No. 647,683. Patented Apr. 17, 1900.

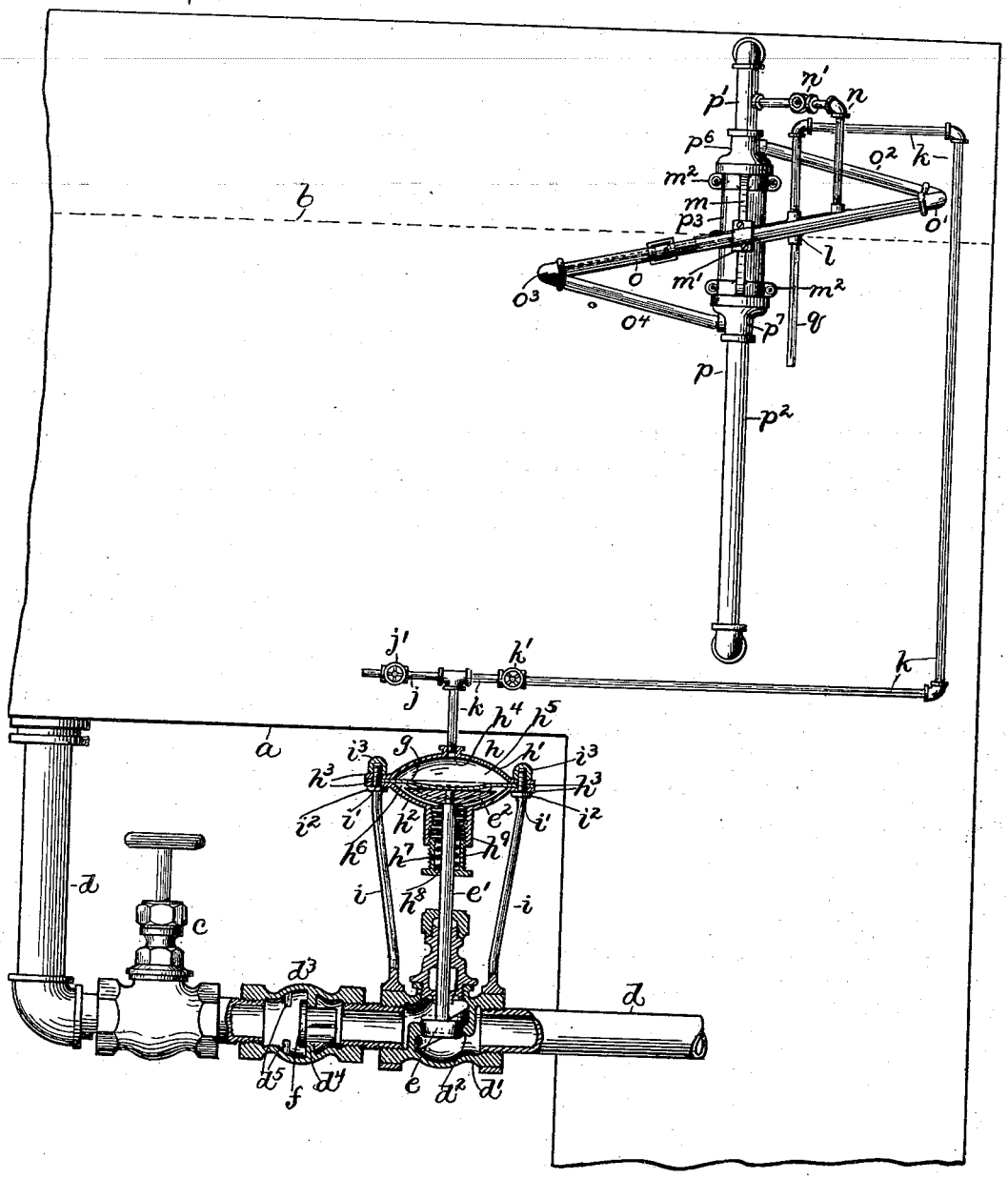
C. E. SQUIRES.

