No. 777,119. PATENTED DEC. 13, 1904.

P. MARSHALL.

BOILER FEED MECHANISM.

APPLICATION FILED JUNE 16, 1904.

NO MODEL. 8 SHEETS—SHEET 1.

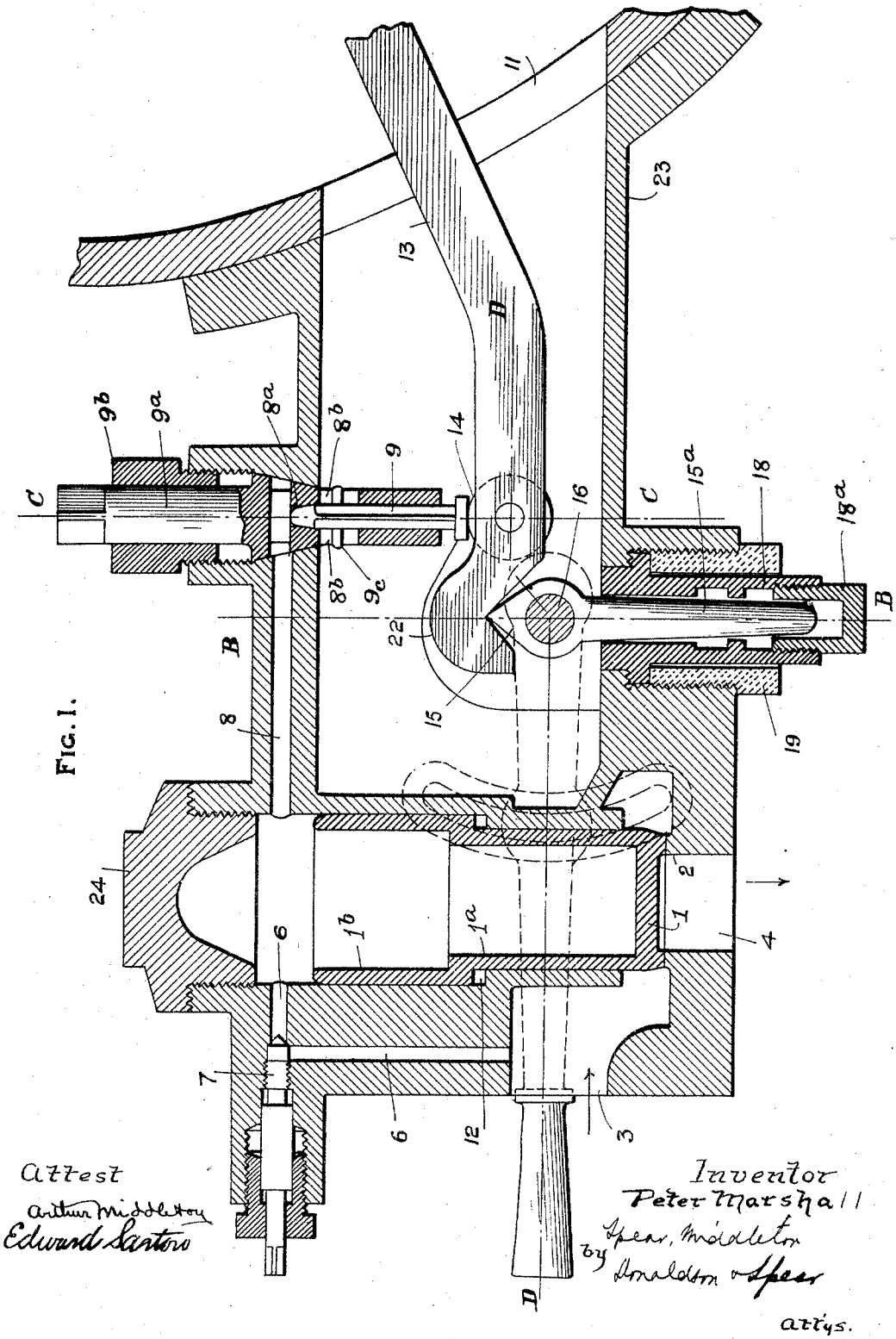

FIG. 1.

