T. R. BROWN.

SYSTEM OF BOILER FEED.

APPLICATION FILED MAY 11, 1908.

924,141.

Patented June 8, 1909.

3 SHEETS—SHEET 1.

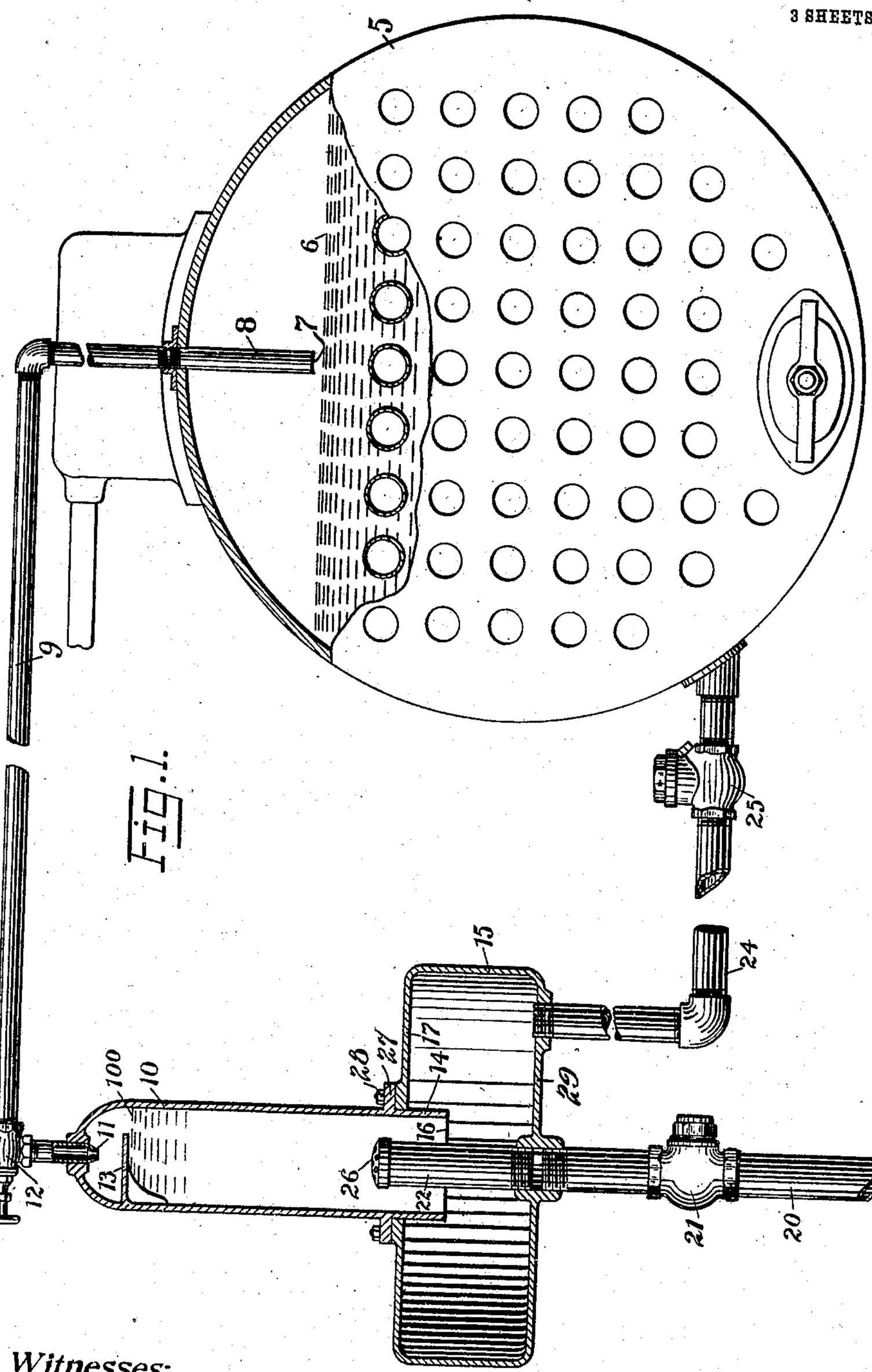

Fig. 1.

