No. 682,488. Patented Sept. 10, 1901.

J. A. E. M. P. B. O'BRIEN.

APPARATUS FOR TRANSFORMING STEAM.

Application filed Aug. 7, 1900.)

(No Model.)

Fig. 3.

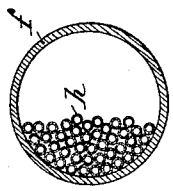


Fig. 4.

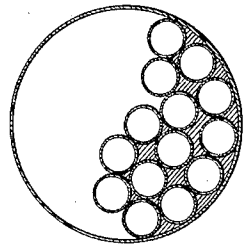


Fig. 2.

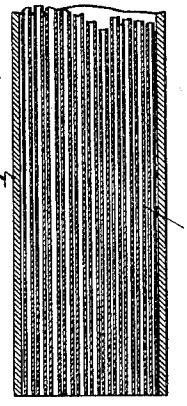


Fig. 6.

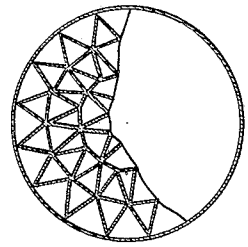


Fig. 5.

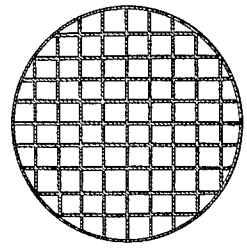
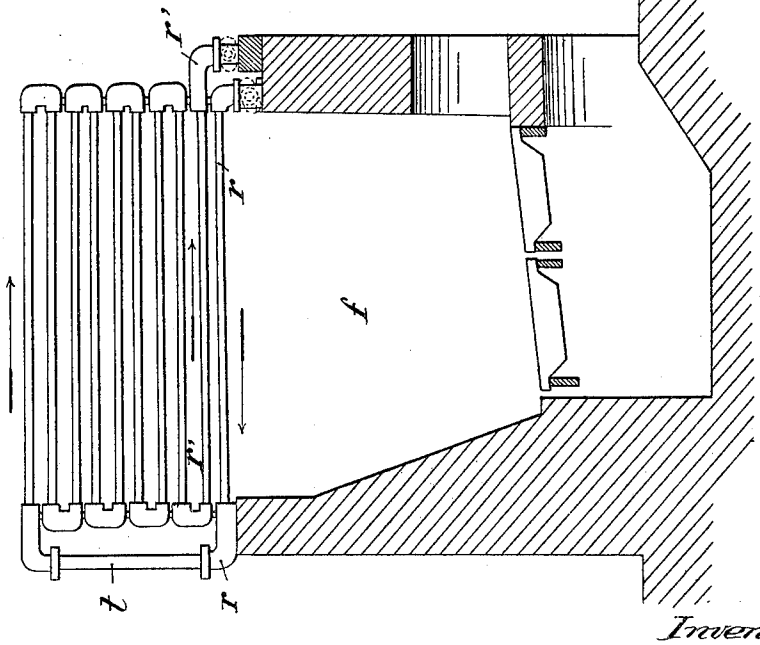


Fig. 1.



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UNITED STATES PATENT OFFICE.

JACQUES ANDRÉ ETIENNE MARIE PATRICE BERNARD O'BRIEN, OF PARIS, FRANCE.

APPARATUS FOR TRANSFORMING STEAM.

SPECIFICATION forming part of Letters Patent No. 682,488, dated September 10, 1901.

Application filed August 7, 1900. Serial No. 26,149. (No model.)

To all whom it may concern:

Be it known that I, JACQUES ANDRÉ ETIENNE MARIE PATRICE BERNARD O'BRIEN, engineer, of 20 Rue des Pyramides, in the city of Paris, Republic of France, have invented an Improved Apparatus for Transforming Steam, of which the following is a full, clear, and exact description.

This invention relates to an improved apparatus for transforming steam, and has for its object an apparatus by the use of which it becomes possible to convert or transform the steam by economically imparting to the latter any required degree of temperature without increasing the density thereof, and by causing this steam to circulate without too great a friction within a series of metal tubes, whose great surface operates upon the steam submitted to exceedingly-great division. The tubes constituting such apparatus are heated either by the waste hot gases escaping from the steam-generating furnace on their way to the chimney or by any convenient special furnace, so as to distribute the heat as uniformly as possible.

