

J. B. WARD.  
Steam Boiler.

No. 231,874.

Patented Aug. 31, 1880.

Fig. 1.

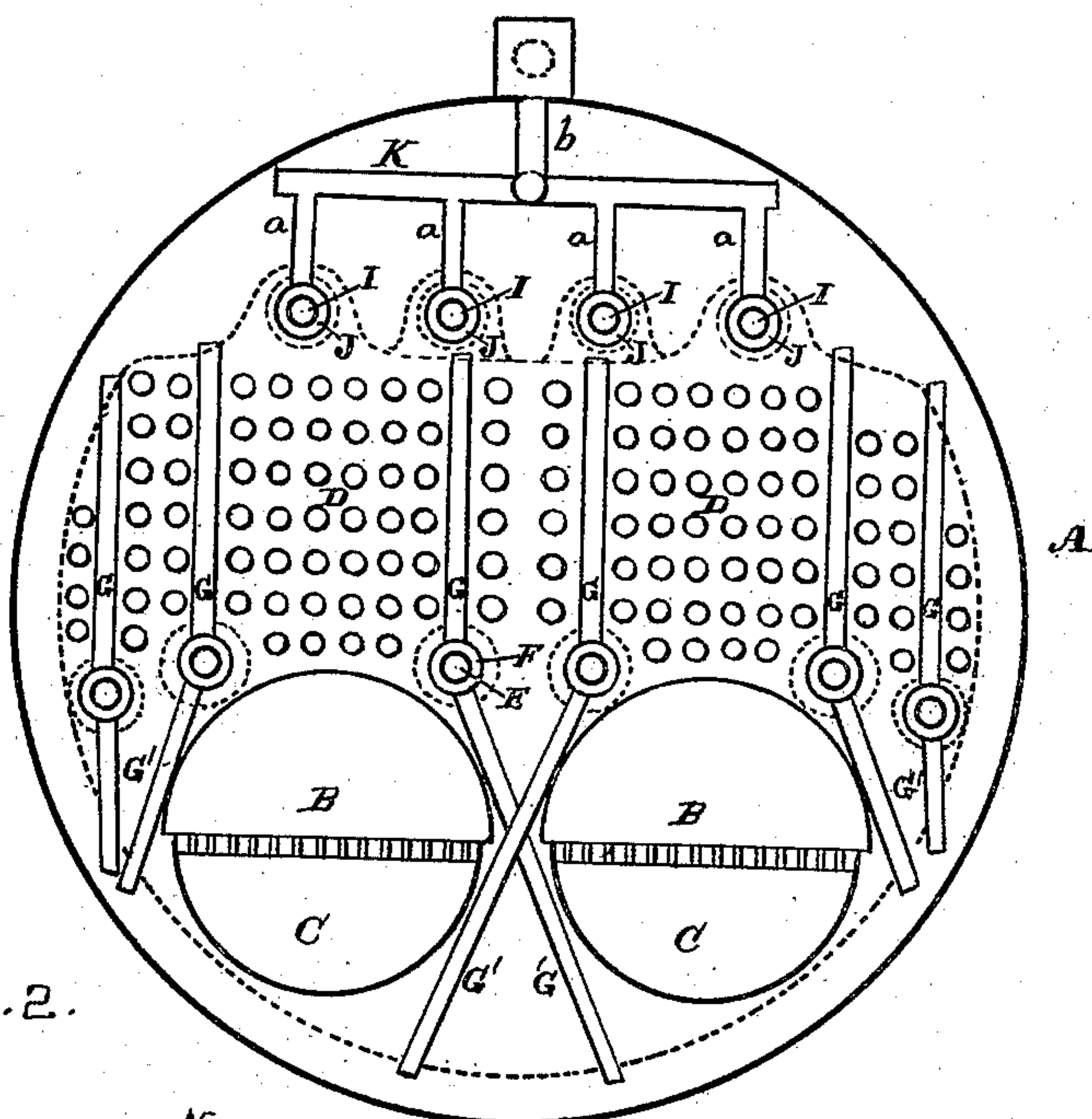
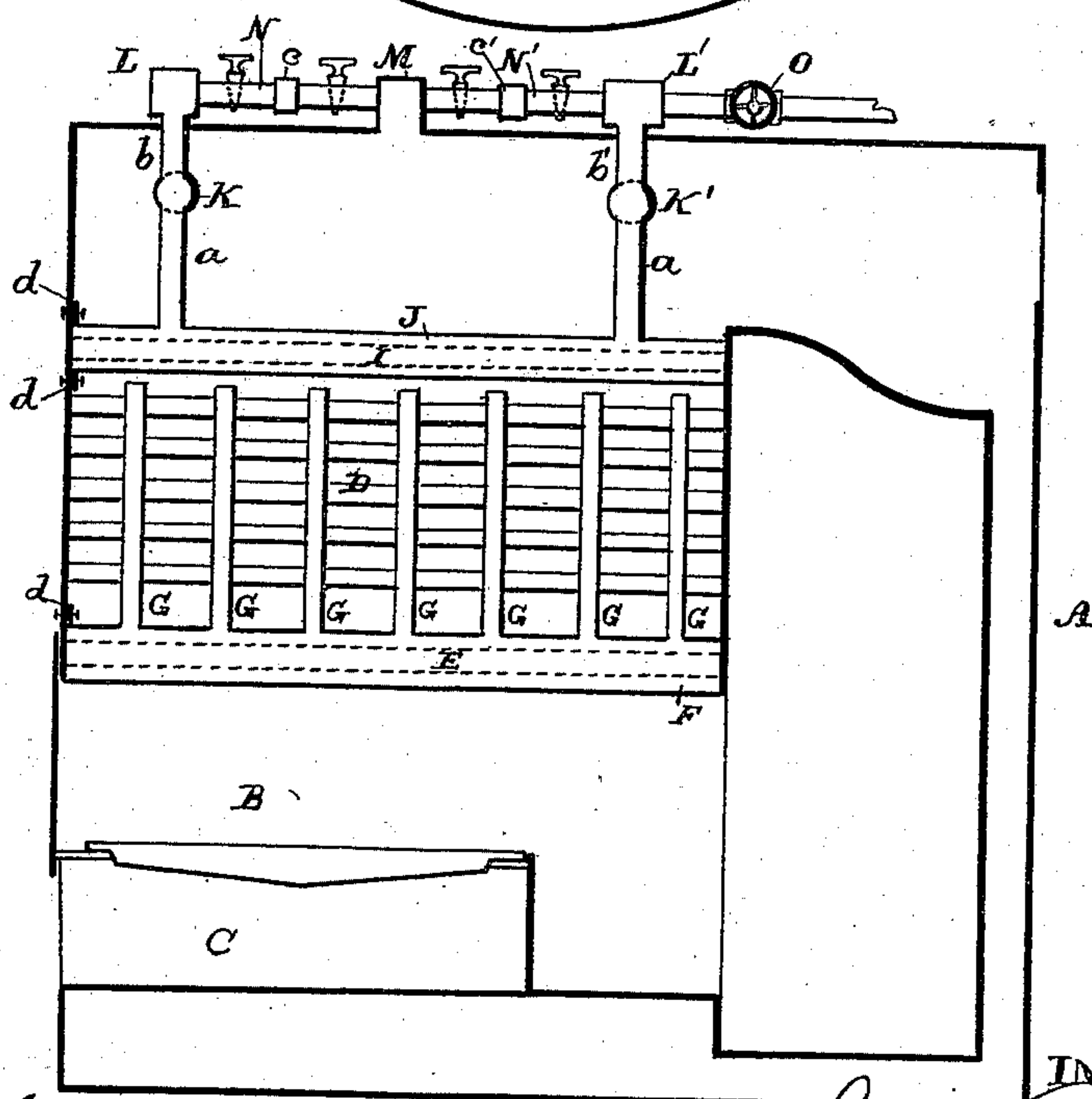


