(No Model.) 2 Sheets—Sheet 1.

R. G. McAULEY & L. B. FULTON.

BOILER FEEDER.

No. 549,877. Patented Nov. 12, 1895.

Fig. 8.

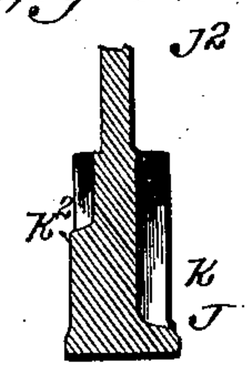


Fig. 9.

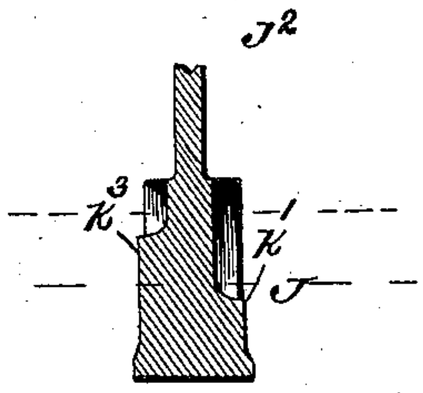


Fig. 10.

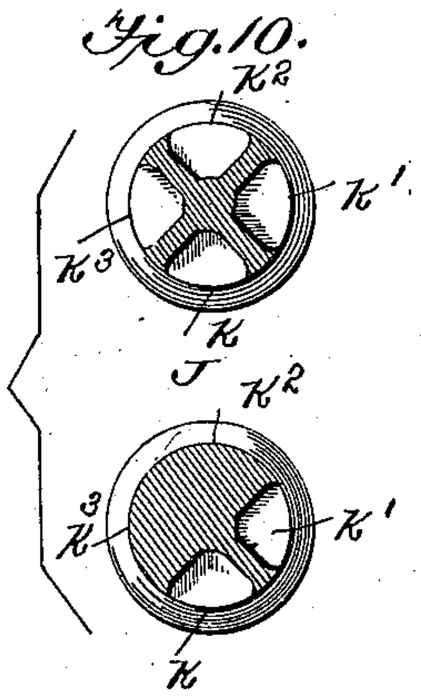


Fig. 1.

