No. 833,642. PATENTED OCT. 16, 1906.

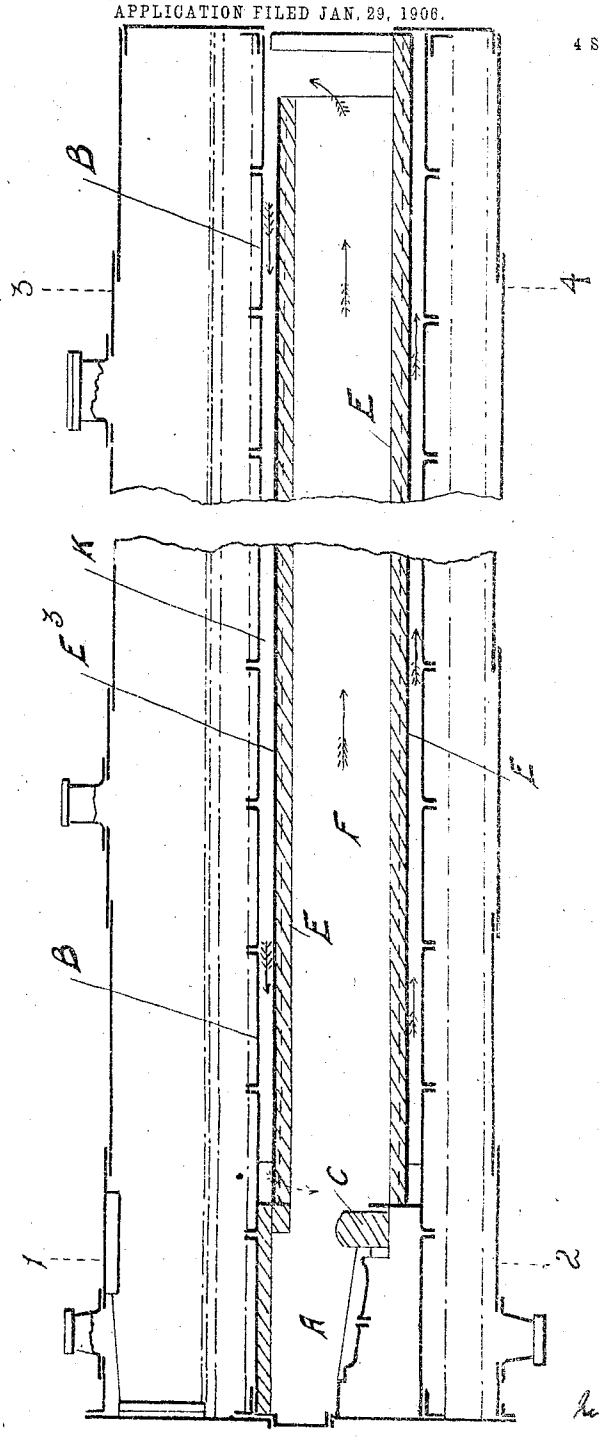
A. SMALLWOOD.

HEAT DIFFUSER FOR STEAM BOILERS.

APPLICATION FILED JAN. 29, 1906.

4 SHEETS—SHEET 1.

FIG. 1.



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4 SHEETS—SHEET 2.