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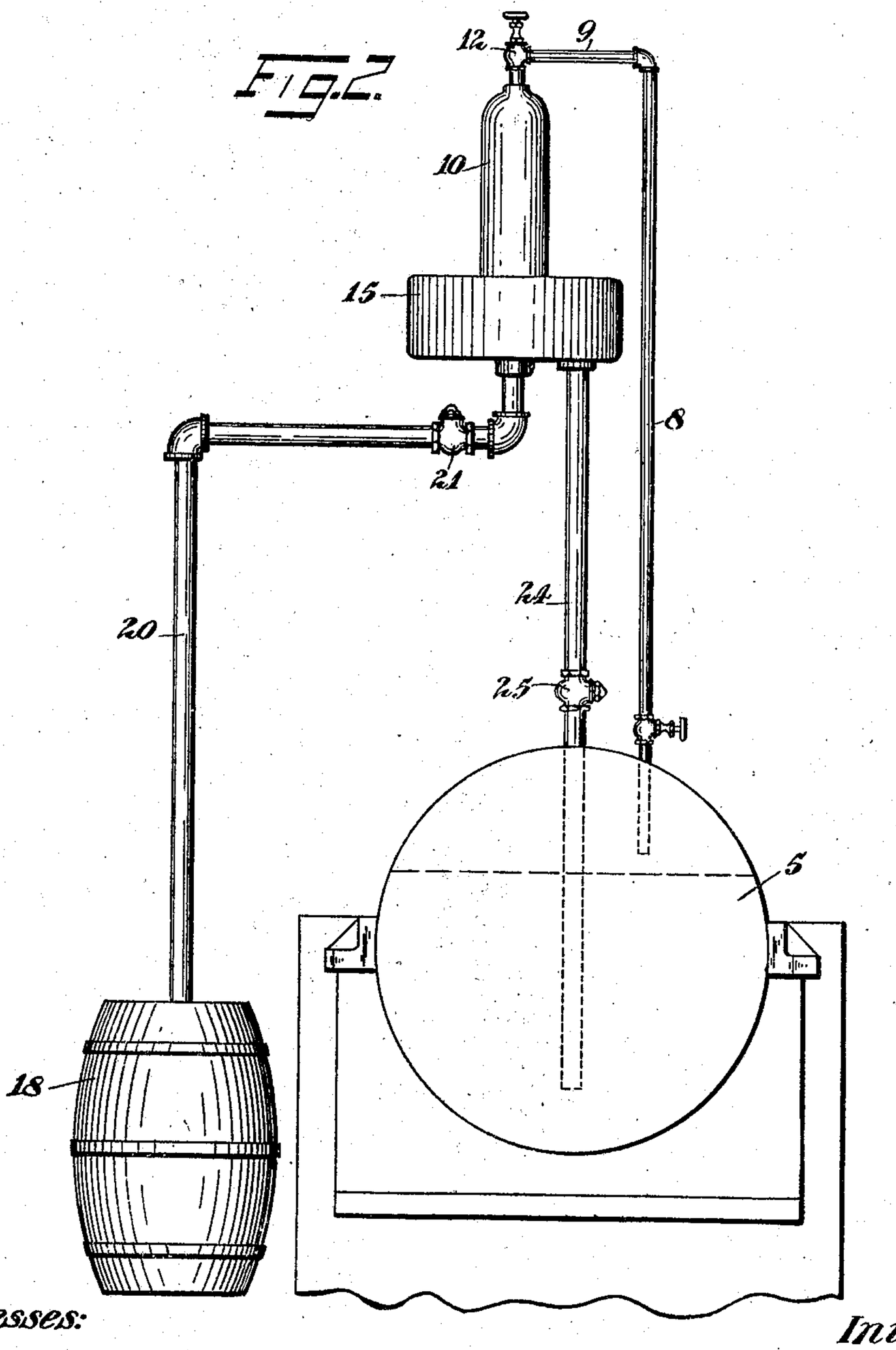
3 SHEETS—SHEET 2.

Fig. 2.



