

No. 635,126.

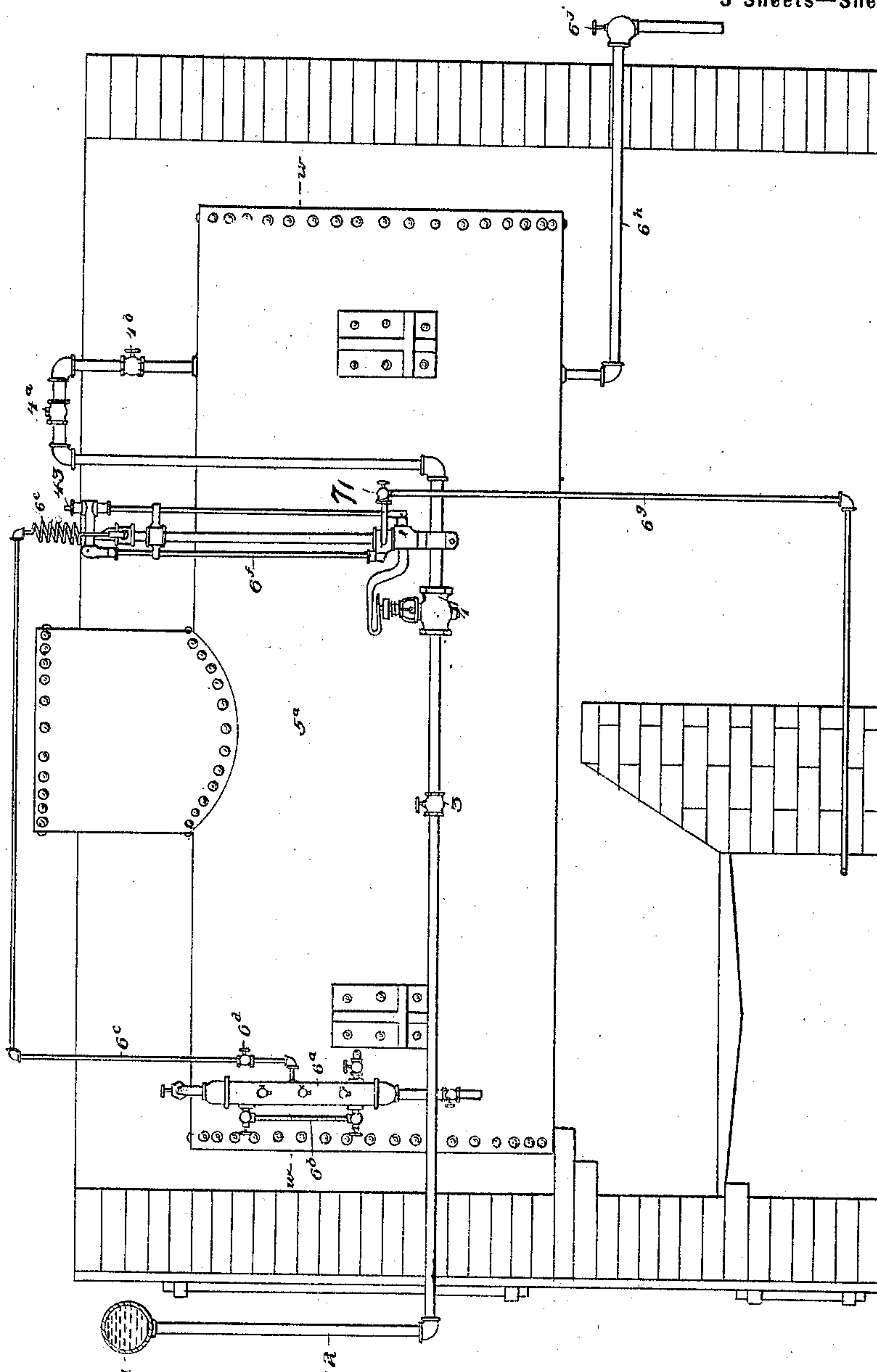
Patented Oct. 17, 1899.