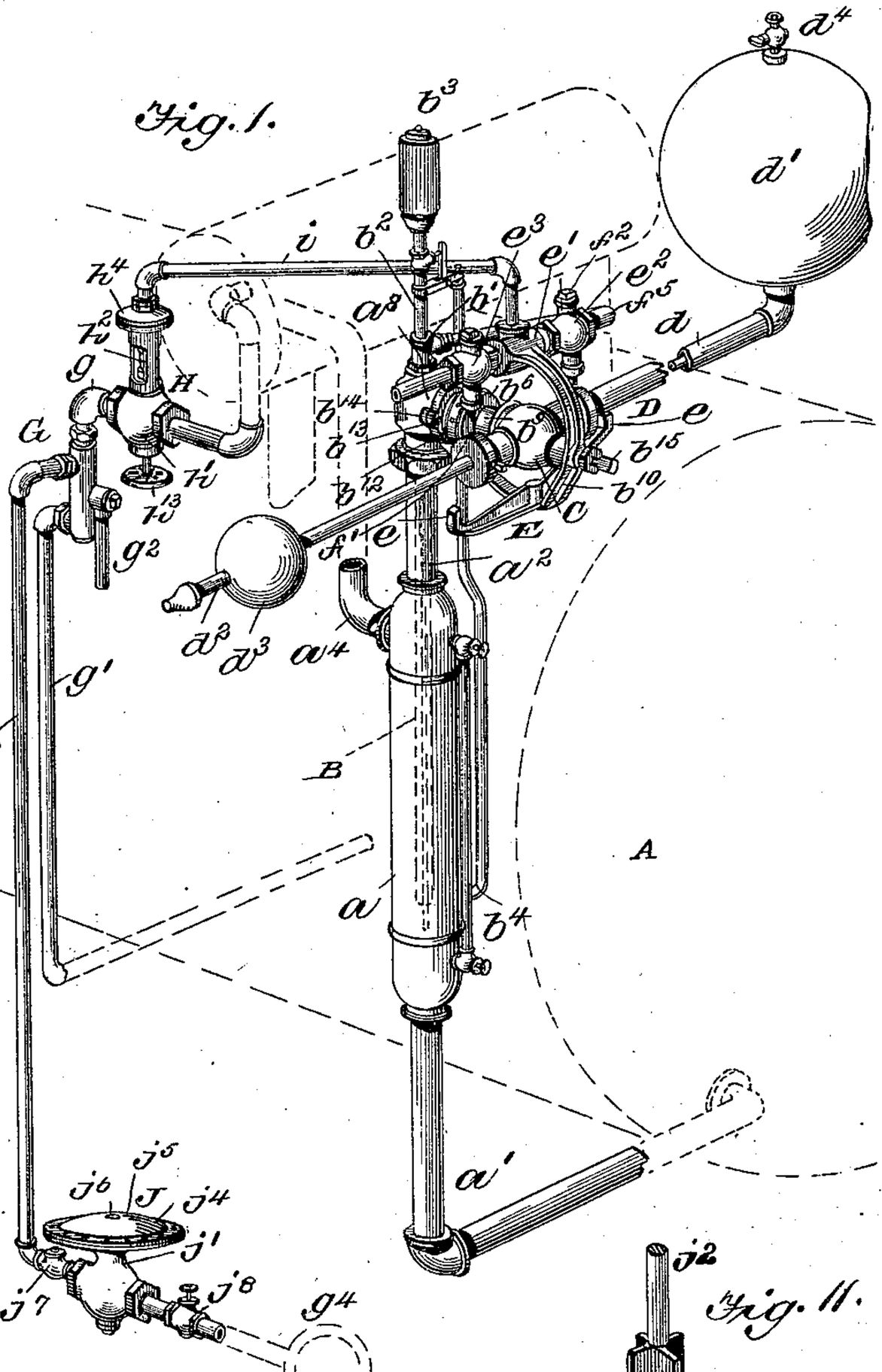


Fig. 7.

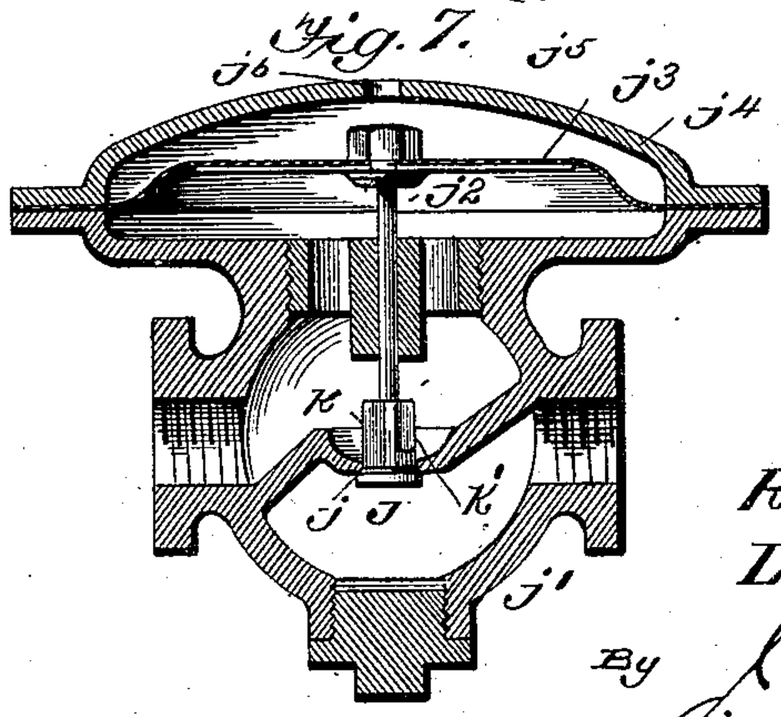
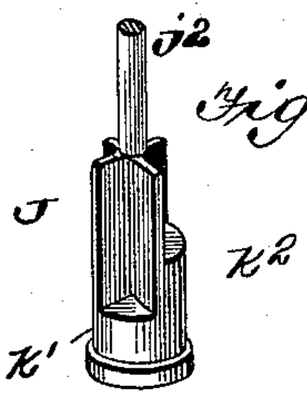


Fig. 11.



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(No Model.) 2 Sheets—Sheet 2.

R. G. McAULEY & L. B. FULTON.

BOILER FEEDER.

No. 549,877. Patented Nov. 12, 1895.

Fig. 2.