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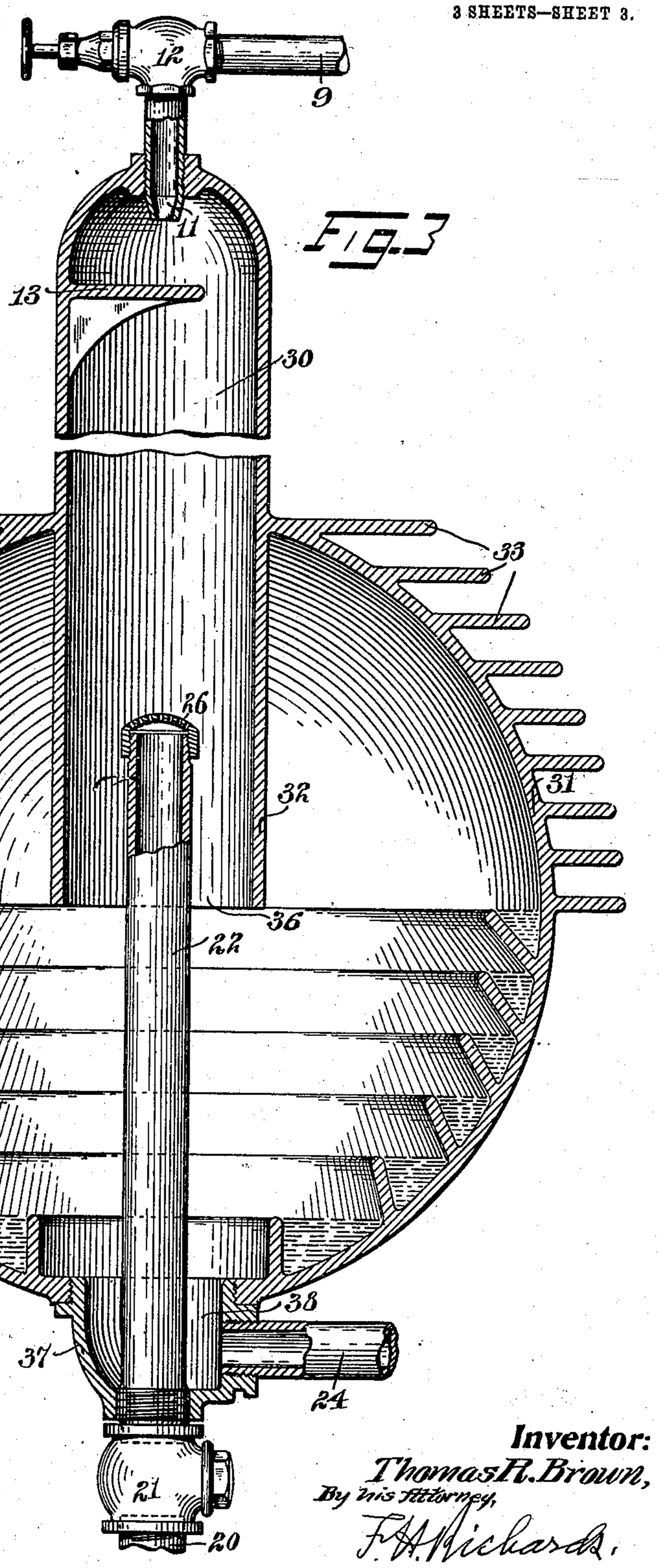

Fig. 3

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UNITED STATES PATENT OFFICE.

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SYSTEM OF BOILER-FEED.

No. 924,141. Specification of Letters Patent. Patented June 8, 1909.

Application filed May 11, 1908. Serial No. 432,210.

To all whom it may concern:

Be it known that I, THOMAS R. BROWN, a citizen of the United States, residing in Milton, in the county of Northumberland and State of Pennsylvania, have invented certain new and useful Improvements in Systems of Boiler-Feed, of which the following is a specification.

This invention relates to a system of boiler feed, and has for an object to provide means for supplying feed water to a boiler and is automatically controlled by the steam from the boiler when the surface of the water within the boiler falls below or rises above a predetermined normal level.

In my improved apparatus a chamber is provided which is located above the boiler or above the water level therein and is connected with the water supply and with the boiler at a point normally below the surface of the water for forcing the feed water into the boiler, and is also connected with the boiler at about the normal water line. When such normal water line falls sufficiently to permit steam, preferably dry steam, to pass into said chamber, the steam will be instrumental in forcing the supply of water out of said chamber and into the boiler, the steam remaining in the chamber will be rapidly condensed, thereby forming a vacuum which will cause a fresh supply of water to enter such chamber. Steam again coming over from the boiler will balance the pressure at the ends of a column of water which will then have static force enough to enter the boiler. The apparatus also includes in connection with said chamber means producing a spray within the chamber for condensing the steam therein and an enlarged chamber below such chamber in which the steam will be condensed by means of the extended walls and the extended water surface which is presented to the steam.