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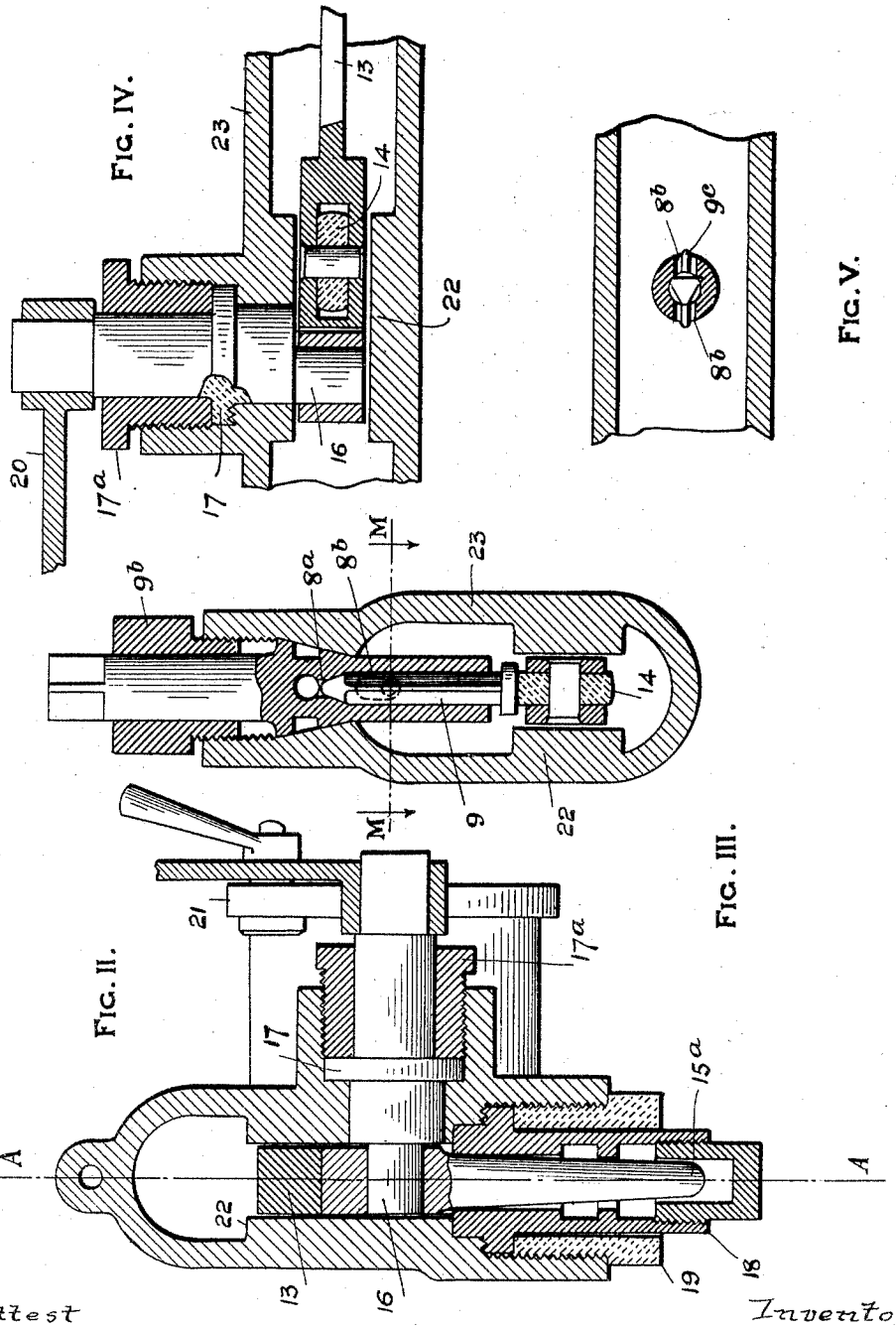
NO MODEL. 8 SHEETS—SHEET 2.



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NO MODEL. 8 SHEETS—SHEET 3.

FIG. VII.

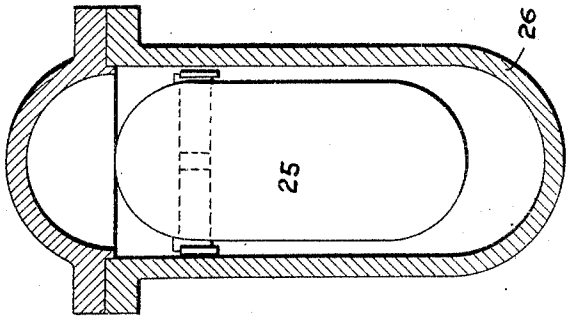
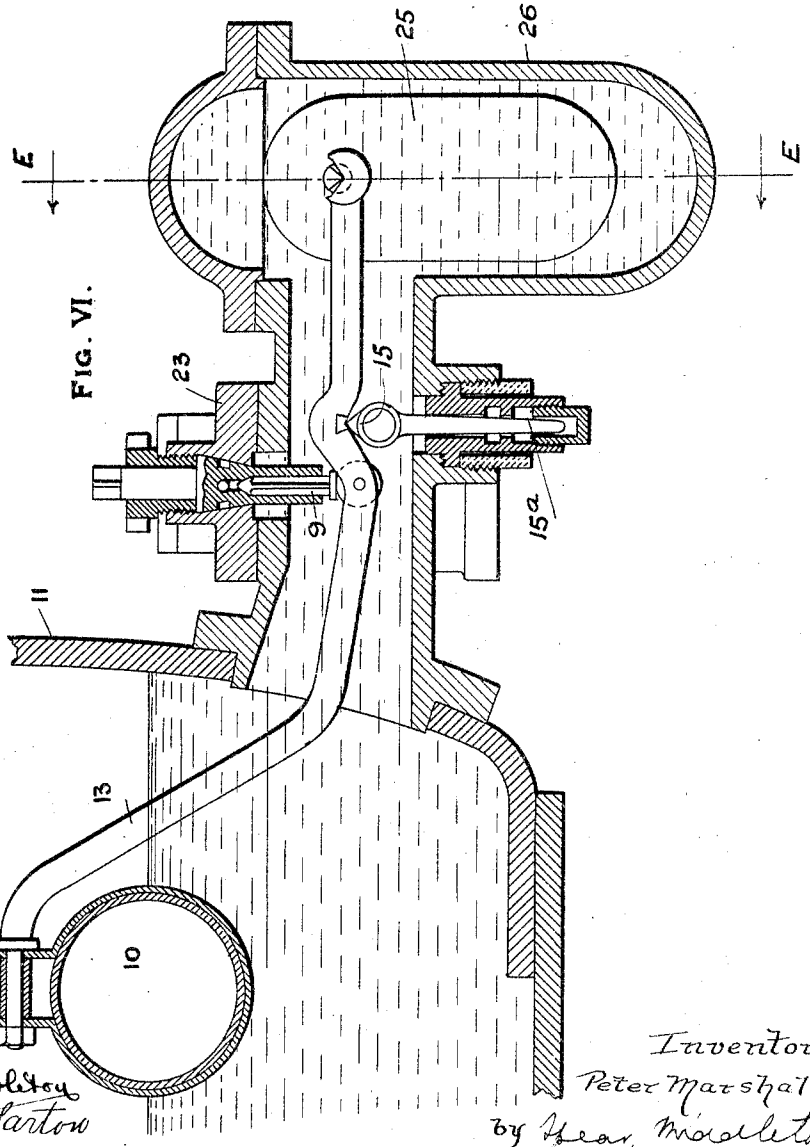


