

V. ANDRIOLI.

APPARATUS FOR PRODUCING CIRCULATION IN STEAM BOILERS.

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913,347.

Patented Feb. 23, 1909.

2 SHEETS—SHEET 1.

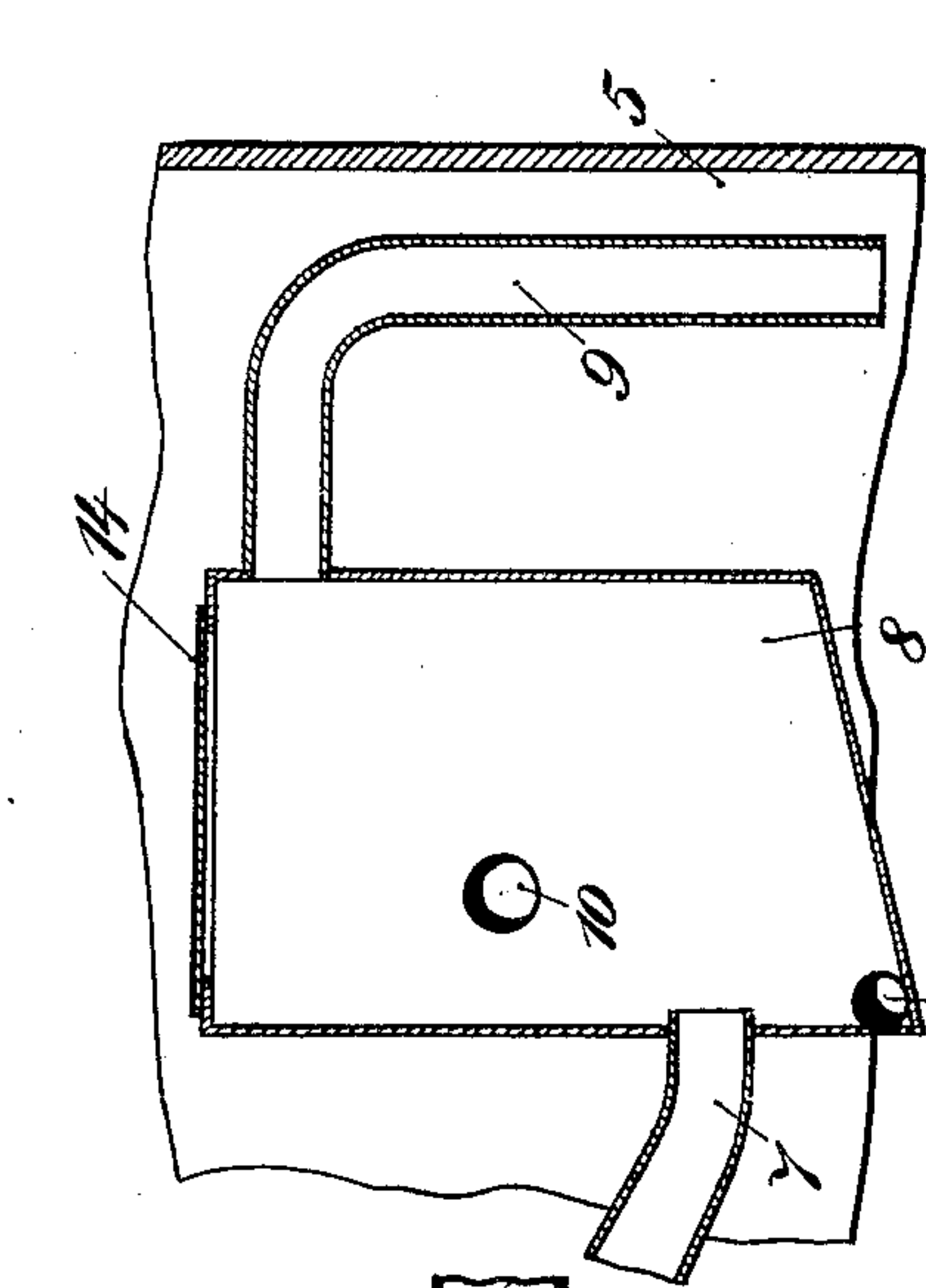


Fig. 1.