F. M. CHAPPELL.
AUTOMATIC FEED WATER REGULATOR.

(Application filed Apr. 15, 1899.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES:

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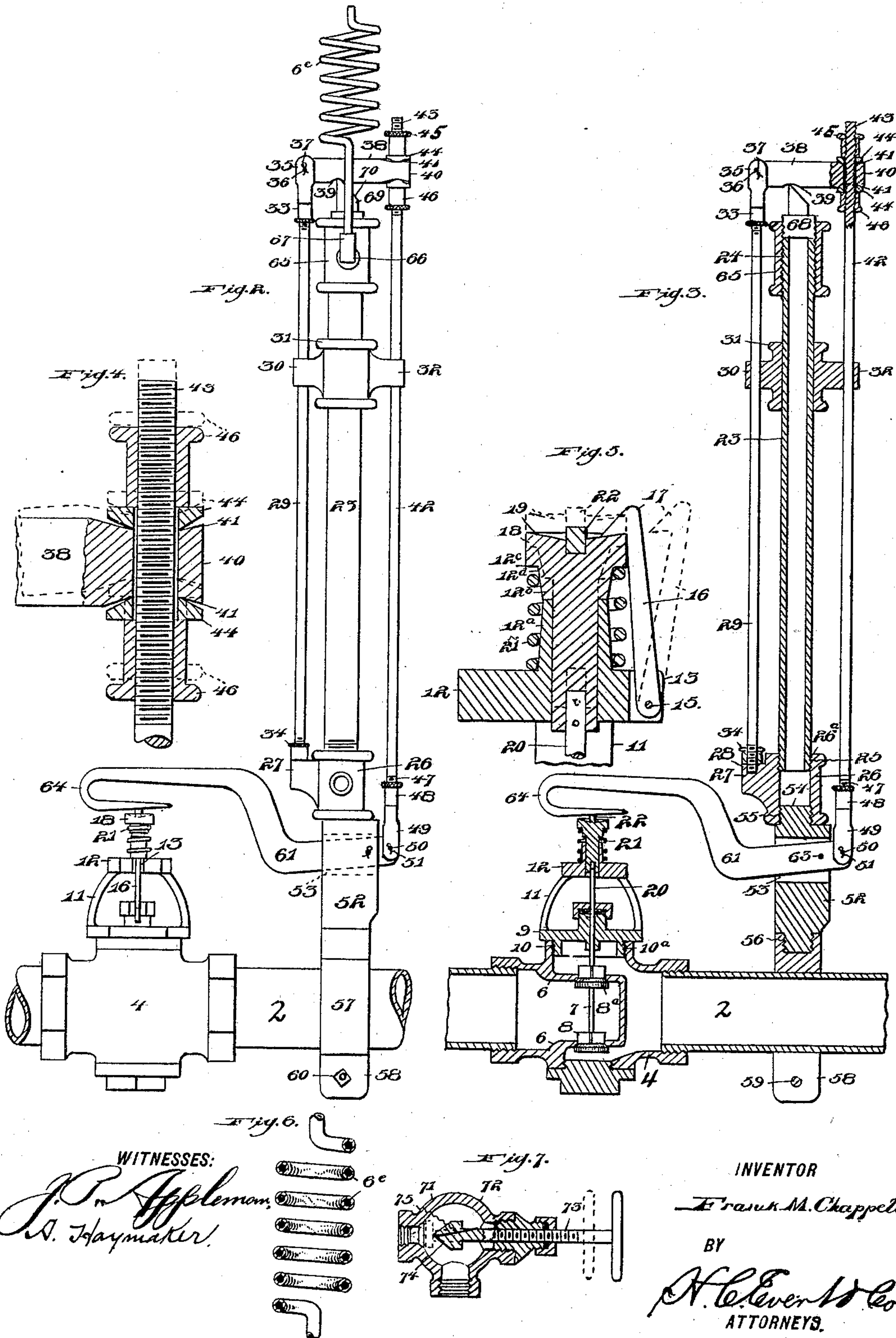
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3 Sheets—Sheet 2.



