

J. R. BROWN & W. A. FOSKETT.
Feed-Water Heaters.

No. 158,398.

Patented Jan. 5, 1875.

Fig: I.

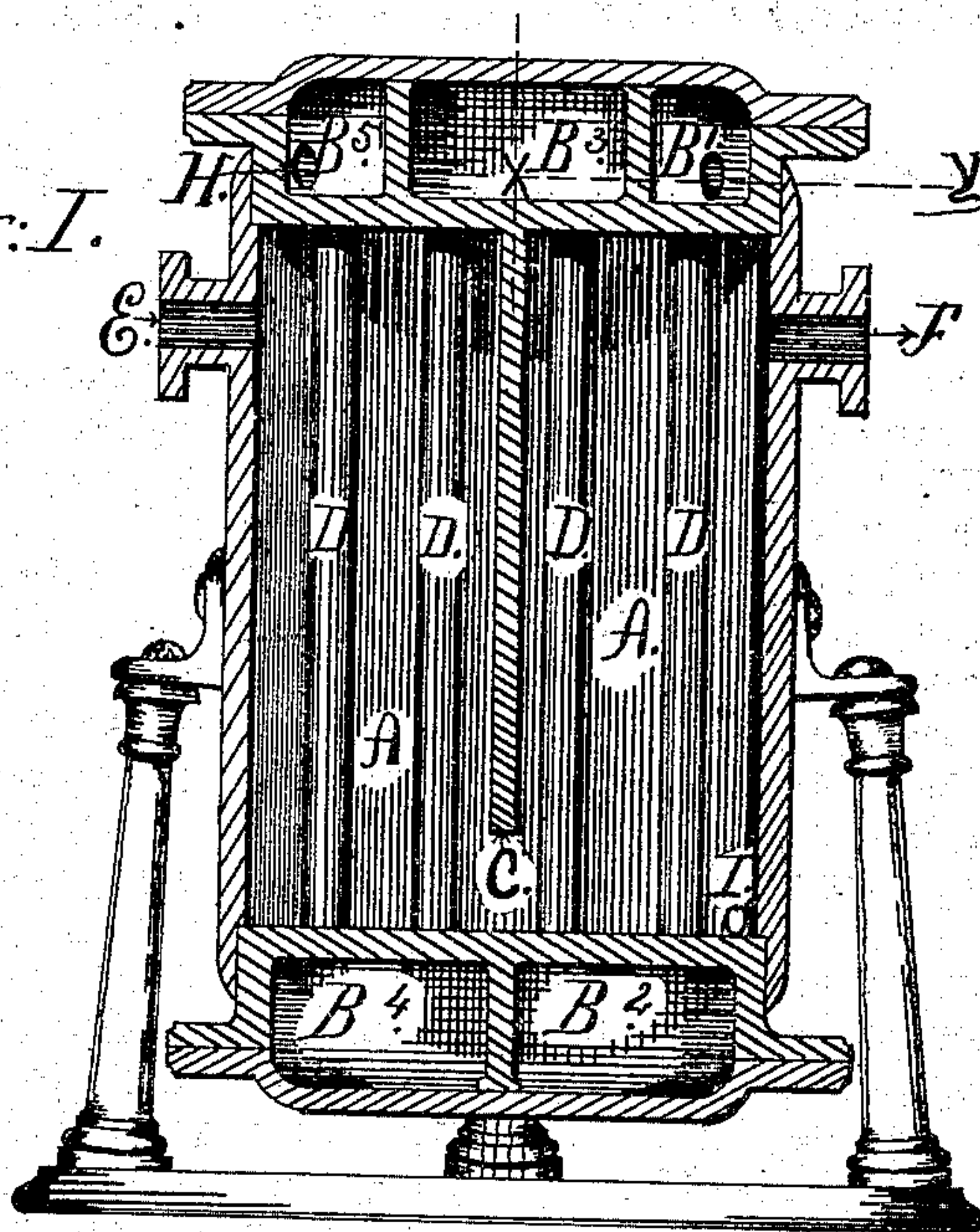
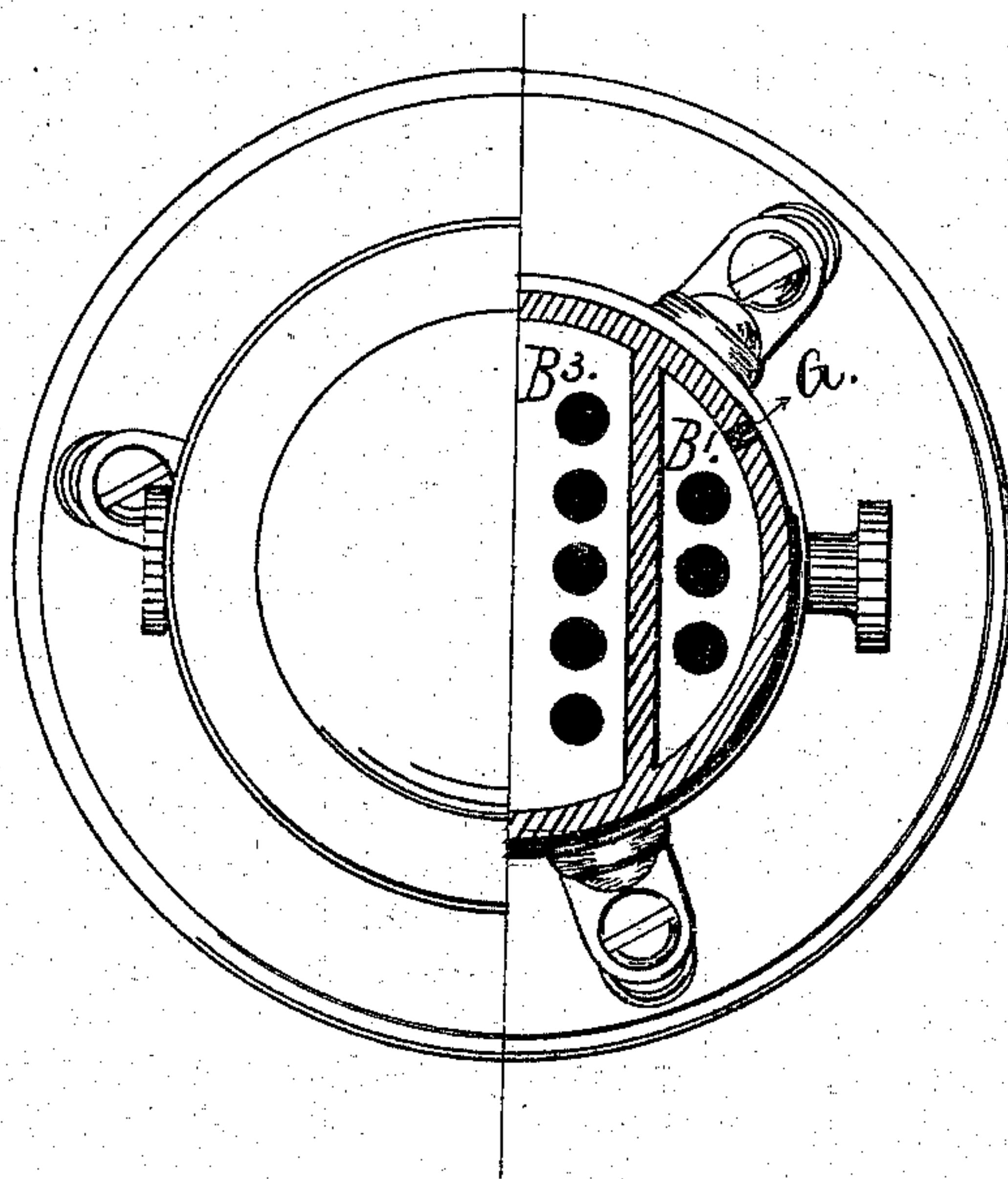


