(No Model.) 4 Sheets—Sheet 1.

D. B. MORISON.

WATER CIRCULATING, FEEDING, AND DISCHARGING APPARATUS FOR STEAM BOILERS.

No. 523,915. Patented July 31, 1894.

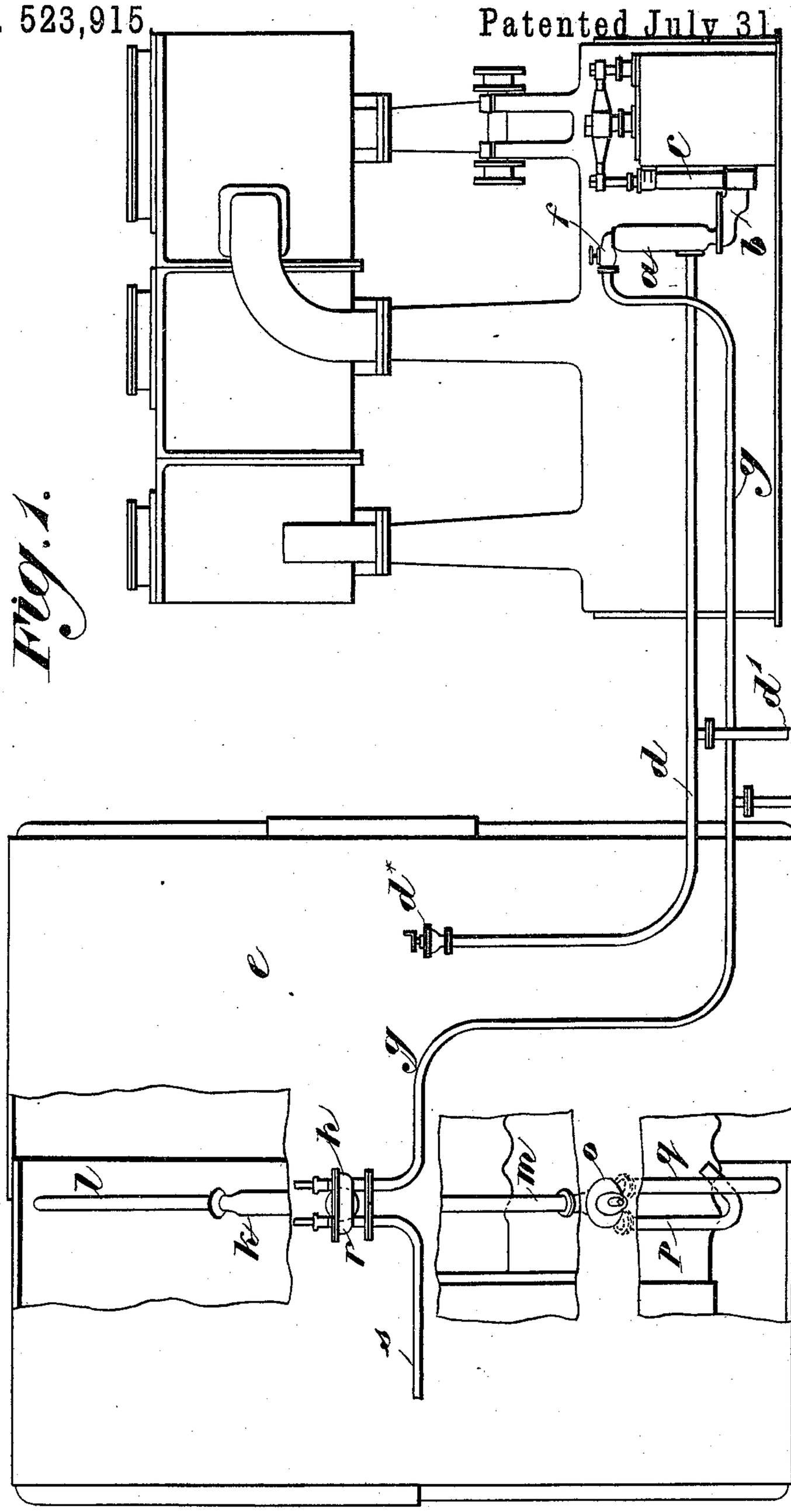

Fig. 1.

Witnesses
L. D. Wingate.
J. T. Bickford

Inventor
By O. E. Duff & Att'y D. B. Morison

(No Model.) 4 Sheets—Sheet 2.

D. B. MORISON.

WATER CIRCULATING, FEEDING, AND DISCHARGING APPARATUS FOR STEAM BOILERS.