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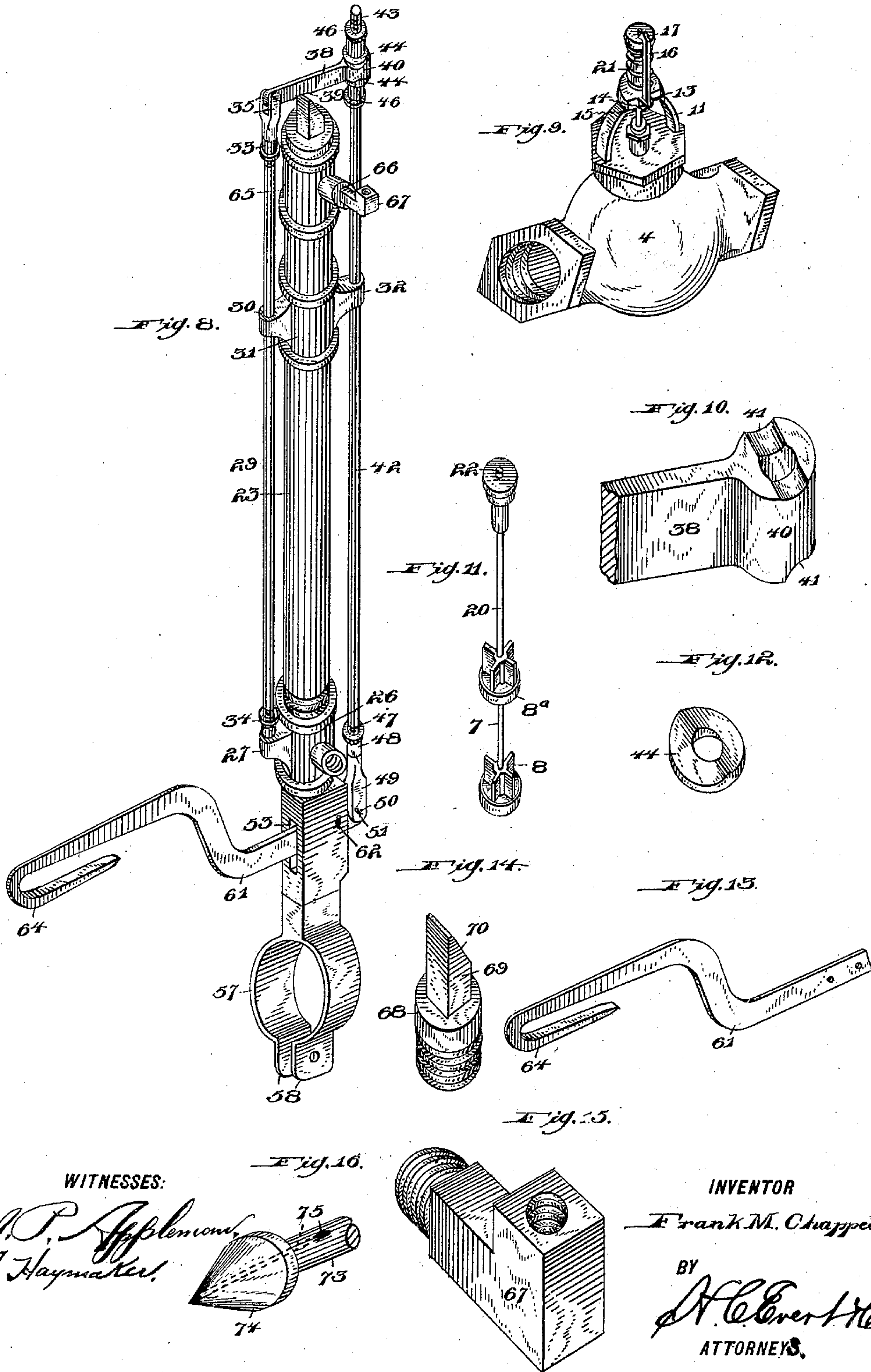
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3 Sheets—Sheet 3.



