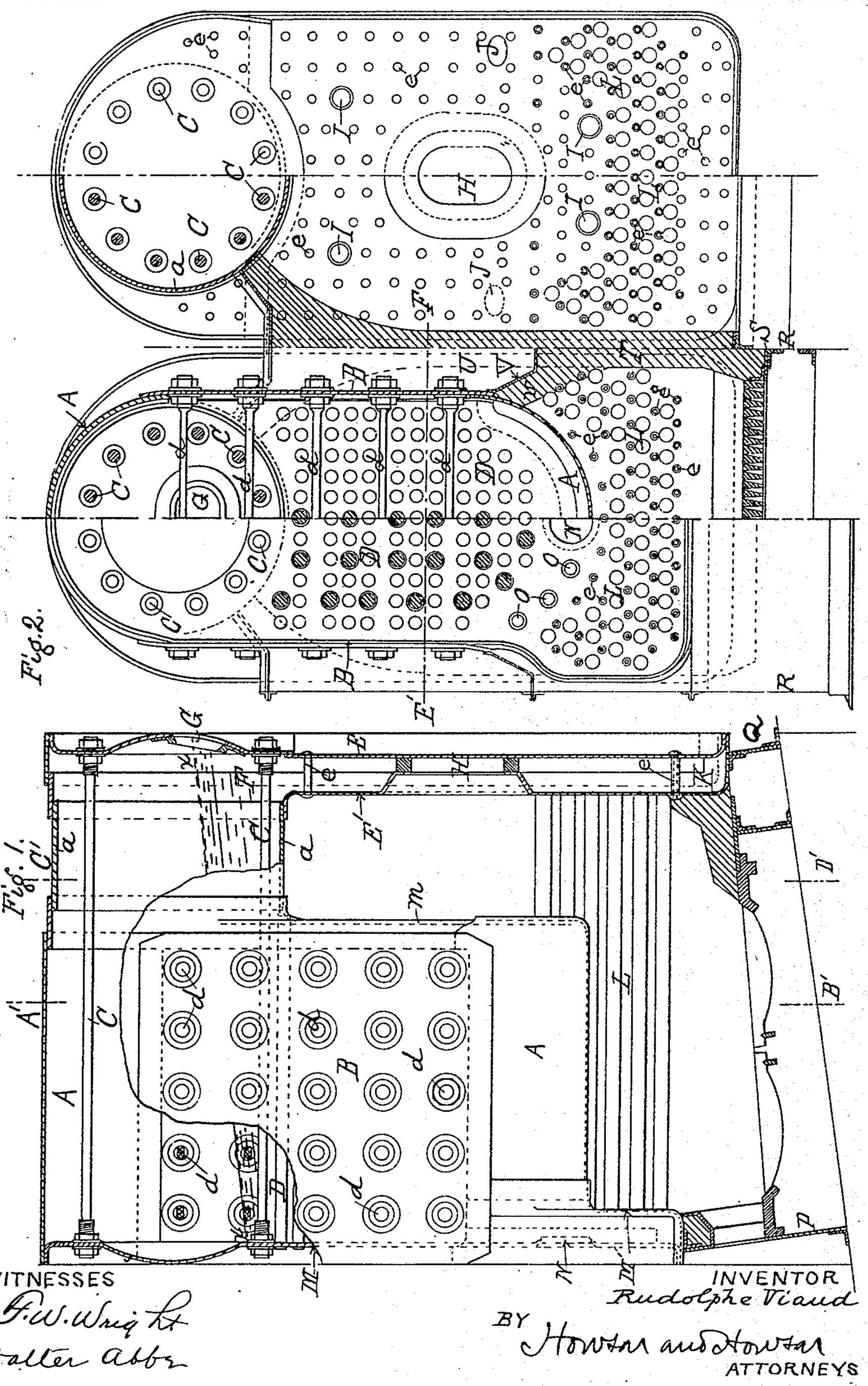
No. 771,513. PATENTED OCT. 4, 1904.

R. VIAUD.

BOILER.

APPLICATION FILED MAY 16, 1902.

NO MODEL. 2 SHEETS—SHEET 1.