WATER FEEDING DEVICE FOR BOILERS.

(Application filed Dec. 4, 1899.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.



WITNESSES:

David E. Daly.

A. H. Parrall

INVENTOR

Charles E. Squires

BY

Lynch & Dorer

his ATTORNEYS

No. 647,683. Patented Apr. 17, 1900.

C. E. SQUIRES.

WATER FEEDING DEVICE FOR BOILERS.

(Application filed Dec. 4, 1899.)

(No Model.) 2 Sheets—Sheet 2.

FIG. II.

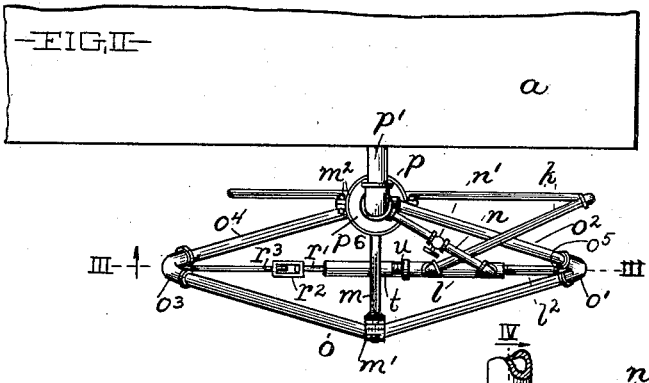


FIG. III.

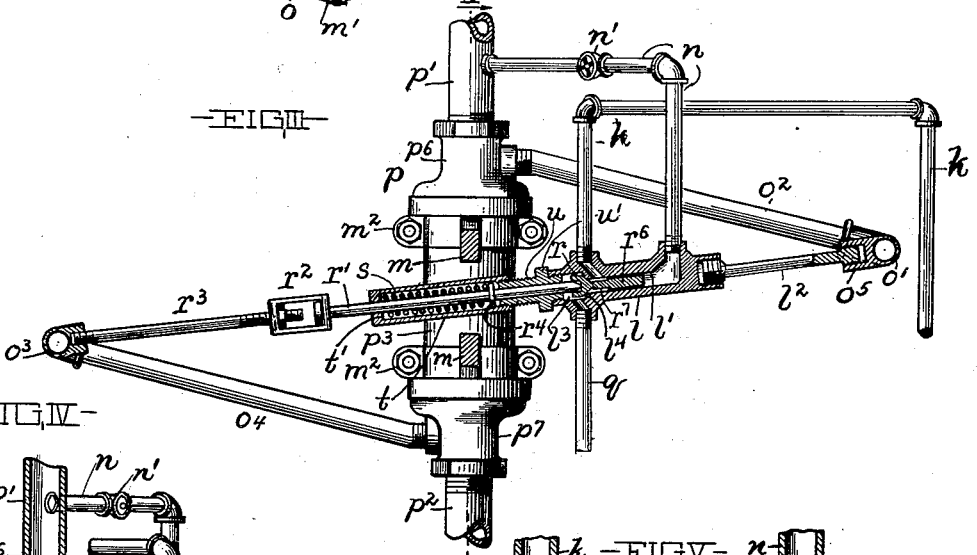


FIG. IV.