UNITED STATES PATENT OFFICE.

FRANK M. CHAPPELL, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE
PITTSBURG GAGE AND SUPPLY COMPANY, OF SAME PLACE.

AUTOMATIC FEED-WATER REGULATOR.

SPECIFICATION forming part of Letters Patent No. 635,126, dated October 17, 1899.

Application filed April 15, 1899. Serial No. 713,160. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. CHAPPELL, a citizen of the United States of America, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Feed-Water Regulators, of which the following is a specification, reference being had therein to the accompanying drawings.

10 The herein-described invention relates to certain new and useful improvements in automatic feed-water regulators, and more particularly to that class in which a thermostat is employed

15 The invention has for its object to construct an apparatus of the above-referred-to class that will automatically regulate the water-line in water-tube or other boilers and retain such line at any predetermined point or level.

20 The invention further aims to construct an automatic feed apparatus that will be of the simplest construction, with no delicate parts that can be easily put out of order, and an apparatus that will effectively maintain the
25 water at a certain level as fast as it evaporates.

Furthermore, the invention aims to construct an apparatus of the above-referred-to class that may be manufactured at a comparatively small cost.

30 With the above and other objects in view the invention finally consists in the novel construction, combination, and arrangement of parts to be hereinafter more particularly described, and specifically pointed out in the
35 claims.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this specification, wherein
40 like numerals of reference indicate corresponding parts throughout the several views thereof, and in which—

Figure 1 is a side elevation of a horizontal tubular boiler, showing my improved apparatus attached thereto. Fig. 2 is a view in side elevation of the thermostat and controlling-valve. Fig. 3 is a vertical sectional view of the same. Fig. 4 is an enlarged detail view showing the lever-arm partly broken away,
50 carrying a sleeve, washers, adjusting-butts, and connecting-rod. Fig. 5 is an enlarged

detail view, in vertical section, of the top plate together with its parts forming the locking mechanism of the controlling-valve. Fig. 6 is an enlarged vertical sectional view of the
55 condensing-coil. Fig. 7 is an enlarged longitudinal vertical sectional view of the waste-controlling valve. Fig. 8 is a perspective view of the thermostat, showing the same disconnected. Fig. 9 is a perspective view of the
60 controlling-valve. Fig. 10 is a perspective view of the end of the lever-arm and sleeve, showing the lever-arm partly broken away. Fig. 11 is a perspective view of the valve, stem, and guides of the controlling-valve. 65
Fig. 12 is a detail view in perspective of one of the convexed washers. Fig. 13 is a detail view in perspective of the elliptical spring lever-arm. Fig. 14 is a detail view in perspective of the fulcrum-block. Fig. 15 is a detail
70 view in perspective of the elbow connecting the thermostat and the condensing-coil. Fig. 16 is an enlarged detail view in perspective of the controlling-valve of the waste-pipe.

Referring to the drawings by reference-numerals, 1 indicates a main feed-pipe communicating with a feed-pipe 2.

3 indicates an auxiliary valve attached to the feed-pipe 2, said feed-pipe being further provided with a balance-controlling lock-
80 valve 4.

The reference-numeral 4^a indicates an ordinary check-valve arranged in the feed-pipe 2, and 4^b an auxiliary valve arranged on the feed-pipe near the boiler 5^a. 85

The reference-numeral 6^a indicates a water-column carrying a water-gage 6^b. To the said water-column 6^a is attached a flow-pipe 6^c, and in said flow-pipe 6^c is arranged a valve 6^d. 90

The reference-numeral 6^e is a condensing-coil connecting with the flow-pipe 6^c and the thermostat 6^f.

The reference-numeral 6^g indicates a waste-pipe, having secured near the thermostat a
95 waste-controlling valve 71.

6^h represents a blow-off pipe having a blow-off valve 6ⁱ.

The dotted lines *ww* indicate the water-line in the boiler 5^a. 100

The balance-controlling lock-valve 4 consists of a casing and is provided with the

usual valve-seats 6 6, a valve-stem 7, carrying guides 8, and valves 8^a, arranged thereto.