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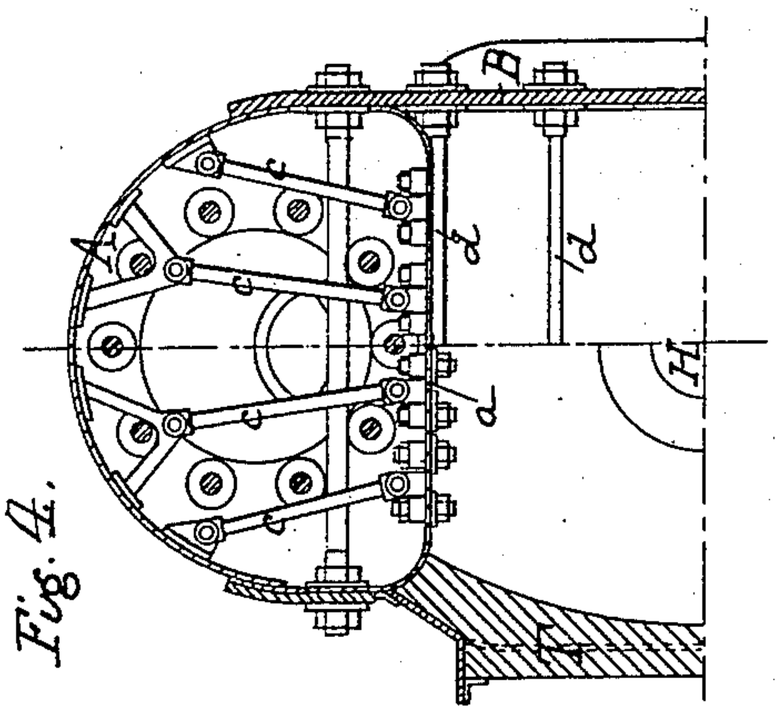

Fig. 4.

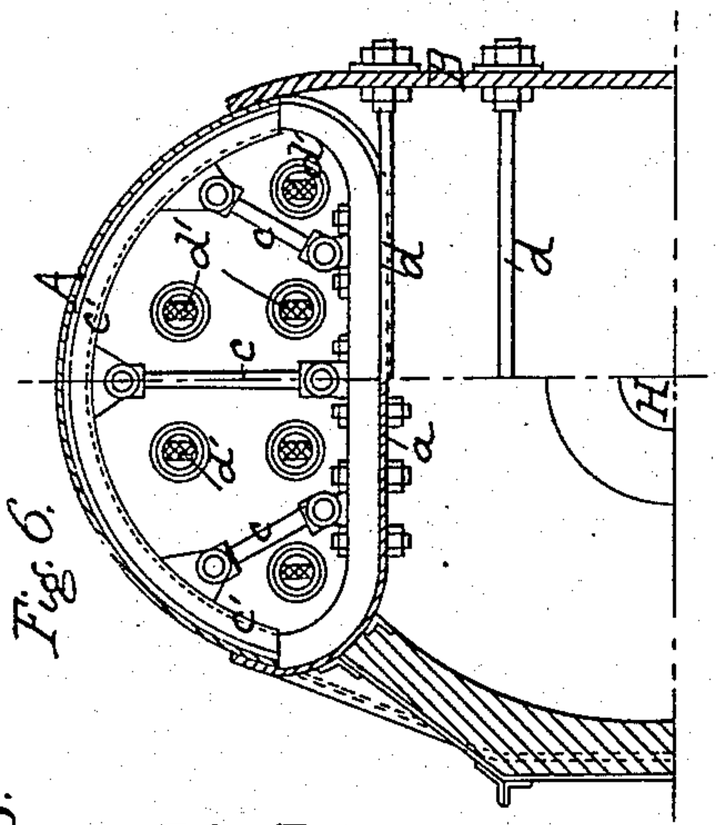

Fig. 6.

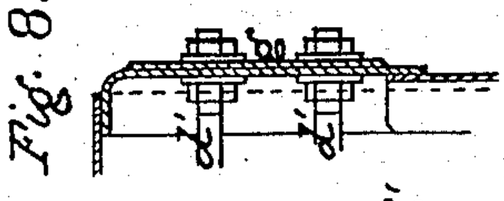

Fig. 8.

