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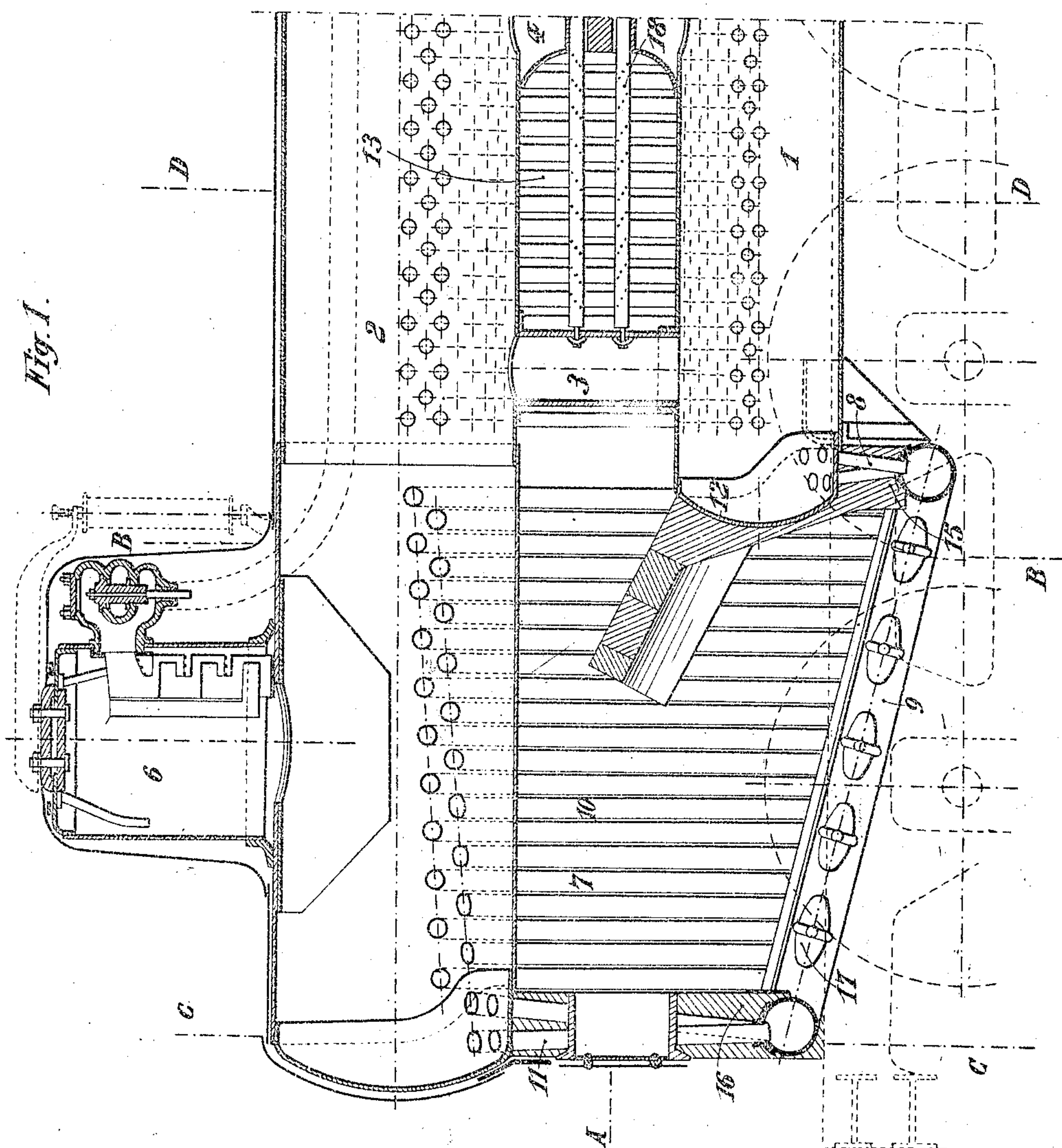
PATENTED FEB. 13, 1906.

J. ROBERT.

WATER TUBE LOCOMOTIVE BOILER.

APPLICATION FILED MAY 4, 1906.

6 SHEETS—SHEET 1



Witnesses:
William T. Jones.

E. J. Keeler

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Jacques Robert
By James L. Norris.