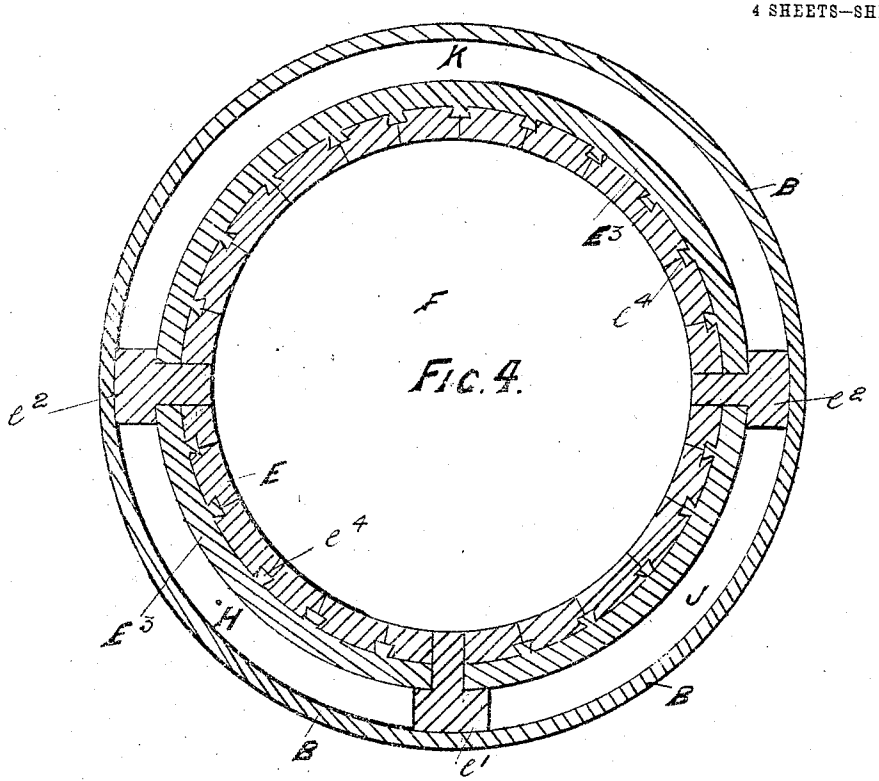
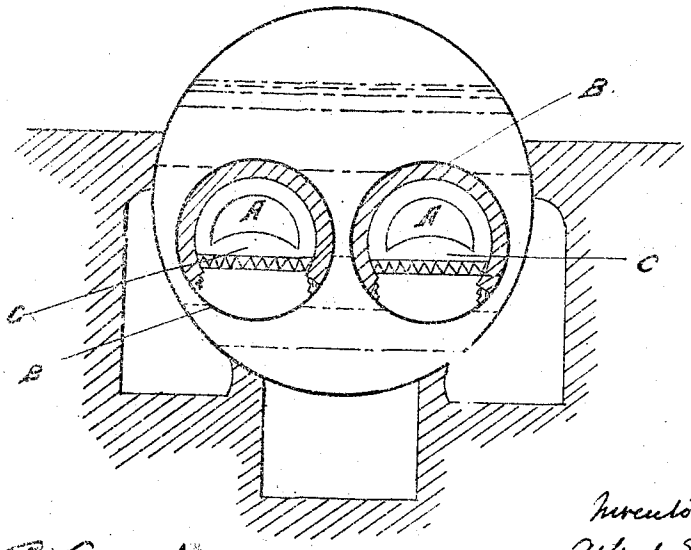


FIG. 4.

FIG. 2.



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4 SHEETS—SHEET 3.

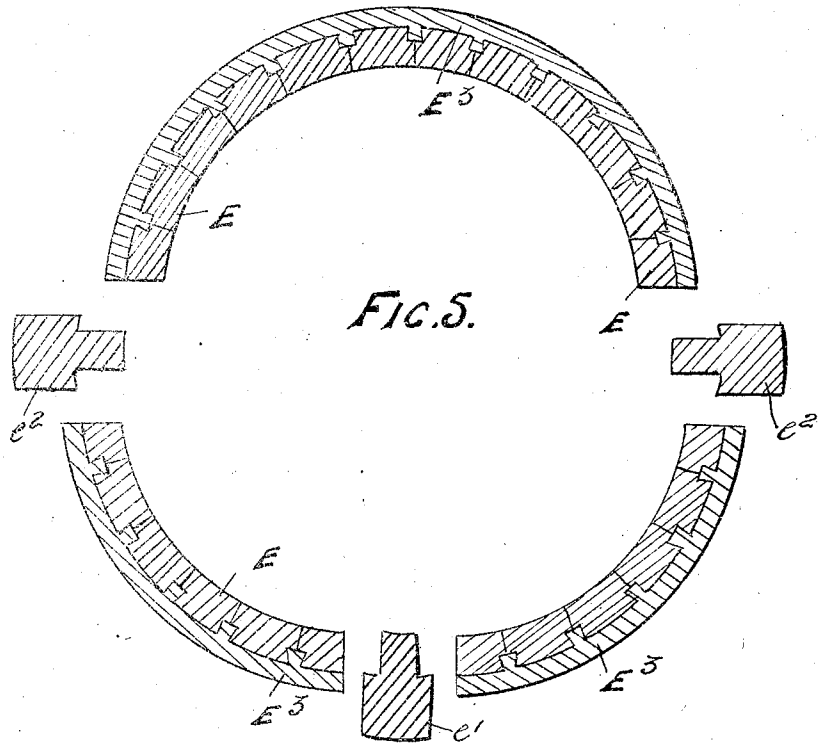


FIG. 5.