The reference-numeral 9 indicates a cap which is exteriorly screw-threaded at 10 and adapted to engage an interiorly-screw-threaded nipple 10^a of the valve-casing. Said cap carries a yoke 11, and formed integral therewith is a top plate 12, said top plate being provided with lugs 13 13, which are apertured at 14 and adapted to receive a pin 15, to which is swingingly secured a lock-lever 16, carrying on its free end a hook portion 17. On the upper face of said top plate 12, formed integral therewith, is arranged an upwardly-extending sleeve 12^a, having converging sides, and the under face of said sleeve serving as a guide and is adapted to receive an enlarged portion 12^b of the valve-stem. The underface of said hook portion is adapted to engage a head 18, said head having a concaved upper face 19, carrying on its under face a shoulder 12^c, having converging sides 12^d, the latter being oppositely inclined to the sides of the sleeve 12^a, said sides being formed integral with the said head and the enlarged portion 12^b of the valve-stem 20, which forms a guide operating through the top plate 12.

The reference-numeral 21 is a spiral spring surrounding the sleeve 12^a and the enlarged portion 12^b and abutting against the lower face of the head and the upper face of the top plate 12, said spring serving to normally retain the ports of the valve closed. A pin 22, which is preferably formed of hardened metal, is centrally secured upon the upper face of the head 18.

The thermostat 6^f consists of a tubular extension 23, which is exteriorly screw-threaded at its upper extremity, as shown at 24, and is similarly screw-threaded at its lower extremity, as shown at 25. To the said lower extremity is secured a fitting 26, which is interiorly screw-threaded at 26^a and adapted to receive the screw-threaded portion 25. This fitting carries on its inner side a solid shoulder 27, formed integral therewith, this shoulder being tapped on its upper face, as at 28, and adapted to receive the screw-threaded end of a stay-rod 29. The said stay-rod operates through a guide 30 of the collar 31, which is rigidly secured to and surrounds the tubular extension 23. Said collar 31 is further provided with a similar guide 32, which is arranged diametrically opposite the guide 30. The upper end of the stay-rod 29 is screw-threaded and adapted to receive an adjusting-nut 33. At the lower end of said stay-rod is a similar adjusting-nut 34. The said stay-rod is further provided at the upper extremity with a forked end 35, the latter being also interiorly screw-threaded and adapted to receive the exteriorly-screw-threaded end of the said stay-rod. The forked end 35 is apertured at 36 36 for the reception of a pin 37, which engages a lever-arm 38, operating in the forked end 35 and arranged approximately at a right angle to the said stay-rod

29, the said lever-arm 38 having on its lower face a concaved recess 39 and carrying on its other engaging end a sleeve 40, which is formed integral therewith, said sleeve having formed on its upper and lower faces concaved recesses 41 41. A connecting-rod 42 carries screw-threaded ends 43 at its upper extremity which are adapted to operate through the sleeve 40. Convexed washers 44 44 are arranged on the said connecting-rod and placed above and below the said sleeve, the convexed faces of which are adapted to engage the concaved recesses of the said sleeve. The inner diameters of the convexed washers of the sleeve are greater than the diameter of the screw-threaded portion of the connecting-rod, which allows a free movement upon the same.

At the upper extremity of the screw-threaded connecting-rod is arranged an adjusting-nut 45, said connecting-rod being further provided with similar adjusting-nuts 46, which are arranged above and below the sleeve 40, the said rod extending downwardly and operating through a guide 32 of the collar 31. The lower end of the connecting-rod is likewise screw-threaded, as shown at 47, for the reception of an adjusting-nut 48 and the screw-threaded forked end 49, the latter being apertured at 50 to receive a pin 51.

A connecting-bar 52, having arranged therein a transverse slot 53, carries on its upper extremity a screw-threaded extension 54, which is adapted to receive a fitting 26, the latter engaging an interiorly-screw-threaded portion 55. Said connecting-bar is similarly provided at its lower extremity with a screw-threaded portion 56, to which is secured a spring clamp-support 57, carrying apertured ears 58, said clamp being adapted to encircle the feed-pipe 2 and the apertured ears being provided with a bolt 59, carrying adjusting-nuts 60.