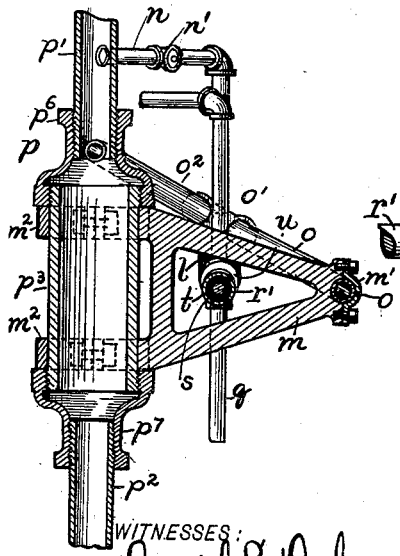
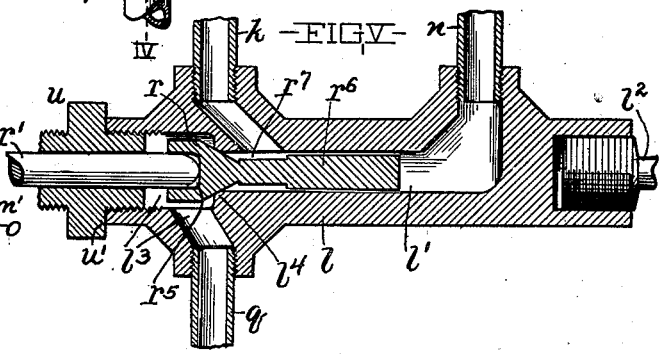


FIG. V.



WITNESSES:

Daniel E. Daly.

A. H. Parratt

INVENTOR

Charles E. Squires

BY

Squires & Dorer

his ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES E. SQUIRES, OF CLEVELAND, OHIO.

WATER-FEEDING DEVICE FOR BOILERS.

SPECIFICATION forming part of Letters Patent No. 647,683, dated April 17, 1900.

Application filed December 4, 1899. Serial No. 739,112. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SQUIRES, residing at No. 42 Forestdale avenue, Cleveland, county of Cuyahoga, and State of Ohio, have invented certain new and useful Improvements in Water-Feeding Devices for Boilers; 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 pertains to make and use the same.

My invention relates to improvements in water-feeding devices for boilers.

The object of this invention is to provide apparatus whereby the water in a steam-boiler is automatically maintained at the desired level and that is exceedingly reliable in its operation and simple and durable in its construction.

With this object in view and to the end of realizing other advantages hereinafter appearing the invention consists in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure I is a side elevation of a portion of a steam-boiler provided with automatically-operated water-feeding apparatus embodying my invention. Portions are in section in this figure to more clearly show the construction. Fig. II is a top plan of a portion of the boiler and the connected apparatus. Fig. III is a side elevation, partly in vertical section, on line III III, Fig. II. Fig. IV is an elevation in vertical section on line IV IV, Fig. III, looking to the right. Fig. V is an enlarged side elevation in section of the valve r and the inclosing valve-casing and the pipes directly connected with the said casing. Fig. V is drawn on a larger scale than Figs. III and IV, that are drawn on a larger scale than Figs. I and II.

Referring to the drawings, a designates an ordinary steam-boiler, and b a horizontal dotted line that represents the water-level desired to be maintained within the boiler. A water-supply pipe-line d communicates with the lower portion of the water-space of the boiler in the usual manner. The pipe-line d has a valve-casing d' arranged in the line thereof, which casing is provided internally with a seat d^2 for a vertically-shiftable valve e, that establishes or interrupts continuity in the passage-way through the valve-casing d', according as the valve is shifted from or to its seat. The pipe-line d at any suitable point between the valve e and the discharging end of the pipe-line is provided with a check-valve f, that has a limited movement longitudinally of the pipe-line. The casing d^3 for the valve f forms a part of the pipe-line d and is provided internally with a seat d^4 for the check-valve. The arrangement of the seat d^4 and the valve f is such that the valve is capable of opening to accommodate the flow of water through the pipe-line d to the boiler, but will prevent return of water by back pressure from within the boiler. Stop-forming lugs d^5 are formed internally of the valve-casing d^3 and have the arrangement required to render them capable of limiting the movement of the check-valve f during the actuation of the latter into its extreme open position. The pipe-line d, at any suitable point between the check-valve f and the water-space of the boiler, is provided with a manually-operated valve c of any approved construction capable of controlling the volume of the stream of water adapted to be conducted by pipe-line d to the boiler and adapted to entirely interrupt the flow of water to the boiler, as required when the boiler requires repairs or cleaning internally.