Ch. 1

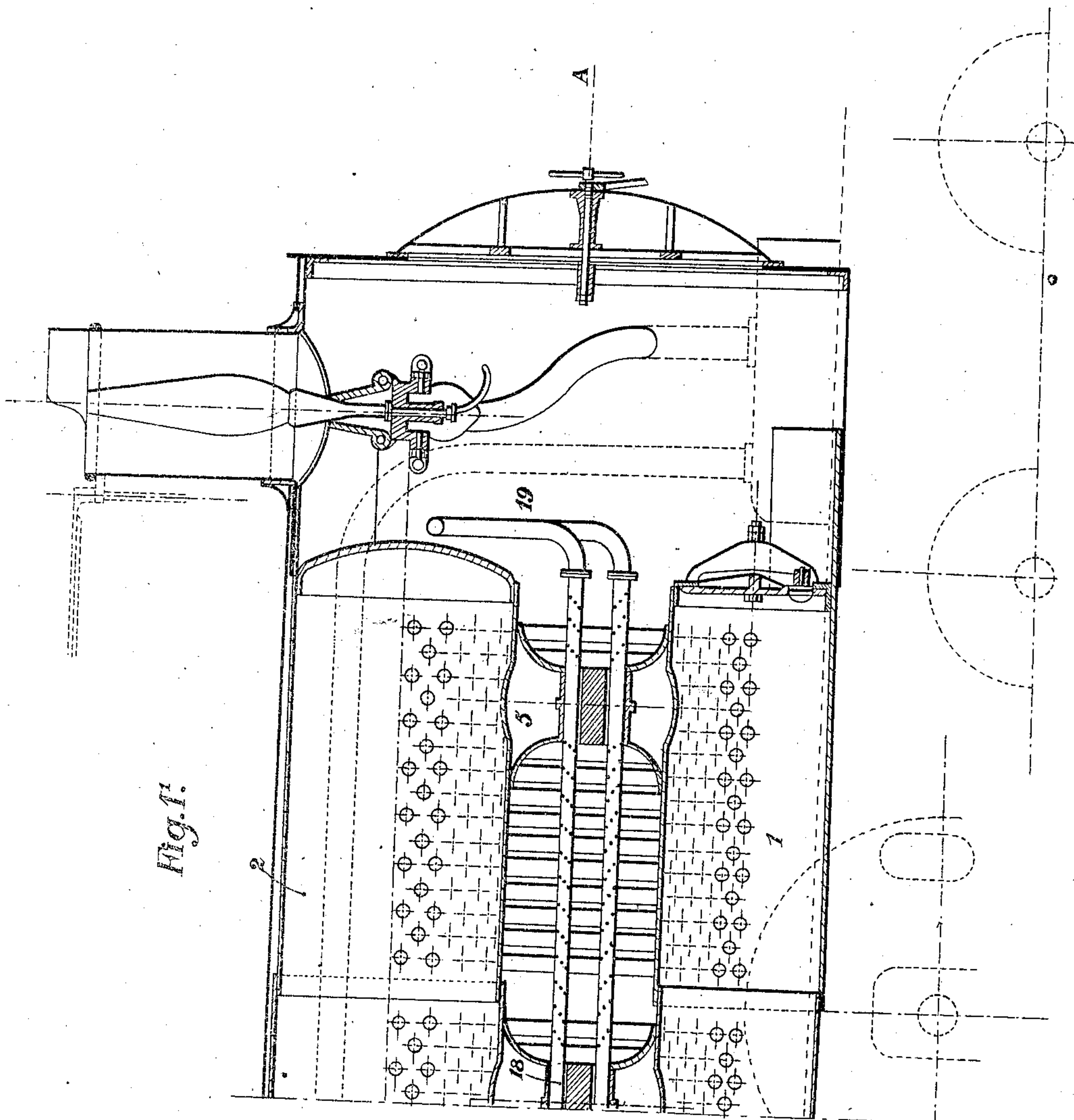
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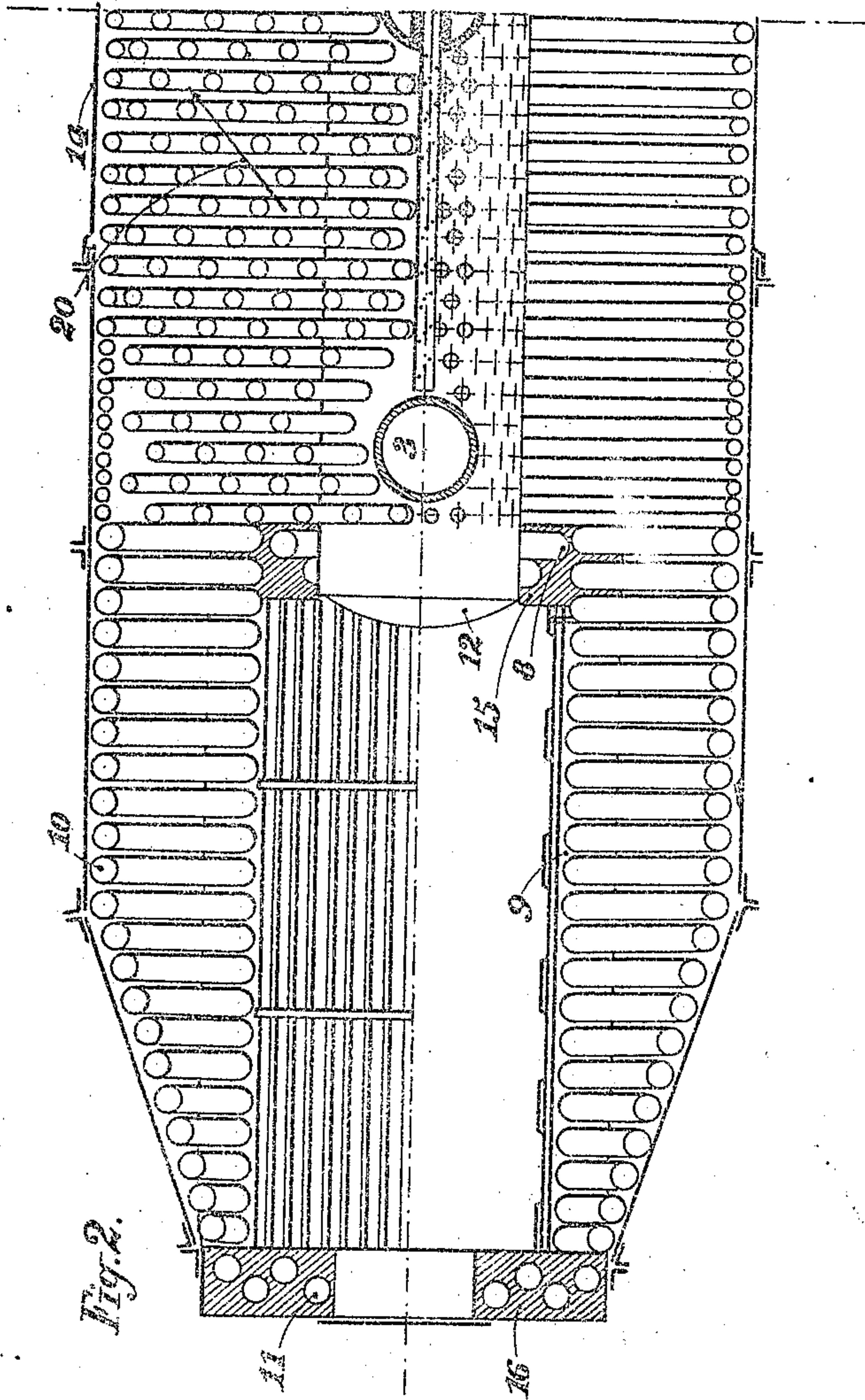