One of the important features of my invention consists in the fact that the large tubes containing the bundles of numerous smaller tubes directly receive and also directly transmit by conductibility the heat of the hearth to the steam.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is a vertical section of a hearth or furnace provided with my improved apparatus. Fig. 2 is a detail longitudinal section of one of the steam-tubes. Fig. 3 is a cross-section thereof, and Figs. 4, 5, and 6 are cross-sections of other tubes constructed according to my invention.

As illustrated in Fig. 1, I employ a series of superposed tubes or tiers of tubes located above the furnace f, the lowermost tube or tier r being therefore exposed directly to the action of the combustion products. Steam from the boiler or any other fluid to be heated is admitted at the right-hand end of said lowermost tube and passes at the left-hand end of said tube into an upright tube t, connected with the uppermost tube r^2, and then the steam or other fluid passes successively downward through the tubes below until it reaches the tube r', located immediately above the lowermost tube r. From the discharge end of said tube r' the steam or other fluid, which has been thoroughly superheated during its passage through the tubes, passes to the place of consumption, as to a steam-engine. It will be understood that steam of the lowest temperature passes through the lowermost tube, which being exposed to the strongest heat may require cooling in order to prevent injury thereto. In the main, however, the steam travels toward the furnace—that is, the heating action increases in energy as the steam travels toward the discharge end of the superheater, and thus I secure a very energetic action.

To further increase the heating effect, I construct each of the tubes after the principle shown in Figs. 2 to 6—that is, I locate within the tube r, which may be termed the "inclosing" tube, a series of small tubes h, open at both ends and extending lengthwise of said tube. These small tubes are in contact with each other and the outermost tubes are in contact with the inclosing tube. Thus the heat received by the inclosing tube will be transmitted to the small tubes and through their medium to the steam circulating through and between the small tubes. By this arrangement I secure, first, a subdivision of the steam or other fluid into thin streams, which facilitates its heating; second, I obtain a large metallic heating-surface, and, third, a multiplicity of points of contact between the small tubes themselves and the inclosing tube and a thorough transmission of heat.

The form of the inner tubes may be varied; but in any event they are to be open at both ends, so as to allow the fluid to pass through them. As shown in Figs. 2 and 3, the tubes h are cylindrical and spaces are left between them. In the construction shown in Fig. 4 the tubes h' are also cylindrical, but the spaces between them are filled, and in this construction while the cross-sectional area of the steam-passage is reduced the transmission of heat is enhanced by the greater body of metal. In Fig. 5 the tubes h^2 are of sub-

stantially square formation, excepting those located at the periphery of the inclosing tube r. In Fig. 6 the tubes h^3 are triangular in cross-section.

I claim—

1. In a superheater for steam and other fluids, a tube adapted for connection with the steam-supply, and a series of small tubes, open at both ends, located in the first-named or inclosing tube and extending lengthwise thereof, said small tubes being in contact with each other, and the outermost small tubes being in contact with the inclosing tube, so that the heat received by the inclosing tube will be transmitted to the small tubes and through their medium to the steam circulating through the small tubes, thereby securing first, a subdivision of the steam into thin streams to facilitate its heating, second, a large metallic heating-surface, and third, a multiplicity of points of contact between the small tubes themselves and the inclosing tube, and consequently, a thorough transmission of heat.

2. A superheater for steam and other fluids, consisting of a series of superposed tubes of which the lowermost is adapted for connection with a steam-supply at one end, while the other end of said lowermost tube is connected with one end of the uppermost tube, the other end of said uppermost tube being connected with one end of the next tube below, and so forth, to cause the steam to travel downward to the outlet, which is at one end of the tube immediately above the lowermost tube.

The foregoing specification of my improved apparatus for transforming steam signed by me this 27th day of July, 1900.

JACQUES ANDRÉ ETIENNE MARIE PATRICE BERNARD O'BRIEN.

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