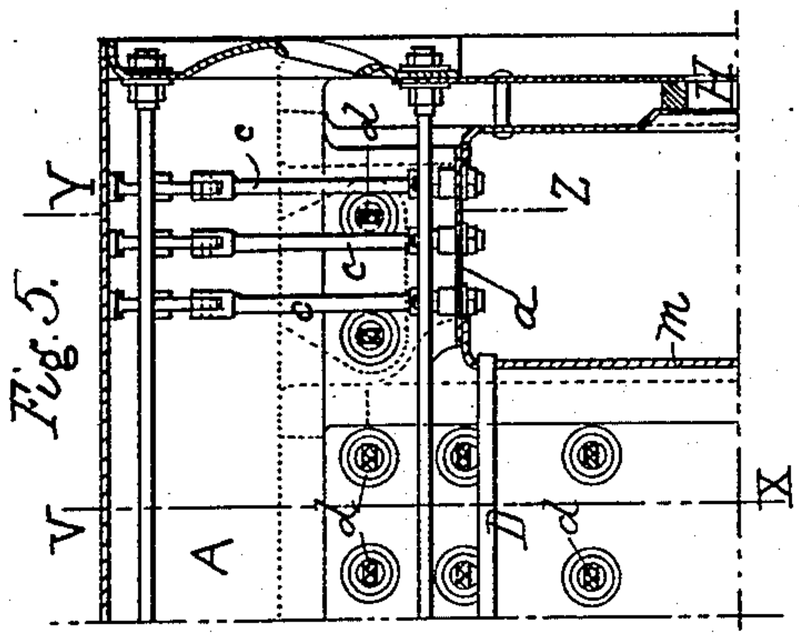

Fig. 5.

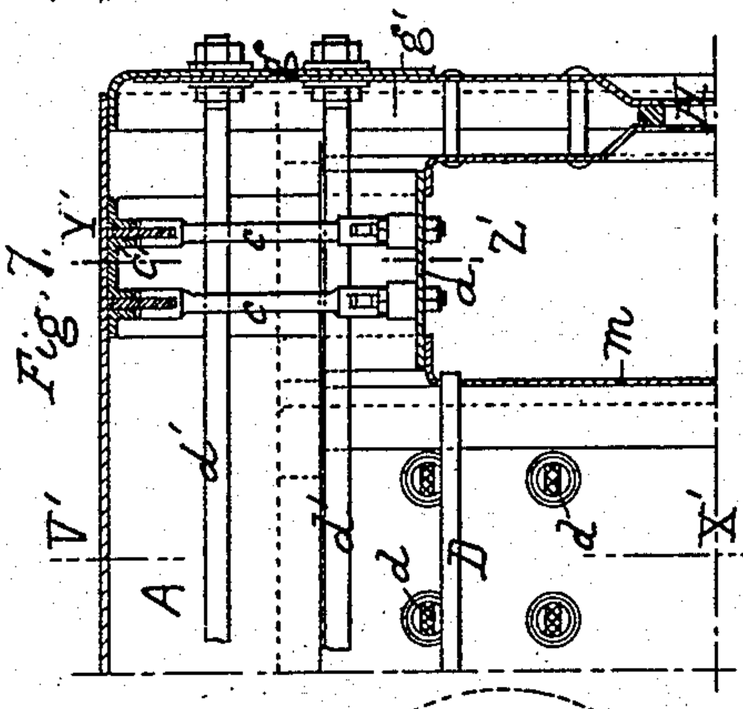

Fig. 7.