The valve e is movable vertically and provided with an upwardly-extending vertically-arranged stem e', that at its upper end is provided with a head e^2, arranged within the lower portion of a closed case or shell h, that consists of two parts h' and h^2, arranged the one, h', above the other, h^2, and has a diaphragm g interposed between the said parts. The said parts h' and h^2 are secured together in any approved manner. Preferably the case or shell h is provided with two depending legs i and i, arranged at opposite sides, respectively, of the valve-stem e' and supported in any approved manner from the valve-casing d', and the said legs i at their upper ends are provided with vertically-arranged studs i', that extend through holes formed in ears or flanges h^3, formed externally of and upon the parts h' and h^2 of the aforesaid case, and through the diaphragm g. The legs i have shoulders i^2 engaging the un-

der side of the ears or flanges upon the part h^2, and nuts i^3 are mounted upon the studs i' at the upper side of the ears or flanges upon the part h'. By tightening the nuts i^3 the two parts of the case h and the interposed diaphragm are securely clamped together, and upon loosening and removing the said nuts the parts can be separated or detached for repairs or other purposes. The diaphragm g is flexible and elastic and consists, preferably, of a sheet of rubber. The upper part h' of the case or shell h is provided centrally with a fluid-pressure inlet h^4. The diaphragm g divides the case h into two chambers h^5 and h^6. The upper chamber h^5 is the fluid-pressure-receiving chamber of the case, and the lower chamber h^6 contains the head e^2 of the stem of the valve e. Means acting to hold the diaphragm g in its normal position is provided, and consists, preferably, of a suitably-applied spiral spring h^7, that is mounted and confined upon the valve-stem e' between the lower side of the head e^2 and the shoulder h^8, formed internally of the lower end of the case h^9, that surrounds the spring and depends from and is rigid with the lower part h^2 of the case h. The arrangement of parts is such that the head e^2 of the valve-stem has a limited play in a vertical direction below the diaphragm, but is held in contact with the diaphragm by the spring h^7. In dotted lines, Fig. I, the valve e is shown open, and the said spring acts to retain the valve open. The admission of pressure into chamber a^5, and consequently to the upper side of the diaphragm, will result, as already indicated, in the downward actuation of the valve-stem against the action of the spring h^7 and close or lower the valve e. Upon the relief or removal of the said pressure the spring will return the diaphragm into its normal position.

By the peculiar construction and arrangement of parts hereinbefore described the supply of water to the boiler can be regulated with great accuracy and the desired water-level maintained within the boiler by mechanism or apparatus adapted to admit enough fluid-pressure to the diaphragm g or relieve the pressure upon the diaphragm, according as the water-level within the boiler is the level desired to be maintained in the boiler or according as the water-level falls below the desired level, and the improved mechanism or apparatus that I have provided for automatically regulating the supply of fluid-pressure to the diaphragm g to automatically operate the latter as required to maintain the desired water-level in the boiler is as follows: The inlet h^3 of the fluid-pressure-receiving chamber of the case h is connected with one end of a pipe-line k, that has its other end communicating with a passage-way l', formed in and extending through the valve-casing l, that is arranged externally of the boiler, preferably just above the water-level desired to be maintained within the boiler. The pipe k near its discharging end has a branch j, that discharges into the external atmosphere and is provided with a valve j' for controlling or interrupting the passage of fluid therethrough. The pipe k is provided also with a valve k' for interrupting, if required, the supply of fluid-pressure to the case h. The other end of the passage-way l' of the valve-casing l is in open relation with a pipe n, that extends to and communicates with the upper and steam-receiving portion of a pipe-line p, arranged vertically externally of and near the boiler. The upper end of the pipe p communicates with the steam-space within and above the water-level desired to be maintained within the boiler. The lower end of the pipe p communicates with the lower portion of the water-space of the boiler. Obviously, therefore, the pipe n is adapted to conduct steam from the upper portion of the pipe-line p into one end of the passage-way l' of the valve-casing l, and the pipe-line k is adapted to conduct steam from the other end of the said passage-way l' to the chamber h^5 of the case h. The pipe n is provided with a valve n' for controlling or interrupting the supply of steam to the passage-way l'. That portion of the pipe-line p that is above the water-level desired to be maintained within the boiler is the steam-receiving portion of the said pipe-line. The remainder or lower portion of the said pipe-line p is adapted to fill with water received thereby from the boiler. A zigzag pipe-line establishes open relation between the steam-receiving portion and the water-receiving portion of the pipe-line p, and comprises, preferably, three pipe-sections o, o^2, and o^4 and two elbows o' and o^3. The pipe-section o is arranged centrally between the pipe-sections o^2 and o^4 and is inclined and extends longitudinally of the boiler, at the outer side of and a suitable distance from the pipe-line p, and the pipe-sections o^2 and o^4 are arranged at opposite sides, respectively, of the pipe-line p. The upper end of the pipe-section o is connected by an elbow o' with the lower end of the pipe-section o^2, that inclines upwardly from the said elbow toward the steam-receiving portion of the pipe-line p, to which its upper end is connected. The lower end of the pipe-section o is connected by an elbow o^3 with the upper end of the pipe-section o^4, that has its opposite end connected with the water-receiving portion of the pipe-line p and inclines upwardly from the latter toward the pipe-section o. The pipe-section o bulges or bends forwardly or outwardly away from the pipe-line p to accommodate the location and operation between the pipe-line p and the pipe-section o of the following: the valve-casing l, the valve r within the said casing and adapted to control the relief of pressure upon the diaphragm g, the support for the said casing, and the operative connection between the said valve r and the zigzag pipe-line. As already indicated, the arrangement of the zigzag pipe-line relative to

