

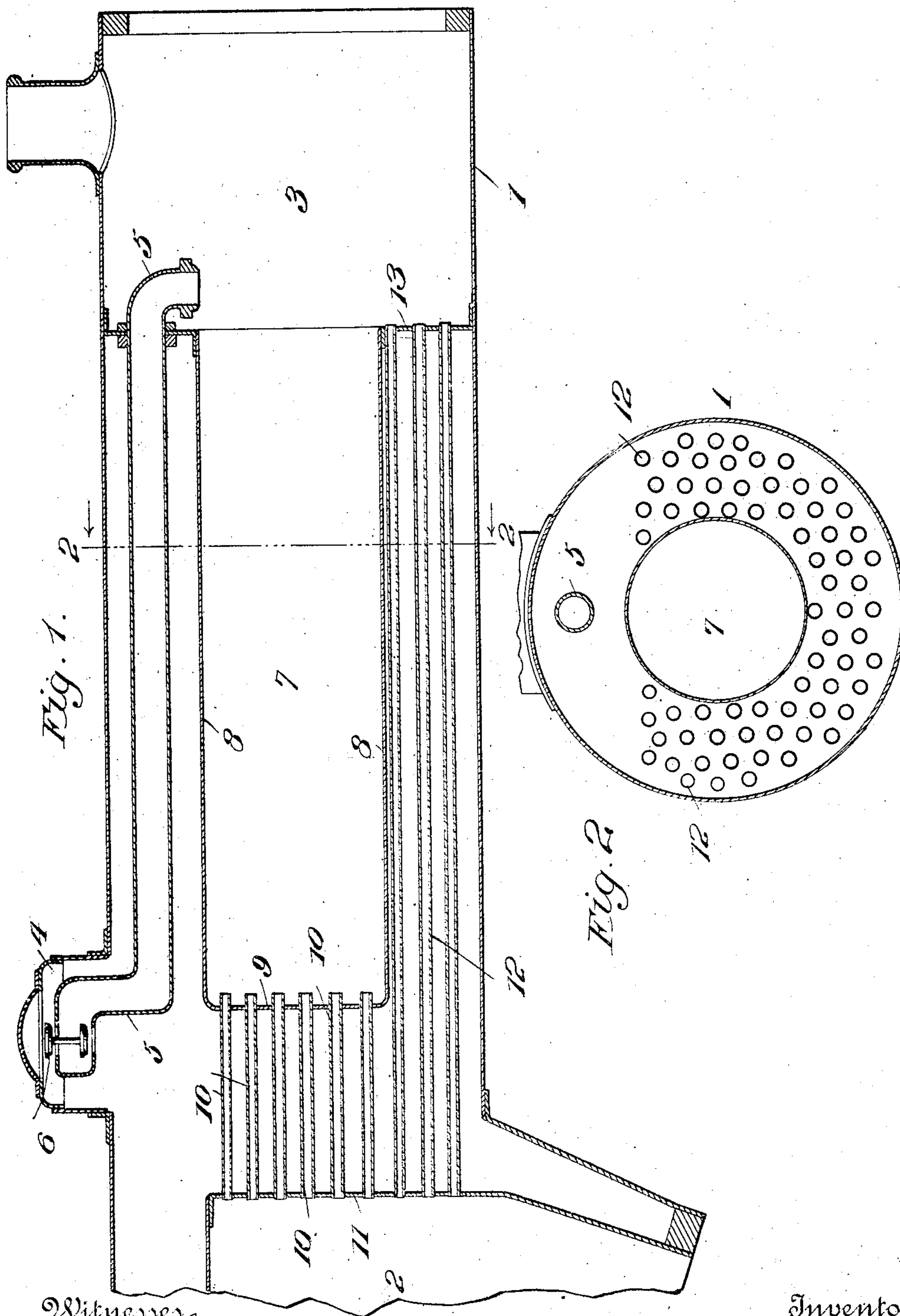
No. 847,407.

PATENTED MAR. 19, 1907.

F. A. HAUGHTON.
STEAM GENERATOR AND SUPERHEATER.

APPLICATION FILED APR. 8, 1905.