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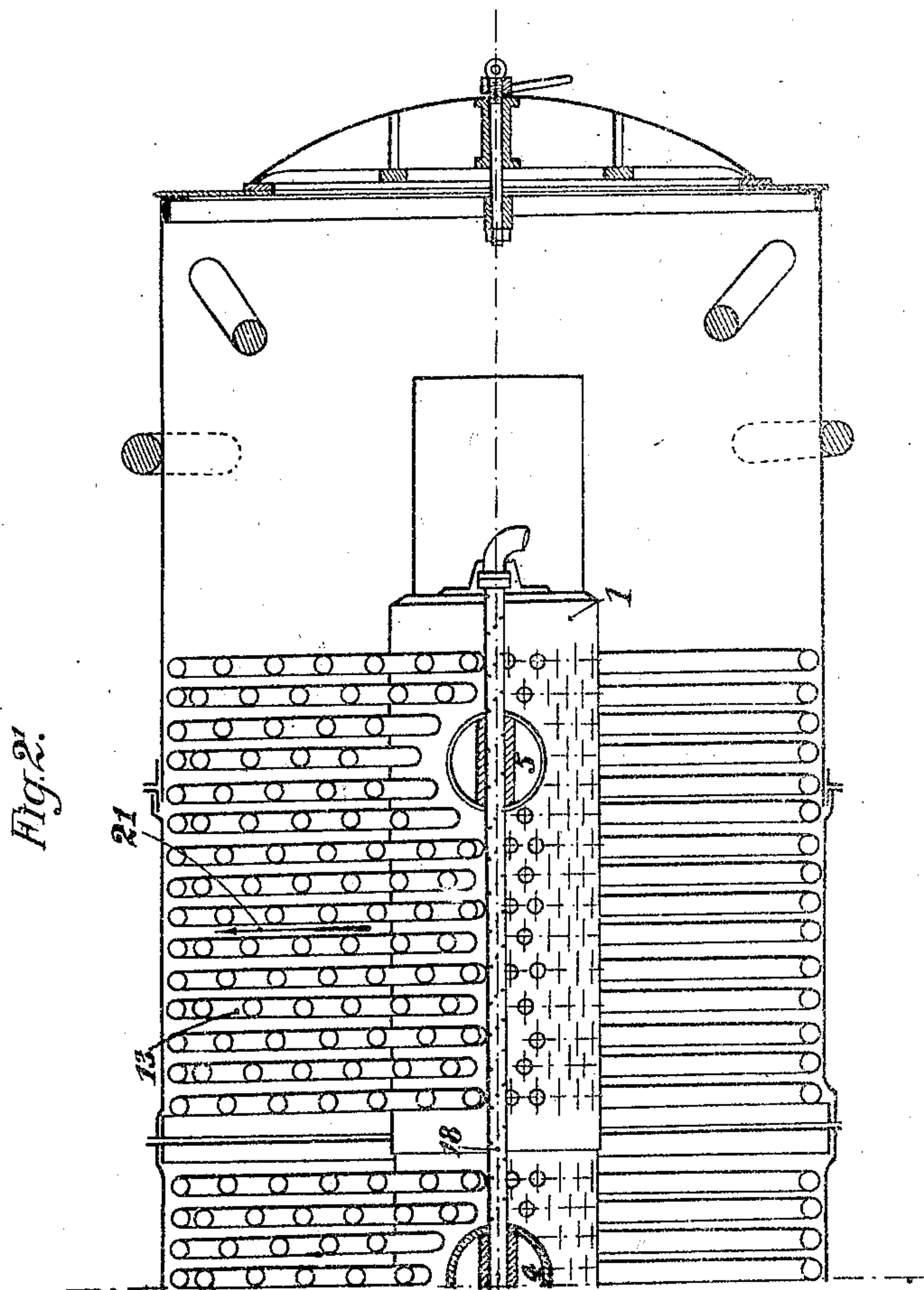
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