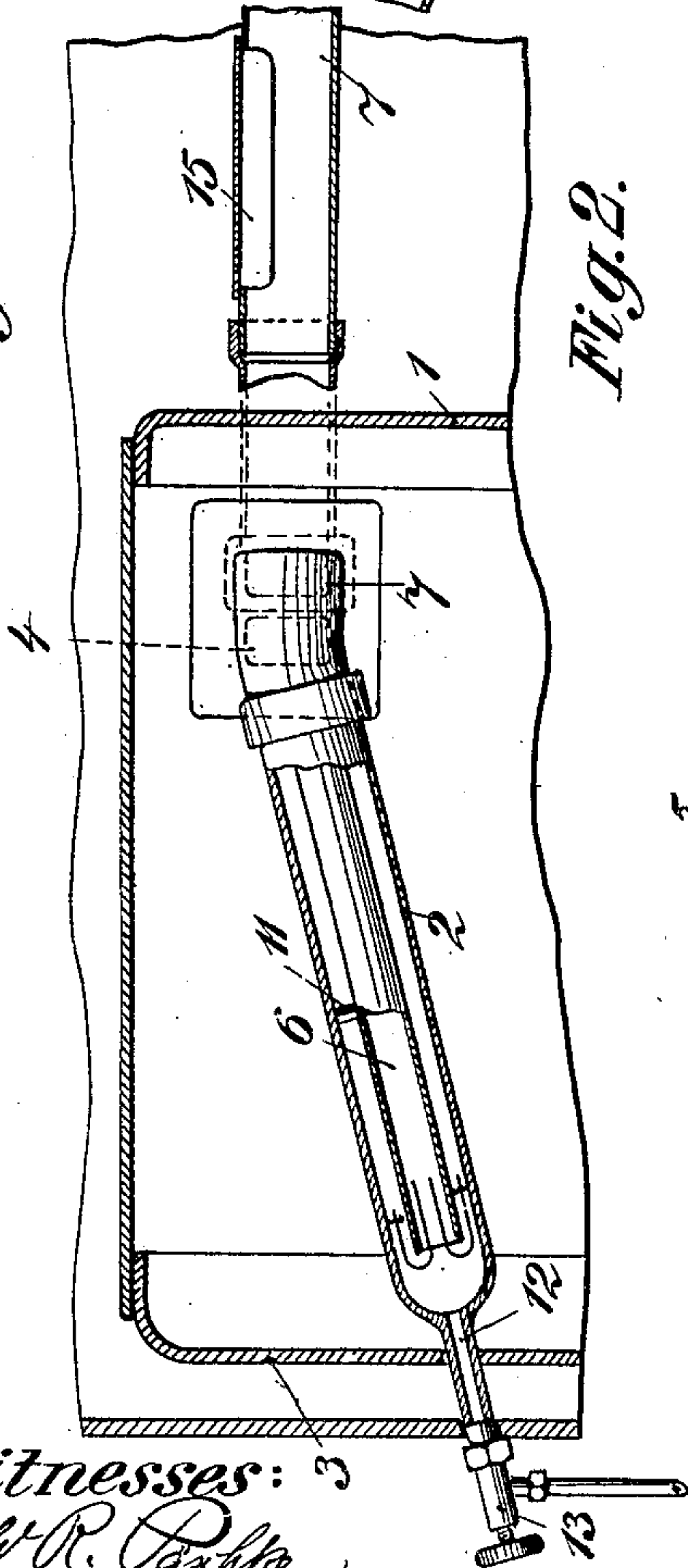


Fig. 2.