the water-level desired to be maintained within the boiler is such that the lower half of the said pipe-line is filled with water when the desired water-level obtains within the boiler. The pipe-sections of the zigzag pipe-line are composed of metal or material—such, for instance, as copper—that will expand or contract, according as it is exposed to a greater or lower temperature, and the valve r is operated by the expansion and contraction of the said expansible and contractible pipe-line. The valve-casing l and the operative connection between the valve r and the said contractible and expansible pipe-line are arranged in line and in an inclined plane between the elbows o' and o^3. The valve-casing l is connected at its upper end to the one end of a bar l^2, that is inclined and arranged in line with the said valve-casing, and has its opposite end secured to the elbow o'. The elbow-engaging end of the bar l^2 is preferably detachably secured to the elbow o', and consequently is externally screw-threaded and engages a correspondingly internally threaded socket o^5, formed upon the said elbow. To prevent the expansion and contraction of the pipe-section o in a lateral direction and to cause the zigzag pipe-line to expand or contract lengthwise according as it is exposed to a higher or lower temperature, the pipe-section o is embraced at its central portion by a sleeve m', that is formed upon the outer or free end of a stationary bracket m, that projects laterally and outwardly from the pipe-line p and is secured to the latter in any approved manner. Preferably the pipe-line p is composed of three pipe-sections—an upper pipe-section p', communicating with the steam-space of the boiler, a lower pipe-section p^2, communicating with the water-containing portion of the boiler, and a central pipe-section p^3, that bears the bracket m and is embraced by clamps or clips m^2, with which the inner end of the said bracket is provided. The bracket m is snugly interposed between the opposing ends of the couplings p^6 and p^7, that connect the upper end and lower end, respectively, of the bracket-bearing pipe-section p^3 with the upper pipe-section p' and lower pipe-section p^2, respectively. The valve-casing l within its lower end has an annular seat l^4 for the valve r, that is arranged centrally of the said portion of the valve-casing and is shiftable endwise of the casing to and from the said seat. The valve r is arranged to move within a chamber or passage-way l^3, formed in the valve-casing and communicating with an exhaust-pipe q, that depends from and is attached to the valve-casing. The valve-seat l^4 is formed, therefore, between the passage-ways l' and l^3, and the valve is adapted to establish and interrupt open relation between the said passage-ways. A suitably-applied spring s acts to retain the valve r in the latter's closed position. The valve r has a stem r' extending in the direction of the lower end of the pipe-section o and connected by a turnbuckle r^2 with the one end of a bar r^3, whose other end is fixed to the elbow o^3, that, as already indicated, joins the lower end of a pipe-section o with the upper end of the pipe-section o^4. The spring s is preferably a spiral spring coiled and confined upon the valve-stem r' between a shoulder l', formed upon and internally of a case t, that incloses the said spring, and an external shoulder r^4, formed upon the valve-stem within the said case. The valve-stem extends, therefore, through the spring-containing case t, that is screw-threaded internally and embraces and engages a correspondingly-threaded end of a sleeve u, that loosely embraces the valve-stem, and has its opposite end screw-threaded externally and engaging the adjacent and correspondingly internally threaded end of the valve-casing l, and has an external annular shoulder u, that is adapted to abut against the valve-casing l and form a stop to prevent screwing of the sleeve u too far into the valve-casing l. By the construction described the parts are readily separated for repairs or other purposes, and the tension of the spring s can be regulated by the case t and is increased by screwing the said case farther onto the sleeve u. The valve r is provided with a cavity r^5, that is engaged by that end of the stem r' that extends into the valve-casing l. The valve r has an arm r^6, that extends into the passage-way l' of the valve-casing l between the pipes k and n. The valve-arm r^6 is not as thick, as at r^7, next adjacent to the valve as the portion of the arm that extends centrally between the pipes k and n, and consequently the capacity of the space around the valve-arm's portion that is next to the valve is greater than the capacity of the space around the outer and thicker portion of the said arm, so that when the valve is opened sufficiently far the passage-way l^3 between the exhaust-pipe q and the passage-way l' will have a greater steam-conducting capacity than the space around the thicker portion of the said valve-arm, and this is not unimportant, as will hereinafter more fully appear.