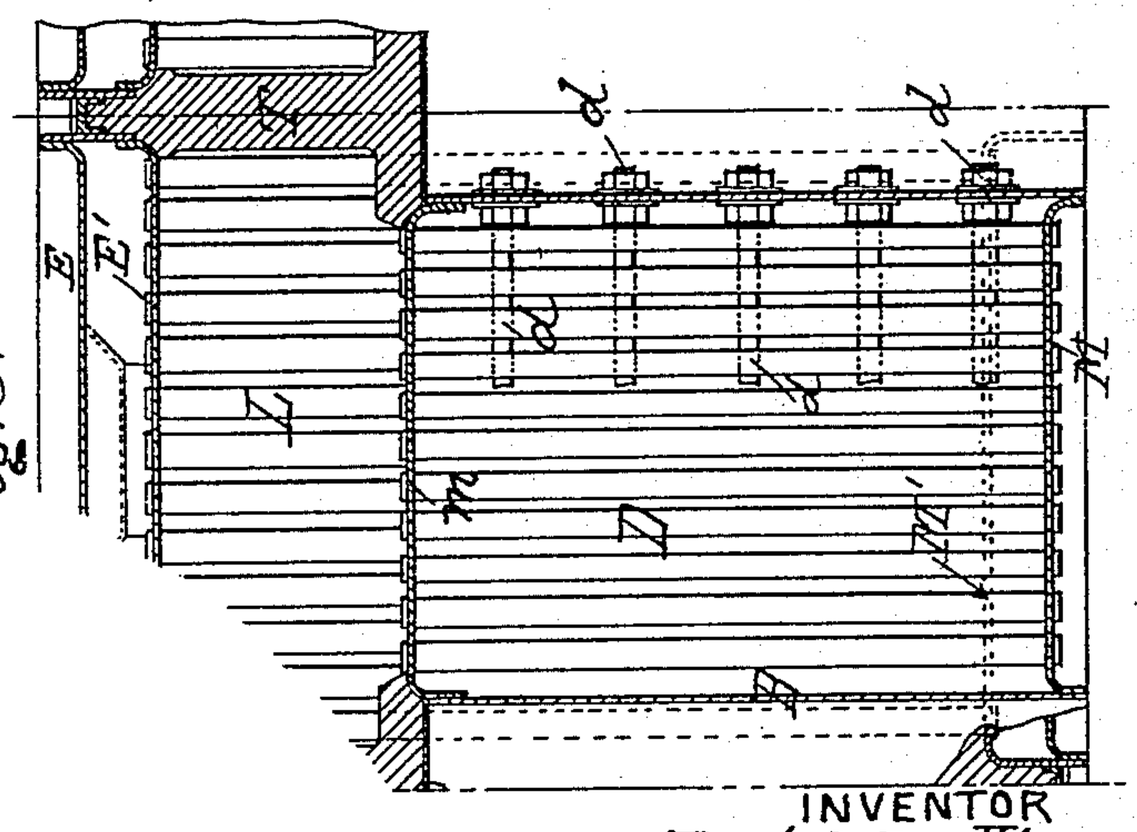

Fig. 3.

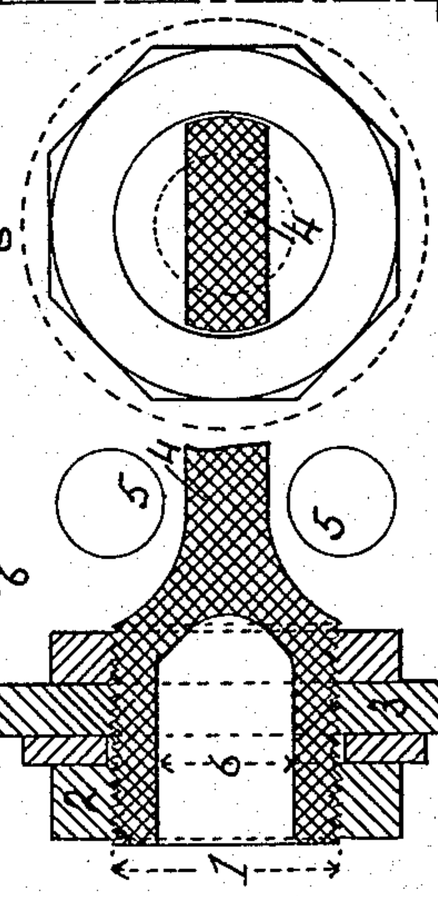

Fig. 9.

Fig. 10

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No. 771,513.

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UNITED STATES PATENT OFFICE.

RODOLPHE VIAUD, OF CHANTENAY-SUR-LOIRE, FRANCE.

BOILER.

SPECIFICATION forming part of Letters Patent No. 771,513, dated October 4, 1904.

Application filed May 16, 1902. Serial No. 107,683. (No model.)

To all whom it may concern:

Be it known that I, RODOLPHE VIAUD, mechanician, a citizen of the Republic of France, and a resident of Chantenay-sur-Loire, France, have invented Improvements in Boilers, of which the following is a specification.

This invention has for its object a type of boiler which is intended to combine the qualities of good utilization of the fuel, facility of circulation, of feed, maintenance, and of flue-cleaning and the like which a boiler having a return-flue possesses, and also the qualities of occupying small space, of lightness, power of being constructed for the highest ordinary pressures, and other properties belonging to water-tube boilers.