FIG. VI.



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NO MODEL. 8 SHEETS—SHEET 4.

FIG. IX.

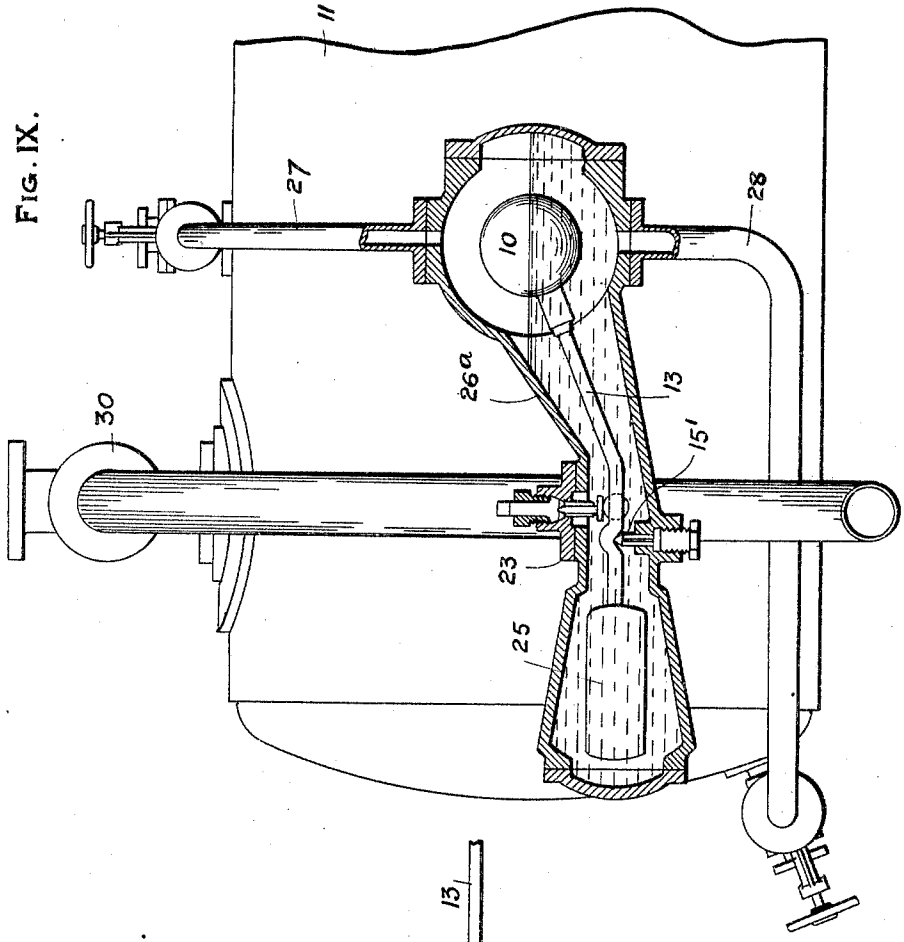
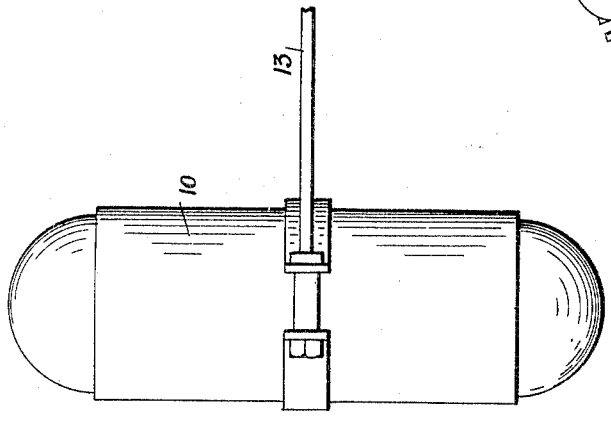


FIG. VIII.



