J. H. ROSENTHAL & A. SPYER.

WATER TUBE STEAM GENERATOR.

APPLICATION FILED FEB. 16, 1909.

959,612.

Patented May 31, 1910.

3 SHEETS—SHEET 1.

Fig. 4.

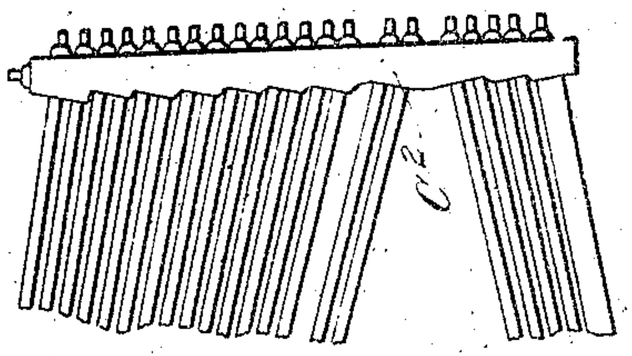
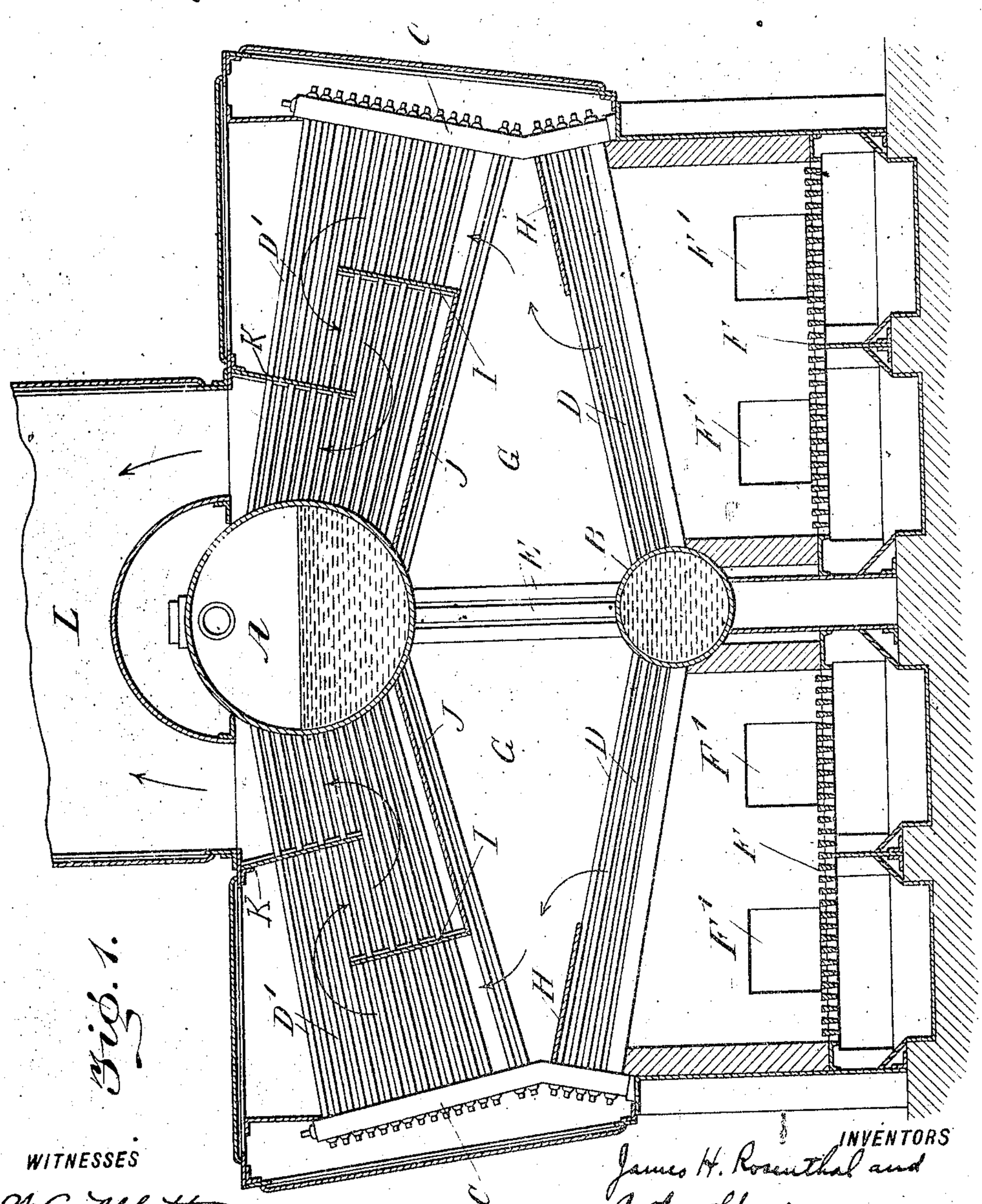