Fig. 2.



Witnesses

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# UNITED STATES PATENT OFFICE.

JOHN B. WARD, OF SAN FRANCISCO, CALIFORNIA.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 231,874, dated August 31, 1880.

Application filed December 15, 1879.

*To all whom it may concern:*

Be it known that I, JOHN B. WARD, of the city and county of San Francisco, and State of California, have invented an Improvement in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in steam-boilers and superheaters, and refers particularly to improvements on the device for a similar purpose for which application for Letters Patent was filed July 17, 1879, and allowed August 8, 1879.

My improvements consist in certain details of construction, whereby perfect circulation of the water in the boiler is accomplished by the water being drawn from the colder portions of the boiler to that where greater heat is obtained.

It also relates to a peculiar means by which the steam is dried and superheated while in the boiler, so that the cylinder of the engine will receive dry steam direct from the boiler at each stroke of the piston, as is more fully described in the accompanying drawings, in which—

Figure 1 is a transverse section of a boiler showing my invention. Fig. 2 is a longitudinal section of the same.

Let A represent an ordinary return-flue marine boiler, having the usual fire-places B and ash-boxes C. In addition to the usual flues D, I place at certain stated intervals along a central horizontal line in the boiler supplemental flues E, each of which is surrounded by a tube or jacket, F, as shown. Communicating with the interior of this tube or jacket F are upright pipes G G', extending down to the water in the bottom of the boiler and up toward the surface, as shown. The object of this construction is to cause a constant and regular circulation of the water in the boiler, in order that it may generate steam rapidly.

It is well known that ordinarily the water in the central and upper part of the boiler becomes heated more rapidly than that below, and that the lower water is usually at a less degree of temperature than that above. My object in the construction of the supplemental flues with their jackets is to establish such a circulation as shall constantly draw the water from below and pass it into the central and upper heated portion of the boiler. Each one of these flues E is surrounded by the jacket or

tube, the water in which is, of course, kept separate from that immediately surrounding it in the boiler. As the water in this jacket becomes heated by the flame in the tube it naturally rises to the surface through the pipes G, and the fresh supply for the jacket is drawn up through the pipes G' from below, and, in turn, heated and discharged above. In this way all the colder water at the bottom and lower sides of the boiler is first drawn to the center, where it receives an accession of heat, and then sent to the surface, and a constant and rapid circulation is kept up within the boiler by this means, so that the steam is very rapidly generated. No connection with the water in the boiler is allowed from these jackets F except through the pipes G G', although the jackets themselves are surrounded by heated water.

I do not wish to confine myself to placing these supplemental tubes with their inclosing-jackets in any specified position in the boiler, but put them in any part where it is practicable to extend the vertical or inclined tubes or pipes G G'. For this purpose the regularity of the usual flues may be broken at suitable intervals, whenever required, in order to interpose the supplemental flues, with their jackets and conducting or circulating pipes.

At any suitable point in the upper part of the interior of the boiler is placed a series of superheating tubes or flues, I, surrounded by pipes or jackets J, with a space between the flue and jacket, as shown. I have shown four of these; but a greater or less number may be used, as desired.

The space between the flue and jacket connects by pipes *a* with tubes K K', which, in turn, are connected by pipes *b b'* with the chambers or drums L L' on top of the boiler. Centrally placed between these chambers is the steam drum or dome M, connected with the oppositely-placed chambers L L' by means of the pipes N N', provided with check-valves *c c'*, as shown.

The object of this construction is to furnish dry or superheated steam to the cylinder without the intervention of any outside superheating apparatus.

The operation is as follows: The upper part of the boiler, above the flues and surface of the water, is filled with steam, which carries water in suspension in a greater or less degree. This steam rises into the steam dome or drum



M, and at each stroke of the piston, as herein-  
after described, the steam in this drum passes  
through the pipe N into the chamber L, the  
check-valve *c* opening to allow it to pass into  
5 said chamber. From this chamber L the same  
operation of the piston causes this wet steam  
to pass down the pipe *b* into the tubes K and  
through the pipes *a* into the jackets or tubes  
surrounding the flues I. It is here subjected  
10 to the superheating influence exerted by the  
heat, flame, and products of combustion pass-  
ing through the flue I from the fire-place to  
the stack, and the watery particles are by this  
accession of heat thoroughly vaporized and  
15 suddenly expanded. The next stroke of the  
piston in the cylinder of the engine opens the  
valve, and this dried and superheated steam  
passes out of the jacket J up through the pipes  
*a*, tubes K', and pipes *b'* into the chamber L',  
20 and thence through the throttle-valve O into  
the cylinder. The check-valves may be raised  
when a very rapid action of the piston is in  
progress without interfering with the operation  
of the superheating device.