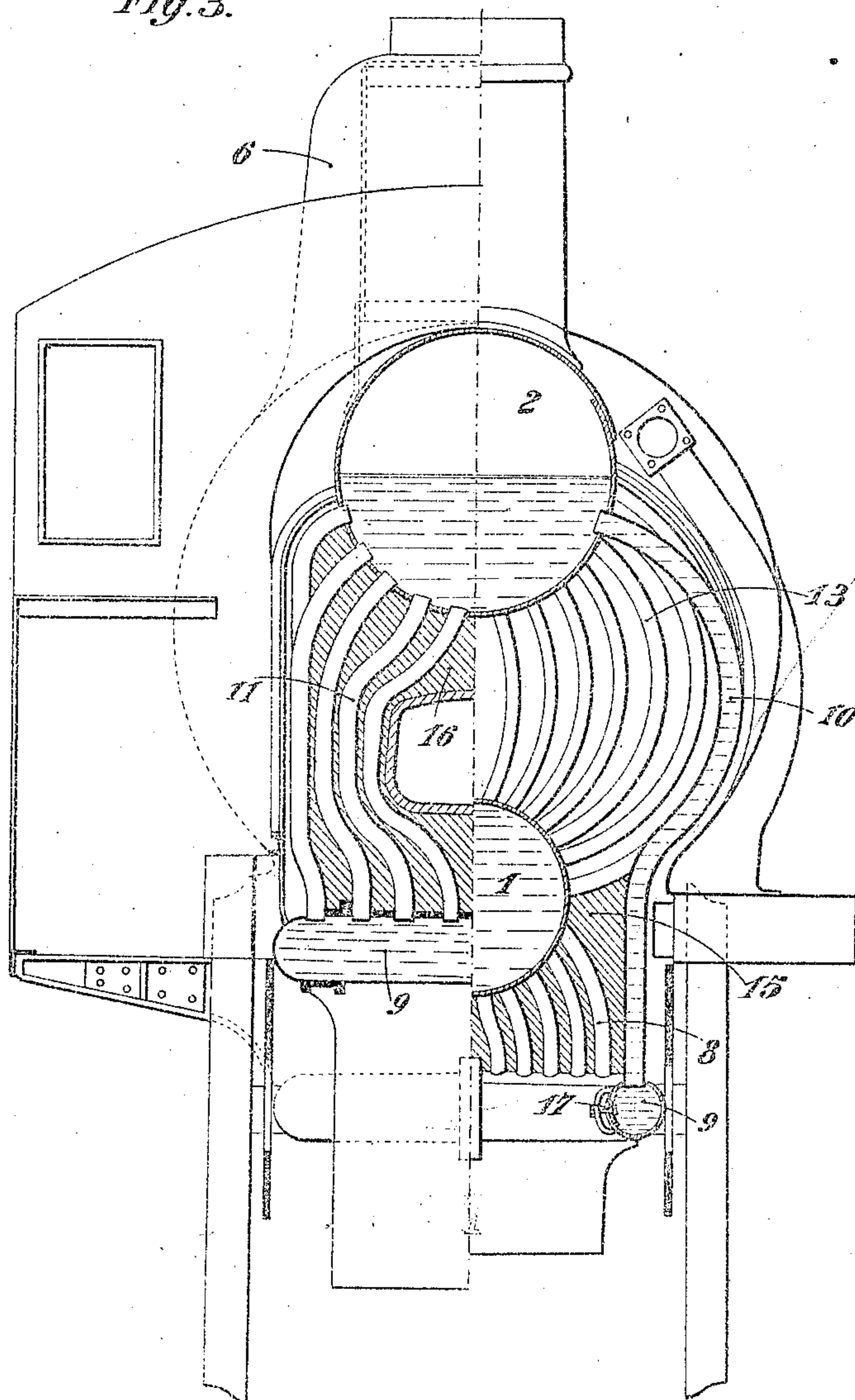
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6 SHEETS—SHEET 5.