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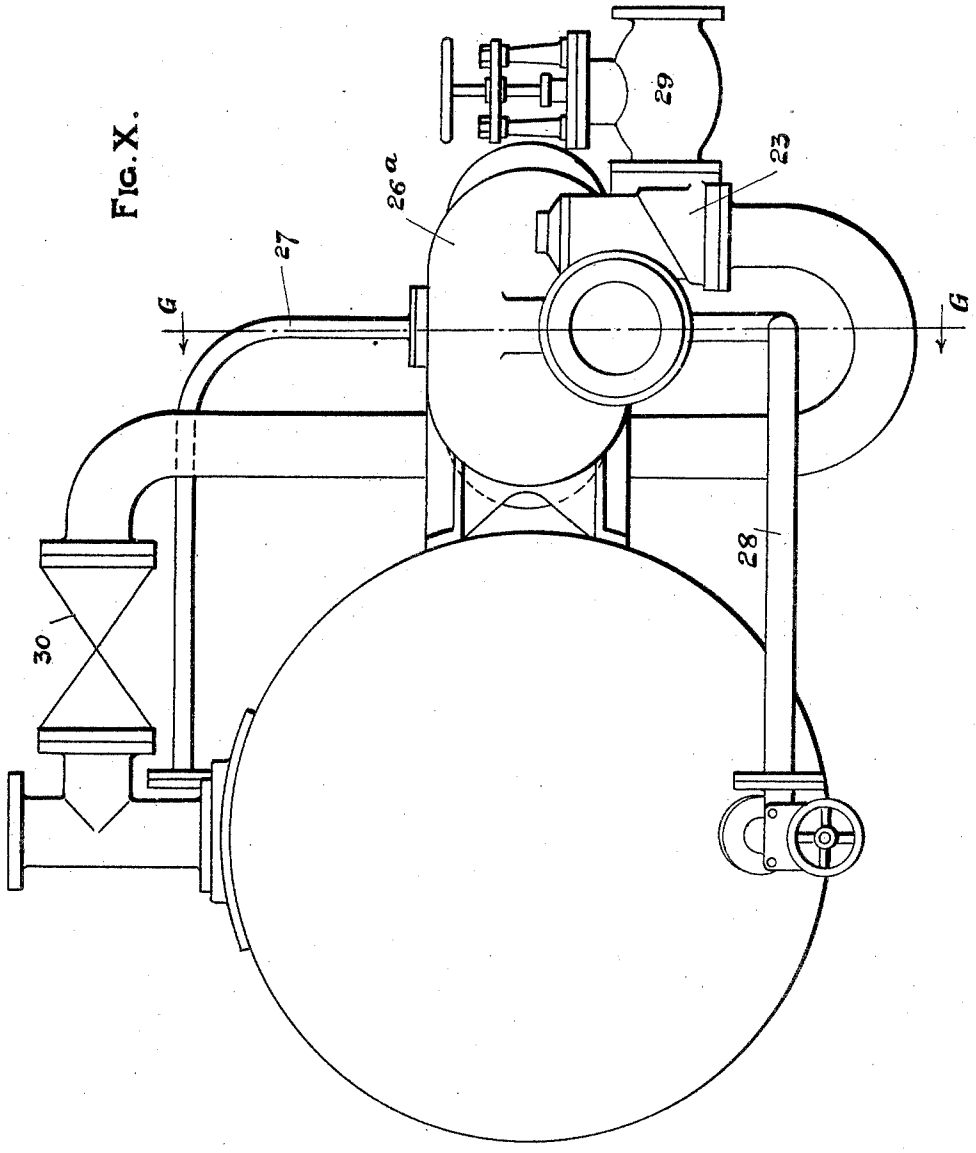
NO MODEL. 8 SHEETS—SHEET 5.

FIG. X.



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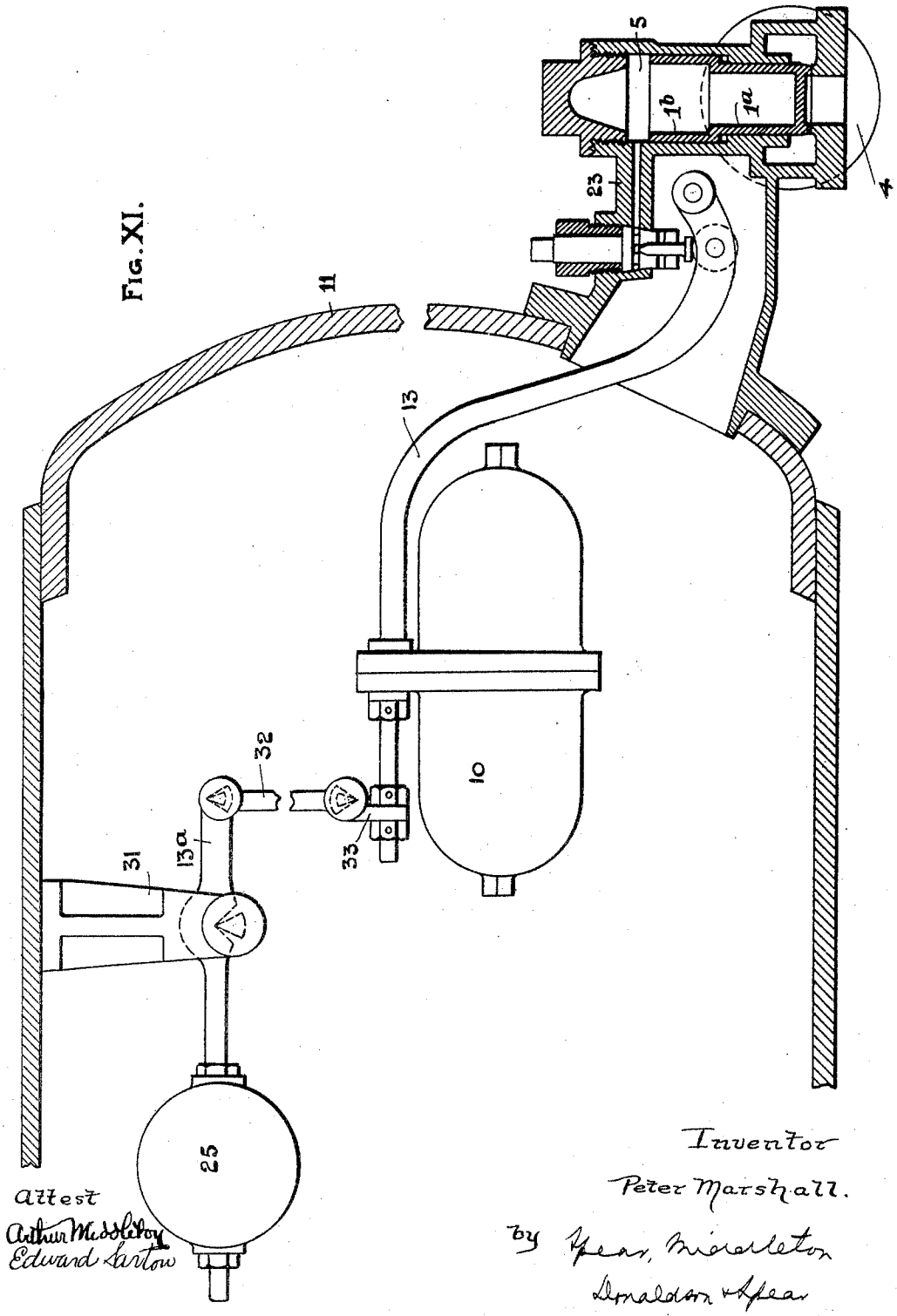
NO MODEL. 8 SHEETS—SHEET 6.