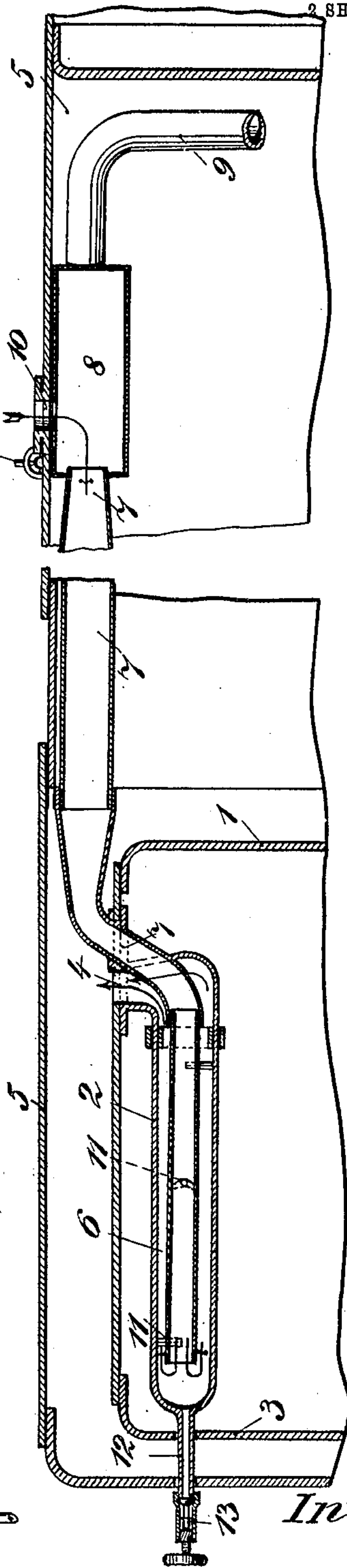
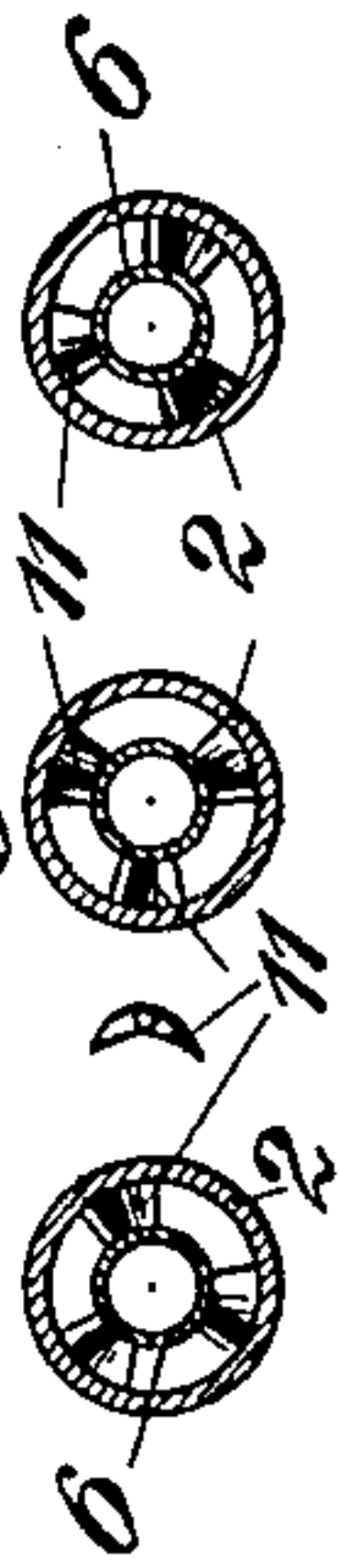


Fig. 3.



Witnesses:  
Berthold R. Pascha  
George Otto.

Inventor:  
Andrioli  
Vittorio.