This improved boiler has fire-tubes and water-tubes. It is constructed in such a way as to give a somewhat large proportion between the heating-surface and the grate-surface. The fire-tubes are relatively small, while the arrangement of water-tubes insures an active and regular circulation in a well-defined direction, thus producing a very high steaming per unit of heating-surface. These qualities in combination with the reduction in the weight of the boiler enable a very reduced weight per horse-power to be obtained. On the other hand, the arrangement of the furnace, the groups of tubes, and the combustion-chamber are favorable for a good utilization of the fuel, and the high pressure for which this boiler may be built allows of a very small consumption per horse-power.

My invention is shown in the accompanying drawings, in which—

Figure 1 is a view, partly in longitudinal section and partly in external elevation, of the body of a boiler of my system. Fig. 2 is a view across two of my improved boilers, one quarter being a front elevation, the next quarter a section on line A′ B′, Fig. 1, the next quarter being a section on C′ D′, Fig. 1, and the fourth quarter being an end elevation in reverse. Fig. 3 is a horizontal sectional view on line E′ E′, Fig. 2. Fig. 4 is a sectional view of a part of my boiler, half on line V X and half on line Y Z, Fig. 5. Fig. 5 is a longitudinal section of sufficient of a boiler to illustrate the stay-rod construction. Fig. 6 is a section of a portion of a modified form of my improved boiler on line V′ X′ and Y′ Z′ of Fig. 7. Fig. 7 is a view similar to Fig. 5 of the modified form of boiler of Fig. 6. Fig. 8 is a sectional detail of stay-rod construction. Fig. 9 and 10 are longitudinal and vertical sections, respectively, of my improved form of stay-rod.

As may be seen in Figs. 1 to 3, the boiler is composed of—

First, a principal body forming a water and steam reservoir composed of two semicylindrical parts A, connected by two flat parts B and containing a group of fire-tubes D. At the rear the body terminates in a cylindrical part *a*. The group of tubes has approximately the form of a parallelepipedon, which has been adopted in order to allow of a greater number of tubes being lodged therein, and, further, transverse tie-rods C, which strengthen the flat side walls, have a form especially favorable to economy of space and weight. These tie-rods will be more particularly hereinafter described with reference to Figs. 9 to 10. Longitudinal tie-rods C, screwed in the two end plates, connect the front of the principal body of the boiler with the rear face of the boiler. Said tie-rods arranged circumferentially circumscribe in the two ends two recessed parts, which allows of sufficient space for gaining access to the reservoir. For this arrangement one of the modifications shown in Figs. 4 to 8 may be substituted.

Second, of a group of fire-tubes D, composed of ordinary drawn tubes and of tie-bar tubes screwed in the two tube-plates M and *m* of the principal reservoir.

Third, of a rear sheet of water contained between two plates E and E′ and connected with the main body of water at its upper end by a cylindrical communication F. The two plates confining this sheet of water are maintained by screwed cross-bolts *e*. The cross-bolts placed between the lower tubes are bored or perforated to allow of the introduction of a jet of steam for cleansing while at work. All the other cross-bars may also be hollow, with the object of utilizing these holes, if necessary, for maintaining the masonry along the rear sheet of water, which will protect this

sheet of water against too high a temperature, which might be unfavorable to the circulation. in a suitable direction. A manhole G is placed in the upper part to give access to the steam-reservoir. Another manhole H is arranged toward the center to allow of admission to the combustion-chamber. Four inspection-openings I are formed to allow of looking into the combustion-chamber during the working. The lower part of the plate E′ receives the rear extremities of the water-tubes, and the plate E is perforated with holes for the insertion of these tubes. In operation they are stopped up by autoclave plugs. An available space K exists in the lower part beneath the last row of tubes for receiving deposits and is easily cleaned. This rear sheet of water is wider than the principal body of the chamber.

Fourth, of a group of water-tubes L, connecting the lower part of the rear sheet of water with the front sheet of water. This group of tubes may have in addition to the slope of the boiler a supplementary slope relatively to this latter, which will be favorable to the evolution of steam-bubbles. I may also arrange the tubes so that they are nearer one another in the rear part than in the fore part, which will tend to cause the gases in the group to repass toward the front.