3 SHEETS—SHEET 1.



Witnesses
Edward Rowland,
Per *[Signature]*

Inventor
Frank A. Haughton
By *[Signature]* Stuart & Stuart Attys.

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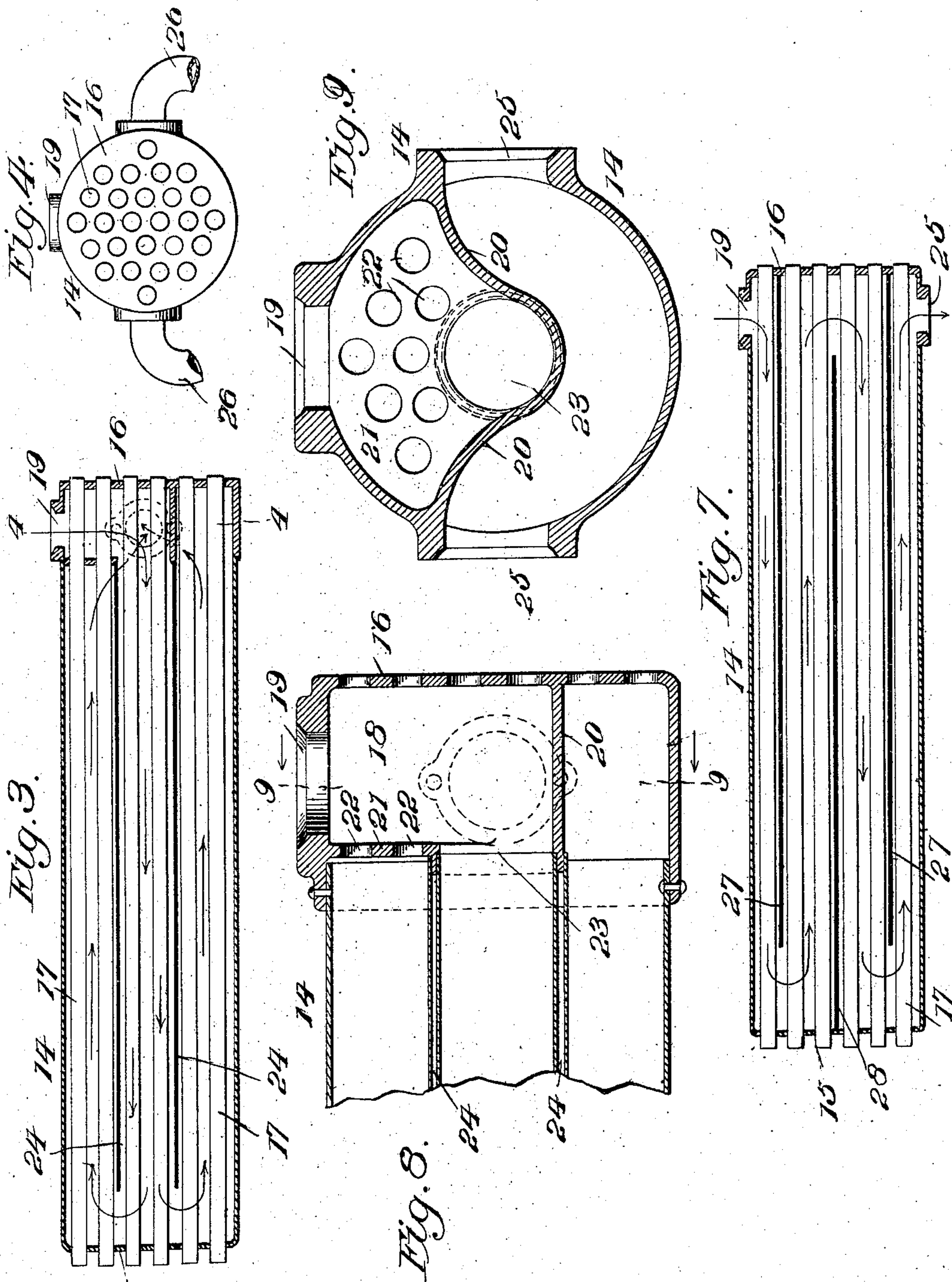
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3 SHEETS—SHEET 2.