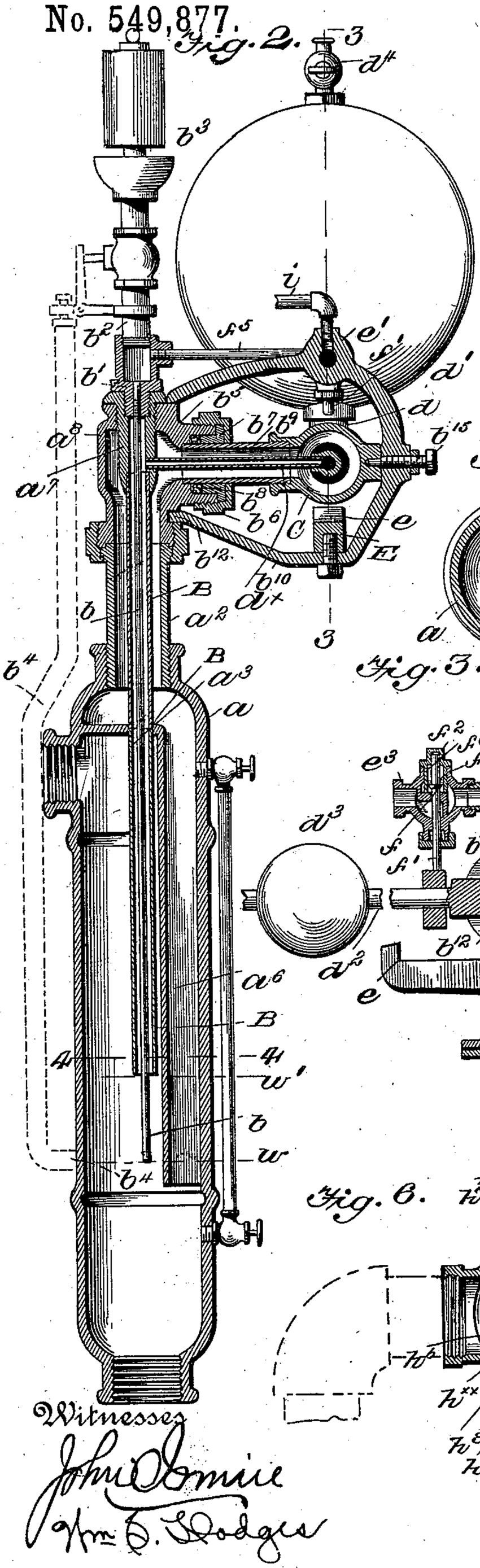


Fig. 5.

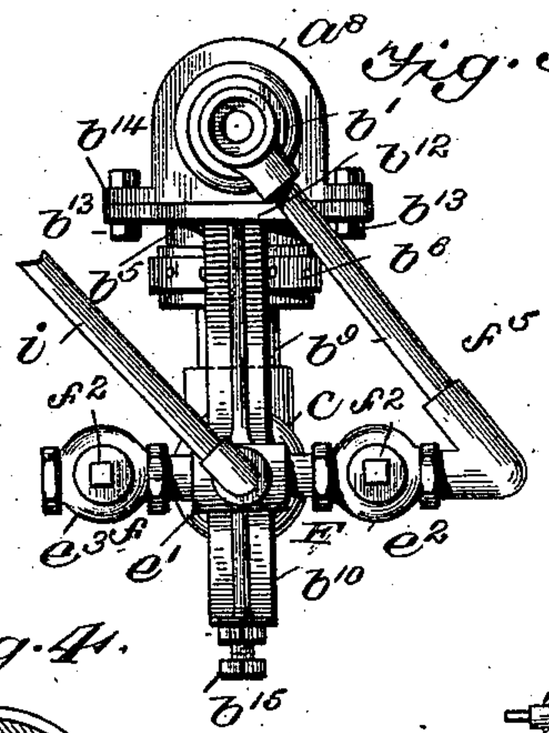
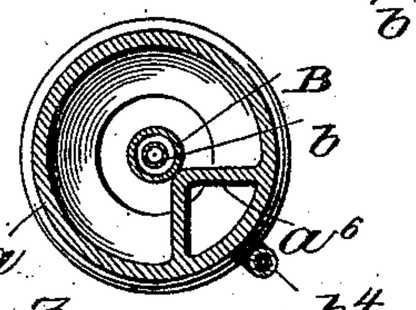


Fig. 4.

Fig. 3.