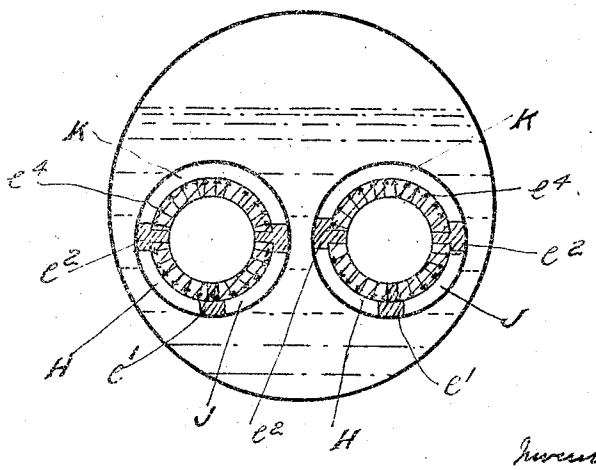


FIG. 3.

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4 SHEETS—SHEET 4.

FIG. 6.

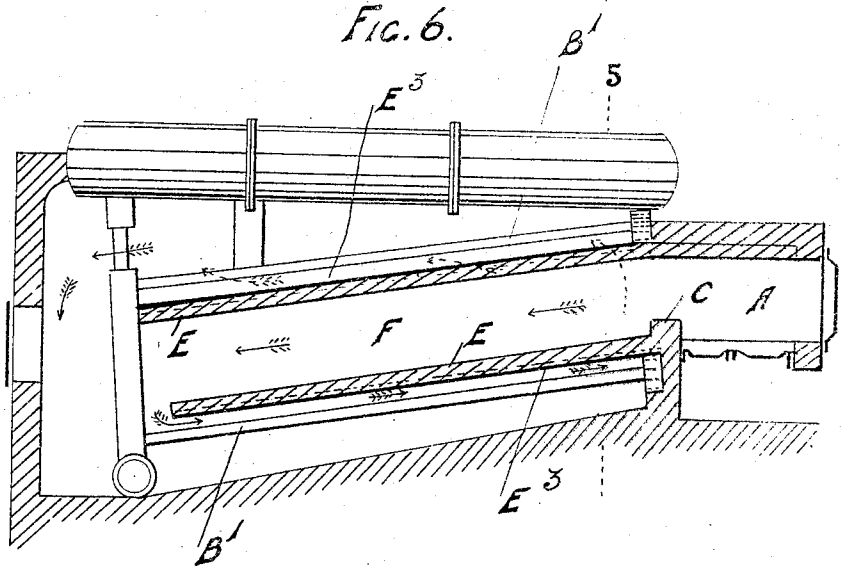
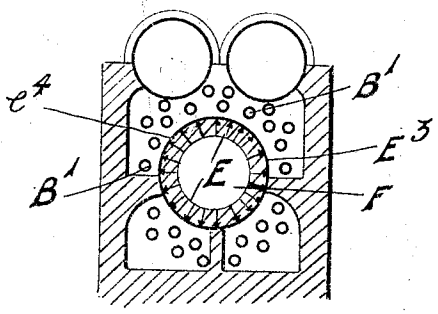


FIG. 7.



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UNITED STATES PATENT OFFICE.

ALFRED SMALLWOOD, OF LONDON, ENGLAND.

HEAT-DIFFUSER FOR STEAM-BOILERS.

No. 833,642. Specification of Letters Patent. Patented Oct. 16, 1906.

Application filed January 29, 1906. Serial No. 298,536.

To all whom it may concern:

Be it known that I, ALFRED SMALLWOOD, metallurgist, a subject of the King of Great Britain, and a resident of 34 Old Broad street, in the city of London, in the county of Middlesex, England, have invented certain new and useful Improvements in Heat-Diffusers for Steam-Boilers, (for which I have applied for patents in Great Britain, Patent No. 1,865, dated January 31, 1905; Austria, certificate dated December 13, 1905; Hungary, certificate No. 15,177, dated December 12, 1905; Luxemburg, Patent No. 6,141, dated December 13, 1905,) of which the following is a specification.

This invention relates to improvements in the means for generating and diffusing heat in connection with steam-boilers of the Lancashire, Cornish, water-tube, or other similar type, and which, in combination with the improved generating of the heat, has for its object the more perfect application of the heat to the furnace-tubes of the boiler.