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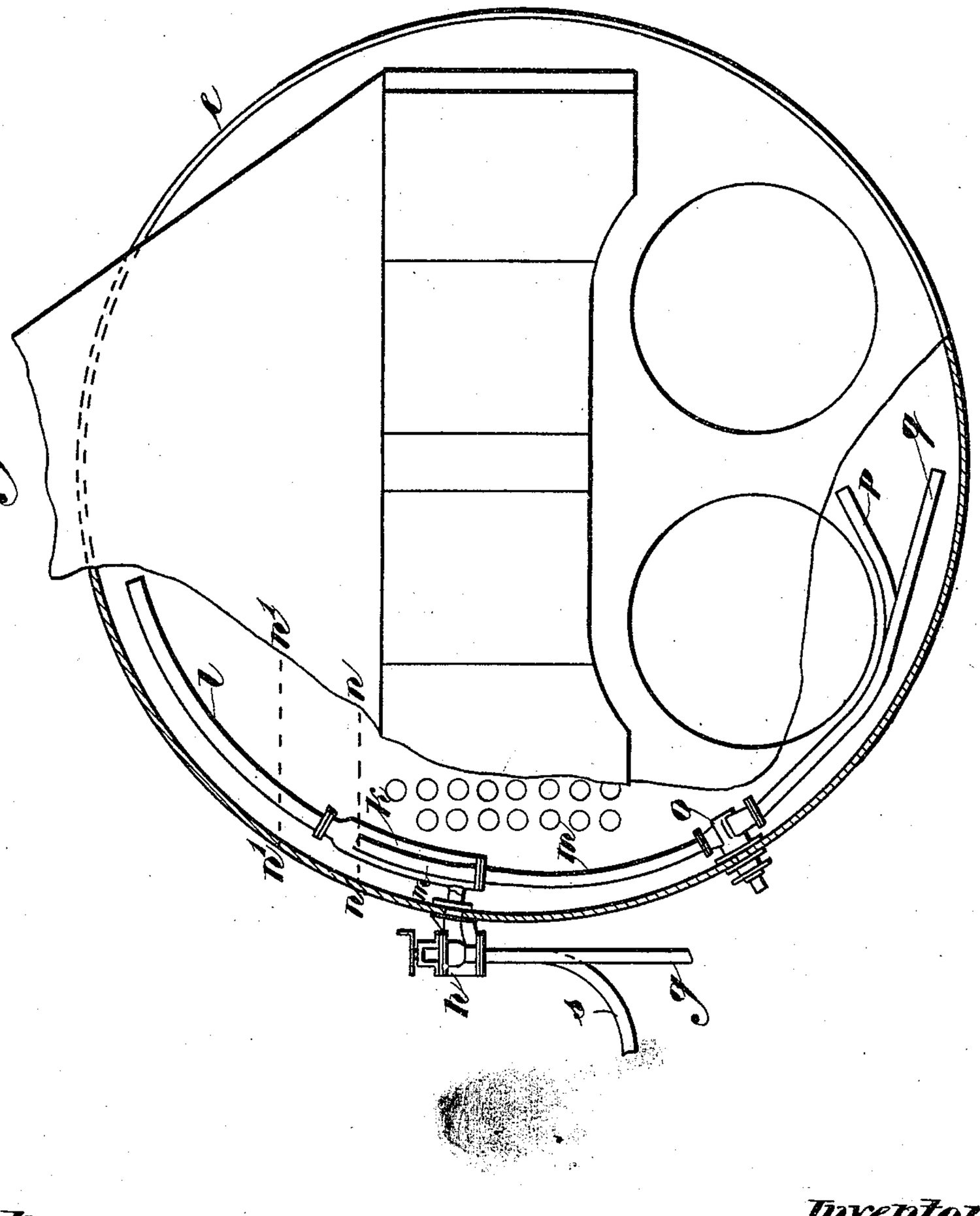
Fig. 2.



Witnesses
L. D. Nugate.
J. T. Bickford.

Inventor
D. B. Morison
By O. E. Duffy Atty.

(No Model.) 4 Sheets—Sheet 3.

D. B. MORISON.

WATER CIRCULATING, FEEDING, AND DISCHARGING APPARATUS FOR STEAM BOILERS.

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Fig. 5.

