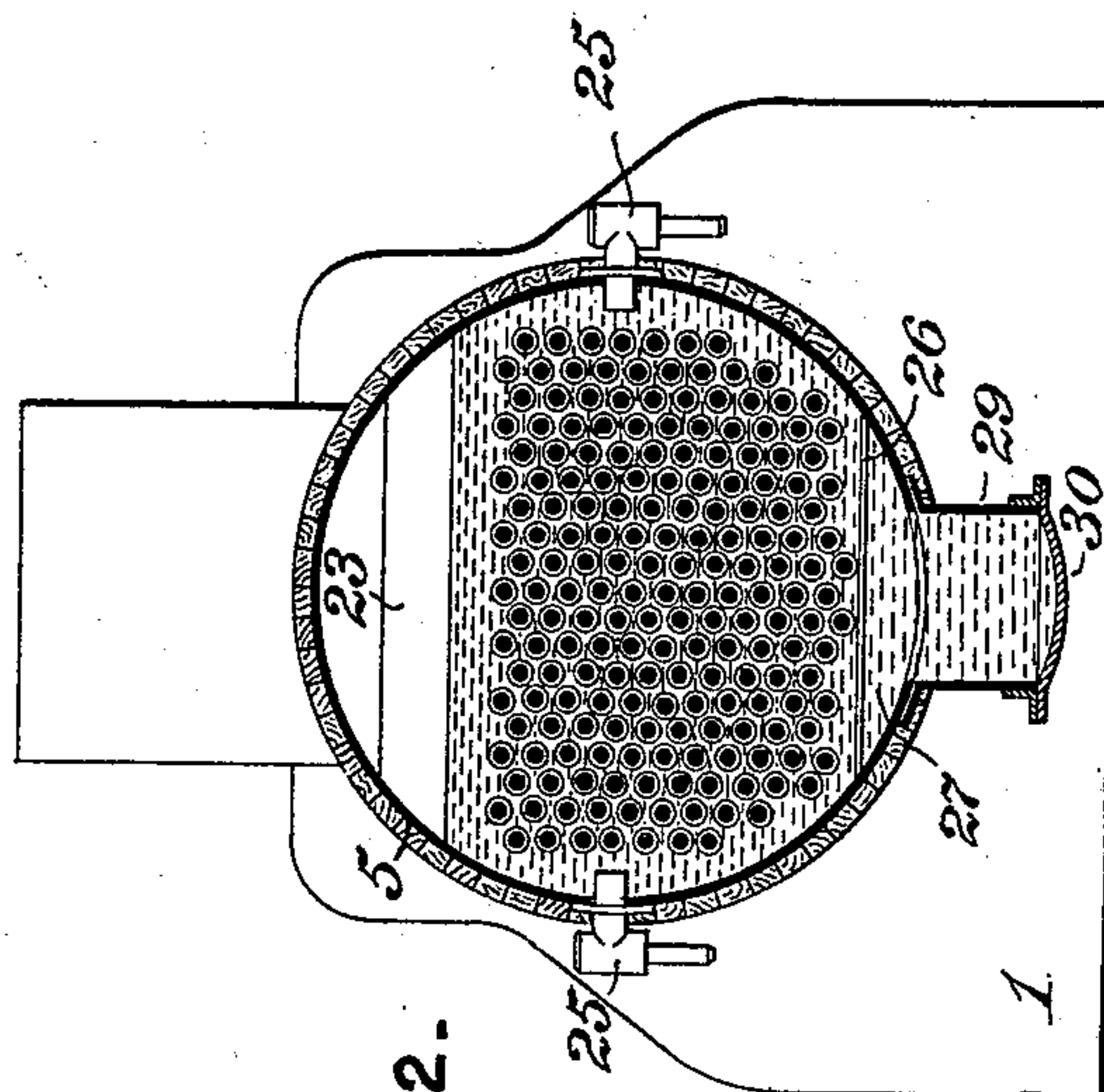