The operation of my improved apparatus is as follows: In the normal position of the parts, with valves c, k', and n' open and with valve j' closed, when the water-level within the boiler is at the elevation desired to be maintained valve r of the valve-casing l, as well as valve e within the line of the water-supply pipe d, are closed, and in this position of the parts the greater portion of the pipe-line p, as well as the lower half of the expansible and contractible zigzag pipe-line, are filled with water, and the upper portion of the said pipe-lines is supplied with steam from the steam-space of the boiler, and pipe n, passage-way l', pipe k, and the chamber h^5 of the case h are supplied with steam, and the steam-pressure upon the diaphragm g within the case h acts to retain the water-supply-

regulating valve *e* closed against the action of the spring h^7. When the water-level falls, steam passes farther into the expansible and contractible pipe-line and exposes the latter to a higher temperature and results in the expansion of the said pipe-line longitudinally, so as to actuate the valve-stem r' in the direction required to release or open the valve *r* against the action of the spring *s*, that, as already indicated, acts to retain the valve *r* in its closed position. The opening of the valve *r* establishes open relation between the passage-way l' of the valve-casing *l* and the exhaust-pipe *q*, and the result is obviously not only to permit the escape of steam to the exhaust-pipe, but primarily to relieve the pressure upon the diaphragm *g*. The relief of the pressure upon the diaphragm *g* obviously results in the return of the diaphragm into its horizontal and valve-opening position by the action of the spring h^7. The extent to which the valve *e* is opened by the spring h^7 will depend upon the extent to which the pressure upon the valve-operating diaphragm has been relieved, and the valve will open more or less, according as the said pressure has been more or less relieved by the arrangement and construction of the parts hereinbefore described. The opening of the valve *e* results in the flow of water to the boiler to reestablish the desired water-level within the boiler, and when the desired water-level has again been established and the water risen within the pipe *p* and the connected expansible and contractible pipe-line the temperature of the said last-mentioned pipe-line has been reduced to the extent required to have contracted the same longitudinally, as required to permit the valve-stem r' to be closed by the spring *s*, that is strong enough to hold the valve *r* in its closed position when the valve is again seated within the valve-casing *l*. This closing of the valve *r* again interrupts open relation between the passage-way l' of the said valve-casing and the exhaust-pipe *q*, and consequently again causes the diaphragm *g* to be depressed by the steam-pressure within the pipe *k*, so as to close the valve *e*, and thereby cut off a further supply of water to the boiler. It will be observed, therefore, that the valve *e* is operated automatically and is opened or closed according as the water-level desired to be maintained within the boiler falls below or rises to the desired level.