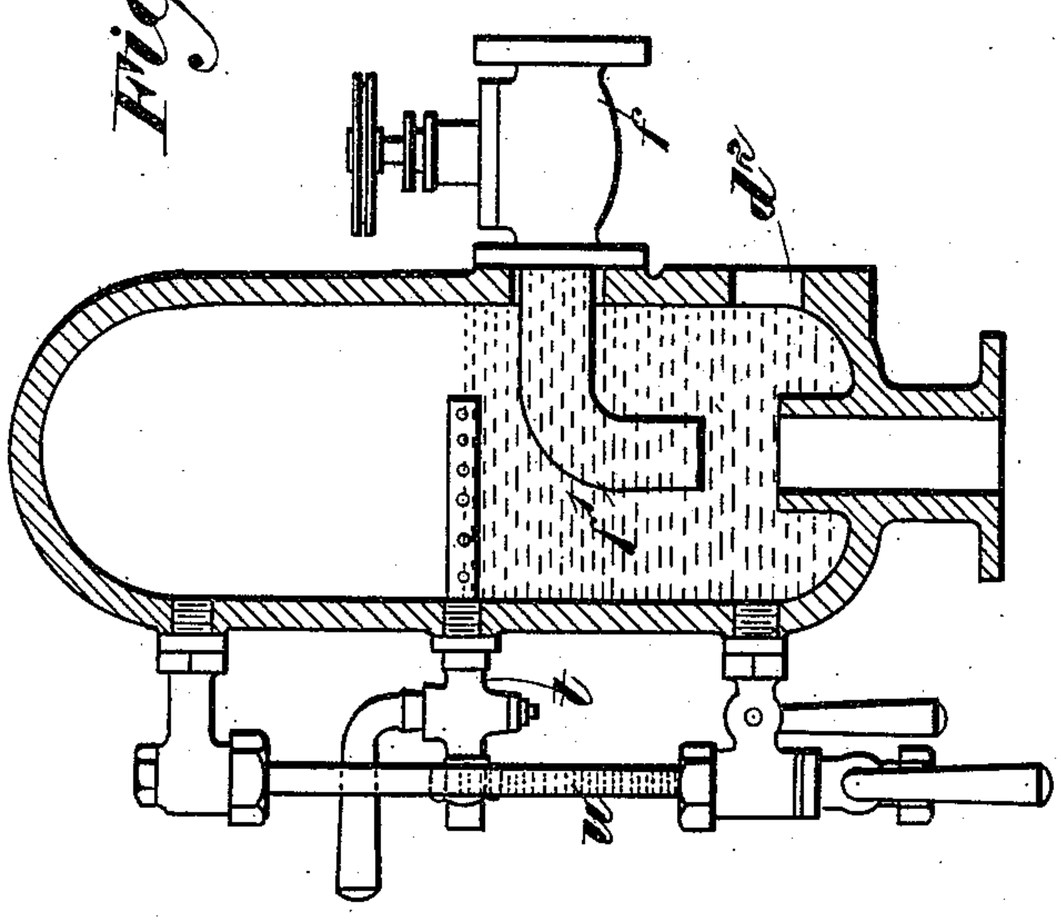


Fig. 6.