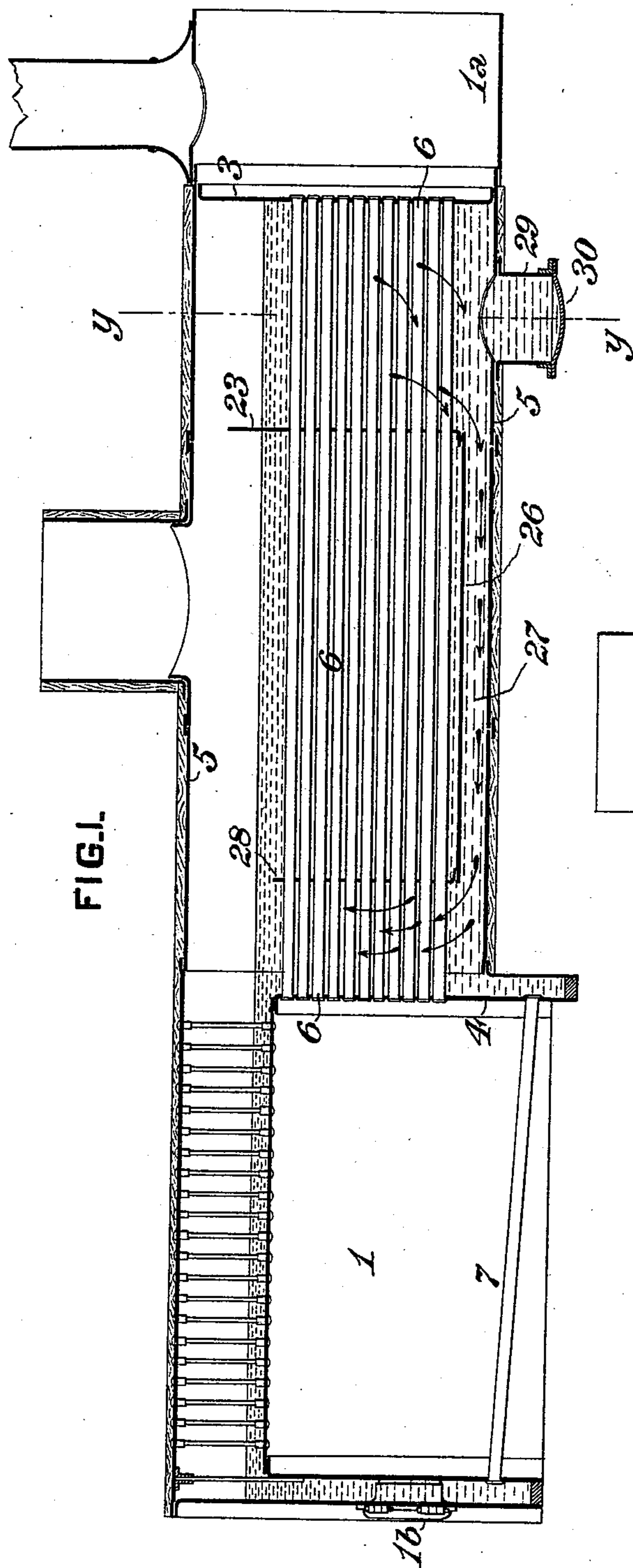