Other features of the invention will be referred to in the description.

The drawings accompanying and forming a part of this specification illustrate a form of device for carrying out my invention.

Figure 1 illustrates a boiler shown in end view but partly broken away in cross section and a device for supplying feed water, which is illustrated partly in elevation and partly in vertical section. Fig. 2 illustrates an end view of a boiler diagrammatically, the feeder in elevation, a series of pipes, and a source of water supply also in elevation; and Fig. 3 is a vertical central sectional view of a form of feeder.

The steam generator, which may be a boiler, indicated by 5, is shown as containing water rising to a level or line indicated by 6, which may be the normal water line at which position the water will control the tendency of the apparatus to force feed water into the boiler, when the surface of the water sinks below the predetermined level it will permit the feed water device to become active in the manner presently to be described. It might here be remarked that in a boiler the surface of the water when generating steam is not calm and the amount of agitation varies in various classes of boilers, and will also vary from time to time in the same boiler. Not only is the surface of the water agitated, but the steam immediately adjacent to the surface is apt to be moist and contain a certain amount of particles of water which is not present a little higher up in the boiler. For this reason the steam for operating the feeder apparatus will be at a little distance above the normal water level so that the apparatus will be operated not by the actual uncovering and covering of an opening, but by the passage of dry steam from the boiler into the proper chamber of the feeder apparatus. In the present illustration the open end 7 of the pipe 8 furnishes this steam outlet. The pipe 8 passes out of the boiler and connects with a line of piping 9. The feeder apparatus will preferably be placed at some distance above the boiler so that the water contained in the chambers of such apparatus will at the proper time find entrance into the boiler from its gravity when the pressure at the top of such chamber and of the boiler are equalized.

The feeder apparatus is shown as comprising a chamber 10 which for convenience we will call a steam receiving chamber, since a nozzle 11 from the pipe 9 enters the upper part of this chamber, and the amount of steam which will be received in the chamber will be controlled by some suitable hand valve. A hand valve is indicated at 12. It is desirable in this apparatus to prevent the water from being raised to a high temperature, and since it is a known fact that a jet of steam entering water will cause this to boil, whereas steam, even under considerable pressure, being in contact with a still surface of water will not cause the same to boil, there is provided a baffle plate 13 in the nature of a

shelf within the upper portion of the chamber 10 at a point above the normal water level 100 in such chamber. The coolness of the water will assist in the rapid condensation of the steam at the appropriate time.

The chamber 10 is mounted upon the chamber 15 and has a flange portion 14 extending into such chamber 15, the open end 16 of the chamber 15 being at an appreciable distance below the upper wall or head 17 of the chamber 15. The chamber 15 is relatively larger in cross sectional area than the chamber 10 and is of less height. The wall, formed by the flange 14 in the present illustration, which depends into the larger chamber is for providing a space at the upper part thereof, closed except at the lower part which is open at the lower end of the steam receiving chamber. The wall or head 17 is preferably substantially flat and of considerable extent for the purpose of affording a condensation radiating surface.

The water, in the present instance shown as coming from the tank 18, will be fed by means of a supply pipe 20 to the steam receiving chamber, there being a back pressure valve 21, and the pipe continues at 22 into such chamber where it is provided with a sprinkler head 26, such sprinkler head being located above the open end 16 of flange 14.

A line of piping 24, provided with a back pressure valve 25 opening toward the boiler, will extend from the lower part of the chamber 15 to a point within a boiler, preferably below the water level.