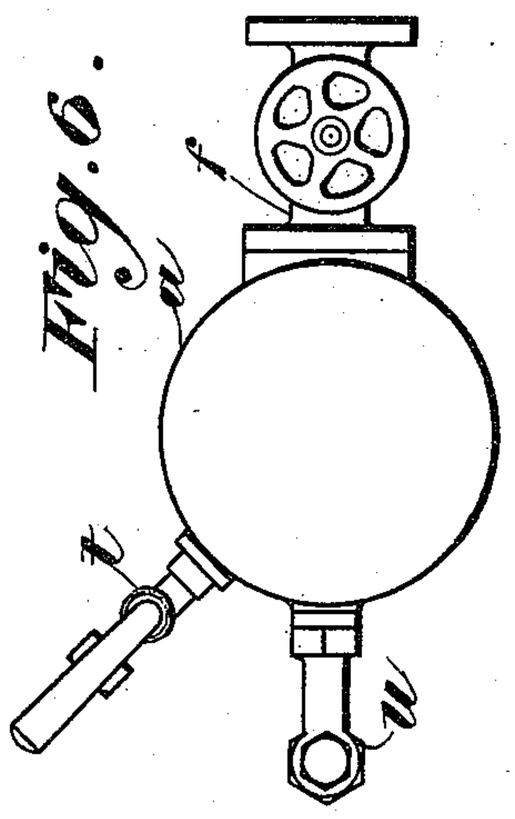


Fig. 3

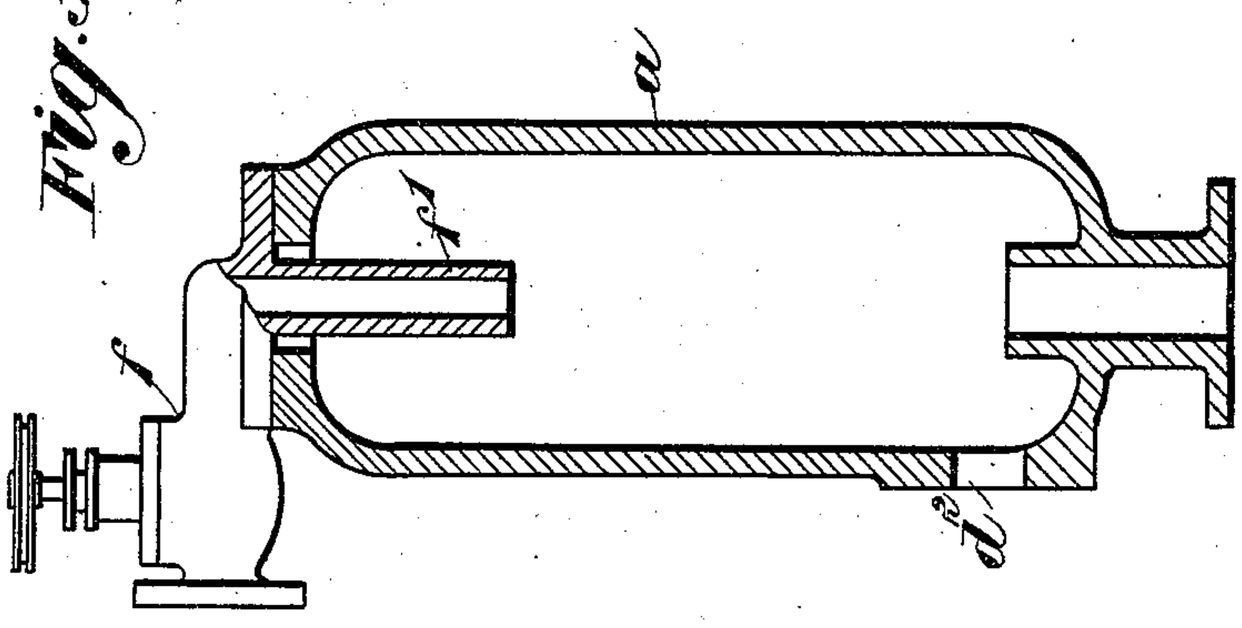
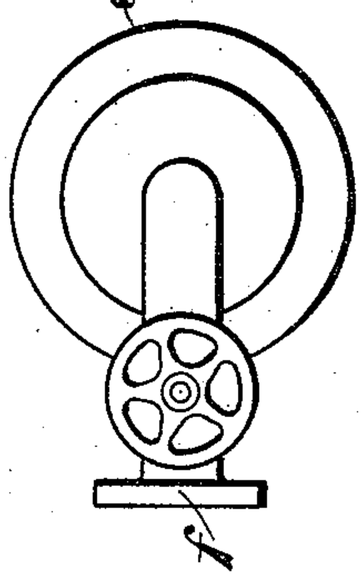


Fig. 4.



Witnesses
L. D. Nugate.
D. T. Bickford.

Inventor
D. B. Morison
By O. E. Duffy Atty

(No Model.) 4 Sheets—Sheet 4.

D. B. MORISON.

WATER CIRCULATING, FEEDING, AND DISCHARGING APPARATUS FOR STEAM BOILERS.

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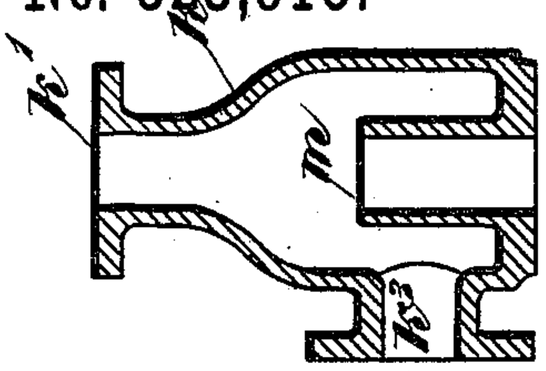

Fig. 12.

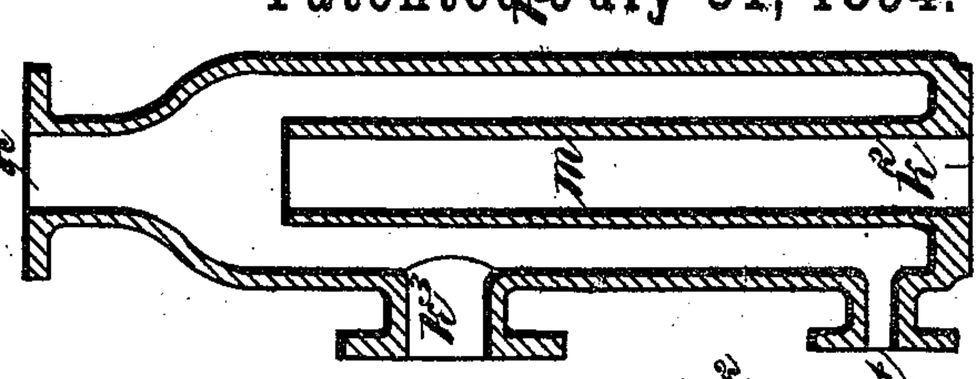

Fig. 11.