Fig II.



Witnesses

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IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **158,398**, dated January 5, 1875; application filed September 30, 1874.

To all whom it may concern:

Be it known that we, JOSEPH R. BROWN and WILLIAM A. FOSKETT, both of the city and county of New Haven, State of Connecticut, have invented a new and useful Improvement in Surface-Condensers; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure I is an elevation in section of our improved condenser, showing the chambers B, the tubes D, the baffle-plate C, as also the connections of the different pipes. Fig. II is a cross-section through the chambers B¹ B³ on the dotted line X Y, half the diameter and a top view the other half.

Our invention has reference to that class of condensers in which the exhaust steam and the condensing water pass in opposite directions, and in which the heat from the exhaust steam of a steam-engine is utilized to heat water; and consists in the combination and arrangement of certain of its parts in such a manner that the water shall be as long as possible in contact with the steam; that the steam also shall be as long as possible in contact with the water; and, also, so that the cold water entering the condenser shall be in contact with the steam leaving the same, but shall not affect the temperature of all the water in the condenser, and reduce the same, and that the water on leaving the condenser shall be as hot as the steam entering the condenser can make the same.

To accomplish these results, we place within the chamber A, which may be cylindrical or of any other suitable form, a series of tubes, D D, extending from one end to the other, they being secured to the tube-sheet, forming the end of the chamber A in the usual manner. Each end of the chamber A is divided by partitions into compartments, so that a series of tubes, D, open to the compartment B¹, will also be open to the compartment B², and another series of tubes open to B² will also be open to B³, and another series of tubes open both to compartments B³ and B⁴, while still another will communicate with both B⁴

and B⁵, where the outlet-pipe is connected, so as to form continuous up-and-down or forward-and-backward water-passages between the compartment B¹ and B⁵. The compartments are closed by a plate bolted to the outer flange, and also to the partitions separating the compartments B, by the removal of which free access is secured to the tubes D without disturbing any connections, all of which are made to the case A; the tubes may therefore be cleaned, packed, renewed, or repaired. The inlet for the water is by the pipe at G, and the outlet at H; the inlet for the steam is at E, and the outlet at F. C is a baffle-plate, which compels the steam to descend while surrounding one-half of the condensing-surface, and to ascend surrounding the other half before it can escape at F. I is the drip-pipe, by which the condensed water is drawn from the interior of the condenser.

We prefer to set up the condenser in its vertical position, as shown in the drawings, but also use the same when placed horizontal.

The action of the condenser when placed vertical is as follows: Supposing steam exhausting into the same, and cold water entering at G, the same would descend the series of tubes connecting the compartment B¹ with B², and in this descent would be in contact with surface heated by steam already deprived of the greater part of its heat. As, however, the absorption of heat depends primarily on the difference in temperature, the cold water would still absorb a large amount of heat from the steam about to escape. From the compartment B² the water ascends the tubes to the compartment B³; but the colder water could not so ascend, and thereby reduce the temperature of the water in the tubes and the compartment B³, as by gravitation the colder and heavier water would remain at the bottom, and the hotter water ascend to B³, for it must be remembered that the area of all the tubes connecting B² with B³ is much greater than the inlet and outlet pipes, and is but little effected by the water entering or leaving the condenser. In this respect this condenser must not be confounded with the well-known coil-heater, in which a number of pipes, connected by bends and elbows of uniform or nearly uniform diameter,

form forward-and-backward or up-and-down water-channels, through which the water is passed in a regularly progressive course, having no opportunity to allow the heated water to ascend, and so allow the colder to take its place, as is the case in our condenser, where the area of the tubes connecting B^2 and B^3 is a great many times the area of the inlet or outlet pipes. From the compartment B^3 the water descends through the tubes D to B^4 , and thence ascends to B^5 . The descent from B^3 to B^4 , and the ascent from B^4 to B^5 , depends in its velocity on the amount of water withdrawn, and the water is here exposed to the heat of the steam entering the condenser, so that the water before it leaves the compartment B^5 , is as hot as the steam in contact with the tubes can make the same, and much hotter than it can be made in a condenser in which the water is exposed to the temperature of the steam, both when entering and leaving the same, as in such a condenser the average heat is much lower than the water in our condenser when entering the compartment B^5 .

Our condenser is also superior to one in which the cold water enters the mass of water in the same, and thus reduces the temperature of the water to the average between the cold water and the water heated by the steam.

The steam is also deprived of its heat, and more completely condensed on account of the difference in the temperature of the water in the different groups of tubes, and the consequent difference in the temperature of the surface of the tubes to which the steam is exposed in succession, so as to come in contact with tubes containing cold water before it leaves the condenser.

When the condenser occupies a horizontal position, the absorption of heat by the water is not as complete, as the water, having absorbed heat, cannot ascend as readily from the surface of the tubes and allow the cooler water to take its place. As, however, in the compartments B ,

the hotter water may ascend, a partial separation takes place, and the hotter water will reach the outlet first. As the flow of water through the groups of tubes is very slow, and as the baffle-plate prevents the steam from rushing through the condenser, and is brought in contact with the warmest water first and the cold water last, the baffle-plate nearly dividing the condenser into two parts, and thus allowing a difference of temperature not possible with other condensers, this condenser, even in a horizontal position, is more efficient than a continuous coil-heater, or a condenser in which the tubes are not divided into groups, and the water compelled to pass from one compartment to the other, while the steam, preferably entering on top of the condenser, leaves the same at the bottom, and is thus brought in contact with the tube surface nearly as efficiently as when placed in the vertical position.

We do not claim as our invention entering the steam and water so as to flow in opposite directions, being aware the beer-coolers and coolers for other liquids are constructed on this principle. We claim, however, the peculiar means by which we accomplish the results, which, in practice, have been demonstrated as above stated.

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

The combination, in a surface-condenser, of the case A , circulating-tubes $D D D D$, the compartments B^1, B^2, B^3, B^4 , and B^5 , the compartments B^1 and B^5 containing a less number of tubes than the intermediate ones, and the baffle-plate C , the parts being arranged to operate substantially as and for the purpose set forth.

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Witnesses:

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