The operation of the device is substantially as follows: Assuming that water is within the chamber 10 and has its surface level at about the place indicated by 100, which, as was before explained, is at some distance above the water level 6 in the boiler, and also assuming that the water level 6 has fallen to such an extent that dry steam will pass through the opening 7, the pipe 8, pipe 9, and nozzle 11 into the upper portion of the chamber 10, the pressure against the valve 25 will then be overbalanced, because the steam pressure at each end of the column of water in the pipe 24 is equal to the gravity of the water in the pipe 25, chambers 15 and 10 and may then permit the water to pass into the boiler. The water within the chamber 15 will upon this operation have a tendency to create a slight vacuum above the opening 16, and since the water has all left the chamber 10 steam will rush into that vacuum, the outward rush of the steam will permit momentarily an amount of water to leave the chamber 15, but such steam extending over a large cooling surface; the surface of the water in the chamber 15 and the head wall 17 of the chamber; will rapidly condense, which will draw more steam from the chamber 10 and condense this, which will have a tendency to produce a vacuum, or if not a vacuum a lowering of pressure in the chamber 10, and draw in water from the supply pipe, the water coming in through the spraying device 26 will rapidly condense the steam which remains in the chamber 10 and form a vacuum, which will then draw water in rapidly from the supply and again fill the chamber 10 to its normal level. The water will remain in these chambers until dry steam again passes out of the opening 7, when the operation will be repeated.

The water in passing around the depending wall 14 and into the space at the upper portion of the chamber 15 will create considerable agitation of the water, and this agitation will accelerate the condensation. The rapid condensation of the steam after the water has been forced into the boiler is desirable so that a vacuum, in many instances complete, will be formed to insure the rapid filling of the chambers for furnishing the fresh supply. This is particularly desirable when one charge of water entering the boiler is not sufficient to raise the water line therein to a height which will prevent the passage of steam through the opening communicating with the feeder apparatus.

The chambers 10 and 15 may be made of castings if desired and the casting comprising the chamber 10 may be provided with a flange 27 for resting upon the top of the top plate 17 of the chamber 15 to which it may be bolted by bolts 28. In this instance the flange 14 is part of the walls constituting the chamber 10.

The form of larger chamber illustrated in Figs. 1 and 2 is useful in some situations where it is desired to present an extended surface, as for instance the surface of the plate 17 for radiation and an extended surface of water for condensation. The flat plate or head 17 and the bottom 29 of the chamber 15 in some instances would not stand the amount of internal pressure to which the device would be subjected, particularly where the chamber 15 is relatively large and high boiler pressure is maintained, and stays would be necessary to prevent the bulging of the parts. Where high boiler pressure is maintained the spherical formation of the larger chamber is regarded as a strong construction, and such is the construction illustrated in Fig. 3. In this view a steam receiving chamber is designated by 30 and may be cast integral with the chamber 31 which has a cubical capacity in excess of the cubical capacity of the chamber 30. This chamber 31 is provided with a spherical wall, and not only are the walls constituting the chamber 30 integral with the walls constituting the chamber 31 in that portion which is above or outside of the chamber 31, but also the flange portion 32 which extends inwardly into the chamber may be a portion of the same casting. In certain conditions

of operation all the water will be driven out of the chambers 30 and 31, and for the purpose of condensing the steam in chamber 31 its walls are to be so constructed that they will readily cool or present a cold surface to the steam. This may be accomplished by radiation plates or by means of presenting water to the steam.

In Fig. 3 the upper portion of the wall of the chamber 31 is provided with a series of radiation plates, designated without preference by the reference character 33, and at the lower portion of the chamber its walls carry inwardly projecting flanges, designated without preference by the reference character 34, which will act as pockets for receiving water. So that after a charge of feed water has left the chamber there will be bodies of water, as 35, left in the pockets formed by these flanges 34. And the steam which is within the chamber 31 will find presented to it a surface cooled by the radiation plates 33 and the exposed faces of the flanges 34 each of which flanges will be cooled by the body of water within it, and which bodies of water will also present steam condensing surfaces. By having the height of the flanges 34 so adjusted and positioned one relative to the other that the surface of water in the lower flange will come up to the base of the flange above it a continuous cooling surface may be provided and a surface whose area is in excess of the normal area of the surface of the walls of the chamber. In Fig. 3 the open end 36 of the chamber 30 is about at the center of the chamber 31. The water connections for the chamber illustrated in Fig. 3 may be such as is convenient in practice to use, but there has been illustrated a fitting 37 having a screw threaded engagement with the lower portion of the walls of the chamber 31 which fitting has a chamber 38 opening into the chamber 31 and which is in communication with the pipe 24 which leads to the generator. The pipe 20 with its back pressure valve 21 may be connected to the pipe 22 which passes through the chamber 38 and has a screw threaded connection with the coupling member 37. By the means just described but one opening for the entrance and discharge of the feed water need be provided in the casting, and the feed water can be drawn entirely out of the chamber 31 with the exception of that which is retained for condensation purposes in the pockets formed by the flanges 34.