Fig. 3.



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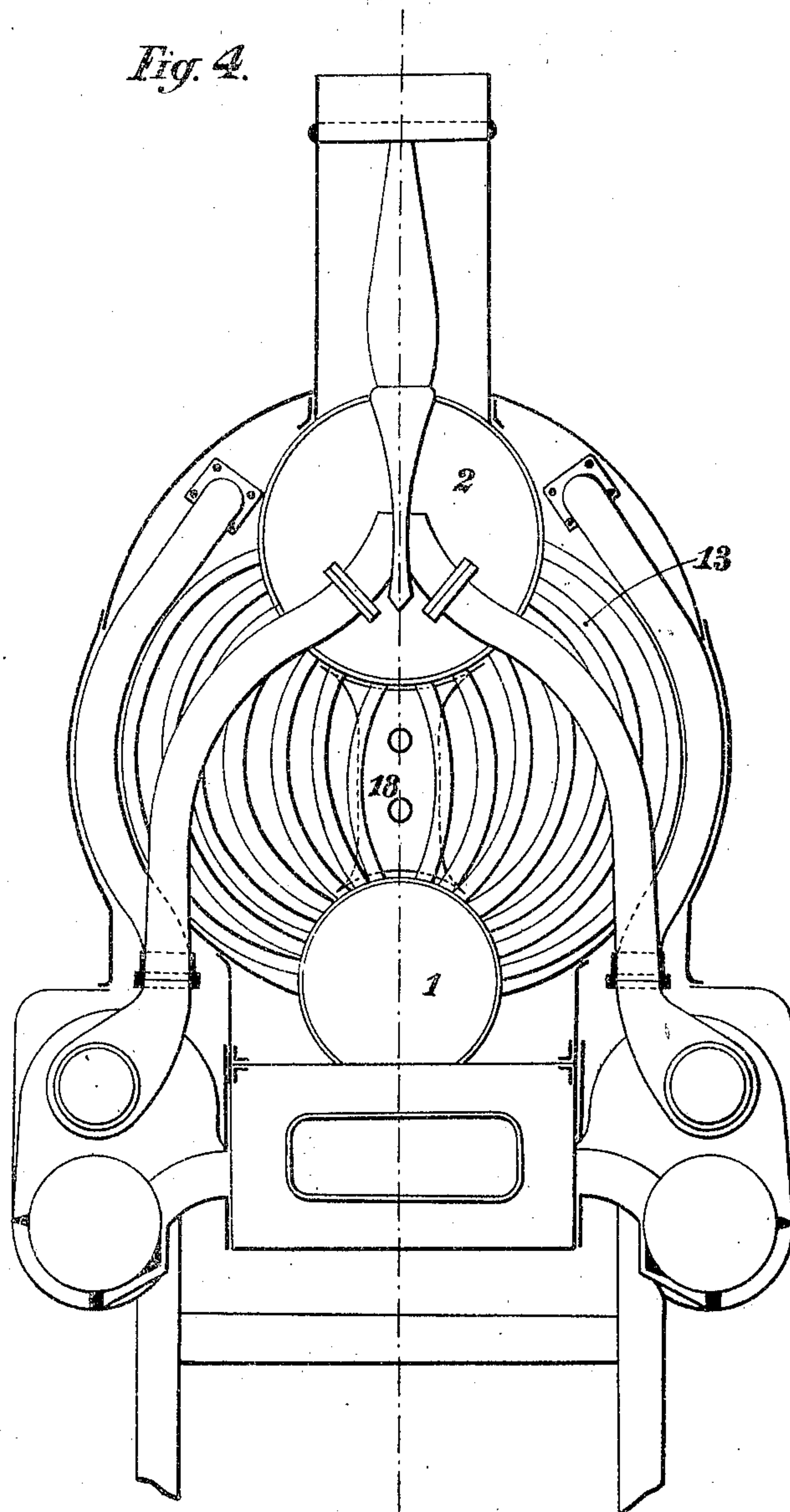
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6 SHEETS—SHEET 6.