(No Model.)

M. N. FORNEY.
STEAM BOILER.

No. 518,399.

Patented Apr. 17, 1894.



16

FIG. 2.

WITNESSES:

T. J. Hogan.
J. E. Gaither.

INVENTOR,

INVENTOR,
W. H. Forney,
by J. Snowden Bell.

Att'y.

UNITED STATES PATENT OFFICE.

MATTHIAS N. FORNEY, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 518,399, dated April 17, 1894.

Original application filed June 23, 1893, Serial No. 473,646. Divided and this application filed November 9, 1893. Serial No. 490,409. (No model.)

To all whom it may concern:

Be it known that I, MATTHIAS N. FORNEY, of the city, county, and State of New York, have invented a certain new and useful Improvement in Steam-Boilers, of which improvement the following is a specification.

My invention more particularly relates to steam boilers of what is known as the "locomotive" type, although it is not limited in application to locomotive engines, and its object is to provide simple, effective, and desirable means for promoting the circulation of the water in the boiler, in order to protect the tubes from undue and excessive heat.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a longitudinal central section through a steam boiler, illustrating an application of my invention, and Fig. 2, a transverse section through the same at the line *y, y*, of Fig. 1.

In a separate application filed by me June 23, 1893, Serial No. 473,646, and patented December 12, 1893, No. 510,636, of which this application is a division, I illustrate, but do not describe or claim, my present invention, as applied in a locomotive boiler having its fire-box lined with refractory material. In the instance herein set forth the firebox is provided with the ordinary water legs or walls, to which construction my improvement is equally applicable, as no specific form or type of firebox is essential to its application and practice. The main body or waist of the boiler may be of the ordinary cylindrical form, provided with a series of fire tubes 6, which extend from the firebox 1 to the smoke box 1^a, and are secured, at their ends, in a back tube sheet 4 and a front tube plate or head 3. The firebox is provided with a firedoor or doors 1^b, and with a fire grate 7, of any suitable and preferred construction, and as it does not, in and of itself, form any part of my present invention, it need not be fully and at length described.

A difficulty which has been frequently experienced with locomotive boilers, is that the heat generated in the firebox becomes, from time to time, so intense that the tubes cannot be kept tight. Recent investigations have shown that this difficulty is largely due to de-

ficient circulation of water in the boiler. On the other hand it has been thought, that if cold water is brought into contact with the ends of the tubes where they are attached to the fire-box tube-plate, the cooling effect is likely to cause the tubes to leak. It is the fact that the transmission of heat from the tubes to the water outside of them is in proportion to the difference in temperature on the two sides, from which it follows that the greater the difference in temperature between the water in contact with the front ends of the tubes, or where the products of combustion leave them, and the products passing through the tubes, the greater will be the heat transmitted to the water from the tubes. It is therefore desirable that the coldest water in the boiler should be in contact with the tubes at the front end, or where the smoke and gases from the fire escape into the smoke-box. To this end, and also to prevent the access of cold water to the fire-box ends of the tubes, a diaphragm or division plate 23, is located in the boiler, a short distance back of the front tube-plate 3, and the feed water is admitted through casings 25, fitted with proper check valves, into the division thus formed between the diaphragm and the front tube plate.

The excessive heat at the fire-box end of the tubes tends to drive the water away from them, and from the tube plate at that end, unless special provision is made for promoting circulation. To this end a circulating plate 26, is located a short distance above the bottom of the boiler, so as to provide a space 27 between it and the shell. This plate, as shown, does not extend entirely back to the back tube-plate 4. As the diaphragm 23 extends a short distance above the water level, the consequence is that when feed water is forced into the space between the diaphragm and the front tube-plate 3, it will rise slightly above the level of the water in the rest of the boiler, thus producing a current, indicated by the arrows, through the space or channel 27, which current is delivered immediately in front of and against the fire-box tube-plate, and to the back ends of the tubes. This current is first warmed by the front ends of the tubes, and is then discharged at their back ends. A second diaphragm 28, at the rear

end of the plate 26 may, if desired, be also provided, so as to keep the backward current of water in contact with the back ends of the tubes as long as possible. When this second
5 diaphragm 28 is employed, it should not extend quite up to the water level in the boiler, so that the water from the back compartment can flow from it to the space in the middle of the boiler. Below the front space in the
10 boiler is placed what is called a mud-drum 29. It is well known that cold water will hold in solution more of some kind of substance than it will when it is heated, and, therefore, as soon as the feed water is heated by the front
15 ends of the tubes, much of the material held in solution will be deposited at this point and be collected in this drum, from which it may readily be removed. By removing the cover or bottom 30 of the mud drum, access may be
20 had to the channel 27, to remove any solid substances deposited therein.

I am aware that diaphragms or circulating plates located in boilers, for promoting circulation and confining the cold feed water to a
25 particular part of the boiler, were known in

the art prior to my invention, and do not therefore broadly claim such feature.

I claim as my invention and desire to secure by Letters Patent—

1. The combination in a steam boiler, of a diaphragm, forming the rear wall of a space between itself and the front tube-plate, a channel at the bottom of the boiler connecting said space with the back end of the boiler, and a feed water inlet communicating with
30 said space, substantially as set forth. 35

2. The combination, in a steam boiler, of a diaphragm, forming the rear wall of a space between itself and the front tube-plate, a channel at the bottom of the boiler connecting said space with the back end of the boiler, a feed water inlet communicating with said
40 space, and a second diaphragm forming a space between itself and the back tube plate, substantially as set forth.

MATTHIAS N. FORNEY.

Witnesses:

FRANK J. FRENCH,
GEO. L. FOWLER.