Fifth, a sheet of water having the form comprised between two walls M M′, communicating with the lower front part of the principal body. The interior plate M receives the water-tubes, and holes are formed in the external plate M′ for the insertion and fitting in of these tubes. When at work, they are plugged with hermetically-fitting plugs. The cross-pieces placed between the water-tubes are perforated to allow of the introduction of a jet of steam for the cleansing of the group of tubes while at work. It must be noted that this cleansing while at work is very efficacious, because the number of tubes is not large, and no partition exists capable of forming corners where soot could accumulate, and the latter is therefore carried off by the draft or will fall on the grate. A manhole N is arranged at the junction of this water sheet with the main body, allowing a man to enter the lower part of this body, and a certain number of small tie-rods O strengthen the front tube-plate in addition to the two groups of tubes. This water sheet is of the same width as the rear water sheet.

Sixth, of a boiler-support forming a furnace and ash-pan. This support consists of a transverse beam P, supporting the front, and another similar beam Q, supporting the rear of the boiler. These two beams are connected by longitudinal beams R, inclosing the ash-pans and forming sheet-metal tables S, intended to support the bricks forming the walls of the furnace and the combustion-chamber. The supports for the grates are fixed on the longitudinal beams, and the doors of the furnaces and ash-pans are cut out in the front transverse beam P.

Seventh, of masonry walls T, resting on the horizontal parts of the ash-pans and forming the walls of the furnaces and the combustion-chamber. The arrangement of these walls in conjunction with the peculiar form of the boiler allows of the coupling of two adjacent bodies, which is very advantageous from the point of view of economy of space and weight, said coupling being obtained in the manner shown in Fig. 2 in the following way: The boiler-bodies are assembled on their supports one beside the other, so that there is about .10 of a meter of space between the two adjacent water sheets. The excess in the width of the water sheets over the principal boiler-bodies has the effect of leaving between these bodies a sufficient space U to allow of the passage of a man. A double wall V of bricks, built on the separating-partition of two adjacent ash-pans, separates the furnaces of two contiguous boilers. It rests on several water-tubes and terminates at the side of the principal bodies, leaving free above it the space U, previously mentioned. This wall extends in the same manner up to the end of the principal bodies, where it rises between the boiler-bodies, assuming in plan view the form of a T, separating the two adjacent fire-boxes, and terminates by forming a vault or dome on the communications between the principal body and the water sheet. The external part of this wall is protected by a thin metal plate V, covered with a refractory substance. This coupling of the two boilers utilizes very well the space in a horizontal plane, because the grates, as well as the combustion-chambers, are placed side by side and are only separated by a brick wall, while reserving the necessary space for the inspection of the tie-rods and fastenings of the principal body. The advantages obtained by this kind of coupling are greater when there is a larger number of boilers arranged in a single row. In addition to the hereinbefore-stated advantages it is also found that the coupling mentioned has the further effect of diminishing the loss of heat by external radiation.

In the modification shown in Figs. 4 and 5 the part *a* of the principal body is given below a flat form instead of being completely cylindrical, which form allows of a wider boiler being obtained of a better shape for fixing a larger number of tubes, while preserving the suitable height for the steam-reservoir. The flat bottom is strengthened by tie-rods *c*, connected with the upper part of the boiler and which may be dismounted, if necessary, for inspection.

In the modification shown in Figs. 6 and 7 and 8 the boiler is still greater in width, and the form of the part *a* without flat lateral surfaces allows of the transverse tie-rods being dispensed with in this part, which is suffi-

ciently strengthened by the tie-rods *c*, connected with continuous stiffeners *c'*, riveted on the casing A. The ends and also the faces of the steam-reservoir are flat. They are held by tie-rods *d'* of the form already described, which gives a larger space for the flow in the desired direction and allows of the thickness of the plates being slightly diminished. The end and front plates at the places where the tie-rods *d'* enter them are strengthened for very high pressures either by means of a supplementary plate *g'*, riveted thereon, as shown in Fig. 7, or the said plates are of sufficient thickness to resist the strain and are diminished at the places where they are riveted to the other plates, as shown in Fig. 8.