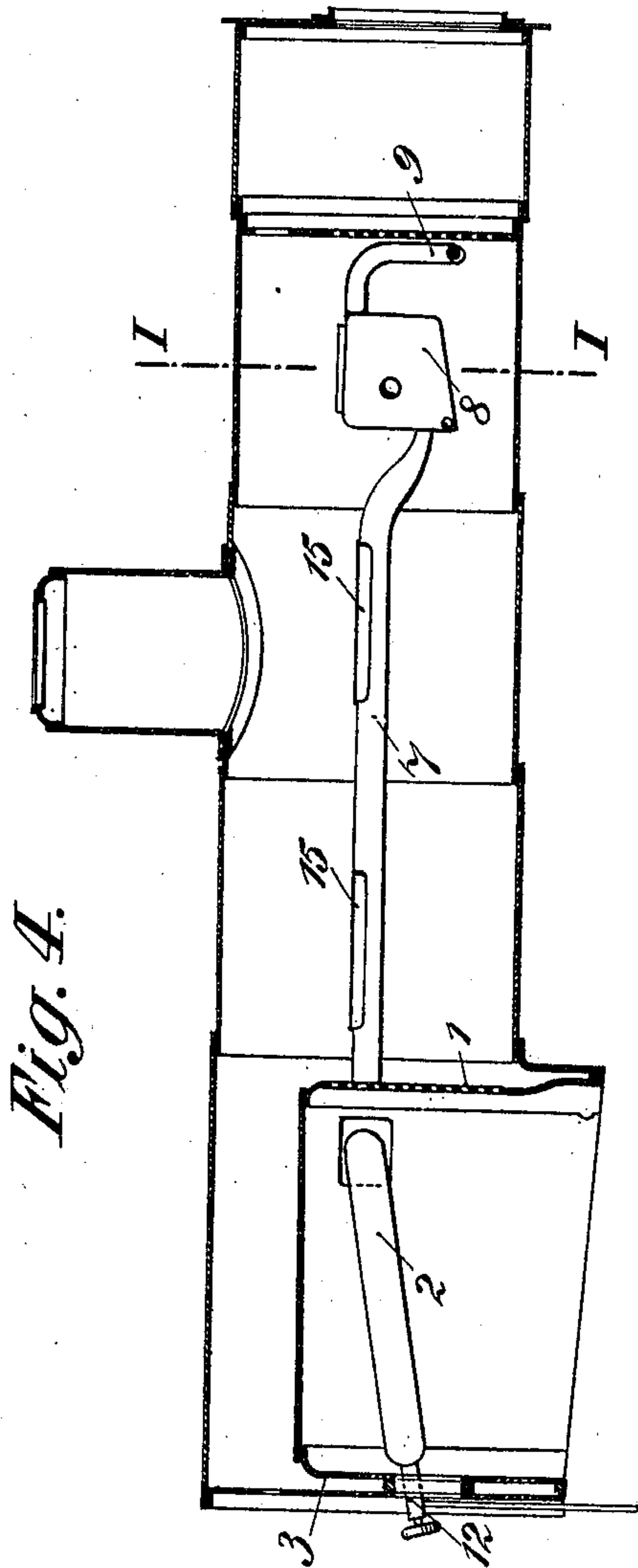
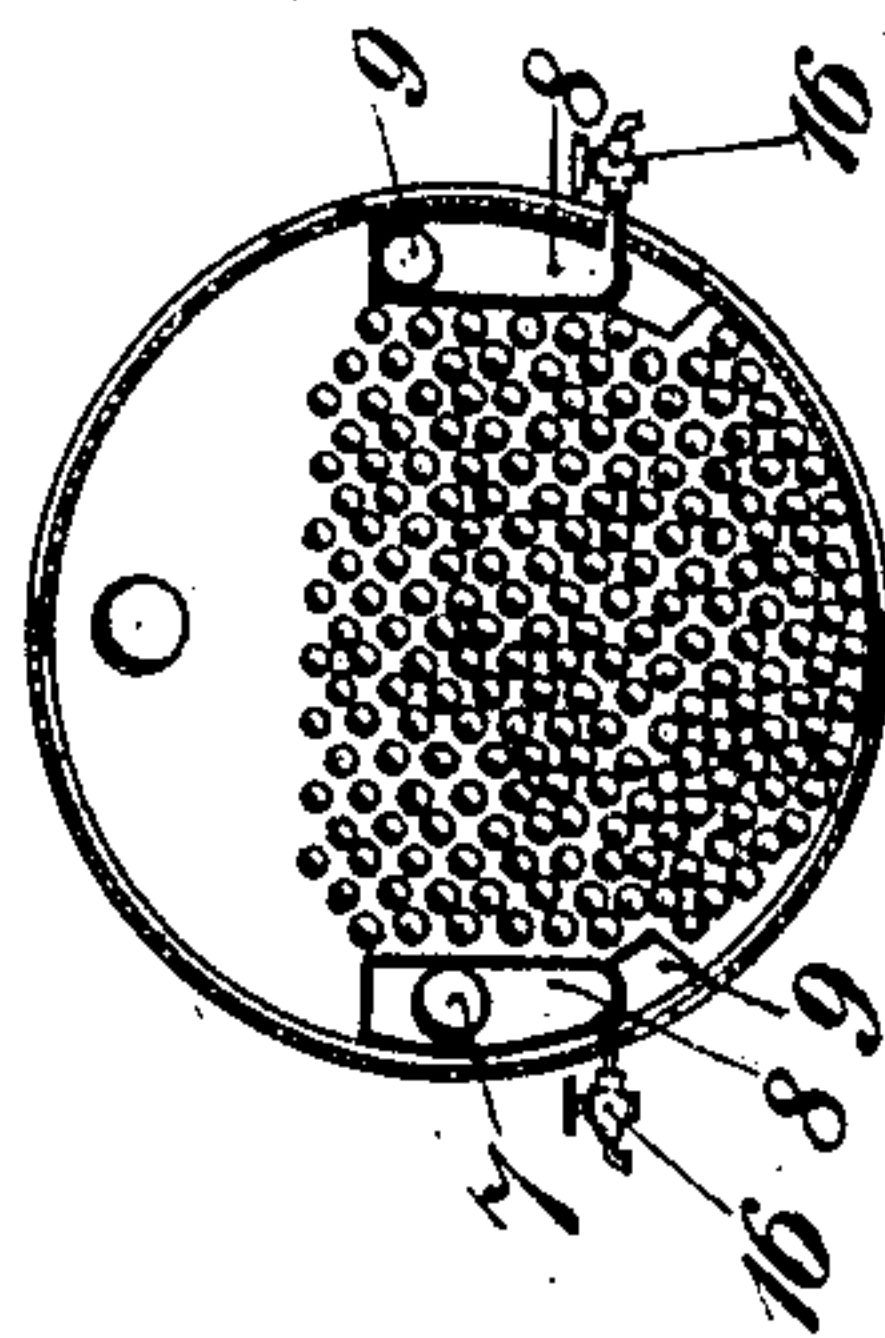