By the hereinafter-described arrangement of chambers the unignited gases are first passed from the fire-grate through a fire-brick, fire-clay, or the like combustion-chamber, whereby they are thoroughly ignited and converted into heated gases previously to the said heated gases being allowed to have contact with the heat-absorbing surface of the boiler-tube, such heated gases being passed between the outside of the combustion-chamber and the inside of the boiler-tube, by which means the heat is not only imparted to the tube, but also serves to retain the tube forming the combustion-chamber in a more or less incandescent state, thus assisting in the ignition of the unconsumed gases as they pass through the combustion-chamber, in addition to which the combustion-chamber is so constructed as to assist in the retardation and accumulation of the constant proportion of heat for igniting the carbon and other uncombusted gases in their passage through the combustion-chamber and at the same time so as to assist in the application and diffusion of the remaining heat thus generated, the application and diffusion being effected in such a manner as to transfer the heat to the boiler in a direct and rapid manner.

In order that this invention may be clearly understood and more easily carried into practice, I have appended hereunto three sheets of drawings upon which I have illustrated the nature of my said invention.

Figure 1 is a longitudinal section through a Lancashire boiler, illustrating the application of my improvements thereto. Fig. 2 is a section through Fig. 1 on the line 1 2. Fig. 3 is a section through Fig. 1 on the line 3 4. Fig. 4 is an enlarged section through one of the fire-tubes. Fig. 5 is also an enlarged section illustrating one form in which the parts of the inner tube shown in the previous figures may be made up. Fig. 6 is a longitudinal section through one form of water-tube boiler, illustrating the application of these improvements thereto. Fig. 7 is a cross-section through Fig. 6 on the line 5 6.

In carrying this invention into effect and referring to the application of the improvements to a Lancashire boiler the grates or furnaces A are formed within or adjoining the front end of the furnace-tubes B and may be provided with a bridge C, beyond which an inner tube E, of fire-brick, fire-clay, plumbago, or other suitable material, is provided and supported in a position at or near the center of the furnace-tube by means of a supporting-division e' in such a manner that a space is provided between the inner tube and the boiler-tube. In addition to the bottom or supporting division e' the space between the tubes is divided upon each side at e^2, thus dividing the space into the three longitudinal flues H, J, and K, the two lower ones, H and J, each occupying a quarter of the circumference, while the top one, K, occupies the other half. The inner or fire-brick tube E communicates at the front end with the grate A and forms the combustion-chamber F, the rear end being connected with the top flue or chamber, by which means the heated gases ignited in the combustion-chamber are first passed through the top flue K or chamber over the combustion-chamber and back again under the combustion-chamber by the bottom flues H and J, the top flue K being connected with the bottom flues H and J at the grate end of the furnace-tube to enable the heated gases to take this course. By this arrangement the tube E, forming the combustion-chamber F, is retained in a state of incandescence by reason of the passage of the fully-ignited gases through the flues H, J, and K, thus assisting to ignite the uncombusted gases in their passage through the combustion-chamber, while at the same time the ar-

rangement of the combustion-chamber E, with its surrounding heat-chambers H, J, and K insures a more perfect application of the heat to the boiler through the furnace-tubes.

The combustion-chamber tube E may be formed to a cone shape, so as to be reduced in diameter at the reverse end to that of the grate, and both the combustion and heat chambers may be more or less extended in length, and the interior of the combustion-chamber may be provided with suitable projections or extensions for assisting in mixing up and igniting the uncombusted gases in their passage through the combustion-chamber.

The particular arrangement of the supporting-divisions e' e^2 of the intermediate or heat chamber, as hereinbefore described, may be varied without departing from the nature of my said invention.