Figs. 9 and 10 represent the special tie-rod, to which allusion has been hereinbefore made. This kind of tie-rod is of a diameter 1 at its ends larger than is absolutely necessary, which allows of the size of the nut 2 and also the thickness 3 of the plate held to be diminished. It is reduced in its length 4 between the threaded parts to a suitable half-thickness, the section of which is sufficient for the stress and which allows the rows of adjacent tubes 5 to be brought nearer together and also permits of the easy embedding of this tie-rod, which must be screwed into the two plates at its ends. If the cylindrical heads of the tie-rods be recessed to a certain diameter 6, so as to only leave a ring of metal necessary for the solidity of this part, their weight is thereby reduced to a minimum. By using this improved kind of tie-rod in place of the ordinary cylindrical one a larger number of tubes may be fitted in a given space, and, further, the thickness of the walls of the casing of the tubular group may be diminished for a given pressure.

The arrangement of boiler just described offers, as may easily be seen, great advantages, more particularly as regards general arrangement and coupling, enabling it to be used more particularly for marine purposes, where the weight and volume play a very great part.

This boiler, with a given production of steam in a given time, is smaller than any other like apparatus. The arrangement of its parts is such that a certain economy of fuel may be realized. Its combustion is perfect, and the heat is utilized under the best conditions.

It will be seen that in the general arrangement of the boiler endeavors have been made to obtain a great simplicity of construction. It is also well to know that this type of boiler gives entire security, more particularly in case the water-level of the boiler descends below the normal. In such case, in fact, if Fig. 1 of the drawings be examined and *x x* be taken as indicating the ordinary level of the water it will be seen that the first points uncovered by the liquid are situated in the part which is at the lowest temperature of the heating-surface, and consequently the least dangerous.

By the construction of depending water-drum A, held and connected by the vertical side plates B with the steam and water drum A, which extends the entire width of the boiler, together with the depending water-legs E and M, allow me to place a few water-tubes between the depending water-legs to insure a rapid circulation, and at the same time the depending water-space may have an extensive fire-heating surface, due to the great number of fire-tubes I am enabled to pass through it.

I claim as my invention—

1. A steam-boiler, comprising a steam and water drum at the top of the boiler extending the entire length of the boiler, a water-leg at the rear of said drum depending from it, a water-drum extending from the front of the boiler backward over the fire but not meeting said water-leg; flat upright plates connecting said drum with the forward end of said steam and water drum, creating thereby a water-space of substantial volume depending from said steam and water drum, fire-tubes passing through the depending water-space thus formed, a water-leg depending from the forward under side of said water-drum and water-tubes between the two said water-legs.

2. A steam-boiler, comprising a steam and water drum at the top of the boiler extending the entire length of the boiler, a water-leg at the rear of said drum depending from it, a water-drum extending from the front of the boiler backward over the fire but not meeting said water-leg, flat upright plates connecting said water-drum with the forward end of said steam and water drum, creating thereby a water-space of substantial volume depending from said steam and water drum, fire-tubes passing through the depending water-space thus formed, a water-leg depending from the forward under side of said water-drum and water-tubes between the two said water-legs, said drums and tubes being parallel to one another but all oblique to the horizontal.

3. A steam-boiler, comprising a steam and water drum at the top of the boiler extending the entire length of the boiler, a water-leg at the rear of said drum depending from it, a water-drum extending from the front of the boiler backward over the fire but not meeting said water-leg, flat upright plates connecting said water-drum with the forward end of said steam and water drum, creating thereby a water-space of substantial volume depending from said steam and water drum, fire-tubes passing through the depending water-space thus formed, a water-leg depending from the forward under side of said water-drum and water-tubes between the two said water-legs, said pair of water-legs being of greater width than the water and steam and water drum, whereby a large fire-space may be obtained

and the drums and vertical plates left accessible for repairs.

4. A steam-boiler, comprising a steam and water drum at the top of the boiler extending the entire length of the boiler, a water-leg at the rear of said drum depending from it, a water-drum extending from the front of the boiler backward over the fire but not meeting said water-leg, flat upright plates connecting said water-drum with the forward end of said steam and water drum, creating thereby a water-space of substantial volume depending from said steam and water drum, fire-tubes passing through the depending water-space thus formed, a water-leg depending from the forward under side of said water-drum and water-tubes between the two said water-legs, and flat stay-bolts passing from one vertical side of the water-space to the other with their flat surfaces between adjacent fire-tubes.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RODOLPHE VIAUD.

Witnesses:
EDWARD P. MACLEAN,
ALPHONSE MÉJEAN.