FIG. XI.



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NO MODEL. 8 SHEETS—SHEET 7.

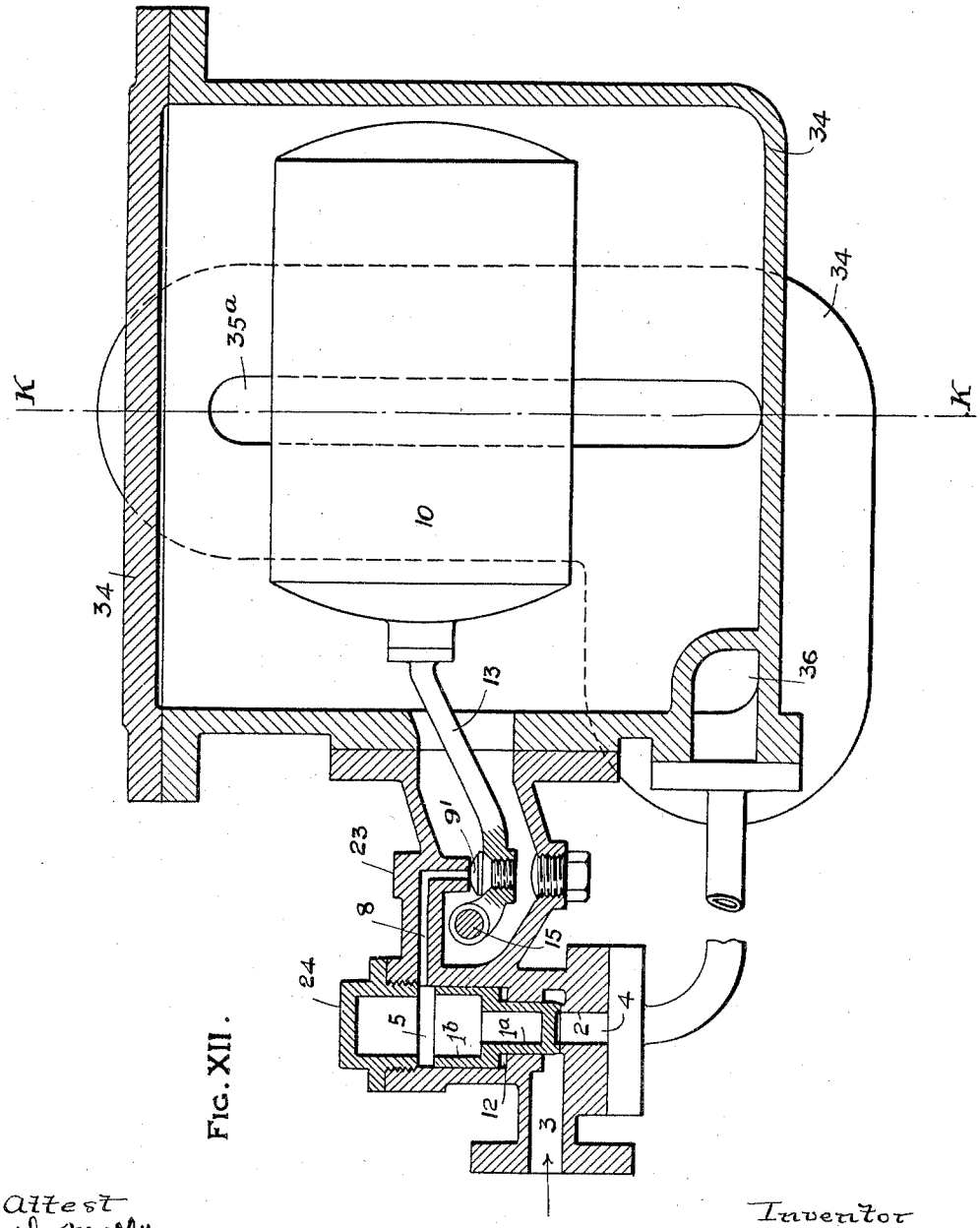

FIG. XII.