An elliptical spring-lever 61 is pivotally secured by means of the pin 50 to the forked end 49 and passes through the slot 53. An aperture 62 extends through the sides of the connecting-bar, through which passes a pin 63 and lever 61, forming a fulcrum for the latter. The elliptical end 64 tapers to a point or feather-edge, the under face being flat and adapted to engage the pin 22 of the balance-controlling lock-valve.

A fitting 65, interiorly screw-threaded, is arranged upon the screw-threaded portion 24 of the tubular extension 23, said fitting having a nipple 66, adapted to receive an elbow 67, which is interiorly screw-threaded to receive the condensing-coil 6^e. The said fitting is further provided at its top with a plug 68, which is preferably composed of hardened material. Said plug carries on its upper end a fulcrum-block 69, the latter having a beveled face 70, which tapers to a feather-edge, forming a fulcrum-bearing and operating in the concave recess 39 of the lever-arm 38.

A waste-controlling valve 71 is arranged at the base of the thermostat, which controls

the action of the same, and is formed of a casing 72, in which is arranged an ordinary valve-stem 73, carrying on its inner end the valve proper, which is cone-shaped and is indicated by the reference-numeral 74, said valve having formed therein an opening 75, extending from the apex of the cone 74 rearwardly at an angle and terminating at a point on the stem in the rear of the valve proper.

The operation of the apparatus is as follows: Water is conducted through the main feed-pipe 1 to the feed-pipe 2 and is conducted through a valve 3, through the balance-controlling lock-valve 4, thence through the ordinary check-valve 4^a and through an auxiliary valve 4^b to the boiler 5^a. For the purpose of illustrating the exact operation of this apparatus we will presume that it is desired to retain the water-line at a point which is approximately in the center of the water-column 6^a and the water-gage 6^b. The flow-pipe 6^c is attached to the water-column 6^a at a point where it is desired to retain the water-level in the boiler and indicated on the drawings by the dotted lines *ww*. For the purpose of further illustrating the operation of my improved apparatus it will be presumed that the water has not as yet reached this height in the boiler. Steam will be conducted through the flow-pipe 6^c into the condensing-coil 6^e, thence into the thermostat 6^f, which will cause the same to expand, thereby raising the fulcrum-block 69, raising the lever-arm 38 and connecting-rod 42, thereby communicating a downward movement to the elliptical end 64 of the elliptical spring-lever 61, the said end depressing the pin 22 of the valve-stem 20 and simultaneously depressing the spring 21, thereby causing the valve to open and freely admit the water-supply. As soon as sufficient water has entered the boiler and the desired water-line is obtained it will cover the mouth of the flow-pipe 6^c in the water-column 6^a, which will immediately fill the flow-pipe 6^c with water, and the same will be conducted through the condensing-coil 6^e, thereby cooling the same, and thence into the thermostat 6^f, causing the latter to contract, thereby lowering the fulcrum-block 69, relieving the thermostatic pressure from the lever-arm 38, and allowing the connecting-rod 42 to descend slightly by gravity, raising the elliptical end 64 of the elliptical lever-arm 61 and relieving the thermostatic pressure from the pin 22, operating the valve-stem of the balance-controlling lock-valve 4, and permitting the same to close by reason of the expansion of the spiral spring 21, thereby shutting off the water-supply. The balance-controlling lock-valve 4 remains in this position until the water-line in the boiler has lowered to a point which will again unseal the mouth of the flow-pipe 6^c, allowing steam to enter and forcing the water in the flow-pipe 6^c through the condensing-coil 6^e, thence through the thermostat 6^f, through the waste-controlling valve 71, and through the waste-pipe 6^g.

When said water has been forced out of the thermostat, the steam will again cause the same to expand and the first operation as herein described will be repeated. By this means a perfect water-line is constantly maintained. The water-line will only vary the distance of the diameter of the mouth of the flow-pipe 6^c.