While the hereinbefore-described combustion-chamber, which is formed of fire-brick, fire-clay, or the like, forms an excellent accumulation and retarder of the heat and will radiate sufficient heat for the ignition of the unconsumed gases in the combustion-chamber, the casing, being of a non-conducting nature, forms an imperfect conductor in connection with the diffusion and transfer of the additional heated gases generated to the boiler or other article which it is required to heat, and it is one of the objects of this invention to overcome such deficiency and to effect which the tube forming the combustion-chamber is constructed with a fire-brick, fire-clay, or other lining which in working of the furnace becomes incandescent and forms a retarder and accumulator of a proportion of the heat which radiates into the combustion-chamber sufficiently to assist in igniting the unconsumed gases as they pass through from the grate, as hereinbefore referred to, while around this lining a more or less heavy metal tube or casing E^3 is provided and connected to the lining by dovetail or other projecting ribs e^4, which are provided upon the tube E^3 and which fit into dovetail or other suitable recesses formed in the lining, the combustion-chamber being formed in sections or lengths to admit of such construction. By means of this metal tube or casing a considerable proportion of the heat of the combustion-chamber is diffused and transmitted to the fire-tube or other part of the boiler to be heated, in addition to which the end of the combustion-chamber is connected with the annular space, and the whole of the remaining heated gases are passed between the outer lining E^3 of the combustion-chamber and the fire-tube B, the annular space being preferably divided to form a top and bottom flue through which the heated gases pass, as before described.

In the application of this invention to water-tube boilers the combustion-chamber is shaped so as to be contained within, arranged around, or adjacent to the groups of water-tubes, as may be rendered necessary to suit their particular arrangement, one form being illustrated by Figs. 5 and 6, in which the partition E, forming the combustion-chamber, is constructed as hereinbefore described and arranged with the metal casing E^3, facing the tubes B′ for the diffusion of heat thereto, while the remaining heat from the inside of the combustion-chamber is passed, as indicated by arrows, through the chambers M and N, which contain the water-tubes B′. In all cases the width of the annular or equivalent space between the combustion-chamber casing E^3 and the boiler B or water-tubes B′ is so arranged that the high temperature of the metal casing of the combustion-chamber is limited by the absorption of the heat by the boiler or water-tubes, thus preventing the casing E^3 from becoming sufficiently heated to damage the boiler and at the same time increasing the life of such metal casing.

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

1. A means for generating and diffusing heat in connection with steam-boilers comprising a furnace-tube, a furnace formed within and adjoining the front end thereof, an inner tube of mineral material capable of becoming incandescent centrally located within the furnace-tube, supporting-divisions to maintain the inner tube correctly positioned within the furnace-tube and to form the space between the inner and furnace-tubes into separate flues, means for the passage of the gases from the inner tube at the opposite end thereof to the furnace into one of said flues, and other means for the passage of the gases from said flue into the other flue or flues at the opposite end thereof to the first-mentioned means.

2. A means for generating and diffusing heat in connection with steam-boilers comprising a furnace-tube, a furnace formed within and adjoining the front end thereof, an inner tube of mineral material capable of becoming incandescent centrally located within the furnace-tube, supporting-divisions to maintain the inner tube correctly positioned within the furnace-tube and to form the space between the inner and furnace tubes into separate flues, means for the passage of the gases from the inner tube at the opposite end thereof to the furnace into one of said flues, other means for the passage of the gases from said flue into the other flue or flues at the opposite end thereof to the first-mentioned means, and a metallic casing inclosing the inner tube and having dovetails formed on its inner face to enter dovetail grooves in the outer face of the inner tube.

3. A means for generating and diffusing

heat in connection with steam-boilers comprising a furnace-tube, a furnace formed within and adjoining the front end thereof, an inner tube of mineral material capable of becoming incandescent centrally located within the furnace-tube, supporting-divisions to maintain the inner tube correctly positioned within the furnace-tube and to form the space between the inner and furnace-tubes into separate flues, means for the passage of the gases from the inner tube at the opposite end thereof to the furnace into one of said flues, other means for the passage of the gases from said flue into the other flue or flues at the opposite end thereof to the first-mentioned means, and a boiler inclosing the furnace-tube.

4. A means for generating and diffusing heat in connection with steam-boilers comprising a furnace-tube, a furnace formed within and adjoining the front end thereof, an inner tube of mineral material capable of becoming incandescent centrally located within the furnace-tube, supporting-divisions to maintain the inner tube correctly positioned within the furnace-tube and to form the space between the inner and furnace-tubes into separate flues, means for the passage of the gases from the inner tube at the opposite end thereof to the furnace into one of said flues, other means for the passage of the gases from said flue into the other flue or flues at the opposite end thereof to the first-mentioned means, a metallic casing inclosing the inner tube and having dovetails formed on its inner face to enter dovetail grooves in the outer face of the inner tube, and a boiler inclosing the furnace-tube.

In witness whereof I have hereunto set my hand in the presence of two witnesess.

ALFRED SMALLWOOD.

Witnesses:

WALTER H. E. BARTLAM,

JUSTUS JONES.