Fig. 1.



WITNESSES

W. C. Abbott

R. B. Cavanagh.

INVENTORS

James H. Rosenthal and

Arthur Spyer

BY

Jiffard & Bull

ATTORNEYS

959,612.

J. H. ROSENTHAL & A. SPYER.

WATER TUBE STEAM GENERATOR.

APPLICATION FILED FEB. 16, 1909.

Patented May 31, 1910.

3 SHEETS—SHEET 2.

Fig. 6.

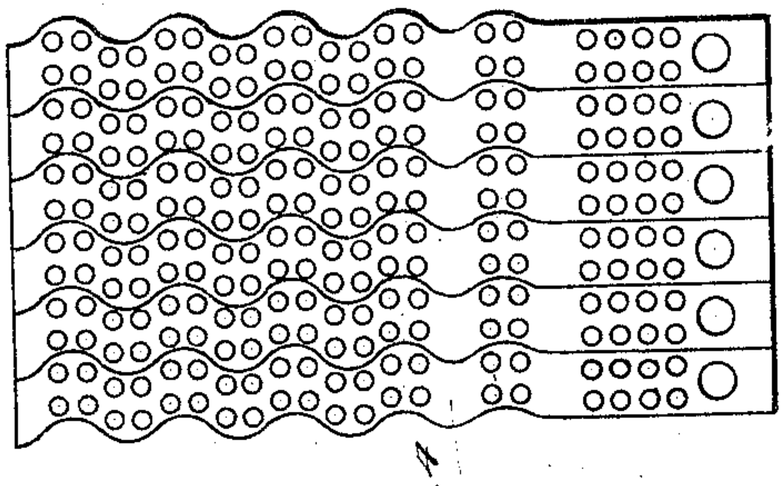
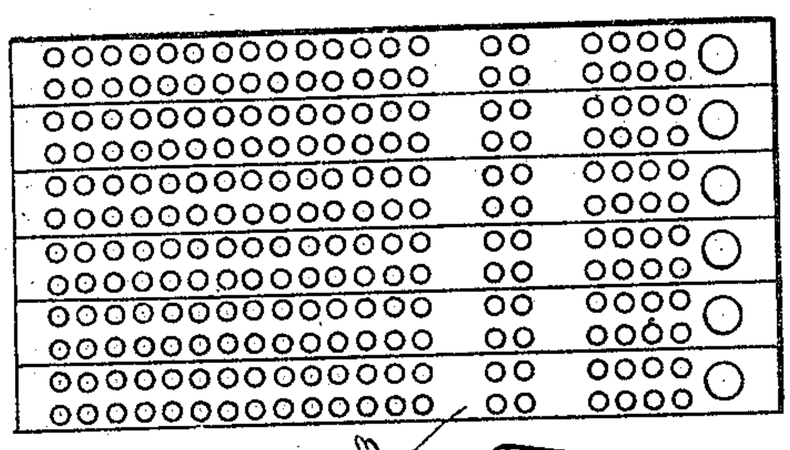


Fig. 5.