This invention is not limited to any particular pressure-supply source, and although the pressure in the case illustrated is obtained from the steam-space of the boiler the pipe *k*, that conducts the fluid-pressure to the pressure-receiving port of the valve-casing, might be connected to any other fluid-pressure-supply source.

What I claim is—

1. The combination, with a boiler and the water-supply pipe or passage-way for conducting water to the boiler, and provided with a valve for controlling or regulating the supply of water to the boiler, means for actuating the valve in the one direction, mechanism for moving the valve in the opposite direction and operated by fluid under pressure, and a suitably-supplied pipe-line for supplying the said fluid-pressure, of a longitudinally expansible and contractible pipe having opposite ends in open relation with the steam-space and water-space, respectively, of the boiler, and a suitably-supported valve-casing provided with an exhaust-outlet and having the following: a passage-way connecting the aforesaid fluid-pressure-supply pipe-line and the exhaust-outlet, a valve for establishing and interrupting continuity in the said connecting passage-way and operatively connected with the aforesaid contractible and expansible pipe, a fluid-pressure inlet, and a port or passage-way connecting the said inlet with the aforesaid fluid-pressure-supply pipe-line, substantially as and for the purpose set forth.

2. The combination with a boiler and the water-supply pipe or passage-way for conducting water to the boiler and provided with a valve for controlling or regulating the supply of water to the boiler; means for actuating the said valve in the one direction, and mechanism for actuating the valve in the opposite direction and operated by fluid under pressure and a suitably-supplied pipe-line for supplying the said fluid-pressure: of a longitudinally expansible and contractible pipe extending above and below the water-level desired to be maintained within the boiler and having opposite ends in open relation with the steam-space and water-space, respectively, of the boiler; a suitably-supported valve-casing connected with the aforesaid pipe and provided with an exhaust-outlet and having the following: a passage-way connecting the aforesaid fluid-pressure-supply pipe-line and exhaust-outlet; a valve for establishing and interrupting continuity in the last-mentioned passage-way and operatively connected with the aforesaid expansible and contractible pipe; a fluid-pressure inlet, and a port or passage-way connecting the said inlet with the fluid-pressure-supply pipe-line.

3. The combination with a boiler and the water-supply pipe or passage-way for conducting water to the boiler and provided with a valve for controlling or regulating the supply of water to the boiler; means for actuating the said valve in the one direction, and mechanism for actuating the valve in the opposite direction and operated by fluid under pressure, and the pipe-line *k* for supplying the said fluid-pressure: of a longitudinally expansible and contractible pipe extending above and below the water-level desired to be maintained within the boiler and having opposite ends in open relation with the steam-space and water-space, respectively, of the boiler, and a suitably-supported valve-casing

l having the port or passage-way l' and the chamber or passage-way l^3; a fluid-pressure supply-pipe n; an exhaust-pipe or passage-way q; a valve-seat l^4; the valve r provided with the arm r^6 reduced in cross-section, as at r^7, and an operative connection between the valve and the aforesaid expansible and contractible pipe, all arranged and operating substantially as shown, for the purpose specified.