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NO MODEL. 8 SHEETS—SHEET 8.

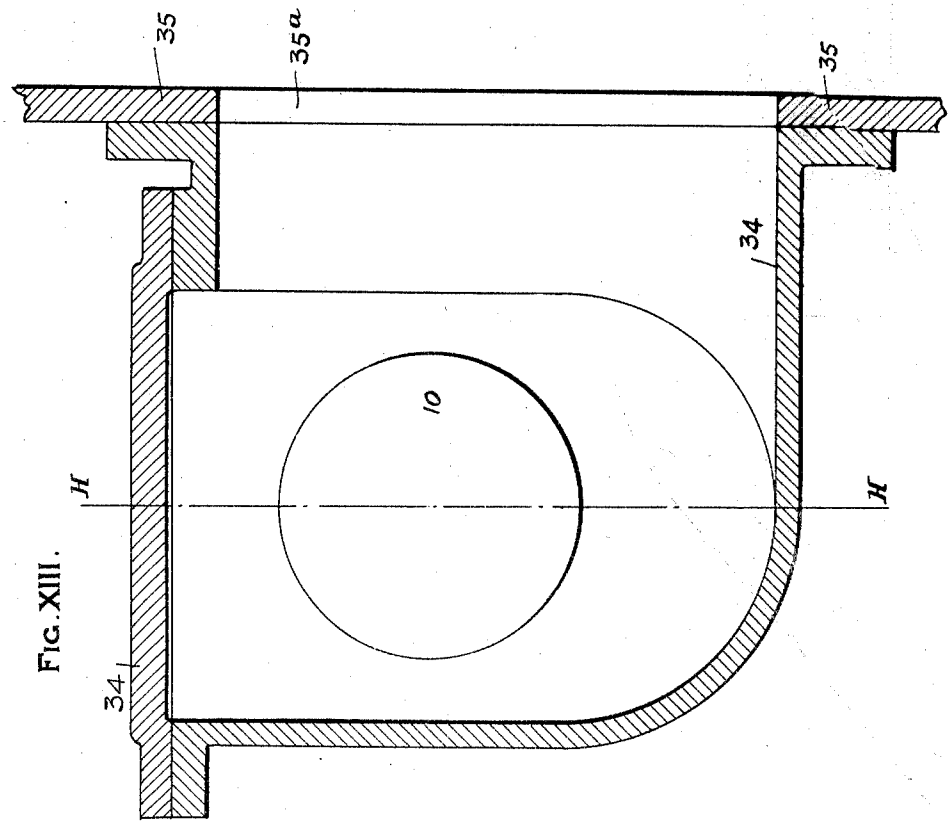

FIG. XIII.

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No. 777,119. Patented December 13, 1904.

UNITED STATES PATENT OFFICE.

PETER MARSHALL, OF LIVERPOOL, ENGLAND.

BOILER-FEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 777,119, dated December 13, 1904.

Application filed June 16, 1904. Serial No. 212,909. (No model.)

To all whom it may concern:

Be it known that I, PETER MARSHALL, a subject of the King of Great Britain, residing in Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Boiler-Feed Mechanism, of which the following is a specification.

This invention relates to valves adapted to be closed by the pressure of the fluid controlled and in means for automatically operating such valves, and my invention is particularly applicable to valves controlling the supply of water to a high-pressure boiler and automatically operated by the rise and fall of the water-level in the boiler, so as to maintain within small limits a practically constant but adjustable level. I will describe this application of my invention, which, however, is applicable generally to all cases where a fluid has to be controlled by a valve adapted to be closed by the pressure of the fluid controlled.

I have illustrated my invention in the accompanying drawings, in which—

Figure I is an elevation in section on the line A A of Fig. II of the main and controlling valves and float-lever, together with the movable fulcrum for the latter. Fig. II is a section on the line B B of Fig. I. Fig. III is a section on the line C C of Fig. I; Fig. IV, a section on the line D D of Fig. I, and Fig. V is a plan of the controlling-valve in section on the line M M of Fig. III. Fig. VI is a sectional elevation of the general arrangement where the float is in the boiler and the balance-weight in a separate casing, and Figs. VII and VIII are respectively an elevation on the line E E of Fig. VI and a plan of the float. Fig. IX is an elevation of the general arrangement where both the float and the balance-weight are in a casing communicating with the boiler, the casing being in section on the line G G of Fig. X; and Fig. X is an end view. Fig. XI is an elevation in section of the general arrangement where both float and balance-weight are in the boiler; and Figs. XII and XIII are an elevation and an end elevation, both in section, on the lines H H and K K, respectively, of the general arrangement when the pressure is comparatively low—say below the atmosphere.

It is found in practice that with the very high pressures now general in boilers it is not practicable to control the main feed-regulating valve directly by means of a float, as the force required in the case of a valve of usual size is much greater than can be obtained in this way, and I accordingly provide a valve which is adapted to be closed by the pressure due to the accumulation of a constant but small flow of the pressure-water from the pump into a leakage-chamber, and I control an escape-passage leading from this chamber to, say, the boiler by a small control-valve operated by a float in such manner that when the control-valve is closed by the float when the water-level rises above the normal the said flow accumulates and the pressure closes the main feed-valve, while, on the other hand, if the control-valve is opened by the float when the water-level falls below the normal the said flow cannot accumulate and the main feed-valve remains open. In this way a very small control-valve operated by a float automatically operates a comparatively large main feed-valve.

I will first describe the main valve and its control-valve, which are features common to each of the modifications illustrated.