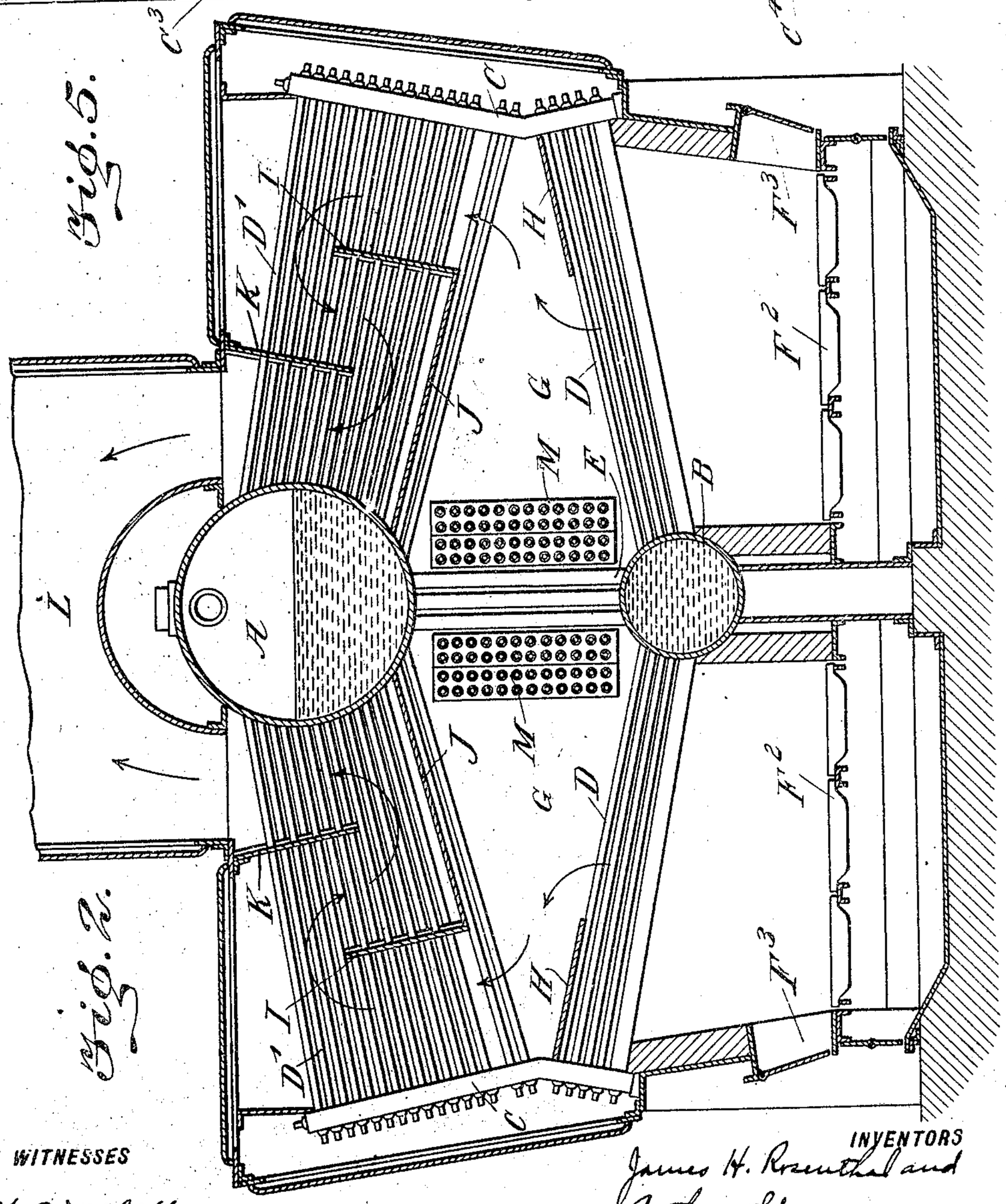


Fig. 2.

WITNESSES

H. C. Abbott

R. B. Cavanagh

INVENTORS

James H. Rosenthal and

Arthur Spyer

BY

Gifford & Bull

ATTORNEYS

J. H. ROSENTHAL & A. SPYER.

WATER TUBE STEAM GENERATOR.

APPLICATION FILED FEB. 16, 1909.

959,612.

Patented May 31, 1910.