Witnesses
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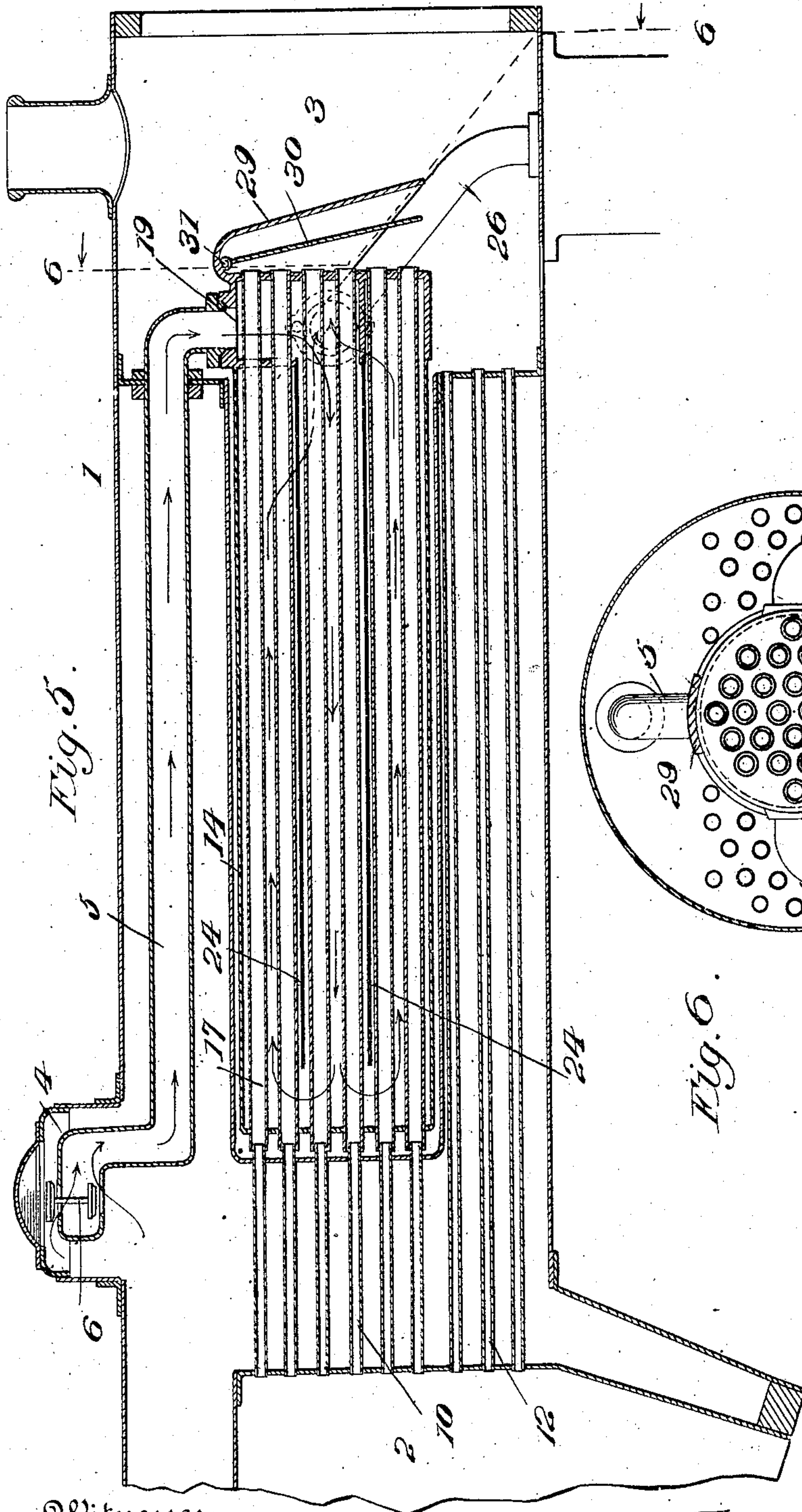


Fig. 5.