I provide a valve 1, which is adapted to close a seating 2, through which the water passes from the feed-pump (which is connected to the inlet 3) to the boiler-inlet, which is connected through a check-valve to the outlet 4. The diameter of the plug 1^a, forming the valve, is increased just above the valve-seating, and this part, which I will term the "stem," passes freely, but approximately fluid-tight, through an opening into what I term a "leakage-cylinder" 5. In the cylinder the diameter of the plug is again increased, so as to form a piston 1^b, working in the cylinder freely, but approximately fluid-tight. It will be seen from this description that with a certain pressure in the leakage-cylinder the valve 1 will be closed and held closed in opposition to the pressure on the valve-face, the pressure in the leakage-cylinder necessary for this purpose depending, of course, upon the relative diameters of the valve 1, the stem 1^a, and the piston 1^b and be-

ing less, equal to, or greater than the normal feeding pressure, as may be desired. Under these circumstances if there be a constant flow of water into the leakage-cylinder the valve will close as soon as the predetermined pressure is reached, and this flow may be a leakage past the stem and piston or it may be a definite flow through a suitable and adjustable port 6, controlled by a valve 7. If, however, an outlet-passage be provided from the leakage-cylinder, then so long as this passage is open the pressure in the leakage-cylinder cannot rise to that necessary to close the main valve. If this passage then be controlled by a valve, which need, of course, only be a small one, since it deals with a leakage-flow only, the movement of this valve may be made to control the main valve. I therefore provide an adjustable passage through which the water from the pump passes into the leakage-chamber or allow a leakage past the piston, and I also provide a passage 8, controlled by a valve 9, through which the water may escape from the leakage-chamber into, say, the boiler, and I operate this valve 9, which I will term the "control-valve," by means of a float 10 and lever 13, actuated by the rise and fall of water-level in the boiler 11.

In dealing with the high pressures which now obtain in boilers I find that the following special constructional features are necessary: The main valve must be cushioned. This cushioning is obtained by allowing the leakage-water, which either passes the valve-stem or piston or enters by a leakage-passage 6, to find its way to the annular space 12 around the stem and between the piston 1^b and the end of the leakage-cylinder. When the leakage-pressure rises high enough to close the valve, the sudden and violent closing is prevented by the water in this annulus 12, which has to be gradually forced out. I have also found that the control-valve 9 must be arranged so that it closes the outlet-passage 8 against the outlet flow—that is to say, the pressure in the leakage-cylinder must tend to open the valve in opposition to an independent closing force, as distinguished from the case in which the pressure tends to close the valve in opposition to an independent opening force. The control-valve is, as stated, operated by a float, and as the float is necessarily within the boiler or in the chamber communicating with the boiler and as the float-lever 13 is articulated to the control-valve the latter valve must be on the boiler side of its seating and within the boiler or the chamber communicating therewith. I therefore carry the valve in a special plug 9^a, in which the necessary port and seating are formed and which is so fitted in position that it and the valve can be readily withdrawn for examination or repair.

I have shown the construction of the valve-seating plug 9^a in Figs. I, III, and V. The plug 9^a, as illustrated, is made taper and is held down in a taper-seating by the nut 9^b, and its periphery is grooved, so that in all positions in its seating the valve-controlled opening 8^a communicates with the passage 8. The valve 9 itself has a taper end and its circular stem is cut away, as shown in Fig. V, to provide a waterway. The valve has a button-head which bears against a roller 14, pivoted in the float-lever 13. The valve 9 is provided with a pin 9^c to prevent its falling out, and the plug 9 has two openings 8^b, through which the escaping water passes to the boiler. I also find with high pressure that a float in the ordinary sense of the term—that is to say, one the weight of which is less than the weight of the volume of water which it displaces—cannot be used, as the shell would not be strong enough to resist the pressure. I therefore employ a copper coil, steel cylinder, or a solid structure and counterbalance it so that the displacement effect causes it to rise and fall with the water-level. As these weights may be considerable, I employ a system of knife-edges for the float-lever connections.

The float itself is either in the boiler proper or in a chamber connected thereto by leveling-pipes, and the control-valve is carried in a casing attached to and opening out from the boiler or the said chamber, as the case may be, and the float-lever is articulated directly to the control-valve and the balance-weight, so obviating the necessity for carrying its spindle through a stuffing-box or the like. The valve is closed as the float rises.

In order to vary the position at which the water-level is to be maintained constant, I provide means for varying the position of the main stationary fulcrum 15 of the float-lever relatively to the control-valve. I do this by carrying the fulcrum at the end of a spindle or tailpiece 15^a, located in a screwed gland, so that the fulcrum may be raised or lowered while maintaining its edge in the proper plane and so that it may be readily withdrawn for examination or repair.

In some cases I support the adjustable knife-edge of the main fulcrum 15 on an eccentric stud 16, which passes steam-tight through the casing, the joint being made by a concentrically-grooved washer 17, held in place by the nut 17^a, and the knife-edge maintained in the proper position by a tailpiece 15^a, guided in a stuffing-box. The tailpiece 15^a is packed in the plug 18 by the gland 18^a, and the plug is held in place by the nut 19. It will be seen that on removing the plug 18 the fulcrum may be withdrawn. The eccentric stud 16 has a projecting head (see Fig. IV) to which is attached the lever 20, which is adjustably secured in position on the quadrant 21 by a suitable screw and nut. In Fig. II the lever is for clearness shown in its upper position. The fulcrum 15 and the lever 13 are maintained in the proper plane by the side cheeks

22, formed on the inside of the casing 23. The main valve is adapted to be withdrawn from the leakage-cylinder through the cap 24.