4. The combination, with the boiler, and the water-supply pipe or passage-way for conducting water to the boiler, and provided with a valve for controlling or regulating the supply of water to the boiler, means for actuating the said valve in the one direction, mechanism for moving the valve in the opposite direction and operated by fluid under pressure, and a pipe-line for supplying the said fluid-pressure, of the longitudinally expansible and contractible pipe-line that is zigzag in form substantially as shown and has opposite ends in open relation with the steam-space and water-space, respectively, of the boiler and braced laterally, a suitably-supported valve-casing provided with an exhaust-outlet and a passage-way for connecting the aforesaid fluid-pressure-supply pipe-line and the exhaust-outlet, a valve for establishing and interrupting continuity in the last-mentioned passage-way, and an operative connection between the said valve and the aforesaid expansible and contractible pipe-line.

5. The combination with a boiler and the water-supply pipe or passage-way for conducting water to the boiler and provided with a valve for controlling or regulating the supply of water to the boiler; means for actuating the said valve in the one direction, and mechanism for actuating the valve in the opposite direction and operated by fluid under pressure, and a pipe-line for supplying the said fluid-pressure: of the longitudinally expansible and contractible zigzag pipe-line extending above and below the water-level desired to be maintained within the boiler and having opposite ends in open relation with the steam-space and water-space, respectively, of the boiler, which last-mentioned pipe-line is braced laterally; a suitably-supported valve-casing connected with the aforesaid fluid-pressure-supply pipe-line and provided with an exhaust-outlet and a passage-way for connecting the said pipe-line and exhaust-outlet; a valve for establishing and interrupting continuity in the last-mentioned passage-way, and an operative connection between the said valve and the aforesaid expansible and contractible pipe-line.

6. The combination, with the boiler, the water-supply pipe or passage-way for conducting water to the boiler and provided with a valve for controlling or regulating the supply of water to the boiler, means for actuating the said valve in the one direction, mechanism for moving the valve in the opposite direction and operated by fluid under pressure, and a pipe-line for supplying the said fluid-pressure, of the upright pipe p composed of a central section p^3 and an upper section and a lower section p' and p^2 attached to opposite ends, respectively, of the central section and communicating with the steam-space and water-space, respectively, of the boiler, a contractible and expansible pipe extending above and below the water-level desired to be maintained within the boiler and having opposite ends in open relation with the said upright pipe above and below the said water-level, respectively, and braced laterally from the central section of the said upright pipe, and a suitably-supported valve-casing connected with the aforesaid fluid-pressure-supply pipe-line having the following: an exhaust-outlet, a passage-way connecting the said pipe-line and the exhaust-outlet, a valve for establishing and interrupting continuity in the last-mentioned passage-way and operatively connected with the aforesaid expansible and contractible pipe, a fluid-pressure inlet and a port or passage-way connecting the said inlet with the aforesaid fluid-pressure-supply pipe-line.

7. The combination, with the boiler, the water-supply pipe or passage-way for conducting water to the boiler and provided with a valve for controlling or regulating the supply of water to the boiler, means for actuating the said valve in one direction, mechanism for moving the valve in the opposite direction and operated by fluid under pressure, and a pipe-line for supplying the said fluid-pressure, of a longitudinally contractible and expansible pipe extending above and below the water-level desired to be maintained within the boiler and having opposite ends in open relation with the steam-space and water-space, respectively, of the boiler; a valve-casing l arranged longitudinally of the expansible and contractible pipe and having the port or passage-way l' and the chamber or passage-way l^3 and the valve-seat l^4; the fluid-pressure supply-pipe n; the exhaust-pipe or passage-way q; the valve r provided with the arm r^6 reduced in cross-section, as at r^7; the valve-stem having one end thereof engaging the valve and operatively connected, at its opposite end, with the expansible and contractible pipe and having the external shoulder r^4, a sleeve u embracing the valve-stem and removably attached, at one end, to the valve-casing and screw-threaded at its opposite end; the case t having screw-threads engaging the last-mentioned threaded end of the aforesaid sleeve and having the internal shoulder t', and the spring s, all arranged and operating substantially as shown, for the purpose specified.

Signed by me at Cleveland, Ohio, this 11th day of November, 1899.

CHARLES E. SQUIRES.

Witnesses:
C. H. DORER,
A. H. PARRATT.