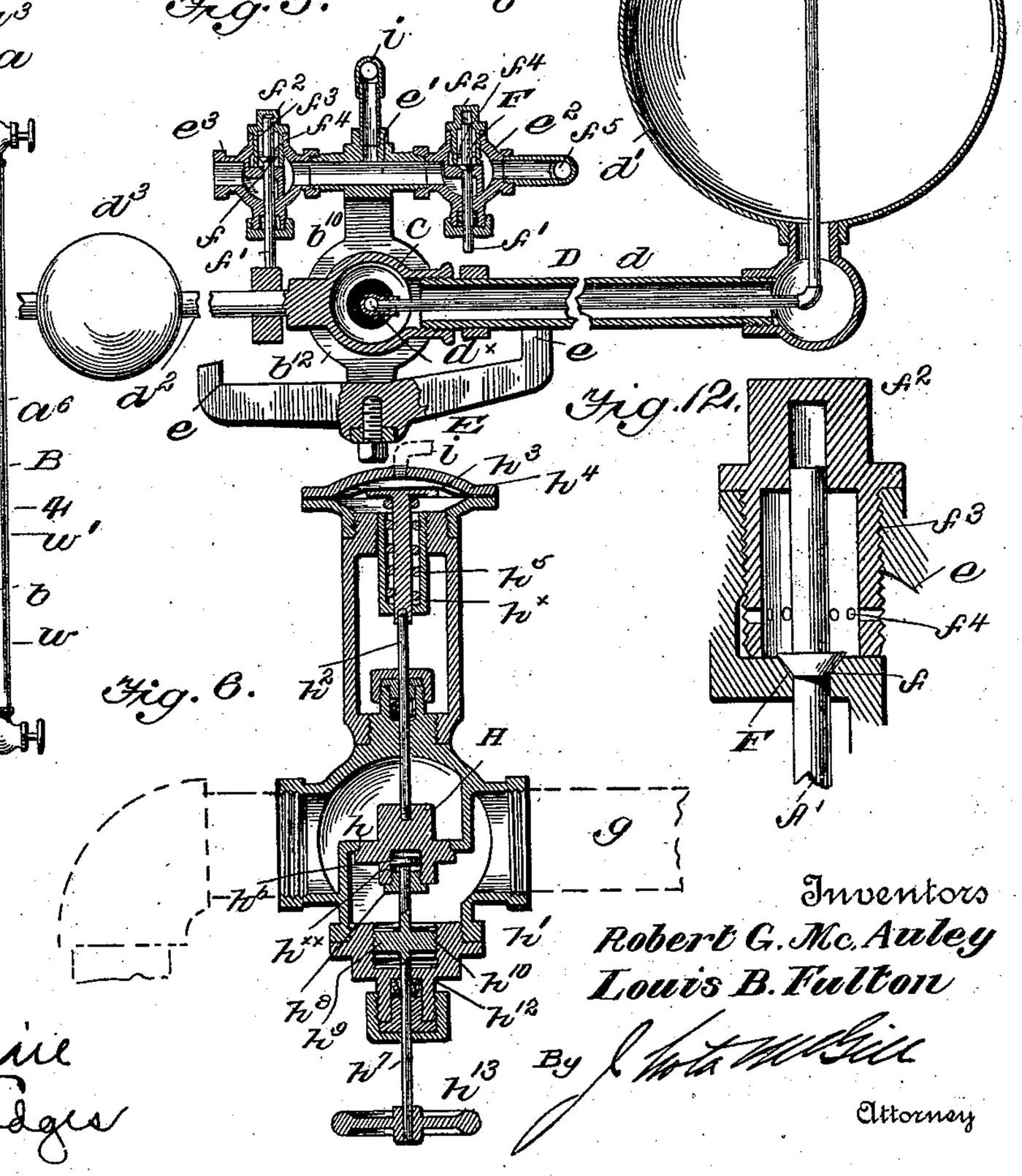


Fig. 12.

Fig. 6.

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UNITED STATES PATENT OFFICE.

ROBERT G. McAULEY AND LOUIS B. FULTON, OF PITTSBURG, PENNSYLVANIA, ASSIGNORS TO THE CHAPLIN-FULTON MANUFACTURING COMPANY, OF SAME PLACE.

BOILER-FEEDER.

SPECIFICATION forming part of Letters Patent No. 549,877, dated November 12, 1895.

Application filed August 24, 1895. Serial No. 560,428. (No model.)

To all whom it may concern:

Be it known that we, ROBERT G. MCAULEY and LOUIS B. FULTON, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Boiler-Feeders; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention contemplates certain new and useful improvements in boiler-feeders.

The principal object of the invention is to provide an automatic feeder the operation of which is controlled by the water in the boiler, whereby it will be automatically set in motion as soon as the water in the boiler falls below the low-water mark and stops when the proper supply has been obtained.

A further object is to provide a feeder all the parts of which will be outside of the boiler-shell, whereby access can be readily had thereto for the purpose of repairing, cleansing, and the like and the movement of the operating-lever will be visible.

A further object is to provide simple and efficient means for maintaining a constant but variant supply to a boiler.

A further object is to obtain a graduated supply of water to the feeder.

A further object is to simplify the construction and arrangement of the parts and insure accuracy of operation.

These objects we accomplish by connecting a water-column and an injector or pump or other feeder to a boiler and two valves which are normally kept closed by the boiler-pressure, one of said valves being unseated by a pivotally-mounted operating-lever, which latter is hollow and communicates with the interior of the water-column and is raised and lowered by the water and steam therein. The auxiliary valve being opened, the boiler-pressure unseats the primary valve, allowing steam from the boiler to pass to the feeder. When the proper supply of water is had to the boiler, the enlarged end of the operating-lever is filled with water, causing the lever to tilt, and said end is emptied when the low-water mark in the boiler is reached. When an injector is used, the same is connected by a suction or supply pipe direct to the water-supply or water main, and a valve located in said pipe is held firmly closed by the water-pressure when the injector is not in operation, but is automatically unseated by the creation of a vacuum in said suction-pipe when steam is admitted to said injector. This valve is graduated so as to control the quantity of water admitted to the supply-pipe, the admission of water being regulated by the suction in said supply-pipe. In some instances, as where a pump or accumulator is used, it is desired to maintain a constant but variant feed-supply to the boiler, and for this purpose the primary valve can be adjusted so as to limit its movement and prevent the full seating thereof. A drain-valve in the suction-pipe between the feeder and the vacuum-valve permits any water remaining in said pipe to escape after the feeder ceases to operate. A steam-pipe leads from the water-column to the operating-lever to effect the return of the water therein to the water-column as soon as the low-water mark is reached. The auxiliary and relief valves are surrounded by inclosing casings provided with apertures, so that the pressure will be direct against said valves and hold them firmly to their seats, the downward movements of the valves being in the direction of the passage of the boiler-pressure.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in perspective, parts being shown in dotted lines. Fig. 2 is a vertical sectional view. Fig. 3 is a view on line 3 3, Fig. 2. Fig. 4 is a horizontal sectional view on line 4 4, Fig. 2. Fig. 5 is a detail plan view, parts being omitted. Fig. 6 is a vertical sectional view of the primary valve. Fig. 7 is a similar view of the vacuum-valve. Figs. 8, 9, and 10 are sectional details thereof. Fig. 11 is a view in perspective of said valve. Fig. 12 is a sectional view of the auxiliary valve.