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UNITED STATES PATENT OFFICE.

JACQUES ROBERT, OF ALGIERS, ALGERIA.

WATER-TUBE LOCOMOTIVE-BOILER.

No. 812,681.

Specification of Letters Patent.

Patented Feb. 13, 1906.

Application filed May 4, 1905. Serial No. 253,857.

To all whom it may concern:

Be it known that I, JACQUES ROBERT, engineer, a citizen of the French Republic, residing at Algiers, Algeria, have invented certain new and useful Improvements in Water-Tube Locomotive-Boilers, of which the following is a specification.

This invention consists of improvements in internally-fired water-tube locomotive-boilers, the object being to secure a better utilization of heat, to facilitate the cleaning or sweeping of the water-tube clusters, and to allow of the ready removal of the scale which accumulates in the base of the fire-box.

The invention further consists of improvements in the arrangement of the parts of the boiler whereby the examination and cleaning thereof are more readily effected and return-water-pipe joints requiring frequent renewal are dispensed with.

In the accompanying drawings, Figure 1 shows a longitudinal section of a portion of a boiler constructed in accordance with this invention. Fig. 1' is a continuation of the section shown by Fig. 1. Fig. 2 is a horizontal section through the part of line *a a* shown by Fig. 1. Fig. 2' is a continuation of the section through the line *a a* as shown by Fig. 1'. Fig. 3 is a transverse section through the machine, the right-hand side of the figure being taken through the line *b b* of Fig. 1 and the left-hand side taken through the line *c c* of Fig. 1'. Fig. 4 is a transverse section through the line *d d* of Fig. 1.