In Figs. I to V, I have described an arrangement of the main valve and controlling-valve which may be applied generally to a suitable float-lever, and although I have shown a float-lever mounted in a special way on an adjustable knife-edge it is to be understood that any suitable arrangement of float-lever may be adopted either with a fixed or movable fulcrum and either with or without knife-edges. For example, the float-lever may when the pressures to be dealt with are not excessive be mounted directly on the eccentric stud 16 instead of mounting a knife-edge thereon. It will also be noted that the valve 1 moves, to close the seating, in the direction of the flow and does not act as a non-return valve. I prefer to put a separate non-return valve between the valve 1 and the boiler.

In the arrangement shown in Figs. VI, VII, and VIII the float is fitted in the boiler and is counterbalanced by a balance-weight 25, located in a separate vessel 26, communicating with the boiler by the casing 23. The float-lever is double-ended and is forked to carry the balance 25. The valve 1 is laterally located in the casing 23.

In the arrangement shown in Figs. IX and X both the float and the balance-weight are located in a casing 26^a, which communicates with the boiler by the leveling-pipes 27 and 28. The feed-water passes to the casing 23, which contains the main valve, through the valve 29, and thence to the boiler through the check-valve 30. In this arrangement the fulcrum 15′ is fixed.

In the arrangement shown in Fig. XI both the float and the balance-weight are in the boiler. In this arrangement the float is counterbalanced by a second lever 13^a, which is carried on knife-edges in a bracket 31 and connected by a link 32 (also articulated by knife-edges) to the float-lever 13 by means of an adjustable knife-edge bracket 33.

My invention is also adapted to control the feed when the pressure within the vessel to be fed is below that of the atmosphere. A suitable arrangement is shown in Figs. XII and XIII. In this case the valve 1 controls the feed to an evaporator in which the water is being evaporated under a partial vacuum. A casing 34 is fitted to the evaporator-shell 35, through which latter a rectangular slot 35^a is formed, which serves to level the water in the casing 34. The valve 1 is constructed as before and carried in the casing 23, bolted to the casing 34, the outlet 4 from the casing 23 being connected to a passage 36, formed in 34 and leading directly to the boiler. In this modification the control-valve 9′ is mounted directly on the float-lever 13.

It will be noted that I carry the casing 23 down round the stem 1^a of the valve 1, so as to prevent the incoming water from the pump from displacing the valve laterally, and while I prefer to make the stem 1^a of the valve somewhat larger in diameter than the valve it may, if desired, be made equal in diameter with the valve.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a boiler-feed-regulating apparatus, in combination with the boiler and the feed-supply passage provided with a valve-seating: a plunger of two diameters the smaller end of which is adapted to close the said valve-seating on the supply side thereof and the larger end of which works in a leakage-chamber; a leakage-chamber connected by an inlet-passage of adjustable area to the supply-passage on the supply side of the said seating and also connected by an outlet-passage to the boiler; a valve adapted to close the said outlet-passage; and a lever actuated by a float which is raised and lowered by the water in the boiler as the level thereof rises and falls, said lever closing the said valve as the float rises; substantially as described.

2. In a boiler-feed-regulating apparatus, in combination with the boiler, the feed-supply passage having a valve-seating, the leakage-chamber, the control-valve and the float-lever: the plug of two diameters the upper part of which forms a piston in the leakage-chamber and the lower part of which works in a prolongation of the leakage-chamber, the length of the two parts of the plug being such as to form a cushioning-chamber between the shoulder thereof and the bottom of the leakage-chamber; substantially as described.

3. In a boiler-feed-regulating apparatus, in combination with a boiler, a feed-supply passage, the two-diameter plug controlling said passage, the leakage-chamber, the control-valve and the lever and float, an adjustable knife-edge for the float supported by an eccentric stud angularly adjustable which raises and lowers the knife-edge; substantially as described.

4. In a boiler-feed-regulating apparatus, in combination with a boiler, a feed-supply passage, the two-diameter plug controlling said passage, the leakage-chamber, the control-valve and the lever and float, an adjustable knife-edge for the float supported by an eccentric stud angularly adjustable which raises and lowers the knife-edge, said knife-edge having a tailpiece guided by and housed in a plug which makes joint with an opening through which the said knife-edge may be removed; substantially as described.

5. In a boiler-feed-regulating apparatus, in combination with a boiler, a feed-supply passage, the two-diameter plug controlling said passage, the leakage-chamber, the lever and float, a valve, controlling the outlet-passage from the leakage-chamber and operated by

the said lever, carried in a removable plug in which the valve-seating is formed, said plug making joint with an opening through which the valve and spindle are adapted to be withdrawn, substantially as described.

6. In a boiler-feed-regulating apparatus, in combination with the boiler, the feed-supply passage, the plug controlling said passage, the leakage-chamber, the control-valve and the lever and float: a casing such as 23 connected at one end to the feed-supply and at the other end to the boiler, and in which casing are formed, the supply-passage valve-seating, the leakage-chamber and its passages, the openings for the plugs carrying the adjustable fulcrum and the control-valve and through the opening of which into the boiler the lever connected to the float passes; substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

PETER MARSHALL.

Witnesses:
J. E. LLOYD BARNES,
JOSEPH E. HIRST.