Referring to the drawings, A designates a boiler, a portion of which is shown in outline; *a*, a water-column, which may be located at any convenient point and is connected at its lower end to the boiler by a pipe *a'*, which opens therein below the water-line. Into the

top of the column is screwed a water-pipe a^2. In the column, near the top thereof, is a horizontal partition a^3. A steam-pipe a^4, leading from the steam-dome of the boiler, opens into the water-column immediately beneath this partition, and with one side of the latter is formed a vertical right-angular partition a^6, which extends down into the column below the danger-line w, so that its lower end will always be submerged in the water. This right-angular partition constitutes a continuation of the water-pipe a^2. Into a central threaded opening in the partition a^3 are screwed the threaded ends of sections of a steam-pipe B, the lower end of which latter extends to the low-water line w', while its upper end fits in and is inclosed by a depending hollow plug a^7 of a T-coupling a^8, screwed on the top of water-pipe a^2. Within this steam-pipe is a smaller pipe b, which extends through plug a^7 and is screwed into a second hollow plug b'. From the upper end of this plug b' a pipe b^2 extends to a steam-whistle b^3. The lower end of pipe b is carried to the danger-line w. Into the water-column along the danger-line w opens the lower end of a thermostatic copper pipe b^4, which is connected at its upper end to the whistle b^3, the same being designed to effect the operation of the whistle when the water falls below the danger-line.

The horizontal branch b^5 of coupling a^8 is exteriorly threaded to accommodate a flanged nut b^6, which holds a flanged ring b^7 and packing b^8 within said branch, the same encircling a rotatable coupling-tube b^9, on the projecting end of which is screwed a T-coupling C of an operating-lever D. A skeleton-like yoke b^{10}, having an inner ring b^{12}, held by bolts b^{13} to lateral flanges b^{14} of coupling a^8 at its outer end, supports an adjustable screw b^{15}, the inner rounded end of which fits in a corresponding opening of coupling C and serves to support the latter. In this way the operating-lever is free to move on its fulcrum, the coupling-tube b^9 being held in coupling a^8 steam and water tight. The arm d of lever D is made hollow and upon its outer end is a hollow ball or sphere d', while upon the other or solid arm d^2 is a counterbalancing-weight d^3. From the hollow plug a^7 extends a continuation $d^\times$ of steam-pipe B, which passes centrally through the hollow arm of the lever and extends upwardly into the ball or sphere to near the upper end thereof. A vent-valve d^4 is connected to the top of said ball or sphere. When the boiler is filled, the water passes up through the water-passage formed by the right-angular partition a^6 and the pipe a^2 through the hollow arm of the lever to the ball or sphere, entirely filling the latter, the air therein escaping through vent-valve d^4 and causing the lowering of that end of the lever as against the weight on the other end. When, however, the water passes below the low-water line w', and hence beyond the lower end of the steam-pipe B, steam will enter through said pipe to the ball or sphere and aid in effecting the emptying thereof through the water-passage, and hence the raising of that end of the lever. This will operate the mechanism for starting the feed-supply. When the ball or sphere is filled with water, the lever occupies an approximately-horizontal position; but when emptied it is inclined. The movement of the lever in either direction is limited by a stop, which is shown as consisting of an inclined cross-bar E, attached to the lower member of yoke b^{10}, said cross-bar having flanged ends e, with either one of which the lever always contacts when at rest.

The yoke b^{10} has an upper transverse tubular portion e' diametrically above cross-bar E, said tubular portion being preferably made integral with the upper bar of said yoke. To the ends of this tubular portion are connected valve-casings e^2 and e^3, the former accommodating what we will hereinafter term the "auxiliary valve" F and the latter a "relief-valve" f. The stems f' of these valves extend above and below the latter, the upper portions moving in removable plugs f^2 and the lower portions being extended downwardly beyond the casings, said lower portion of the relief-valve stem being slightly longer than that of the auxiliary valve. With each of the plugs f^2 is formed a cylindrical extension f^3, having a series of holes f^4 therein for the admission of pressure above the valves, so that it will bear directly down upon the latter and insure the firm seating thereof. The lower ends of these extensions fit snugly upon the valve-seats, and the downward movements of the valves to their seats being in the direction of the passage of the boiler-pressure the seating of said valves is insured.

To the casing of the auxiliary valve is coupled one end of a pipe f^5, the other end of which opens into plug b' above and near the upper end of pipe b. In this way the boiler-pressure is constantly exerted against the auxiliary valve and firmly holds the latter to its seat, save when acted upon by the operating-lever. The pipe b being of small diameter the water in the column will under pressure rise therein and bear on the auxiliary valve; but when the water in the boiler and column reach the danger-line steam will pass up through said pipe to the whistle, &c.