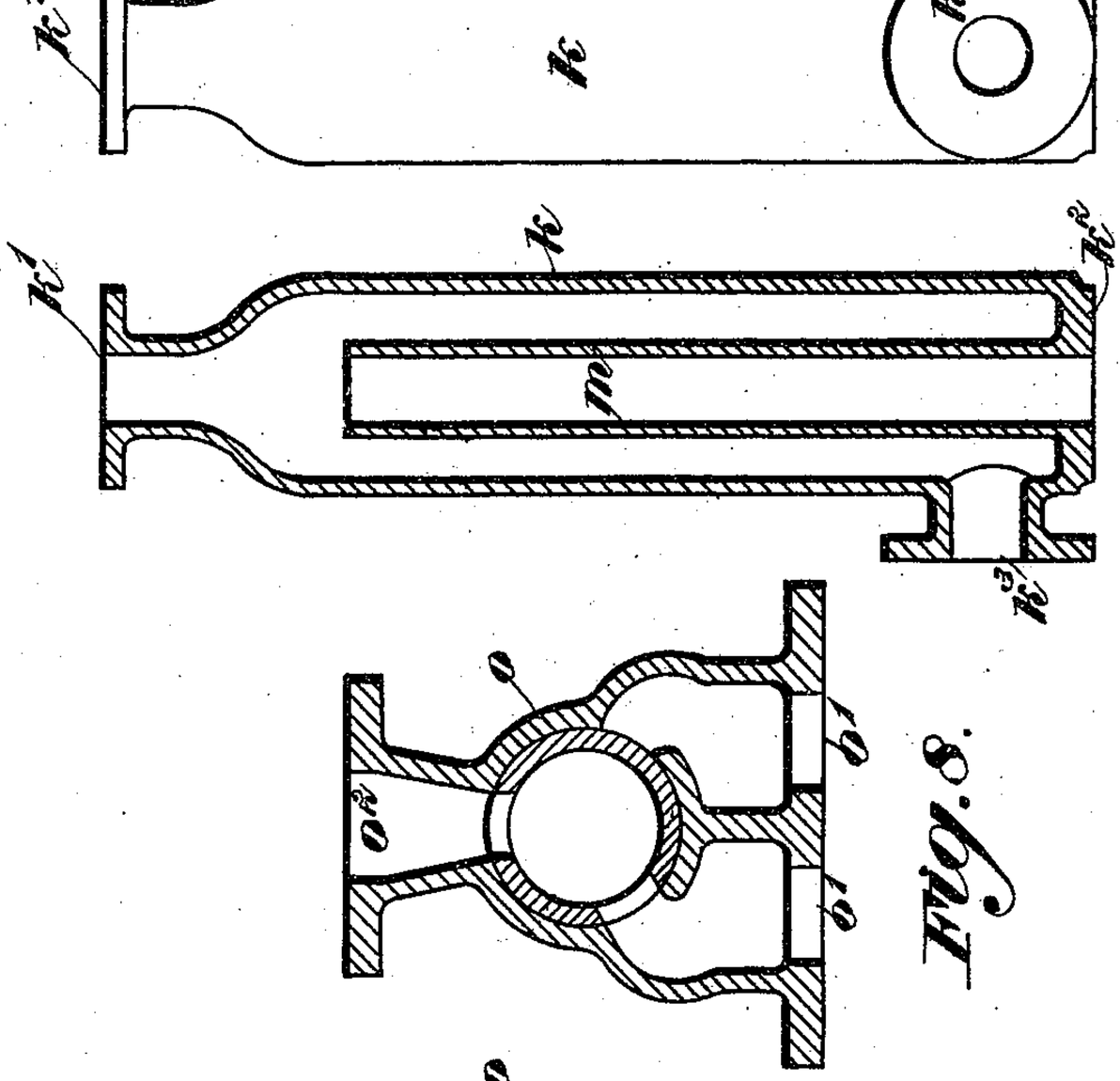

Fig. 10.

Fig. 9.

Fig. 8.