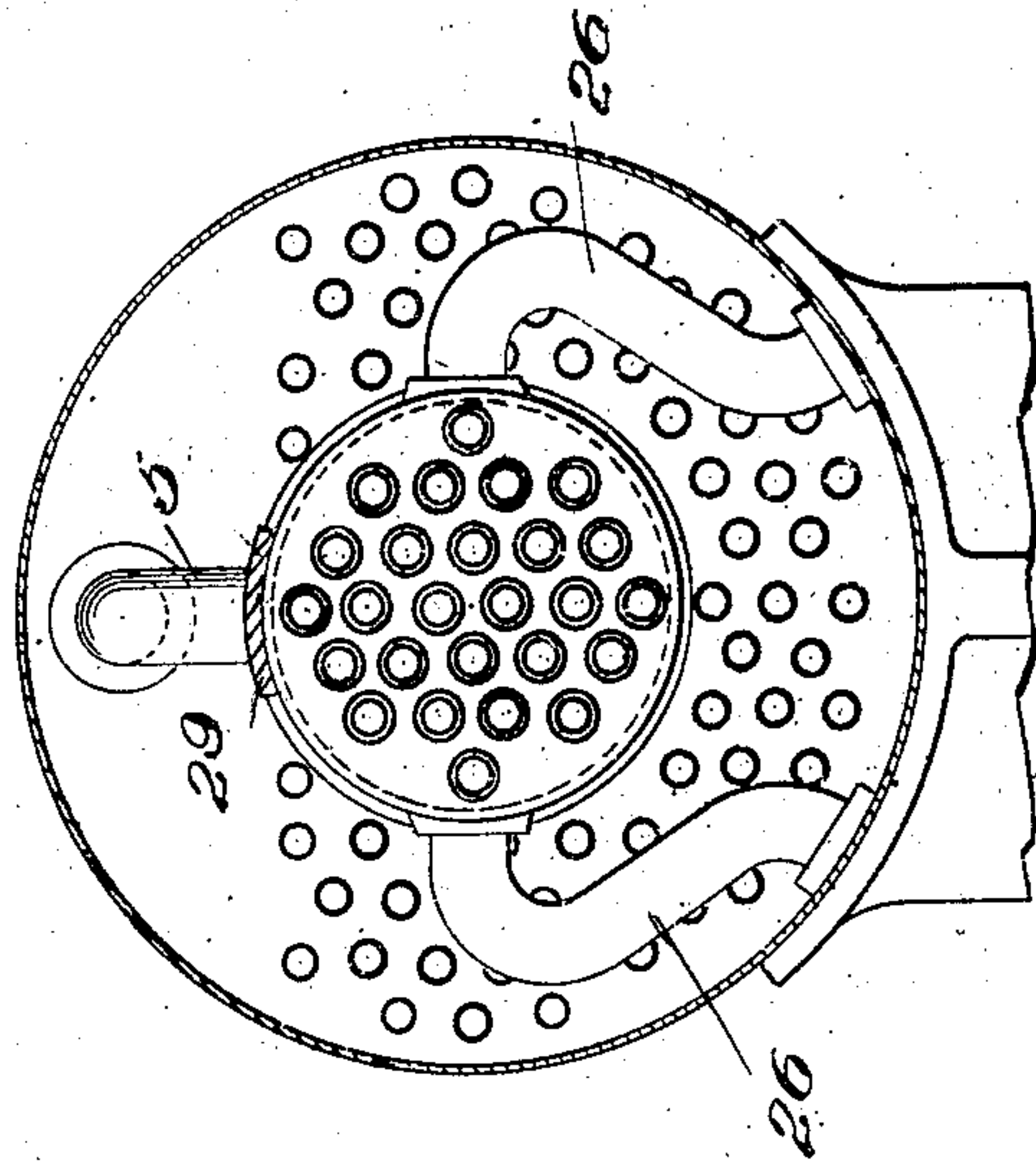


Fig. 6.

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For Invention

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UNITED STATES PATENT OFFICE.

FRANK A. HAUGHTON, OF SCHENECTADY, NEW YORK.

STEAM GENERATOR AND SUPERHEATER.

No. 847,407.

Specification of Letters Patent.

Patented March 19, 1907.

Application filed April 8, 1905. Serial No. 254,544.

To all whom it may concern:

Be it known that I, FRANK A. HAUGHTON, a subject of the King of Great Britain, and a resident of Schenectady, State of New York, have invented certain new and useful Improvements in Steam Generators and Superheaters, of which the following is a specification.

