

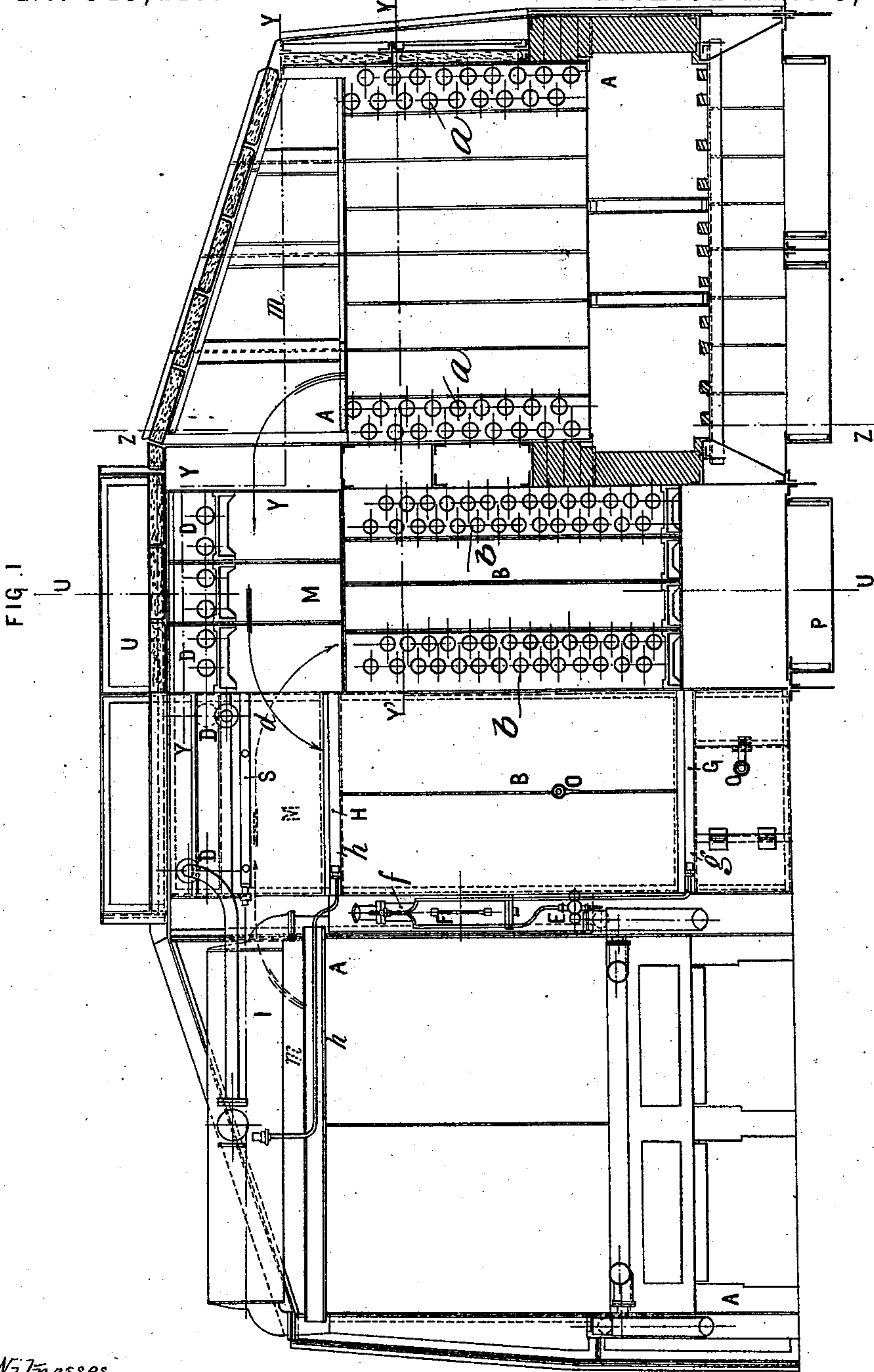
(No Model.)