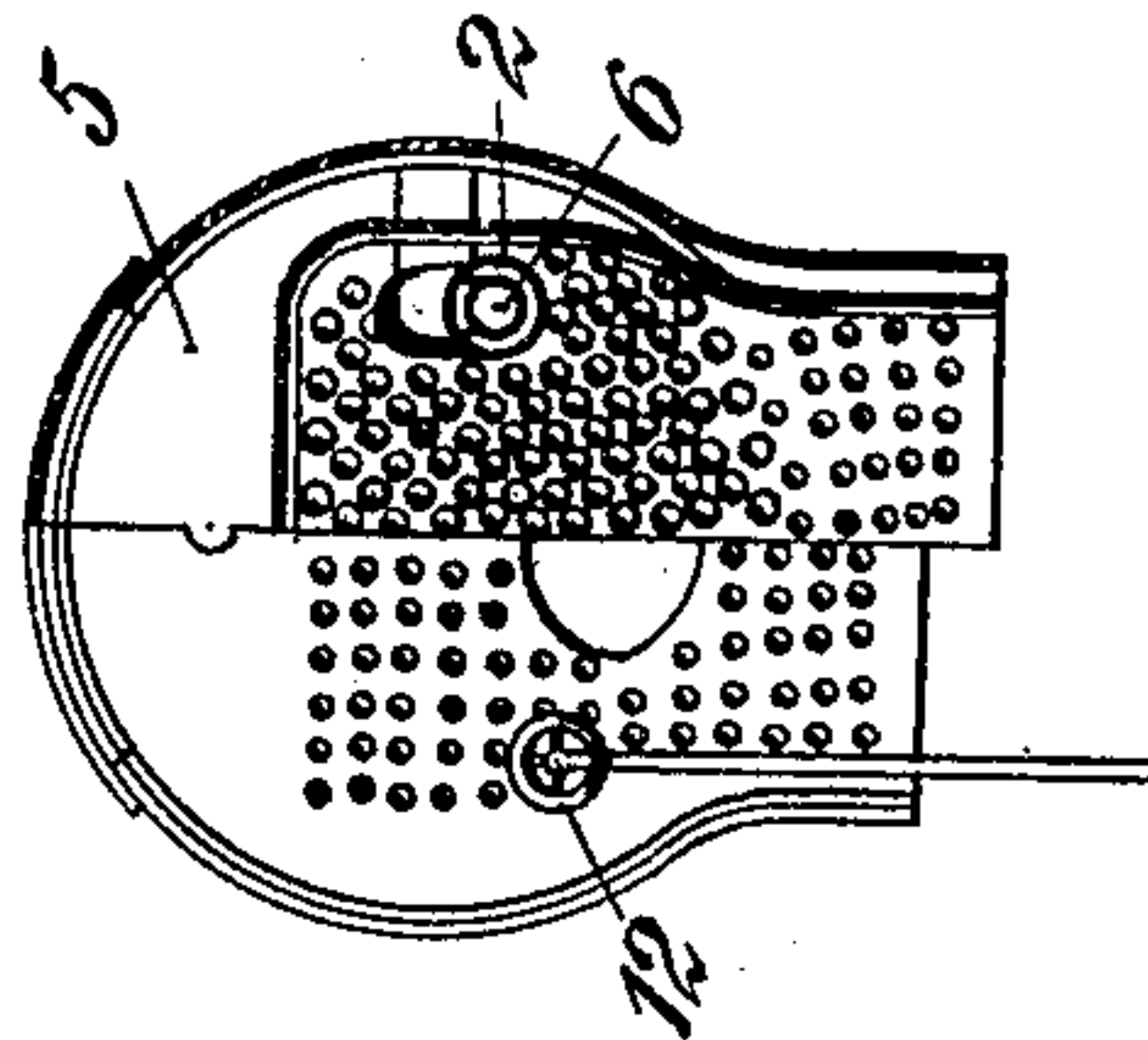