25 It will be readily seen that the steam is both  
generated and superheated in the body of the  
boiler without leaving it at all, and that a  
fresh supply of dry superheated steam is pro-  
vided for the cylinder at each stroke of its pis-  
30 ton. Every time the piston moves and opens  
the valves a fresh supply of wet steam is al-  
lowed to pass into the jacket, which is imme-  
diately superheated, and at the next stroke  
passed directly into the cylinder.

35 The check-valve *c'* comes into play when the  
boiler is in operation and the throttle-valve of  
the engine is closed. Then when the steam is  
superheated it will pass up into the chamber  
L' through the pipe N' and check-valve *c'*, and  
40 into the drum M again, a constant circulation  
being thus maintained even when the engine  
is at rest. The valve *c* acts at each operation  
as an obstacle which separates the wet or sat-  
45 urated steam from that which is dry or super-  
heated in the superheating-jacket, as described.

Flanges *d* are formed in the ends of the  
jacket-tubes, by which they are bolted or riv-  
eted in place, and at the points where they oc-  
cur bolts, rods, or braces for strengthening  
50 may be dispensed with.

The superheating portion of the device is  
applicable to any type of boiler, while that for  
increasing the circulation of the water is more  
particularly adapted to the marine type. The  
55 superheating and circulating devices may  
therefore be used separately when desired.

The tubes inclosed by the jackets will not  
be subject to the deposition of scale to as great  
a degree as the ordinary flues, since there is  
60 so constant and rapid circulation of water  
around them, it never remaining at rest. These  
tubes may, however, be cleaned as readily as  
those of the ordinary type and in the usual  
way.

65 It will be evident that any of the ordinary  
flues of the boiler may be covered by the jacket

which has the circulating-pipes, and it will not  
be necessary always to put in special flues for  
this purpose; but they must be in such a posi-  
70 tion as to admit of the jacket and circulating-  
pipes being suitably connected, as described.

Cocks may be placed in the pipes N N' on  
opposite sides of each of the check-valves *c c'*,  
so that steam may be shut off and the valves  
examined or repaired at any time. 75

In the superheating and circulating tubes  
the flame and heat and products of combus-  
tion move in an opposite direction to each  
other, the steam and water thus receiving a  
gradual accession of heat. The superheating- 80  
tubes may, of course, be placed below the level  
of the water in the boiler without impairing  
their action.

By superheating the steam in the boiler in  
the manner described no loss by radiation oc- 85  
curs, as when the superheating apparatus is  
outside. The steam is used immediately after  
superheating, only so much being superheated  
at once as will fill the cylinder. No heat is  
therefore taken from the boiler to be radiated 90  
and lost.

A water-cock may be placed in the chamber  
L to admit water to the jacket J while steam  
is being raised, to prevent the inner tube, I,  
being burned; or a damper may be used to 95  
close the said flues while steam is being raised.

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

1. In a steam-generator, A, in combination 100  
with the flues E, the surrounding jackets F, pro-  
vided with the upwardly and downwardly ex-  
tending pipes G G', whereby a more perfect  
circulation of the water in the boiler is main-  
105 tained, substantially as herein described.

2. In combination with a steam generator or  
boiler, A, the superheating tubes or flues I,  
with their jackets J, placed inside the genera-  
tor, as shown, said jackets connecting by pipes  
*a* with the tubes K K' and pipes *b b'*, leading 110  
to the chambers L L' on the boiler, these cham-  
bers being connected with the central drum or  
dome, M, by means of pipes N N', having check-  
valves *c c'*, whereby the steam is superheated  
and dried within the boiler and before leaving 115  
it, and a fresh supply of dry steam furnished  
to the cylinder at each stroke of the piston,  
substantially as and for the purpose herein  
described.

3. In a steam generator or boiler, A, the 120  
steam-superheating tubes I, with their jackets  
J, connecting pipes and drums L L' M, when  
said superheating-tubes and jackets are placed  
within the water-space of the boiler in which  
the steam is generated, and constructed and 125  
operated substantially as herein described.

In witness whereof I have hereunto set my  
hand.

JOHN B. WARD.

Witnesses:

CHAS. G. YALE,  
S. H. NOURSE.