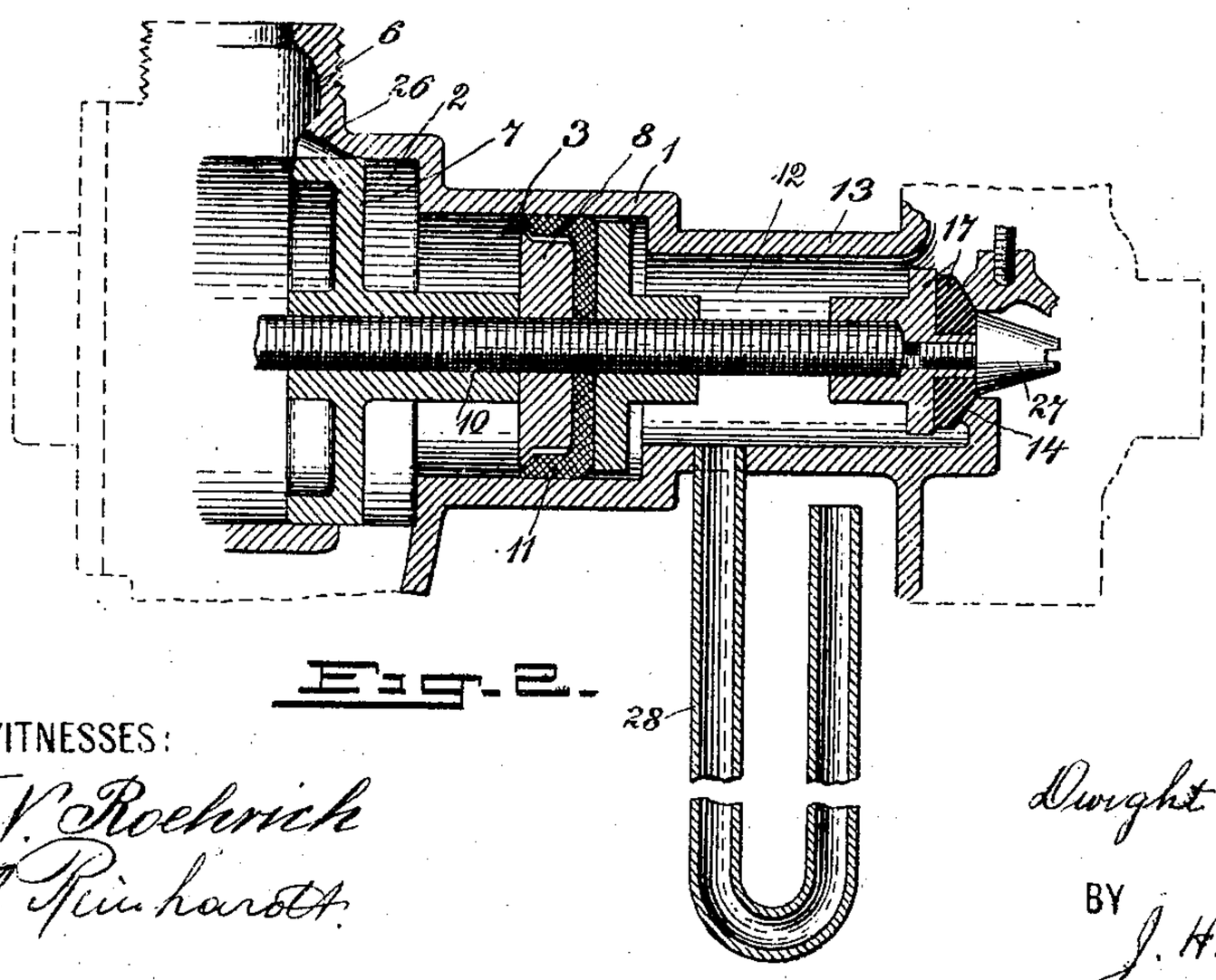

Fig. 2.

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AUTOMATIC VALVE FOR WATER-HEATERS.

SPECIFICATION forming part of Letters Patent No. 715,551, dated December 9, 1902.

Application filed February 6, 1902. Serial No. 92,939. (No model.)

To all whom it may concern:

Be it known that I, DWIGHT S. COLE, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Automatic Valves for Water-Heaters, of which the following is a specification.

My invention relates to water-heaters, and more particularly to an automatic valve mechanism for controlling the flow of fuel to said heaters.

An object of my invention is to provide a mechanism which is simple and cheap in construction and positive and reliable in operation, which at the same time is easily assembled and mounted, and which is readily accessible for cleaning and repairs. These and other objects of my invention will more fully appear from the following description.

My invention consists in the novel parts, improvements, and combinations herein shown and described.