The operation of the thermostat in detail is as follows: When the change of temperature takes place from water to steam conducted through the condensing-coil 6^e, the tubular extension 23 will slightly expand, raising the fulcrum-block 69, operating in the concaved recess 39, causing the sleeve 40 of the lever-arm 38 to rise. As this operation takes place the lower inner concaved recess 41 of the sleeve 40 will engage the inner convexed face of the convexed washer and the outer concaved recess arranged on the upper end of the sleeve will engage the opposite side of the convexed washer, as shown more clearly in Fig. 4 of the drawings, thereby imparting an upward movement to the connecting-rod 42, raising the pivotal end of the elliptical spring-lever 61, and depressing the forward end 64 of the said lever, and depressing the pin 22, opening the valve. The reverse operation will take place when the hydrostatic action upon the thermostat takes place.

When it is desired to admit water into the boiler or cut out the operation of the balance-controlling lock-valve 4, the head 18 is depressed (see Fig. 5 of the drawings) and the lock-lever 16 placed in position, the hook portion of said lever engaging the concaved face 19 of the head. The lower end of the enlarged portion 12^b abutting against the upper face of the sleeve 12^a will limit the movement of the balance-controlling lock-valve, and the same will then be locked and the valve opened, admitting a free passage of the water-supply into the boiler.

The waste-controlling valve 71 being constructed with an opening 75 extending from the apex of the cone rearwardly at an angle and terminating on the valve-stem at a point in the rear of the valve provides an opening for the steam or water to pass to the waste-pipe 6^g at all times. By this means a continuous operation of the pumps or injector, as the case may be, is assured.

From the foregoing description it will be readily apparent the numerous advantages which are obtained by the use of my improved apparatus, which provides new and novel means whereby a direct action is obtained and exercised upon the controlling-valve regulating the feed-water supply, and when a change of temperature takes place the thermostat will cause a direct action upon the controlling-valve without the intervention of auxiliary valves or like means to accomplish the desired result. More accurate and sensitive means of controlling the water-level in the boiler is thus obtained, and the employment of auxiliary valves, which are common

to this class of machines, will be entirely obviated, thereby overcoming a very objectionable feature which can be found in all inventions of this character. Multiplicity of parts and the liability of the same becoming out of order are hazardous and in many cases dangerous and disastrous results follow. All such objectionable features are practically overcome by the use of the herein-described apparatus.

It will be noted that my improved automatic feed-water regulator may be advantageously connected to marine boilers, as all parts are so constructed that they are able to withstand the ordinary jarring and the rocking motion of the vessel without the liability of becoming out of adjustment.

It will be noted that various changes may be made in the details of construction without departing from the general spirit of my invention.

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

1. In an apparatus of the character described in combination with a boiler, a feed-pipe, a controlling-valve arranged in said feed-pipe, a flow-pipe, a condensing-coil attached to said flow-pipe, a thermostat connected to said condensing-coil, said thermostat operating upon said controlling-valve, and a waste-pipe leading from said thermostat, substantially as described.

2. In an apparatus of the character described in combination with a boiler, a feed-pipe, a controlling-valve arranged in said feed-pipe, a flow-pipe, a condensing-coil arranged at the end of said flow-pipe, a thermostat secured to said condensing-coil, a waste-pipe connected to said thermostat, and a waste-controlling valve, all parts being arranged and operating as herein shown and described.

3. In an apparatus of the character described in combination with a boiler, a feed-pipe, a controlling-valve arranged in said feed-pipe, locking means secured to said valve, a flow-pipe, a thermostat, a condensing-coil arranged at the top of the thermostat and connecting the end of said flow-pipe, a waste-pipe arranged to the lower end of the thermostat, and a waste-controlling valve arranged in the said waste-pipe, substantially as described.

4. In an apparatus of the character described in combination with a boiler, a feed-pipe, a balance-controlling lock-valve arranged in said feed-pipe, a flow-pipe, a thermostat, a condensing-coil connecting the said thermostat with said flow-pipe, a waste-pipe, and a waste-controlling valve having an opening arranged therethrough, said waste-controlling valve arranged in said waste-pipe, substantially as described.