3 SHEETS—SHEET 3.

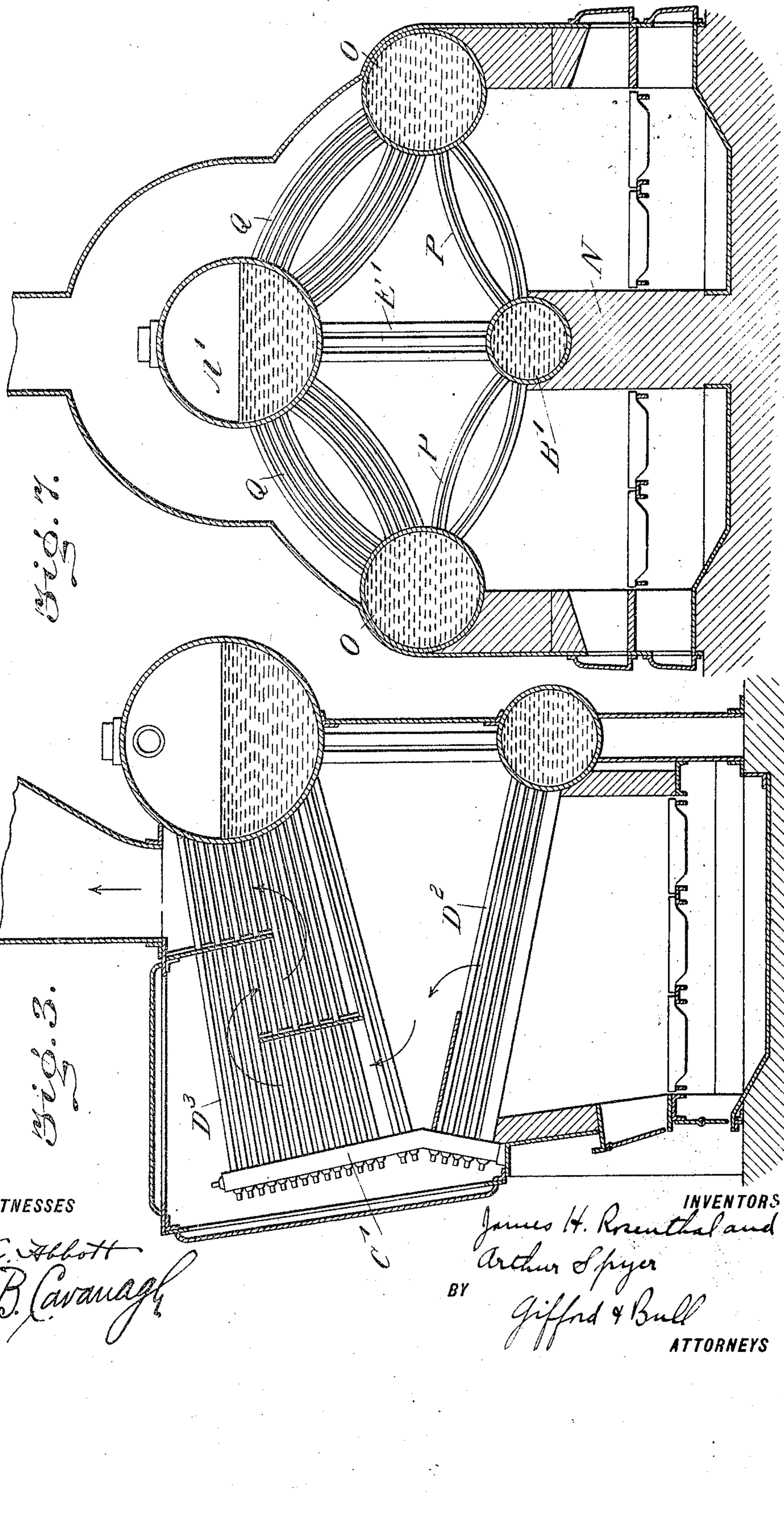


Fig. 3.

WITNESSES

H. C. Abbott

R. B. Cavanagh

INVENTORS

James H. Rosenthal and

Arthur Spyer

BY

Gifford & Bull

ATTORNEYS

UNITED STATES PATENT OFFICE.

JAMES H. ROSENTHAL AND ARTHUR SPYER, OF LONDON, ENGLAND, ASSIGNORS TO THE BABCOCK & WILCOX COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

WATER-TUBE STEAM-GENERATOR.

959,612. Specification of Letters Patent. Patented May 31, 1910.

Application filed February 16, 1909. Serial No. 478,288.

To all whom it may concern:

Be it known that we, JAMES H. ROSENTHAL and ARTHUR SPYER, both subjects of the King of Great Britain, and residents of Oriel House, Farringdon street, London, England, have invented certain new and useful Improvements in Water-Tube Steam-Generators, of which the following is a specification.