My invention relates to an improvement in steam-generators and steam-superheaters, and has for its object to provide an effective superheater in combination with a steam-generator that will give a high temperature of superheated steam and at the same time be simple, practical, and accessible in arrangement.

One of the principal defects common to many forms of superheaters is the obstruction of the flues or fire-tubes by the superheating apparatus, which either interferes with the draft or causes the lodgment of cinders and sparks in the said flues or fire-tubes to such an extent as to entirely close them, which not only impairs or entirely prevents superheating, but causes great inconvenience because of the fact that they have to be cleaned out frequently.

Another common objection to many forms of superheaters is the inaccessibility of the parts in making repairs and the large number of joints, which are likely to leak and give trouble.

It is my aim to overcome all such objections by this invention, the preferred form of which is described in the following specification and accompanying drawings.

Figure 1 shows a longitudinal section of a tubular or locomotive boiler constructed in accordance with my invention with the superheater removed. Fig. 2 is a cross-section of Fig. 1 on line 2 2. Fig. 3 is a longitudinal section of one form of the superheater. Fig. 4 is a front elevation of the superheater. Fig. 5 is a longitudinal sectional elevation of the boiler and superheater assembled. Fig. 6 is a section taken on line 6 6. Fig. 7 is a longitudinal section of a modified form of superheater. Fig. 8 is an enlarged sectional view of the front end of the superheater shown in Fig. 3. Fig. 9 is a cross-section on line 9 9, Fig. 8.

Referring to Fig. 1, 1 is a boiler of the fire-tube or locomotive type.

2 is the fire-box, 3 the smoke-box, 4 the steam-dome, and 5 the dry pipe leading from

near the top of the dome into the superheater, as will be hereinafter described.

6 is a throttle-valve by which steam is admitted into the dry pipe.

7 is a chamber, preferably cylindrical, which opens into the smoke box 3 and extends back into the boiler toward the fire-box 2. This chamber is composed of the side walls 8, which are the walls of the boiler and at its back end terminate in a head 9.

10 are short fire-tubes which extend from the fire-box tube-sheet 11 to the head 9 and which are preferably expanded into the tube-sheet and the head to make them steam-tight. Preferably and as shown these tubes project from the head 9 for a short distance for a purpose to be hereinafter described. Around the chamber 7 are the fire-tubes 12, which extend from the fire-box tube-sheet 11 to the head 13 at the front end of the boiler. These tubes convey the products of combustion directly from the fire-box to the smoke-box in the ordinary manner.

The position of the chamber 7 in the boiler is shown in Fig. 2, from which it will be observed that the chamber is almost surrounded by the tubes 12, which are of normal length—that is, they extend the full distance from the fire-box tube-sheet to the front tube-sheet 13.

Referring to Fig. 3, 14 is a cylindrical steam-tight chamber which forms the superheater and has flat ends 15 16 and is provided with a number of fire-tubes 17, extending clear through the chamber and heads 15 16, the tubes preferably extending beyond the head 15, as shown. The tubes 17 are equal in number to the number of short tubes 10 and are spaced the same distance apart, tube for tube, but of a slightly-greater diameter, so that when the superheater 14 is placed within the chamber 7, as shown in Fig. 5, the tubes 17 of the superheater will register with and telescope over the openings of the tubes 10 in the head 9, thereby causing each tube in the superheater, together with each respective tube of the boiler, to constitute a continuous and unobstructed passage for the gases of combustion from the fire-box 2 to the smoke-box 3.

As will be observed in Fig. 5, I preferably make the diameter of the tubes 12 in the superheater somewhat larger than the tubes 10, so that the projecting ends of the tubes 12 will overlap the projecting ends of the

tubes 10 in the manner of a telescope, thus insuring a perfect register of the tubes and an uninterrupted passage through each and all of them.

In the preferred form of my superheater I provide a chamber 18, into which the steam passes as it enters by the opening 19, to which is connected the end of the dry pipe 5, as shown in Fig. 5. The chamber 18 is formed by the partition 20, which extends across the front end of the superheater, as best shown in Fig. 9.