Having described my invention I claim:

1. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper part with the generator adjacent the normal line of the water level for receiving steam upon fall of such level and communicating near its lower part with the water supply, a chamber larger than the steam receiving chamber communicating at its lower part with the lower part of the generator, said steam receiving chamber being imposed upon and having its walls extended into the upper part of the larger chamber.

2. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper end with the generator adjacent the normal line of the water level for receiving steam upon fall of such level, a spraying device located in said chamber above its lower end and connected with the water supply, a chamber having a cross sectional area larger than that of the steam receiving chamber and disposed below and surrounding the lower end of the same and a discharge from the lower part of the larger chamber to the generator.

3. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper end with the generator adjacent the normal line of the water level for receiving steam upon fall of such level, a spraying device located in said chamber above its lower end and connected with the water supply, a chamber having a radiating top and having a diameter several times greater than the diameter of the steam receiving chamber and disposed below and surrounding the lower end of the same, and a discharge from the larger chamber to the generator.

4. In a system of boiler feed, the combination with a steam generator having an outlet at a point to be exposed for the passage of steam and closed upon fall and rise of the water level, and an inlet at a point to be normally continuously covered by the water, of a source of water supply, a chamber having at its top communication with said outlet for receiving steam upon fall of such level and between its top and bottom having communication with the source of water supply, and a chamber larger than the steam receiving chamber communicating at its lower part with said inlet, said steam receiving chamber being imposed upon and having its walls extended into the upper part of the larger chamber for effecting a sudden condensation of steam in said chamber.

5. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper end with the generator adjacent the normal line of the water level for receiving steam upon fall of such level, a spraying device located in said chamber above its lower end and connected with the water supply, a chamber having a radiating top and having a cross sectional area several times greater than the cross sectional area of the steam receiving chamber and disposed below the same, a wall depending into said larger chamber for providing a space at the upper part thereof closed except at the lower part which is open to the lower

end of the steam receiving chamber, and a discharge from the larger chamber to the generator.

6. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper part with the generator adjacent the normal line of the water level for receiving steam upon fall of such level and communicating near its lower part with the water supply, a larger chamber having greater cubical contents than the steam receiving chamber communicating at its lower part with the lower part of the generator, said steam receiving chamber being imposed upon and having its walls extended into the upper part of the larger chamber, and means for cooling the walls of the larger chamber.

7. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper end with the generator adjacent the normal line of the water level for receiving steam upon fall of such level, a spraying device located in said chamber above its lower end and connected with the water supply, a chamber having greater cubical contents and a cross sectional area larger than that of the steam receiving chamber and disposed below and surrounding the lower end of the same and a discharge from the lower part of the larger chamber to the generator, the walls of the larger chamber being provided at the upper portion upon the outside with radiation plates and the lower portion upon the inside with water pockets.

8. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper end with the generator adjacent the normal line of the water level for receiving steam upon fall of such level, means for supplying water to the steam receiving chamber, a spherical chamber having a cubical capacity greater than that of the steam receiving chamber and disposed below the same, a wall depending into said spherical chamber for providing a space at the upper part thereof closed except at the lower part which is open to the lower end of the steam receiving chamber, and a discharge from the lower part of the spherical chamber to the generator, the walls of the spherical chamber being provided at its upper portion upon the outside with radiation plates and the lower portion upon the inside with water pockets.

9. The combination with a steam generator, of a source of water supply, a chamber communicating at its upper end with the generator adjacent the normal line of the water level for receiving steam upon fall of such level, a spraying device located in said chamber above its lower end and connected with the water supply, a chamber having a cross sectional area several times greater than the cross sectional area of the steam receiving chamber and disposed below the same, a wall depending into said larger chamber for providing a space at the upper part thereof closed except at the lower part which is open to the lower end of the steam receiving chamber, and a discharge from the lower part of the larger chamber to the generator.

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