Fig. 5.



*Witnesses:*  
*Barthold R. Pischke*  
*Georg Otto*

*Inventor:*  
*Andrioli*  
*Vittorio*



# UNITED STATES PATENT OFFICE.

VITTORIO ANDRIOLI, OF MILAN, ITALY.

## APPARATUS FOR PRODUCING CIRCULATION IN STEAM-BOILERS.

No. 913,347.

Specification of Letters Patent.

Patented Feb. 23, 1909.

Application filed June 17, 1908. Serial No. 439,087.

*To all whom it may concern:*

Be it known that I, VITTORIO ANDRIOLI, a subject of the King of Italy, and resident of 3 Via Metastasio, Milan, Italy, have invented certain new and useful Improvements in Apparatus for Producing Circulation in Steam-Generators, of which the following is a specification.

This invention relates to an apparatus for inducing circulation in steam generators, especially traveling generators such as locomotives and so forth, by which the water from the coldest part of the generator is caused to pass along a conduit within the boiler to an evaporator subjected to the direct action of the flames, and then caused to return from the evaporator to the hot water space of the generator. It is advantageous to run also the feed-water into the circulating conduit of the generator and thus cause the feed-water to be thoroughly heated before mixing with the boiler-water, while at the same time causing it to precipitate its calcareous constituents.

The apparatus according to my invention comprises a tubular evaporator placed above the hearth in the fire-box or furnace and having one end closed and its other end in communication with the hot water space. Within the evaporator is another open tube which leads into the interior of the generator and to the farther end thereof where it enters a chamber provided in the generator. The chamber is in communication with the coldest water space of the generator and receives the feed-water.

The apparatus produces constant circulation and increased generation of steam and it is particularly useful for locomotives and like boilers which by reason of their peculiar design, defective fuel consumption and short working life, are otherwise uneconomical. In providing a similar apparatus along each side of the generator, its efficiency is greatly increased owing to the enlarged heating surface within the firebox, and this insures considerable economy in fuel with quick steam raising capacity. Further, the deterioration of the copper firebox through the chilling effect of the feed-water

is avoided because the latter enters the water space of the generator in a highly heated condition, and cannot come in contact with the lower plates of the firebox where the heating tubes are unmounted. In this manner the life of the material of the firebox is greatly prolonged and repairs are less frequent because the molecular contractions due to frequent sudden changes in temperature do not occur and the cracking of the copper plates between the fire-tubes which results from these changes is practically avoided. Finally, the apparatus causes the feed water to deposit its calcareous constituents before entering the generator proper, and so prevents incrustation, of the latter, and all the disadvantages resulting therefrom.

In order that my invention may be clearly understood, I will describe the same fully with reference to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section, and Fig. 2 is a horizontal section of a portion of a steam generator fitted with the circulating, evaporating apparatus, according to the present invention. Fig. 3 shows several cross sections of the tubular evaporator which is fitted in the fire-box. Fig. 4 shows the complete arrangement of the apparatus within the steam generator drawn to a smaller scale. Fig. 5 is a part rear elevation, and part vertical section through the fire box. Fig. 6 is a cross-section taken on the line I—I of Fig. 4.

In the upper portion internally of the fire-box and at an appropriate distance from the wall 1 of the fire-tubes so as to insure free access of the flames to the upper fire-tubes, there is the evaporator 2 which extends in an inclined direction to the wall 3 of the fire-box. The inner end of the evaporator communicates at 4 with the hot-water space of the generator. The evaporator is fitted with an internal concentric tube 6 which opens into the evaporator 2 and leads into a tube 7 which extends almost throughout the length of the generator in the water-space thereof. The tube 7 leads into a closed chamber or vessel 8 from which a dip-pipe



9 descends to the coldest strata of the boiler-water. The feed water is also injected into the chamber 8 through an inlet 10.