21 is a vertical partition extending from the side wall of the superheater to the partition 20. This side wall is provided with openings 22, through which the tubes 17 can pass, and the tubes are made steam-tight in the openings.

23 is an opening made in the partition 21, and 24 is a pipe which preferably, and as shown, is provided with a double wall having a space between the walls which extends back from the partition 21, as shown in Figs. 3 and 8. This pipe terminates a short distance from the rear wall 15 and serves to conduct the steam as it enters the superheater from the boiler back to the rear of the superheater.

25 25 are the openings by which the steam leaves the superheater, these openings being located outside the chamber 18. Consequently the steam entering the superheater by the opening 19 has to pass through the pipe 24, where it is heated by the tubes within the pipe, and then back outside the pipe and among the tubes outside the pipe, till, finally, when it reaches the openings 25, to which the pipes 26 are connected and which lead to the cylinders, the steam is in a highly-superheated and dry state.

I preferably make the walls of the pipe 24 double, as shown, in order that the steam in the pipe may not affect the steam which surrounds the pipe, as the latter has been raised to a much higher temperature.

While I prefer to cause the steam to circulate among the fire-tubes by the means just described, it is evident that such means are not essential to the superheating of the steam, and they may, if desired, be entirely omitted, or the baffle-plates 27 27 28 (shown in the modification illustrated in Fig. 7) may be used. Referring to this latter figure, it will be seen that by arranging the plates as there shown—that is, with the plates 27 27 extending from the front wall 16 toward the rear wall and the plate 28 extending from the rear wall toward the front wall and located between the plates 27—the steam is caused to traverse the path indicated by the arrows and come into intimate contact with the tubes.

The distance from the fire-box tube-sheet 11 to the head 9 is sufficient to permit the hot gases from the fire-box passing through

the tubes 10 to give up a sufficient amount of heat to the water in the boiler as will reduce the temperature of the gases below a point that would injure the superheater and at the same time short enough to permit the gases to reach the superheater at a sufficient temperature to obtain the desired degree of superheat.

In Fig. 5 I show the usual smoke-box diaphragm 29. Behind this diaphragm I preferably mount a damper 30, which is hinged at 31 and operated by means of any suitable mechanism in control of the engineer or automatically closed when the throttle-valve is closed and automatically opened when the throttle is opened. The object of this damper is to close up the ends of the superheater-tubes or to partially close them, thereby reducing or entirely stopping the flow of hot gases through the superheater fire-tubes. This is desirable when the throttle-valve is closed, and consequently no steam is passing through the superheater.

It will be noticed that in the form of my invention shown the forward end of the superheater extends beyond the front of the boiler in order to facilitate the coupling of the intake and outlet pipes for the steam. It will be seen that this entire arrangement is of an extremely simple and practical character, the fire-tubes are entirely free from any obstruction, and the smoke-box is no more obstructed than the ordinary boiler without a superheater. It will also be observed that the space between the shell of the superheater and the wall of the chamber 7 acts as an effective jacket to maintain the high temperature of the steam passing through the superheater.

While I have shown and described what I believe to be the preferred form of my invention, I desire to have it understood that many changes may be made in the form, construction, and arrangement of parts without departing from the spirit of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a boiler provided with fire-tubes, of a superheater provided with fire-tubes, the superheater being inclosed within the boiler and surrounded by the boiler-tubes.

2. The combination with a tubular boiler provided with a chamber surrounded by the tubes of the boiler, a superheater separate from the boiler and provided with fire-tubes, the tubes of the superheater registering with corresponding tubes of the boiler.

3. The combination with a tubular boiler having a chamber formed in one end thereof, a superheater provided with fire-tubes located in the chamber, the tubes of the superheater registering with corresponding tubes of the boiler.

4. A fire-tube boiler in combination with a tubular superheater independently separable from the boiler, the superheater inclosed within the tubular boiler, the tubes of the superheater registering with corresponding tubes of the boiler.

5. A fire-tube boiler in combination with a tubular superheater independently separable from the boiler, the superheater inclosed within the tubular boiler, the tubes of the superheater registering with corresponding tubes of the boiler, means to deflect the steam entering the superheater in contact with its radiating-surface.

6. A fire-tube boiler in combination with a tubular superheater independently separable from the boiler, the superheater being contained within the boiler, the tubes of the superheater registering with corresponding tubes of the boiler.