4 Sheets—Sheet 1.

L. M. G. DELAUNAY-BELLEVILLE.  
WATER TUBE BOILER.

No. 549,447.

Patented Nov. 5, 1895.



Witnesses

G. W. Rea.

Robert Everett.

Inventor

Louis M. G. Delaunay-Belleville.  
By James S. Norris

Atty.

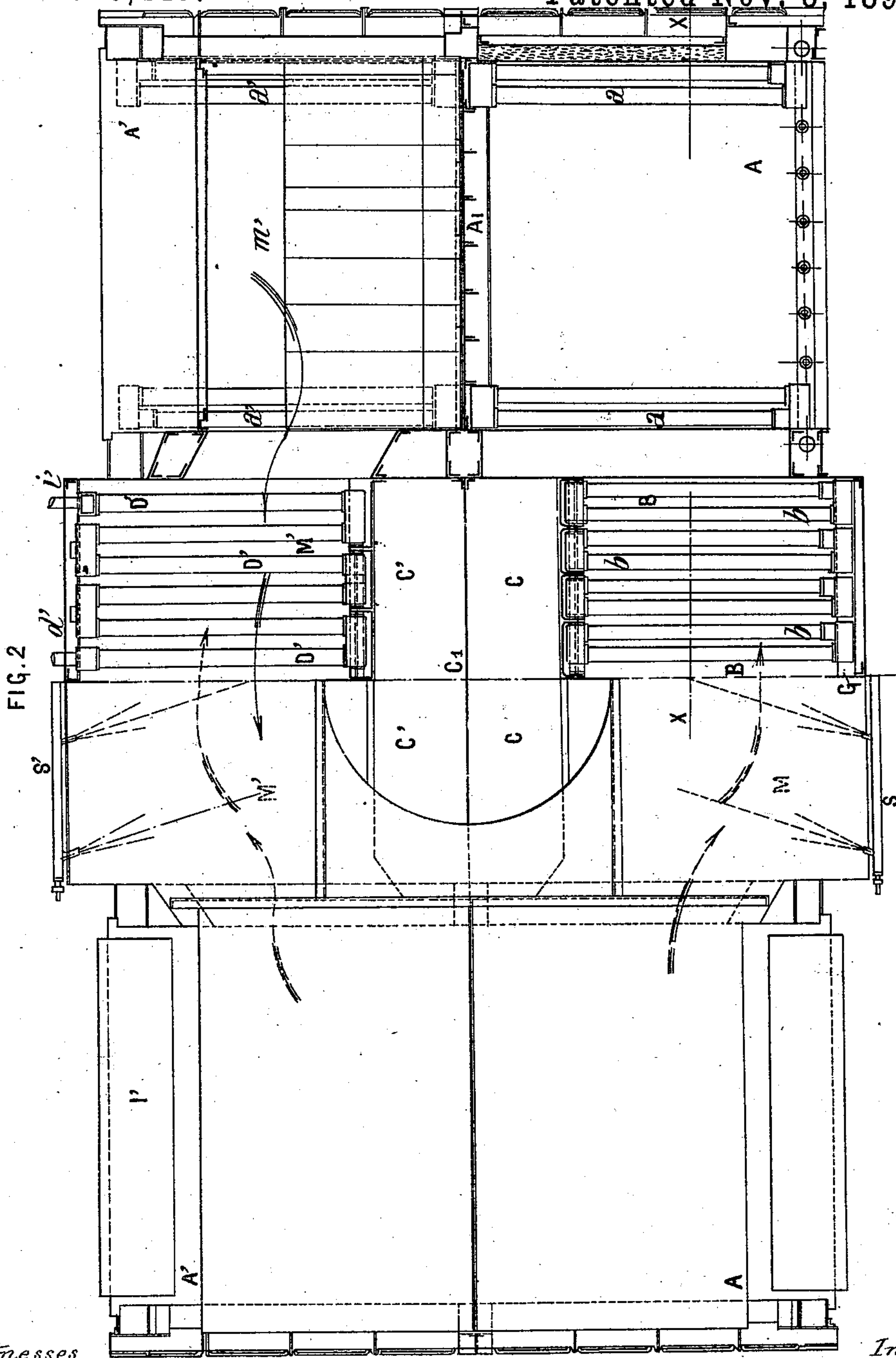
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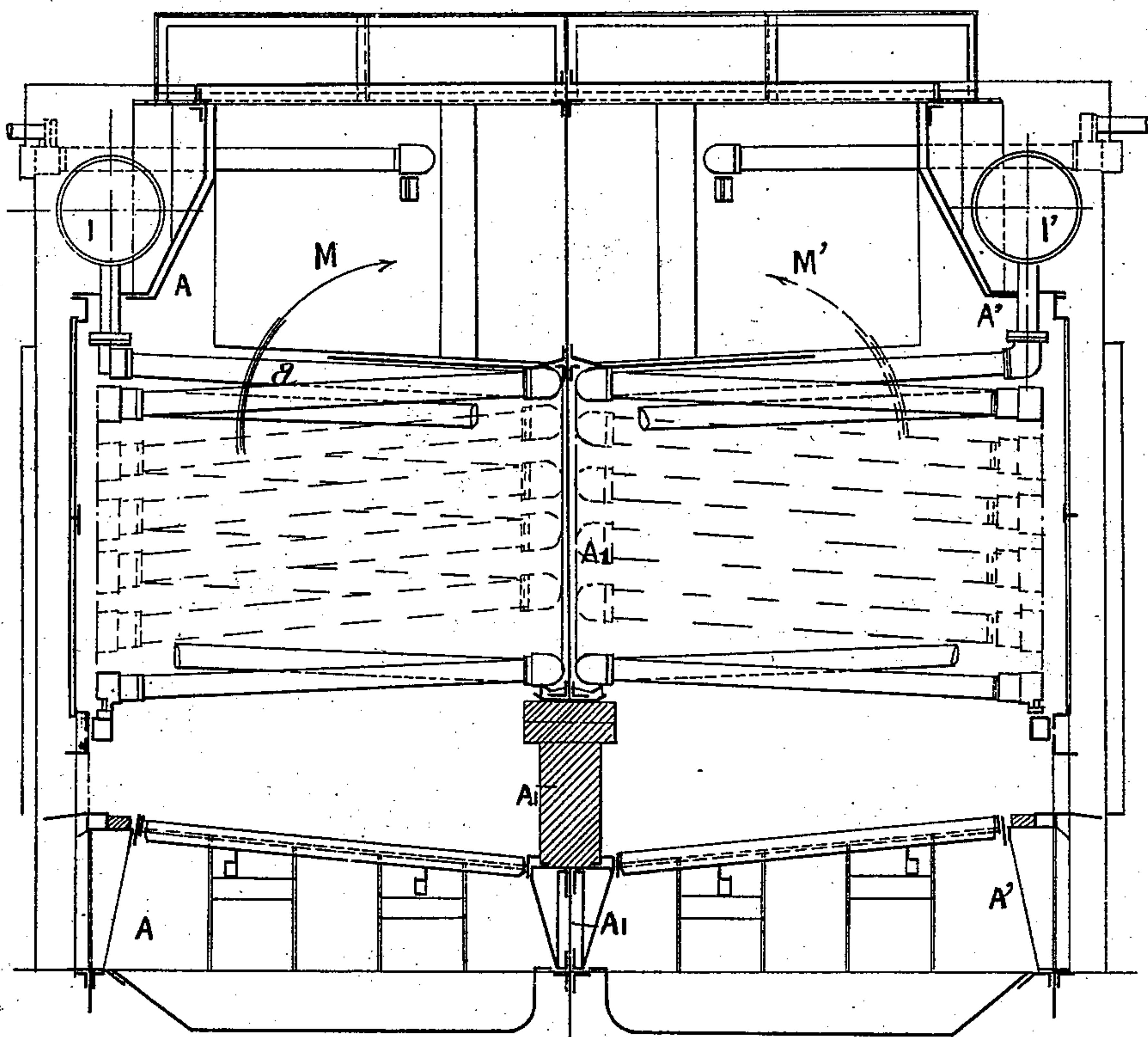
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FIG. 3