5. In combination with a boiler having a feed-pipe connected thereto and to a main feed-pipe, a controlling-valve arranged in said

pipe, a flow-pipe connected at one end to the water-column of the boiler, a condensing-coil connected to the other end of said flow-pipe, a thermostat connected to said condensing-coil and means carried by said thermostat for operating the controlling-valve of the feed-pipe, substantially as described.

6. In combination with a boiler having a feed-pipe connected thereto and to a main feed-pipe, a controlling-valve arranged in said feed-pipe, a thermostat, a condensing-coil connected to the said thermostat, a flow-pipe connecting the water-column of the boiler with said thermostat and a pivoted lever carried by said thermostat and attached to the controlling-valve of the feed-pipe, and adapted to operate the valve, substantially as described.

7. In a feed-water regulator, the combination with a boiler, of a feed-pipe connected thereto and a controlling-valve arranged in said feed-pipe, a thermostat mounted on the feed-pipe, a flow-pipe connected at its one end to the water-column of the boiler, a condensing-coil connecting the other end of said flow-pipe to the thermostat, a stay-rod secured to said thermostat, a lever-arm pivotally secured at its one end to said stay-rod, a lever pivotally secured to the thermostat and engaging said controlling-valve and means connecting said lever-arm and pivoted lever for operating the controlling-valve, substantially as described.

8. In a feed-water regulator, the combination with a boiler, of a feed-pipe connected to the boiler and to a main feed-pipe, a controlling-valve mounted on the feed-pipe, a thermostat, a flow-pipe connecting the thermostat with the boiler, a stay-rod carried by said thermostat, a lever-arm pivotally secured in the upper end of said stay-rod, a lever pivotally secured near the lower end of the thermostat and having an elliptical-shaped end engaging the controlling-valve, and a connecting-rod attached to the free end of the lever-arm and to the end of the lever engaging the controlling-valve for operating the same, substantially as shown and described.

9. In a feed-water regulator, the combination with a boiler of a feed-pipe connected to said boiler, a controlling-valve arranged in said feed-pipe with double valve-seats arranged therein, a valve-stem, valves secured to said stem and engaging said seats, means carried by the valve-casing and engaging said valve-stem for operating the same, a thermostat, a condensing-coil connected thereto, a flow-pipe connecting the boiler with said thermostat, and means carried by said thermostat and operated thereby for operating the controlling-valve, substantially as shown and described.

10. In a feed-water regulator, the combination with a boiler having a feed-supply pipe, a controlling-valve arranged in said supply-pipe, a thermostat supported from the supply-pipe, a flow-pipe connecting the water-column of the boiler with said thermostat, a

stay-rod carried by the thermostat, a lever-arm pivotally secured in the upper end of said stay-rod, a controlling-valve, an operative lever, a connecting-rod secured in the
5 free end of the lever-arm and pivotally attached to the said operative lever, a plug secured in the upper end of said thermostat, a waste-pipe connected to the thermostat and a controlling-valve arranged in said waste-
10 pipe, substantially as described.

11. In an apparatus of the character described, in combination with a boiler, a feed-pipe, a controlling-valve arranged therein, a flow-pipe, a condensing-coil connected to the
15 said flow-pipe, a thermostat and means connected thereto for operating the controlling-valve, substantially as herein shown and described.

12. In an apparatus of the character described, in combination with a boiler, a feed- 20 pipe, a controlling-valve arranged therein, a condensing-coil, a flow-pipe connected at one end to the water-column of the boiler and at its opposite end to the said coil, a thermostat connected to the said condensing-coil, and an
25 operating-lever adjustably connected to the said thermostat and operated thereby for operating the said controlling-valve, substantially as described.

In testimony whereof I affix my signature 30 in the presence of two witnesses.

FRANK M. CHAPPELL.

Witnesses:

JOHN NOLAND,
E. W. ARTHUR.