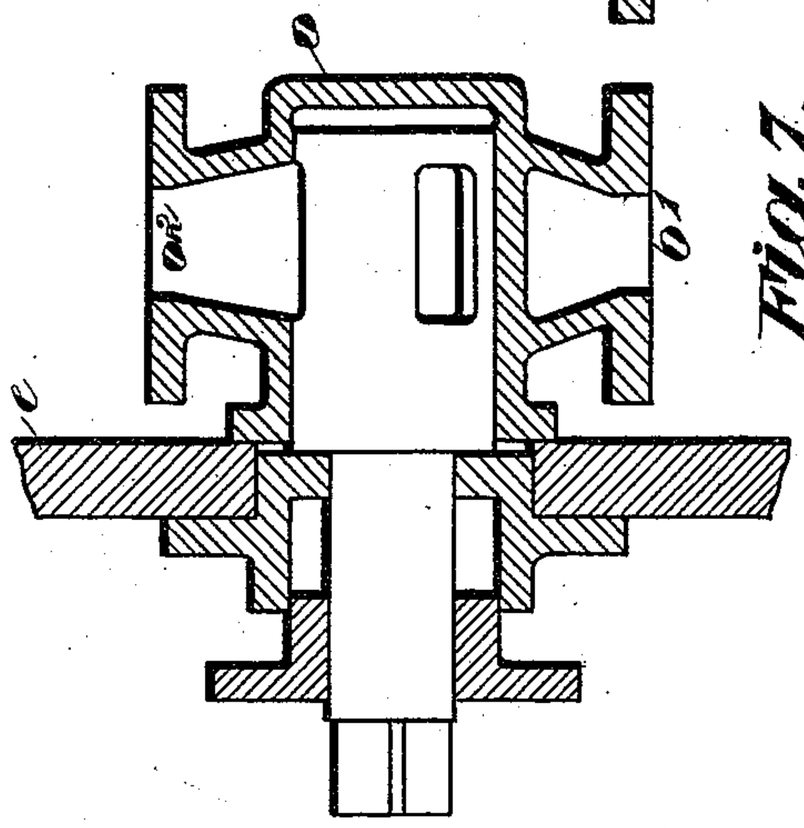

Fig. 7.

Witnesses
L. D. Wingate.
J. T. Bickford.

Inventor
D. B. Morison
By O. E. Duffy Atty.

UNITED STATES PATENT OFFICE.

DONALD BARNS MORISON, OF HARTLEPOOL, ENGLAND.

WATER CIRCULATING, FEEDING, AND DISCHARGING APPARATUS FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 523,915, dated July 31, 1894.

Application filed December 4, 1893. Serial No. 492,685. (No model.) Patented in England July 30, 1892, No. 13,923; in Germany August 19, 1892, No. 67,392; in Belgium September 5, 1892, No. 101,231; in Norway September 5, 1892, No. 2,887; in France September 12, 1892, No. 224,279; in Sweden September 24, 1892, No. 4,552; in Italy November 15, 1892, No. 32,909, and in Austria-Hungary August 12, 1893, No. 34,233.

To all whom it may concern:

Be it known that I, DONALD BARNS MORISON, a subject of the Queen of Great Britain and Ireland, residing at Hartlepool, in the county of Durham, England, have invented Improvements in Water Circulating, Feeding, and Discharging Apparatus for Steam-Boilers, (for which I have obtained Letters Patent in Great Britain, No. 13,923, dated July 30, 1892; in Germany, No. 67,392, dated August 19, 1892; in France, No. 224,279, dated September 12, 1892; in Belgium, No. 101,231, dated September 5, 1892; in Norway, No. 2,887, dated September 5, 1892; in Sweden, No. 4,552, dated September 24, 1892; in Italy, No. 32,909, dated November 15, 1892, and in Austria-Hungary, No. 34,233, dated August 12, 1893,) of which the following is a specification.

My invention has for objects to cause rapid circulation of water in and discharge of water from a steam boiler or steam boilers by means of apparatus located outside the boiler or boilers, and to prevent the water within the said boiler or boilers from being withdrawn below a predetermined level. For this purpose in boiler water circulating apparatus in which water from the boiler is mixed with the feed water on its passage from the feed pump to the boilers in order to obtain rapid circulation, or the circulation of a maximum quantity of water, I arrange between the discharge valve on the feed pump and the feed check valve on the boiler, an air vessel which is connected to the water space in the boiler through a non-return valve so that on the pressure in the air vessel falling below the pressure in the boiler or boilers, there will be an inflow of water from the boiler or boilers to the air vessel. The discharge from the boiler may be caused to enter the top of the air vessel so that a maximum quantity of water will flow into it by reason of a minimum of resistance, but the discharge may also flow into the water space of the air vessel or into the feed pipe in connection with the air vessel, without departing from the spirit of the invention.

When two or more boilers are provided with the before described apparatus, if, from any cause, the pressure in one boiler is in excess of that in the other or others, then it is possible for water to pass through the circulating apparatus from the boiler of higher pressure to the boiler or boilers of lower pressure, with the consequent danger that the water may fall below the heating surfaces or below a safe limit in the boiler in which the higher pressure obtains. In order to avoid this possible danger when working with the before described circulating apparatus, or when circulating water by a donkey pump, as when raising steam, or by any other form of circulating or discharge apparatus in which this danger exists, I employ the following means:—Instead of withdrawing the water through a pipe connected directly with the water space at or near the boiler bottom, I withdraw it through a pipe that is so arranged within or without the boiler that its open lower end terminates in the water space near the bottom of the boiler while its upper open end terminates at a point above the normal water level, that is to say in the steam space of the boiler, so that both ends of the pipe being in free communication with the top and bottom of the boiler, the pressure in the pipe will be equal to that in the boiler and the water level in the pipe will be the same as that in the boiler. The outlet of this pipe is located at or about the lowest safe level of water in the boiler and it is placed in communication with the air vessel of the feed pump, or it may be connected directly with the feed pipe, or to the donkey pump.