G designates an injector of any preferred construction; g, the steam-supply pipe leading from the boiler to the injector; g', the return or delivery pipe; g^2, the overflow, and g^3 a suction or water-supply pipe, which is connected to a water main g^4 or to any supply-tank. In the steam-supply pipe is located the primary valve H, which is normally held to its seat h in casing h' by the boiler-pressure. The valve-rod h^2 is extended upwardly through the casing and is connected to a diaphragm h^3 in a chamber h^4 of a skeleton-like extension of the valve-casing. A spring h^5, located in a hollow sleeve $h^\times$, depending from the bottom

of chamber h^4, tends to constantly hold the valve against its seat. In some instances in using a pump or accumulator it is desirable to prevent the complete reseating of this valve, in order that a continuous but variant feed-supply may be maintained. For this purpose we form the under side of valve H with a hollow extension $h^{\times\times}$, in which the flanged end h^6 of a screw-rod h^7 is designed to be held by a removable screw-plug h^8. The rod h^7 has an externally-threaded flange h^9, which engages an internally-threaded chamber h^{10} of a lower plug h^{12} of the valve-casing, a hand-wheel h^{13} on the lower end of said rod permitting of the easy adjustment thereof. By adjusting this rod the valve can be prevented from reseating under the action of the diaphragm and a continuous but variant supply to the boiler is had. Into the chamber h^4 above the diaphragm opens one end of a pipe i, the other end of which opens centrally into the tubular portion e' of yoke b^{10}. This pipe i, pipe f^5, and tubular portion e' constitute substantially one continuous pressure-pipe forming a passage between the water-column and the primary valve, with the interposed auxiliary valve, or, in other words, a direct communication is thus established between the interior of the boiler (the water-column being to all intents and purposes a part thereof) and the chamber of the primary valve. The boiler-pressure is constantly maintained in the pipe f^5 and firmly holds the auxiliary valve to its seat—that is, when the ball or sphere of the operating-lever is filled with water. When, however, the supply in the boiler falls below the lower end of the steam-pipe B in the water-column, the water in the ball or sphere is immediately displaced by the steam entering therein and returns to the column through pipe a^2. The raising of this end of the lever causes the unseating of the auxiliary valve and the firm seating of the relief-valve. The pressure then passes from the tubular portion e' through pipe i to the chamber of primary valve H and acting upon the diaphragm will effect the unseating of said primary valve. Steam will thus be permitted to pass from the boiler to the injector, or it may be a feed-pump or accumulator, and after the proper quota of water has been supplied to the boiler the ball or sphere will be again filled with water and by the tilting of the operating-lever the auxiliary valve is immediately reseated and when the lever unseats the relief-valve pressure on the diaphragm of the primary valve is relieved, allowing the reseating of the latter and the consequent cessation of the feeding operation, the valve being held firm to its seat, as before, by the boiler-pressure and the spring. Should the water-level reach the danger-line, steam will pass up through pipes $b\,b^2$ to the whistle and the copper pipe being expanded a signal will be given.

In connection with an injector we employ a vacuum-valve J, which is located in suction or water supply pipes g^3. This valve is normally held firm against its seat j in casing j' by the main pressure, and its rod j^2 is connected to a diaphragm j^3 in an upper chamber j^4, the top j^5 of the casing having an air-inlet hole j^6 therein. It is well known that in starting an injector a vacuum is created in the suction or water chamber as soon as the steam passes through the overflow. Hence the vacuum in the suction-pipe relieving the pressure beneath the diaphragm, the atmospheric pressure on the top thereof will cause the unseating of valve J, allowing the uninterrupted flow of water to the injector. As soon as the latter ceases to work, destroying the vacuum in the suction-pipe, the valve J is instantly reseated and so held by the water-pressure. This vacuum-valve is graduated—that is, it has ports of different lengths—so as to control the admission of water to the suction-pipe and make it commensurate with the suction therein. One side k of the valve is the first to admit water upon the unseating of said valve, and with the three remaining sides at the lower ends of their ports are formed circular portions k' k^2 k^3 of graded lengths or heights, so that as the further the valve is opened the greater the quantity of water admitted through its ports. Each circular portion acts like a piston, and while in alignment with the hole in the valve-seat prevents water from passing through the port at that point. If the pressure is or should become low and the suction in the pipe is increased, the vacuum-valve will be opened until the necessary supply is had. If the demand is not so great and there is a high-pressure supply, the extent to which the valve is opened is not affected by the pressure, but controlled entirely by the suction in the suction-pipe. Adjoining this valve and between it and the injector is a small drain-valve j^7. The object of this valve is to permit any water remaining in the suction-pipe to escape after the injector ceases to work. Should this water remain in the pipe and continue hot before the injector is again started, it would be impossible to create a vacuum in said pipe and thus unseat the vacuum-valve, and hence we have provided this drain-valve j^7 to permit of the escape of this water. An ordinary valve j^8 may be operated for entirely cutting off the water-supply.

The advantages of our invention are apparent. It will be particularly noted that all the working parts of our feeder are outside of the boiler, and hence access can be easily had thereto for the purpose of cleansing, repairing, and the like. It will also be seen that the height of the water in the boiler controls the movement of the operating-lever, and that the latter is itself operated by the water which enters therein and is confined in the enlarged end thereof while the boiler is supplied with the proper quota of water. If, however, for any cause the feeder is not op-

erated at the proper time, a signal is given when the danger-line is reached. The position of the lever relative to the auxiliary and relief valves insures the positive operation of the latter, and by forming the water-column with the interior water passage-way the return of the water to the column from the lever does not in any way interfere with the passage of steam to the ball or sphere. The lower end of said passage-way is always kept submerged. A feeder thus constructed is extremely simple and inexpensive, positive in operation, and not liable to readily get out of order or be deranged.