The accompanying drawings, which are referred to herein and form a part hereof, illustrate two embodiments of my invention and serve with the description herein to explain the principles of the invention and the best mode contemplated by me of applying these principles to practice.

Of the drawings, Figure 1 is a central longitudinal section of a valve mechanism constructed in accordance with my invention. Fig. 2 is a similar view illustrating modifications of certain features of the mechanism; and Fig. 3 is a transverse sectional view on the line 3 3, Fig. 1.

An automatic valve mechanism constructed in accordance with my invention comprises, in combination, a casing having two communicating piston-chambers of different diameters and suitable water inlet and outlet passages connected therewith, a piston in each of said chambers, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between the inlet and outlet passages, a restricted passage connecting the spaces at the opposite sides of the larger piston, a fuel-controlling valve, and connections between said pistons and said fuel-controlling valve. Preferably the fuel-valve chamber forms an extension of the smaller piston-chamber, a suitable water vent or passage being provided in the fuel-valve chamber to drain off any water which might leak past the smaller piston into said chamber. It is also in accordance with the preferred embodiment of my invention that an annular offset or shoulder, adapted to form a valve-seat, be located internally between the smaller piston-chamber and the fuel-valve chamber, a valve being provided to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston-chamber. In this construction the connections between the pistons and the fuel-valve are preferably made yielding, so that the fuel-valve may be pressed upon its seat independently of the valve at the junction of the smaller piston-chamber and the fuel-valve chamber, provision being thereby made for closing the fuel-valve with a uniform pressure regardless of the variance of the hydraulic pressure to which the device is subjected.

Referring to the drawings in detail and at first to the form of the device shown in Fig. 1, numeral 1 indicates the main casing of the valve mechanism, 2 represents the larger piston-chamber, and 3 the smaller piston-chamber thereof. 4 is the water-inlet passage, which communicates with the water-inlet pipe 5, and 6 is the water-outlet passage leading to the heater, which may be of any suitable construction. 7 is a suitable piston fitted in the larger piston-chamber 2, and 8 is a piston arranged to operate in the smaller piston-chamber 3. The water inlet and outlet passages are so arranged with relation to the larger piston 7 that when the latter is at the limit of its stroke in the direction of the smaller piston-chamber said larger piston is located between said passages, so that when water is drawn from the heater said piston will be moved toward the other limit of its stroke, and thus permit communication to the established between said inlet and outlet passages. Provision should be made, however, for a restricted flow of water past the piston 7 when at or near the inner part of its stroke to permit the equalization of the pressures on the opposite sides of this piston for a purpose which will hereinafter more fully appear. This may be accomplished in any suitable way, as by giving

the said piston a suitable amount of clearance in the chamber or by providing it with a small perforation, as indicated at 9. The pistons 7 and 8 are preferably rigidly connected together, as by being threaded on a rod 10, and to prevent leakage the piston 8 is preferably provided with a suitable packing, as the cup-leather 11. This piston mechanism, so far as certain features of my invention are concerned, may be connected to the controlling-valve for the fuel-supply in any suitable way. In accordance with the preferred embodiment of my invention, however, the fuel-valve chamber is formed in the same casing with the water-piston chambers and constitutes an extension of the smaller piston-chamber. As shown in Fig. 1, the fuel-valve chamber 12 is formed in an extension 13 of the casing 1 and is provided with a valve-seat 14, which communicates on the one hand with the fuel-supply passage 15 and on the other hand with the fuel-discharge passage 16. In accordance with the construction shown in Fig. 1 the fuel-valve chamber 12 is bored out concentrically with the piston-chambers 2 and 3, and the fuel-valve 17 is provided with packing-rings 18, which are fitted to the chamber 12, so as to prevent the escape of fuel in the direction of the piston-chambers and to prevent any water which may leak past the piston 8 from flowing through the fuel-valve chamber into the fuel inlet or outlet passages. To make it impossible for any water to reach the fuel-supply passage, a vent-opening 19 is provided in the casing extensions 13 between the packing-rings 18 and the end of the piston-chamber 3; but in order to provide for the retention of a sufficient amount of water in the vented section of the fuel-valve chamber to keep the packing-rings 18 moistened and in good operative condition the vent-opening 19 is preferably located a suitable distance above the bottom of the fuel-valve chamber, as clearly shown in Fig. 3.