I do not confine myself to the use of the above described pipe, which I term a safety pipe, in combination with the water circulating apparatus, as the latter may be used without such safety pipe.

When the safety pipe is arranged inside the boiler, it is preferably constructed in the following manner:—On the inside of the boiler and in communication with the outlet pipe is arranged a tubular junction piece the upper open end of which is connected to a pipe terminating in the steam space of the boiler, while to its lower end is attached an open

pipe which terminates in the lower part or water space of the boiler, and which also projects upward inside the body piece to the lowest safe working level of the water in the boiler. The connection to the outlet or discharge pipe is or may be at the lower end of the junction piece, but below the level of the internal projecting pipe which terminates at the safe working level.

When it is required to circulate or discharge water from two or more levels in the boiler I arrange on the side of the boiler shell, a cock having at its lower part two branches to which are attached two pipes terminating at different levels in the lower part of the boiler. The upper branch of the cock is connected to the lower end of the junction piece. It will be obvious that this arrangement will permit of the sediment being blown out from the bottom of the boiler when required, a suitable blow-off valve being arranged at the outlet from the junction piece adjoining the circulating valve.

In the form of circulating apparatus in which the discharge water from the boiler enters the water space of the air vessel, provision may advantageously be made for extracting oil or other impurities from the feed water, as in this case the mixing of the two fluids at different temperatures will cause a violent disturbance in the air vessel with the result that the oil or other impurities will be driven to the surface of the water from whence they can be discharged through a suitably arranged scum cock.

In the accompanying drawings, Figure 1 shows in side elevation apparatus according to my invention applied to an engine and boiler, the latter being shown partly in section. Fig. 2 is an end elevation partly in section, of a boiler showing an arrangement of safety pipe therein. Figs. 3 and 4 show respectively in sectional elevation and plan, an air vessel in which the discharge water from the boiler is delivered into the air space of such vessel. Figs. 5 and 6 are corresponding views of an air vessel in which the discharge water from the boiler enters the water space of the said vessel. Figs. 7 and 8 are sectional views of a cock such as hereinbefore referred to, arranged on the side of the boiler. Figs. 9 to 12 inclusive are detail views of junction pieces for use with safety pipes arranged inside the boiler. Figs. 1 and 2 are drawn to a smaller scale than the remaining figures.

Referring to Figs. 1 and 2, a is an air vessel arranged between the discharge valve b of a single acting feed pump c and the feed pipe d and feed check valve d^* on the boiler e. This air vessel a is connected to the water space of the boiler through a valve f, pipe g and non-return valve h. The non-return valve h, as will be seen more clearly in Fig. 2, is in communication with a tubular junction piece k arranged inside the boiler and to which is connected the open pipe l terminating in the steam space of the boiler, and the pipe m which projects upward inside the junction piece to the safe level $n\,n$, and is connected at its lower end to a cock or valve o. To this cock o there are connected the open pipes p and q which terminate at different levels in the lower part of the boiler. A blow off valve r is arranged in the valve case containing the circulating valve h, a pipe s leading from this blow-off valve to any desired outlet. With this arrangement, on the downward or forcing stroke of the feed pump c, water will be forced into the feed pipe d, and the pressure in the air vessel a will rise considerably above the pressure in the boiler, and on the upward or suction stroke of the pump, the check valve d^* will close and a reaction will take place, with the result that the pressure of the air in the air vessel will, for a brief period, fall to such an extent that water will flow from the boiler into the air vessel, or into the feed pipe in close proximity thereto, as the case may be.

Only one boiler is shown in the drawings but it is to be understood that when two or more are used, each is provided with a check valve d^*, non-return valve h, safety pipe $k\,l\,m$ with cock o and pipes p, q and blow-off valve r, these parts being connected with the feed pipe d and discharge pipe g, by branch pipes d' and g' respectively so that the air vessel a and feed pump are common to all the boilers.

The arrangement shown in Figs. 1 and 2 is specially suitable for use in cases where two or more boilers are employed, water flowing from the bottom of each boiler through the pipe p therein, cock o, pipe m and from the inside of the junction piece k through the valve h to the corresponding pipes g g' and thence to the air vessel a. With the arrangement described it will be seen that under no circumstances can the level of the water indicated by the line n' be reduced below the lowest safe level n, n.

When it is required to blow off any sediment or other foreign matter from the bottom of the boiler, the branch of the cock o in communication with the pipe p is closed and that communicating with pipe q opened. The circulating valve h is also shut and the blow off cock r opened so that the sediment mixed with water will then be discharged through the said valve r.

With the construction of air vessel a shown in Figs. 3 and 4 the discharge from the boiler enters the top of this vessel through the valve f and discharge pipe f', and after mixing with the feed water in the lower part thereof, is delivered to the boiler or boilers through the opening d^2 which is in communication with the feed pipe d or $d\,d'$ as the case may be.