We claim as our invention—

1. A boiler feeder connected with a boiler, primary and auxiliary valves located between the boiler and the feeder and both normally closed by the boiler pressure, and a hollow lever for operating directly on said auxiliary valve and having a hollow enlarged end, said lever communicating with the interior of said boiler and operated by the water therein, said primary valve being unseated when said auxiliary valve is acted upon by said lever, substantially as set forth.

2. A boiler feeder connected with a boiler, primary and auxiliary valves located between the boiler and the feeder both normally closed by the boiler pressure, a hollow lever for operating said auxiliary valve and having a hollow enlarged end provided with a vent-valve, a steam pipe opening into said hollow end, said lever and steam pipe communicating with the interior of the boiler, substantially as set forth.

3. A boiler feeder connected with a boiler, primary and auxiliary valves located between the boiler and the feeder and both normally closed by the boiler pressure, a water-column opening into the boiler and having a water-pipe extending downwardly therein, a lever for operating said auxiliary valve, said lever being hollow and communicating with said water-pipe to which it is pivotally connected, a ball or sphere on one end of said lever provided with a vent-valve, and a steam-pipe having its inner end opening into said water-column and extending through said column and lever, and at its other end opening into said ball or sphere, substantially as set forth.

4. A boiler feeder connected with a boiler, a primary valve between said feeder and the boiler normally held to its seat by the boiler pressure, a diaphragm to which said valve is connected, a pressure-pipe communicating with the interior of the boiler and opening into the casing of said primary valve above said diaphragm, an auxiliary valve in said pressure-pipe, and a hollow lever having a spherical end and communicating with the interior of said boiler, said lever being designed to operate said auxiliary valve, substantially as set forth.

5. A boiler feeder connected with a boiler, a valve between said feeder and the boiler, normally held to its seat by the pressure in the latter, a pressure-pipe communicating with the interior of the boiler connected to the casing of said valve, an auxiliary valve located in said pressure-pipe, and a hollow operating lever having a spherical end and communicating with the interior of said boiler and designed to operate said auxiliary valve, whereby said primary valve will be operated, as set forth.

6. A boiler feeder connected with a boiler, a valve between said feeder and the boiler normally held to its seat by the boiler pressure, a diaphragm to which said valve is connected, a pressure-pipe communicating with the interior of the boiler and opening into the casing of said valve above said diaphragm, an auxiliary valve in said pipe having a projecting rod, and a hollow lever having a spherical end and communicating with the interior of said boiler, said lever being located beneath said auxiliary valve and designed to engage said rod, substantially as set forth.

7. The combination with a boiler, of a feeder, a pipe connecting said feeder to the boiler, a water-column opening into said boiler, a hollow operating lever having an enlarged end, said lever communicating with the interior of, and pivotally connected to, said water-column, the steam-pipe leading from said water-column to said enlarged end of said lever, a primary-valve located in said connecting-pipe and normally closed by the boiler-pressure, the pressure-pipe leading from said water-column to the casing of said valve, and an auxiliary-valve located in said pressure-pipe and designed to be unseated by said lever, whereby said former valve will be unseated, substantially as set forth.

8. The combination with a boiler, of a feeder, a pipe connecting said feeder to the boiler, a water-column opening into said boiler, a hollow operating lever having an enlarged end, said lever communicating with the interior of and pivotally connected to said water-column, the steam-pipe leading from said water-column to said enlarged end of said lever, a primary-valve located in said connecting-pipe and normally closed by the boiler pressure, the pressure-pipe leading from said water column to the casing of said valve, the relief valve located in said pressure-pipe, an auxiliary valve also located in said pressure-pipe, both said latter valves being designed to be operated by said lever, substantially as set forth.

9. The combination with a boiler, of a feeder, a pipe connecting said feeder to the boiler, a water-column opening into said boiler, a hollow operating lever having an enlarged end, said lever communicating with the interior of, and pivotally connected to, said water-column, the steam-pipe leading to said enlarged end of said lever, a valve located in said connecting pipe normally closed by the boiler pressure, the pressure-pipe leading from said water-column to the casing of said valve and extending substantially par-

allel with and above said lever, a relief valve normally held to its seat and located in said pressure-pipe, and an auxiliary-valve also located in said pressure-pipe, said relief and auxiliary-valves having downwardly extended rods designed to be alternately engaged by said lever, substantially as set forth.

10. A boiler feeder connected with a boiler, a primary-valve between said feeder and the boiler and normally held toward its seat by the boiler-pressure, a pressure-pipe communicating with the interior of the boiler and connected to the casing of said valve, an auxiliary-valve located in said pressure-pipe, a hollow operating-lever having a spherical end and communicating with the interior of said boiler and designed to operate said auxiliary-valve, and means for adjusting said primary-valve whereby the reseating thereof will be prevented, as and for the purpose set forth.