With the object in view of removing the greater part of the force of the water-pressure acting upon piston 8 from the fuel-valve 17 and also of providing an additional precaution against leakage of water past the said piston 8 an annular shoulder, forming a valve-seat 20, is provided at the end of the piston-chamber 3, against which a suitable valve 21 is arranged to be seated when the piston 8 is at the limit of its movement in the direction of the fuel-valve chamber 12. To permit the fuel-valve 17 to be seated independently of the valve 21 and with a limited yielding pressure and at the same time to provide for its positive operation in opening the fuel-passage, it is loosely confined to the end of the rod 10, as by means of the transverse pin 22 in the rod, which pin engages the elongated openings 23 in the valve 17, and a compression-spring 24 is provided between the valve 21 and the packing-rings 18 on the valve 17, said spring serving to confine the valve 17 to its seat with a limited pressure when the valve 21 is seated. It will also be observed that by reason of this construction the packing-rings 18 are permitted to expand laterally, thereby preventing undue binding of the valve in the chamber.

By reason of the fact that the chambers 2, 3, and 12 are successively smaller in diameter and that the pistons and valve working in said chambers are all connected to the rod 10 it is evident that when the cap 25, which closes the larger piston-chamber 2, is removed all the moving parts of the mechanism may be withdrawn from the casing for the purpose of being cleaned or repaired and that this may be done without disturbing any of the pipe connections. The headed nut 25ª is provided to facilitate the removal of the pistons, and said nut also serves, in connection with the cap 25, as a stop to limit the opening movement of the pistons.

It follows from the construction above described that when water is drawn from the heater in a sufficient quantity to reduce the pressure therein and thence through the outlet-port 6 on that face of the larger piston 7 farthest from the smaller piston-chamber there will be an unbalanced pressure on the opposite face of said piston which will act to move said piston and the parts connected therewith in a direction to establish communication between the inlet and outlet water-passages and to open the fuel-valve 17. The parts will remain in this position as long as a sufficient flow of water through the heater is maintained; but when the flow of water through the heater is stopped or reduced to such an amount that it may be supplied by the small flow past the piston 7 or through the small perforation 9 in the same without maintaining a sufficient difference in pressure on the opposite sides of said piston to overcome the pressure of the water on the smaller piston 8 the latter pressure will move the parts in a direction to close the fuel-valve, and thus render the device inoperative.

Should the relative flows of water and fuel at any time be such as to cause the generation of steam in the heater so that the pressure in the heater equals the pressure in the water-supply passage, the pressures on the opposite faces of the larger piston will be equalized, thereby rendering the pressure on the smaller piston effective to close the fuel-valve, and thus render the device inoperative.

With the object in view of having the fuel-valve opened sufficiently to permit a full flow of fuel whenever any water is drawn from the heater the water-outlet port 6 is preferably so located with relation to the position occupied by piston 7 when the device is inactive that said piston has to move far enough to fully open the fuel-valve before communication is established between the water inlet and outlet ports. By reason of this construction the proper operation of the burner each

time water is drawn from the heater is insured and the water is heated in the shortest possible time. The temperature of the water may be varied from the boiling-point (if the restricted passage connecting the spaces at the opposite sides of the piston 7 is sufficiently small) to lukewarm by regulating the flow of water through the heater, this regulation being effected by the user at the point where the heated water is being drawn. It is often desirable, however, that the flow of fuel be made approximately proportional to the flow of water so as to maintain a substantially uniform temperature of the water delivered by the heater irrespective of variations in the volume thereof. A simple way of accomplishing this in a valve mechanism constructed in accordance with my invention is illustrated by Fig. 2. The feature of this construction whereby this result is accomplished consists in providing the water-outlet port 6 with a suitably-tapered extension 26, which terminates at or near the face of the piston 7 nearest the smaller piston-chamber when the latter is at the limit of its stroke in the direction of the smaller piston-chamber. By reason of this construction it will be observed that the distance through which the piston is moved by the water will be proportional to the volume of water being drawn from the heater. To get a proportional flow of fuel, therefore, it will only be necessary to provide a fuel-controlling valve, the opening through which varies with relation to its movement in proportion to the corresponding variations in the opening through the passage 26. In accordance with the construction shown in Fig. 2 this is accomplished by providing the valve 17 with a conical extension 27. To attain great accuracy in this regulation there preferably should be no lost motion between the valve 17 and the piston 7. To this end the valve 17 in Fig. 2 is rigidly connected to the end of the rod 10. In accordance with this construction also the valve 21 is dispensed with, as is also the packing 18, the cup-leather 11 being solely depended upon to prevent the escape of water into the fuel-valve chamber. The force of the water-pressure on the piston 8 when the heater is not in operation is entirely sustained by the valve 17, resting upon its seat 14. A vent-pipe 28 is provided to take care of any possible leakage past the piston 8. To prevent the escape of a gaseous fuel through the vent-pipe 28, the latter is extended a suitable distance, depending on the pressure of the fuel, below the valve-chamber and is provided with a return-bend or riser to form a liquid seal, said riser being terminated at some point below the valve-seat 14. It will be seen that while this construction provides an effective seal against the escape of a gas any water which may collect in the bottom of the fuel-valve chamber 12 will be permitted to escape. As the operation of this device is substantially the same as that of the device previously described, further description of the operation will be unnecessary except to state that as the passage 26 will form an effective restricted passage connecting the spaces at the opposite sides of the piston 7 no other provision need be made to enable the piston 8 to close the fuel-valve when the flow of water from the heater is discontinued.