It is to be noted that the entire apparatus 5 is disposed at about the same level as the axis of the generator and consequently the evaporator and the tube 7 are considerably below the low-water mark so that a constant supply of water is insured.

10 As the evaporator 2 is exposed to direct action of the fire-gases, the comparatively thin annular water column within such evaporator becomes quickly heated to a higher temperature to that of water in the water 15 space 5 of the boiler. The difference in temperature thus created will produce perfect circulation of the water. The hot water passes upward in the inclined evaporator 2 and then runs through the opening 4 into 20 the rear part of the generator while the tubes 6 and 7 constantly supply water of lower temperature.

When the feed water is stopped, the dip-pipe 9 supplies the boiler water to the chamber 8 and so keeps the circulation uninterrupted. Irregularities in the boiler feed are, therefore, automatically compensated for by the action of the dip-pipe which controls the 30 pipe serves as an overflow, while with little feed, extra water will come through the said pipe.

As the feed water passes through the apparatus, its temperature rises in each section 35 thereof. When the feed water enters the chamber 8, its temperature will rise immediately and a large proportion of its calcareous constituents will be precipitated on the floor of the tank by reason of the low 40 velocity of the water. The water passes hence into the tube 7 at about the level of the axial line of the generator and so assumes a higher and higher temperature in its advance toward the firebox while at the same time precipitating further quantities of lime and 45 magnesium compounds. When it reaches the evaporator it is almost pure water and is then suddenly heated to the highest temperature and freed from all 50 traces of impurities. To prevent these impurities from being drawn with the current into the boiler, I have provided in the evaporator 2 a plurality of scooped baffles 11 in these different sections which in 55 their totality are equal to the sectional area of the annular space of the evaporator. The baffles are so disposed as to prevent the water flowing in a straight path and causing it to separate out all the impurities. The baffles 60 serve also to hold the tube 6 in position within the evaporator. The rear end of the evaporator 2 ends in a tube 12 which passes through the rear of the generator and is fitted with a tap 13 through which the dirt 65 can be ejected from time to time. The cham-

ber 8 is advantageously formed with an inclined floor with the lower part of which a tap 16 communicates for use in clearing out mud. The chamber 8 and tube 7 have removable inspection covers 14 and 15 respectively. As before stated there should be a similar apparatus at each side of the generator. Obviously, the same arrangement may be adopted in fire-tube boilers whereby the water would be supplied to an evaporator 75 disposed in the fire-tube.

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

1. Apparatus for producing circulation in steam generators consisting of an evaporator 80 directly exposed to the fire-gases, said evaporator having its one end in communication with the hot water space of the generator, a tube having its one open end within the said evaporator and passing through 85 the entire water space of the generator, a closed water chamber arranged in the generator, the said tube being at its other end in communication with the said water chamber, the feed water inlet tube leading into 90 said water chamber, the latter being in communication with the coldest water space of the generator, substantially as set forth.

2. Apparatus for producing circulation in steam generators consisting of an evaporator 95 directly exposed to the fire-gases, said evaporator having its one end closed and its other end in communication with the hot water space of the generator, a tube concentrically arranged in the said evaporator and 100 having its one open end next to the closed end of the said evaporator, said tube passing through the entire water space of the generator, a closed water chamber arranged in the generator and having an inclined bot- 105 tom, the said tube being at its other end in communication with the said water chamber, the feed-water inlet tube leading into said water chamber, a second tube which opens into said water chamber and having 110 its other end in the coldest water space of the generator, substantially as set forth.

3. Apparatus for producing circulation in steam generators consisting of an evaporator 115 arranged in an inclined position immediately above the fire, a tap which communicates with the lower end of the said evaporator, the latter having its other end in communication with the hot water space of the generator, a tube concentrically arranged in 120 the said evaporator and having its one open end next to the lower end of the said evaporator, said tube passing through the entire water space of the generator, scooped baffles for holding the said tube in position 125 within the said evaporator, a closed water chamber in the generator and having an inclined bottom, a tap which communicates with the lower part of the latter, the said tube being connected to the said water 130



chamber, the feed-water inlet tube leading into said water chamber, a second tube which opens into said water chamber and having its other end in the coldest water space of the generator, substantially as set forth.

In testimony whereof I have hereunto

signed my name this third day of June 1908, in the presence of two subscribing witnesses.

VITTORIO ANDRIOLI.

Witnesses:

MICHAEL SIERSDERFER, Jr.,  
J. H. READER.