In the construction of air vessel shown in Figs. 5 and 6 the discharge water from the

boiler enters the water space of the air vessel through the valve *f* and pipe *f'*. Such an arrangement as this may advantageously be used in connection with means for extracting oil or other impurities from the feed water. For this purpose the air vessel is fitted with a scum cock *t* and gage glass *u*.

The mixing of the two liquids at different temperatures causes a violent disturbance in the air vessel with the result that the oil, impurities or other matter in the water will be driven to the surface of the water and can thence be expelled through the scum cock *t*.

Figs. 7 and 8 show the construction of the cock *o* which is attached to the inside of the boiler *e*. This cock is provided with two branches *o'* and *o'* which are placed in communication with the lower part of the boiler by the pipes *p* and *q* as already described, and with a branch o^2 which is placed in communication with the junction piece *k* by the pipe *m*.

The junction piece *k* which may be constructed with an upwardly projecting internal pipe *m* as shown in Figs. 9 and 10 is provided with a branch *k'* for attachment to the pipe *l* (Fig. 2) that is in communication with the steam space of the boiler and with a flange k^3 that is attached to the shell of the boiler so as to be in communication with the valve case containing the circulating valve *h* and blow-off valve *r*. To the lower end or branch k^2 of the said junction piece is connected the upper end of the pipe *m*. Or this pipe may extend into the said junction piece as shown in Fig. 2.

Fig. 11 shows a modified construction of junction piece in which the position of the branch k^3 is arranged nearer to the top thereof than in Figs. 9 and 10 so as to suit varying requirements, and another branch k^4 is provided for blowing out any sediment which might accumulate in the bottom of the said junction piece.

Fig. 12 shows a further modification in which the junction piece is made much shorter than in the previous arrangements in order to adapt it to special applications.

What I claim is—

1. Water circulating, feeding and discharging apparatus for a steam boiler comprising a single acting water feeding device, a feed pipe with check-valve connecting the delivery of said device with said boiler, an air vessel in communication with the delivery outlet of said water feeding device, and a water discharge pipe connecting the water space of said boiler with said delivery passage and provided with a non-return valve substantially as herein described.

2. Water circulating, feeding and discharging apparatus for a steam boiler comprising a single acting feeding device, a feed pipe with check valve connecting the delivery of said device with said boiler, an air vessel in communication with the delivery outlet of said water feeding device, and a water discharge pipe connecting the water space of said boiler with the interior of said air vessel and provided with a non-return valve substantially as herein described.

3. Water circulating apparatus for steam boilers comprising a water circulating device and a safety pipe for each boiler, each safety pipe having its upper and lower ends in communication respectively with the steam space and lower water space of said boiler and its discharge outlet arranged at a suitable predetermined point below the normal water level in said boiler and connected with said circulating apparatus substantially as herein described for the purpose specified.

4. Water circulating, feeding and discharging apparatus for a steam boiler, comprising a single acting feed water pump, a feed pipe with check-valve connecting the delivery of said pump with said boiler, an air vessel and a discharge pipe in connection with said delivery, a safety pipe connected at its upper and lower ends respectively with the steam and water spaces of said boiler and having its discharge outlet arranged at a predetermined distance below the normal water level in said boiler and connected with said discharge pipe substantially as herein described for the purpose specified.

5. Water circulating and discharging apparatus for a steam boiler, comprising a feed pump having its delivery in connection with the boiler through a check-valve, a discharge pipe connected with said delivery, a blow-off pipe, a safety pipe having its upper end in communication with the steam space of said boiler, its lower end connected with two lower pipes terminating at different levels in the lower part of said boiler, and its outlet arranged at a predetermined distance below the normal water level, a valve controlling the communication between said pipes and the lower end of said safety pipe, and discharge and blow-off valves controlling the communication between said outlet and said discharge and blow-off pipes respectively substantially as herein described.

6. In water circulating apparatus for steam boilers, the combination with a single acting water feeding device having its delivery in connection with a boiler through a pipe provided with a check-valve, of an air-vessel arranged between said delivery and check-valve, a discharge pipe connecting the water space of said boiler with the water space of said air vessel and provided with a non-return valve, and a scum cock connected with said air vessel substantially as herein described for the purpose specified.

7. In water circulating apparatus for steam boilers the combination with the discharge and blow-off pipes of each boiler, and the water circulating pump and delivery pipes, of a

safety pipe arranged within each boiler and comprising the junction piece *k* with outlet *k'* and pipes *l m* pipes *p* and *q* with cock *o'* arranged as described, and discharge and blow-off valves *h* and *r* controlling the communication between said outlet *k'* and said discharge and blow off pipes respectively substantially as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DONALD BARNS MORISON.

Witnesses:
T. HARRY TILLY,
Notary Public, West Hartlepool.
I. T. NEWBEGIN,
Cashier, West Hartlepool.