The boiler constructed in accordance with this invention consists of two barrels or cylindrical bodies 1 2, the axes of which are situated in the central vertical plane of the boiler. These two barrels 1 2 are connected to each other by three short vertical connection-tubes 3 4 5. The upper barrel 2 carries the steam-dome 6. The lower barrel 1 contains only water and is shorter than the upper barrel, but is connected by return water-pipes 8 to a rectangular hollow foundation-ring 9, forming the base of the fire-box 7 and connected with the upper barrel 2 by vertical water-tubes 10, which form the sides of the fire-box, return water-tubes 11 forming the rear side of the fire-box. The upper part of the front end of the fire-box 7 is constituted by the end 12 of the lower barrel 1. Refractory material fills up both at the front and back of the fire-box the spaces between the tubes. The upper and lower barrels 2 1 are

also connected by clusters of curved water-tubes 13, which are arranged in transverse rows, Fig. 2, instead of longitudinal rows, as hitherto practiced. The outer of these last-named water-tubes do not form, as hitherto, continuous walls extending from the fire-box to the smoke-box; but at a short distance from the fire-box they cease to be in close contact, and the spaces between them are not filled up, and thus allow the sweeping brush to pass between the tubes. Sheets of metal on the outside of the fire-box tubes and of the tube clusters nearest to the fire-box, and farther on hinged doors 14, mounted on frames of iron of inverted-T section, prevent cold external air from entering the boiler.

By this arrangement the important advantages secured are that the hot gases impinging against the tubes are compelled to pass round them, so that the heat is better utilized and the sweeping or cleaning of the tube clusters is much more easily performed. Hitherto this sweeping or cleaning has been effected from the smoke-box end by means of a long heavy rod which bent under its own weight and carried at one end a spiral brush of inconvenient shape, which was liable to become jammed between the tubes, the longitudinal faces of which only were acted upon by the hot gases and were only swept while the perpendicular faces presented toward the fire-box were not swept. The sweeping or cleaning is in the present arrangement done from the outside of the boiler by opening the aforesaid hinged doors 14 and using a short and light rod carrying at one end a flat brush, which is passed between the parallel transverse rows of tubes, which are at such distances apart that the faces of the said tubes impinged upon by the gases are quickly and thoroughly swept or cleaned without the brush becoming wedged between the tubes. The first part of the tube clusters—that is, the part close to the fire-box, consisting of tubes in close contact—is swept or cleaned at the same time as the other part by passing the brush through the zigzag spaces between the tubes; but when the boiler is cold this part of the tube clusters may be swept from the inside of the fire-box.

The joints of the return-pipes formerly used to connect the two barrels to the hollow foundation-ring had often to be remade on account of the varying stresses they were subjected to. Furthermore, these return-

pipes are difficult to arrange in inside locomotive cylinder-engines and in those having large coupled trailing wheels. These return-tubes are in the present arrangement replaced by the return water-tubes 8 11, (of large diameter,) forming the front and rear faces of the fire-box and having their ends expanded into the hollow foundation-ring and into the lower parts of the barrels. The lining of refractory material protects the said return-tubes 8 and 11 against the injurious action of the fire.

The cross-sectional area of the hollow foundation 9, forming the base of the fire-box, has hitherto often been made rectangular, and for the purpose of expanding the water-tube ends thereto it has been provided on its lower face with as many screw-plugs as there are water-tubes; but it has had only three sides, the front side of the base being omitted so as to allow the longer sides of the base to be connected with the lower barrel 1 by means of return-pipes of large cross-sectional area. In the improved boiler according to this invention the foundation-ring or base is four sided and its cross-section is circular. Hand-holes 17, suitably arranged, permit of expanding the ends of the vertical water-tubes 8 10 11, forming the sides of the fire-box 7, and also of examining the ends of these tubes to ascertain whether they are obstructed by or clear of scale or other foreign bodies. The scale from the vertical water-tubes is removed through these hand-holes 17. The said foundation-ring or base 9 may be made of cast-steel by molding or of plates of metal riveted to a wrought-iron frame provided with holes for the reception of the ends of the tubes.

An active circulation of water and steam is set up in this improved boiler. The water mixed with steam in the vaporizing-tubes 10 13 moves rapidly upward, rushes into the upper barrel 1, wherein it separates from the steam and then returns, through the vertical connection-tubes 3 4 5 between the two barrels, into the lower barrel 1, which feeds the tube clusters, while the down-comers or return-pipes 8 11 at the front and back of the fire-box 7 return the water to the hollow foundation-ring or base 9, whence it again rises in the tubes forming the sides of the fire-box and in the tube clusters. This circulation of the water is very favorable to the transmission of heat; but it is necessary that both the inside and the outside heating-surfaces should be kept very clean. The cleaning of the inner surfaces is very easily done, as it is possible for a man to enter the barrels to remove therefrom any deposit, while the scale can be detached by hand from the water-tubes by means of cylindrical scrapers having somewhat the shape of tulips (the petals of which are made springy) and fixed to the end of a flexible rod, or the scale may be detached by

means of mechanical grinders attached to the end of a flexible shaft actuated by any suitable power.