This invention relates to a water tube steam generator of the Babcock & Wilcox type and has for its object certain modifications in the construction and arrangement of parts as hereinafter described. In general it may be stated that at one end of a single bank of tubes in a single ended boiler, and at the outer ends in a double ended boiler, we retain the system of headers associated with that type of generator, and substitute a drum at the opposite end of the bank in the former case and at the central part of the boiler in the latter case. A boiler so constructed is adapted to be fired either in a direction parallel to the axes of the tubes or in a direction transverse to the axes of the tubes. Additionally in the case of the double ended boiler, there is a substantial saving in weight.

In the accompanying drawings, wherein, by way of illustration, we have shown certain embodiments of our invention, Figure 1 is a longitudinal, sectional view through a double-ended boiler, and showing the furnaces located so as to be fired in a direction transversely of the axes of the tubes; Fig. 2 is a similar view, but showing the furnaces located to be fired in a direction parallel to the axes of the tubes; Fig. 3 is a longitudinal sectional view of a single-ended form of generator, as distinguished from the double-ended forms shown in Figs. 1 and 2; Fig. 4 is a detail sectional view and side elevation showing the water tubes as connected to stepped-end headers, as distinguished from inclined headers shown in Figs. 1–3; Fig. 5 shows headers suitable for straight tube spacing; Fig. 6 shows headers inclined for a zigzag, sinuous or staggered spacing of the tubes; Fig. 7 is a sectional view showing the employment of drums in the place of headers.

Referring now especially to Figs. 1 and 2 of the drawings, the improved generator comprises the steam drum A, the bottom water drum B, the two sets of end headers C, C, one set at each end, the inclined water-circulating tubes D, D, connecting the bottom drum B to the end headers C, and the upper banks or groups of the tubes D′, D′, connecting the headers C and the steam drum A. The steam drum A in turn is connected with the lower water drum B by the down-comer tubes E provided for the return circulation of the water from the drum A to such drum B. The steam drum A and the water drum B with the connecting down-comer tubes E are thus placed centrally of the boiler, the banks of water-circulating tubes D and D respectively, extending to the headers on each side. Under each of the pairs of banks of tubes a furnace F (Fig. 1) is located, and in the instance shown in Fig. 1, these furnaces are arranged to be fired transversely to the axes of the tubes through the firing doors F′ on either or both sides.

In Fig. 2 the furnaces F^2 beneath the banks of tubes are arranged to be fired longitudinally of the axes of the tubes through the firing doors F^3 at each end of the boiler. The products of combustion in the furnaces illustrated are caused to pass over the whole of the heating surfaces.

In the arrangement of baffling shown in Figs. 1 and 2 a short, longitudinal baffle H is arranged above and parallel with each of the lower bank of tubes, the products of combustion passing such lower set through the space G between the lower and upper banks of tubes, thence vertically across the upper bank of tubes, being directed by the vertical baffle I and a longitudinal baffle J, the gases thence making a transverse pass directed by the baffle K, such gases thence passing adjacent to the steam drum and out through the up-take L. The baffling arrangement may be of any suitable and desired character and the up-take L may be arranged as shown, that is to say, in proximity to the steam drum, or it may be arranged at either end of the generator as may be found convenient.

The space between the upper and lower banks of tubes, which we have indicated by the letter G, may be employed for inserting a feed water heater or superheater M, as is shown in Fig. 2.

In Fig. 3 we have shown a modified arrangement of steam generator, in this case the boiler being single-ended and formed

with two banks of tubes, a lower bank D^2 and an upper bank D^3, said tubes connecting the lower water drum and the upper steam drum, respectively, with the header C′. Otherwise, the construction is the same as illustrated for the double-ended boiler.

It will, of course, be understood that the headers employed in connection with our generator may be of any suitable type, or drums may be employed in place of the headers. For instance, in Fig. 4, we have shown what is known as a stepped-end header into which the tubes are expanded, said header being indicated by the reference character C^2. In Fig. 5 we have shown headers formed for straight tube spacing, such headers being indicated by the character C^3, and in Fig. 6, C^4 indicates the headers adapted to be employed for zig-zag spacing of the tubes.