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(No Model.)

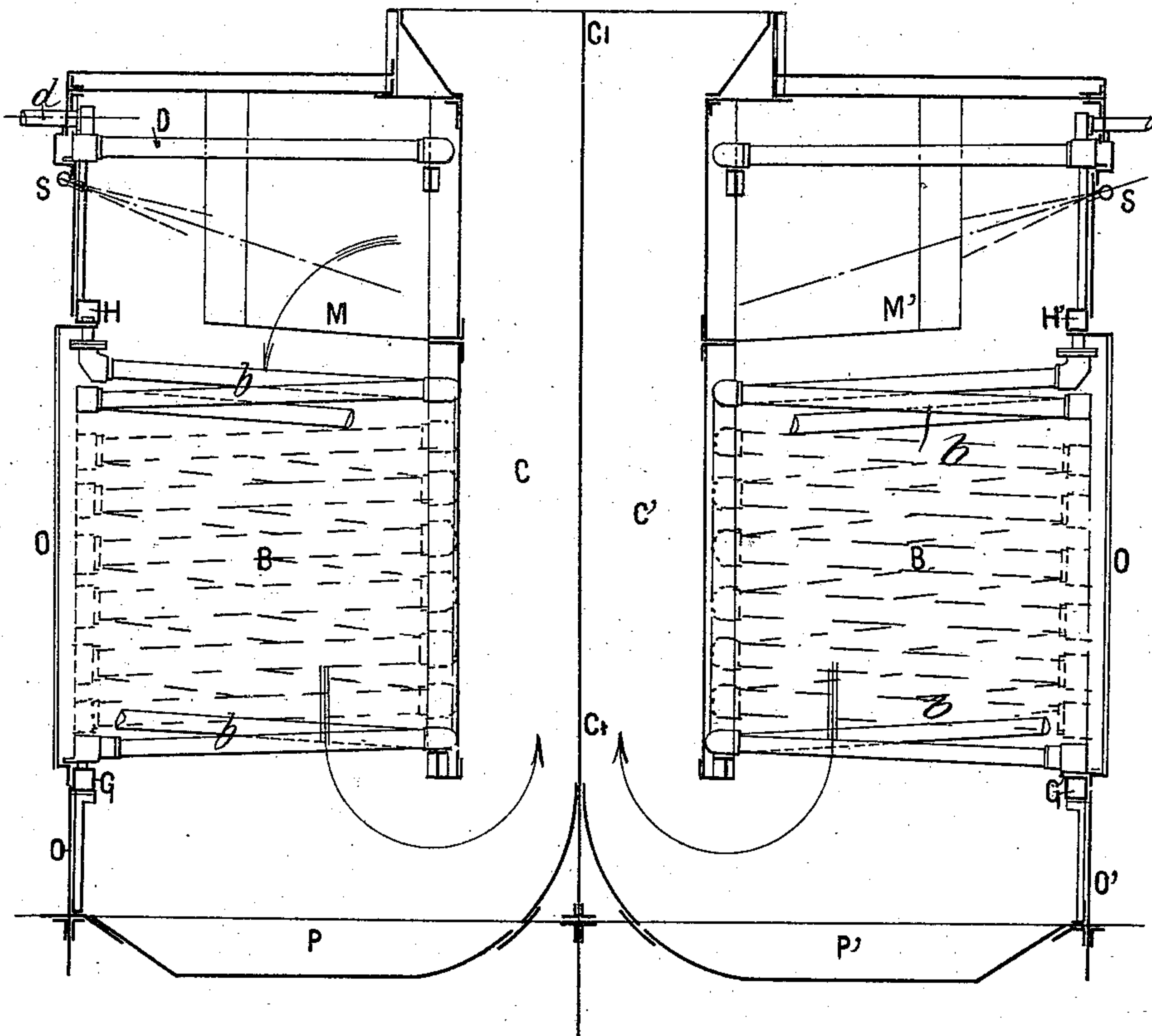
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FIG. 4