7. A boiler in combination with a tubular superheater independently separable from the boiler, the superheater being contained within the boiler, and means to deflect the steam entering the superheater in contact with its radiating-surface.

8. A tubular boiler provided with a cylindrical chamber extending inward from one end of the boiler, the inner end of said chamber terminating in a tube-head, said chamber being connected with the fire-box by fire-tubes extending from the fire-box to the head of said chamber, in combination with a superheater consisting of another chamber located within the aforesaid chamber and provided with fire-tubes which register with the aforesaid fire-tubes.

9. The combination with a tubular boiler having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, the fire-tubes of the superheater registering with the fire-tubes of the boiler which enter the chamber.

10. The combination with a tubular boiler having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, the fire-tubes of the superheater registering with the fire-tubes of the boiler which enter the chamber, the fire-tubes of the superheater exceeding the diameter of those of the boiler, the fire-tubes of both boiler and superheater extending beyond their respective heads and telescoping with each other, tube for tube.

11. The combination with a tubular boiler having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, the fire-

tubes of the superheater registering with the fire-tubes of the boiler, the superheater extending beyond the tube-head of the boiler with the steam inlet and outlet connections located on the extending portion of the superheater.

12. The combination with a tubular boiler having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, a central longitudinal passage within the superheater embracing a portion of its fire-tubes through which the steam is conducted and outside of which the steam returns in the opposite direction to the outlet from the superheater.

13. The combination with a tubular boiler having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, a central longitudinal passage within the superheater embracing a portion of its fire-tubes through which the steam is conducted and outside of which the steam returns in the opposite direction to the outlet from the superheater, said central passage having a wall of double thickness with insulating-space between the walls.

14. The combination with a tubular boiler having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, and a movable damper to cover and uncover the outer end of the superheater-tubes.

15. The combination with a tubular boiler, having a chamber extending inwardly from the head of the boiler, of a superheater consisting of a chamber having a plurality of fire-tubes, the superheater being contained within the chamber in the boiler, and means within the superheater to circulate the steam completely in contact with the fire-tubes of the superheater.

16. A tubular boiler of the fire-tube type in combination with a superheater of the same variety, the generator being so constructed as to embrace within itself the superheater, the tubes of both registering and the two being independently separable.

17. A tubular boiler of the fire-tube type in combination with a superheater of the same variety, the generator being so constructed as to embrace within itself the superheater, the tubes of both registering and the two being independently separable, a portion of the generator-chamber being interposed between the fire-box and the superheater.

18. A tubular boiler of the fire-tube type in combination with a superheater of the

same variety, the generator being so constructed as to embrace within itself the superheater, the tubes of both registering and the two being independently separable, a portion of the generator-chamber being interposed between the fire-box and the superheater, and means to deflect the steam entering the superheater in contact with its radiating-surface.

10 19. A tubular boiler of the straight-tube type in combination with a superheater of the same variety, the generator being so constructed as to embrace within itself the superheater, the tubes of both registering and
15 the two being separable, a portion of the generator-chamber being interposed between the fire-box and the superheater, and means to deflect the steam entering the superheater in contact with its radiating-surface, the superheater extending sufficiently beyond the
20 generator to allow for the intake and output steam connections.

20. The combination with a tubular boiler having a chamber extending inwardly from
25 the head of the boiler, of a superheater consisting of a chamber having a plurality of

fire-tubes, the superheater being contained within the chamber in the boiler, the fire-tubes of the superheater registering with the fire-tubes of the boiler which enter the chamber; a head for said superheater secured thereto and extending beyond the generator; said head being formed in one piece and in itself forming two chambers adapted to cooperate with the structure of the superheater, the one chamber having an inlet-port to receive the steam and the other chamber outlet-ports through which to discharge the same.

21. In a steam-boiler, the combination of a steam-chamber, a series of superheating-tubes passing through said steam-chamber and fire-tubes arranged on both sides of said steam-chamber, substantially as described.

Signed by me at New York city, county and State of New York, this 17th day of March, 1905.

FRANK A. HAUGHTON.

Witnesses:

JANE GONYNGE,
WENDELL P. BARKER.