In Fig. 7 we have shown still further our construction of boiler. In this case the water drum B′, suitably supported by the wall N, is connected with drums O, which we employ in the place of the headers shown in Figs. 1, 2 and 3. The lower banks of tubes P, are curved instead of being straight, as shown in the views heretofore described, and similarly, the upper banks of tubes Q, which connect the drums O with the steam drum A′, are also curved. In Fig. 7 the drum A′ is connected with the water drum B′ through the down-comers E′.

From the above description taken in connection with the accompanying drawings, the operation of the generator will be readily apparent. The steam drum and the bottom water drum being connected together by down-comer tubes, the direction of flow of the circulation is first upward through the lower bank of tubes into the headers or drums used in lieu of the headers, then upward through the headers or drums, then up through the upper bank of tubes. The mixture of steam and water is then delivered to the steam drum, whence by suitable means the steam is passed away into steam pipes, the water passing down the down-comer tubes and thence into the lower water drum.

Owing to the relatively great height of the furnace front available, the boiler is especially suitable for the adaptation of oil fuel, there being ample space for the insertion of the burners which would be required.

It will be noted that we have provided an apparatus wherein the boilers may be fired either in the direction parallel to the axes of the tubes or in a direction transverse to the axes of the tubes. It will further be seen that we may employ any of the well known types of headers, or, in lieu thereof, we may use drums as shown in Fig. 7, or, if desired, we may employ a flat water leg, suitably stayed, as may be deemed necessary.

In Figs. 1 and 2 it will be seen that the tubes are pitched closer together in a vertical plane in the steam drum and in the bottom water drum than they are in the headers, the thickness of the tube plates allowing for this and the holes in the tube plates being counterbored, as required to suit the angle of inclination of the tubes.

The circulation of the boiler is designed so as to give an especially ample water supply to the lower rows of tubes, because the water supply required for the upper banks of tubes is obliged to pass through the lower or fire box bank of tubes, thereby insuring an exceptionally rapid circulation in these latter tubes and enabling the boiler to be pressed to a higher rate of evaporation.

When the boiler is fired parallel to the axes of the tubes all the tubes can be drawn into the stoke hole and each tube examined independently by removing the hand hole fittings in the headers, if this be required. At the same time the whole of the tubes can be examined by simply removing the manhole door off the steam drum, and the manhole door off the water drum, this removal of the two doors rendering the whole of the interior of the boiler visible. A hand-hole fitting may also be placed at the top of each header so that by dropping a light down the header, the tubes can be made visible throughout their entire length from the drum without removing the header hand-hole fittings.

While we have herein shown and described one embodiment of our invention, we wish it to be understood that we do not limit ourselves to the particular embodiment herein set forth, but that modification and variation may be made without departing from the spirit of our invention or exceeding the scope of our claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. A water tube boiler comprising a water drum and a steam and water drum, headers, a bank of tubes extending from opposite sides of the water drum to the lower part of the headers and inclined upwardly, a bank of tubes extending from opposite sides of the steam and water drum to the headers and inclined downwardly, and baffles in the upper banks of tubes forming passes for the products of combustion, the first pass being at the lower ends of the tubes, and down-comer tubes connecting the said drums.

2. A water tube boiler comprising a water drum and a steam and water drum, headers, a bank of tubes extending from opposite sides of the water drum to the lower part of the headers and inclined upwardly, a bank of tubes extending from opposite sides of the steam and water drum to the headers and inclined downwardly, a short longitudinal baffle arranged above and parallel with

each of the lower bank of tubes, and transverse baffles across the upper banks of tubes to provide a plurality of passes, the uptake pass being at the lower ends of the upper bank of tubes, and down-comer tubes connecting the said drums.

3. A water tube boiler comprising a water drum and a steam and water drum, headers, a bank of tubes extending from opposite sides of the water drum to the lower part of the headers and inclined upwardly, a bank of tubes extending from opposite sides of the steam and water drum to the headers and inclined downwardly, said tubes being pitched closer together in a vertical plane in the said drums than they are in the headers, and down-comer tubes connecting the said drums.

JAMES H. ROSENTHAL.
ARTHUR SPYER.

Witnesses:
H. P. SMITH,
SHERWOOD SMITH.