My invention in its broader aspects is not limited to the precise construction shown nor to the particular construction by which it may be carried into effect, as many changes may be made in the construction without departing from the main principles of the invention and without sacrificing its chief advantages.

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

1. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters and suitable water inlet and outlet passages, of a piston in each chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller chamber being located between said inlet and outlet passages, a restricted passage connecting the spaces at the opposite sides of the larger piston, a fuel-controlling valve, and connections between said pistons and said fuel-controlling valve, substantially as described.

2. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters and suitable water inlet and outlet passages, of a piston in each chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller chamber being located between said inlet and outlet passages, a valve-seat located at the end of the smaller piston-chamber farthest from the larger piston-chamber, a valve arranged to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston-chamber, a fuel-controlling valve, and connections between said pistons and said fuel-controlling valve, substantially as described.

3. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters and suitable water inlet and outlet passages, of a piston in each chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller chamber being located between said inlet and outlet passages, a valve-seat located at the end of the smaller piston-chamber farthest from the larger piston-chamber, a valve arranged to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston, a restricted passage connecting the spaces at the opposite sides of the larger piston, a fuel-con-

trolling valve, and connections between said pistons and said fuel-controlling valve, substantially as described.

4. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, a fuel-controlling valve in said fuel-valve chamber, and connections between said pistons and said fuel-controlling valve, substantially as described.

5. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, a water-vent passage communicating with said fuel-valve chamber, a fuel-controlling valve in said fuel-valve chamber, and connections between said pistons and said fuel-controlling valve, substantially as described.

6. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, a fuel-controlling valve in said fuel-valve chamber, and yielding connections between said pistons and said fuel-controlling valve, substantially as described.

7. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, an annular offset or shoulder forming a valve-seat, said shoulder being located between the smaller piston-chamber and the fuel-valve chamber, a valve arranged to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston-chamber, a fuel-controlling valve in said fuel-valve chamber, and connections between said pistons and said fuel-controlling valve, substantially as described.

8. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, an annular offset or shoulder forming a valve-seat, said shoulder being located between the smaller piston-chamber and the fuel-valve chamber, a valve arranged to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston-chamber, a fuel-controlling valve in said fuel-valve chamber, and yielding connections between said pistons and said fuel-controlling valve, substantially as described.

9. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, a fuel-controlling valve in said fuel-valve chamber, a packing in the fuel-valve chamber between the fuel-valve and the piston-chambers, and connections between said pistons and said fuel-controlling valve, substantially as described.

10. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, an annular offset or shoulder forming a valve-seat, said shoulder being located between the smaller piston-chamber and the fuel-valve chamber, a valve arranged to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston-chamber, a fuel-controlling valve in said fuel-valve chamber, a packing in the fuel-valve chamber between the fuel-valve and the piston-chambers, and connections between said pistons and said fuel-controlling valve, substantially as described.

11. In an automatic valve mechanism for water-heaters, the combination with a casing having two communicating piston-chambers

of different diameters, suitable water inlet and outlet passages, and a fuel-valve chamber forming an extension of the smaller piston-chamber, of a piston in each piston-chamber, the piston in the larger chamber when at the limit of its stroke in the direction of the smaller piston-chamber being located between said inlet and outlet passages, an annular offset or shoulder forming a valve-seat, said shoulder being located between the smaller piston-chamber and the fuel-valve chamber, a valve arranged to close on said seat when the smaller piston is at the limit of its stroke farthest from the larger piston-chamber, a restricted passage connecting the spaces at opposite sides of the larger piston, a fuel-controlling valve in said fuel-valve chamber, a packing in the fuel-valve chamber between the fuel-valve and the piston-chambers, and yielding connections between said pistons and said fuel-controlling valve, substantially as described.

12. In an automatic valve mechanism for water-heaters, the combination with a casing having three chambers arranged in line, one of said chambers being of greater diameter than the others, water inlet and outlet connections communicating with the chamber having the greater diameter, said connections being arranged at the sides of the casing, a pressure-operated mechanism consisting of two water-pistons and a fuel-valve all located in said chambers, and a removable head for closing the end of the larger chamber farthest from the other chambers, whereby when said head is removed said operating mechanism may be withdrawn from the casing without disturbing said inlet and outlet connections.

Signed at New York, in the county of New York and State of New York, this 31st day of January, A. D. 1902.

DWIGHT S. COLE.

Witnesses:
J. H. FREEMAN,
EDWIN SEGER.