11. A boiler feeder connected with a boiler, a primary-valve between said feeder and the boiler normally held toward its seat by the boiler-pressure, a diaphragm to which said valve is connected, a spring acting on said diaphragm, said valve having a lower hollow extension, and an adjustable-rod having one end fitted in said hollow extension, a pressure-pipe communicating with the interior of the boiler and connected to the casing of said valve, an auxiliary-valve located in said pressure-pipe, and a hollow operating lever having a spherical end and communicating with the interior of said boiler, and designed to operate said auxiliary-valve, substantially as set forth.

12. A boiler feeder connected with a boiler, means for supplying steam thereto, a suction or water-supply pipe opening into said feeder and connected to the water-supply, and a graduated valve located in said pipe and held firmly to its seat by said water-supply when said feeder is not in operation, said valve being unseated when a vacuum is created in said suction pipe when steam is admitted to said feeder and the latter is operated, the extent to which said valve is unseated being controlled by the suction in the water-supply pipe, as set forth.

13. A boiler feeder connected with a boiler, means for supplying steam thereto, a suction or water-supply pipe opening into said feeder and connected to the water-supply, and a graduated valve located in said pipe and held firmly to its seat by said water-supply when said feeder is not in operation, a valve-casing having an opening therein, and a diaphragm to which said valve is connected, said valve being unseated when a vacuum is created in said suction pipe when steam is admitted to said feeder and the latter is operated, the extent to which said valve is unseated being controlled by the suction in the water-supply pipe, as set forth.

14. A boiler feeder connected with a boiler, means for supplying steam thereto, a suction or water-supply pipe opening into said feeder and connected to the water-supply, and a valve located in said pipe having a series of ports of different lengths, and normally held firmly to its seat by said water-supply when said feeder is not in operation, said valve being unseated when a vacuum is created in said suction-pipe when steam is admitted to said feeder and the latter is operated, the extent to which said valve is unseated being controlled by the suction in the water-supply pipe, as set forth.

15. A boiler feeder connected with a boiler, means for supplying steam thereto, a suction or water-supply pipe opening into said feeder and connected to the water-supply, and a valve located in said pipe having a series of ports and curved portions of different lengths, and normally held firmly to its seat by said water-supply when said feeder is not in operation, said valve being unseated when a vacuum is created in said suction-pipe when steam is admitted to said feeder and the latter is operated, the extent to which said valve is unseated being controlled by the suction in the water-supply pipe, as set forth.

16. A boiler feeder connected with a boiler, means for supplying steam thereto, a suction pipe opening into said feeder and connected to the water-supply, a valve designed to be automatically unseated when a vacuum is created in the suction-pipe, and a valve in said pipe between the feeder and said former valve to permit the escape of any water remaining in said pipe after the feeder ceases to operate, substantially as set forth.

17. In a boiler feeder, the combination with a water-column and primary and auxiliary-valves, of a hollow operating lever for operating said auxiliary-valve communicating with said water-column, a yoke attached to said column and supporting said lever, and a stop for said lever extended in line therewith and with the ends of which stop said lever is designed to contact, as set forth.

18. In a boiler feeder, the combination with a water-column, of a hollow-operating-lever communicating with said water-column, a primary-valve, a pressure-pipe leading from said water-column, to the casing of said primary-valve, a yoke on said water-column pivotally supporting said lever, said yoke having an upper tubular portion above said lever forming part of said pressure-pipe, relief and auxiliary-valves located in said tubular portion and having depending rods designed to be engaged by said lever, and a stop for said lever extended in line therewith and with which said lever is designed to engage, substantially as set forth.

19. In a boiler feeder, the combination with a water-column, an operating lever, and a primary-valve, of a pressure-pipe leading from said water column to said primary valve, the auxiliary and relief valves located in said pressure pipe and designed to be forced to their seats by the pressure therein, and the cylinders inclosing said latter valves having

holes or perforations therein above the valves, substantially as and for the purpose set forth.

20. The combination with a boiler, of a water-column opening therein, a hollow lever pivotally connected thereto and communicating therewith, and having an enlarged end, a weight on the other end of said lever, a steam-pipe located in said water-column and leading to said enlarged end of said lever, a second pipe located in said water-column and having its inner end beneath the inner end of said steam-pipe, a whistle, or the like, with which said second pipe communicates, a thermostat connecting said water-column to said whistle, a feeder, a pipe connecting the latter to the boiler, a primary-valve located therein normally held to its seat by the boiler pressure, a diaphragm to which said valve is connected, a pressure-pipe leading from said water-column to the casing of said primary-valve above said diaphragm, auxiliary and relief-valves located in said pressure pipe above said lever and having downwardly projecting rods designed to be engaged by said lever, a suction pipe leading from the water-supply to said feeder, and a valve located in said latter pipe and designed to be unseated by the creation of a vacuum in said suction pipe, substantially as set forth.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

ROBERT G. McAULEY.
LOUIS B. FULTON.

Witnesses:
M. B. CHAPLIN,
M. R. JONES.