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# UNITED STATES PATENT OFFICE.

LOUIS MARIE GABRIEL DELAUNAY-BELLEVILLE, OF PARIS, FRANCE.

## WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 549,447, dated November 5, 1895.

Application filed February 14, 1895. Serial No. 538,395. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS MARIE GABRIEL DELAUNAY-BELLEVILLE, a citizen of France, and a resident of Paris, in the Department of the Seine, France, have invented a new and useful Improvement in Water-Tube Boilers, of which the following is a specification.

In steam-boilers with water-tubes where the gases rising from the furnace take a vertical course such gases reach the chimney as soon as they leave the series of tubes. Where coal which gives a long flame is burned, or where the furnaces are overloaded with fuel, the gases do not burn thoroughly in the series of tubes, but become extinguished on meeting the water-tubes, and may under certain circumstances become inflamed again on entering the chimney. Owing to this fact a considerable proportion of the heat is lost, and the gases which happen to ignite again in the chimney produce a very high temperature in the latter, which has a disturbing effect on the proper operation of the chimney itself, while at the same time exposing the neighborhood to danger from fire, and this inconvenience is more particularly fraught with danger on board ships, where it is therefore most desirable to find an effective remedy for it.

By causing the gases as they leave the series of steam-generating tubes immediately to pass through a feed-water heater they may be prevented from igniting again, and after traversing the heater their temperature will be sufficiently lowered to make it impossible for them to catch fire in the chimney; but, on the other hand, the combustion of gases which are dealt with in this manner is incomplete; but if there be provided between the steam-generating tubes and the feed-water heater a combustion-chamber wherein the combustible elements of the smoke may mix with the elements, causing combustion at a high temperature, then the gases will be ignited again and burned. The resulting heat is utilized in the feed-water heater. This result is attained with still greater certainty and in a more advantageous manner by using one common mixing and combustion chamber for two steam-boilers, or, indeed, two groups of boilers suitably combined together, between which the feed-water heater is located. In

this case the gases in excess coming from a furnace, (or a series of furnaces,) and which cause combustion, may assist the burning of the gases in excess capable of undergoing combustion and supplied by the other series of furnaces. An air-blast or steam-injector similar to that employed in connection with the furnaces of the well-known Belleville boilers may, moreover, be arranged to effect in the said chamber the thorough union of the various gases meeting therein. By such means the following double result is with certainty attained: the combustion is completed and the gases have their temperature lowered as they enter the chimney. The arrangement which I have devised in order to obtain these results is hereinafter described with reference to the accompanying drawings, which show four marine steam-boilers arranged in pairs, back to back. Between the two boilers on each side (or board) of the vessel (which boilers are set at a suitable distance apart for the purpose) there are located the feed-water heaters, one heater being employed for each boiler. The respective compartments of the heaters communicate at the top and bottom, while the bases or bottoms of the two boilers are connected with the chimney by one common conduit or flue.

In order that my said invention may be fully understood, I shall now proceed more particularly to describe the same and for that purpose shall refer to the several figures on the annexed sheet of drawings, the same letters of reference indicating corresponding parts in all the figures.