For the cleaning of the outer surfaces of the tubes the hand-sweeping, hereinbefore referred to, is not alone relied upon, for an apparatus is provided which enables the cleaning of the tubes to be effected by steam in a few minutes on the road. This apparatus consists of iron or steel pipes 18, arranged between the tube clusters and supported at one end by the rear vertical tube 3, connecting the two barrels. These pipes are provided with perforations opposite to the spaces between the water-tubes, so that one of the perforated pipes serves to sweep the tubes in an oblique direction (arrow 20)—that is, along the zigzag spaces between the tubes—while the other perforated pipe serves to sweep the water-tubes along the spaces between their transverse rows (arrow 21.) The said perforated pipes are connected to a double-plug steam-valve capable of working like two independent steam-cocks. To operate this steam-cleaning apparatus, the plug-valve and the ordinary blower are opened one after the other, and numerous steam-jets are thus produced which are projected in either of the aforesaid directions and then in the other direction with sufficient force to sweep off the soot and ashes deposited on the water-tubes, the soot and ashes being discharged into the smoke-box, from which they are expelled through the chimney by the action of the ordinary blower-pipe.

Having thus described and ascertained the nature of my invention and in what manner the same may be performed, I declare that what I claim is—

1. An internally-fired water-tube locomotive-boiler having an upper barrel or cylindrical body, a lower barrel or cylindrical body, vertical connection-tubes vaporizing curved tubes arranged in transverse rows, which are sufficiently spaced for allowing of hand-sweeping, connecting said barrels or cylindrical bodies, lateral doors for the sweeping, a rectangular hollow foundation-ring forming the base of the fire-box and means for connecting by vaporizing and return water-tubes said hollow foundation-ring to the upper and lower barrels or cylindrical bodies while protecting the return water-tubes from the direct heat of the fire, substantially as described.

2. In a boiler of the character referred to having upper and lower barrels or cylindrical bodies and a hollow foundation-ring at the base of the rear thereof, return water-tubes connecting the lower barrel or cylindrical body and fore part of hollow foundation-ring, and forming the fore side of the fire-box, return water-tubes connecting the upper barrel or cylindrical body and the rear part of the hollow foundation-ring, and forming the rear side of the fire-box, lining of refractory mate-

rials protecting said tubes against the injurious action of the fire, vaporizing - tubes forming the sides of the fire-box and connecting the hollow foundation-ring and the upper barrel or cylindrical body, substantially as described.

3. A boiler having upper and lower barrels, a hollow foundation-ring forming the base of the fire-box and circular in cross-section, the ring being provided with manholes, return water-tubes between the lower barrel and fore part of the ring and between the rear of the latter and upper barrel, and other tubular means connecting the barrels.

4. A water-tube locomotive-boiler of the class specified, having upper and lower barrels with an intermediate space, inner connecting - tubes between the barrels, outer curved vaporizing-tube clusters arranged in transverse rows and also connecting the barrels, and perforated steam-pipes extending longitudinally through the space between the barrels and interiorly with relation to the tube clusters, the said perforated pipes permitting steam to be thrown outwardly there-

from for cleaning the tube clusters from the interior of the boiler.

5. A water-tube locomotive-boiler of the class specified, having upper and lower barrels with an intermediate space between them, inner connecting-tubes between the barrels, outer vaporizing-tube clusters arranged in transverse rows, and upper and lower perforated steam-pipes extending longitudinally through the intermediate spaces between the said tube clusters and also between the upper and lower barrels, the one perforated pipe being arranged to have the steam therefrom sweep the tube clusters in an oblique direction, and the other perforated pipe disposed to cause the steam therefrom to sweep the tubes along the spaces between their transverse rows.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JACQUES ROBERT.

Witnesses:

LUCIEN JULG,

FRANCOIS F. HAMBOUL.