Figure 1 is an elevation, one-half of which is drawn in section on line  $x x$ , Fig. 2. Fig. 2 is a view, one-half of which is a plan, while the remaining two quarters are respectively sections on lines  $y y y y$  and  $y' y'$ , Fig. 1. Fig. 3 is a vertical section on line  $z z$ , Fig. 1. Fig. 4 is a vertical section on line  $u u$ , Fig. 1.

The following is a description of the several parts of the apparatus, indicating both their nature and their respective duties, all with reference to the drawings.

A A or A' A' are boilers of the Belleville type united for purposes of circulation of the combustion gases.

$a a$  or  $a' a'$  are the steam-producing parts of such boilers.



B B or B' B' are compartments of the feed-water heater.

*b b* or *b' b'* are parts of feed-water heaters of the Belleville type of boiler.

5 C C or C' C' are smoke-flues arranged behind the compartments of the feed-water heaters.

A represents water-tight partitions in the boilers A A'.

10 C is a partition between the smoke-flues C C'.

D D or D' D' are small tubular channels traversed by the steam as it issues from the boilers and serving to dry the steam.

15 M or M' represents gas-combustion chambers situated at the top of the boilers above the feed-water-heater compartments.

S or S' represents air-blasts or steam-injectors serving to mix the gases as they meet in the mixing and combustion chamber, the mixing of the gases being effected through the increased speed imparted to them by the action of the air-blasts or steam-injectors while the gases are flowing toward each other. In all other respects the usual arrangement of Belleville boilers is retained.

In the case of each boiler the feed-water is admitted through the graduated cock E, Fig. 1.

It is then distributed through the cock *f* of the self-moving column F and enters at *g* into the lower collector or receiver G of the corresponding water-heating series of tubes. This feed-water is distributed throughout the elements *b b b* of the feed-water heater and rises successively from one tube to the next, being more and more heated at each stage, until it reaches the upper collecting-chamber II. The pipe *h* conducts the feed-water from the collector II to the purifier I of the Belleville boiler, and this boiler operates as though it were fed from the self-acting cock direct, the column F being in communication with the steam-generating apparatus, as usual. The steam which is generated and which comes out of the purifier I through the pipe *i* enters the pipes of the desiccator D and issues therefrom through the short tube-nozzle *d*, by which it is directed toward the engines. The combustion gases as they attain the tops of the series of tubes *a a* or *a' a'* of the combined boilers A A or A' A' pass off

into the smoke-flues *m m'* of the said boilers and converge toward the combustion-chamber M M'. Owing to the speed with which they move along these gases, flowing in opposite directions, penetrate each other and mix, with the result that those of their component elements which are subject to and those which cause combustion (the course of both of which has till then been parallel) meet and become reignited in consequence. The heat produced by this renewed combustion is taken advantage of in the feed-water heaters. When the gases have passed beyond the feed-water heaters and enter the flue C or C', their temperature is no longer sufficiently high for them to be again ignited therein, even though they should have retained any of the combustible elements, and therefore the drawbacks mentioned above are avoided, while at the same time the fuel is turned to better account. Doors O O' are provided in the front part of the series of water-heating tubes *b b* or *b' b'*, so that such parts may be readily cleaned within and without, similarly to what is done as a rule in the steam-generating apparatus of the Belleville boilers. The doors *o'* arranged below the others serve for the removal of the soot left behind by the smoke in the ash-boxes P and P', arranged in the same manner as is usual in steam-boilers.

What I claim is—

In a water-tube steam boiler, the combination with the steam generating elements, the feed water heating elements, and the flue or chimney arranged behind the feed water heating elements and extended from the base of the boiler, of a gas mixing and combustion chamber situated at the top of the boiler, between the steam generating and feed water heating elements and communicating with the flue or chimney through the said feed water heating elements, substantially as and for the purpose described.

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

LOUIS MARIE GABRIEL DELAUNAY-BELLEVILLE.

Witnesses:

CLYDE SHROPSHIRE,  
J. W. JOUY.