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PATENTED OCT. 16, 1906

A. SMALLWOOD.

MEANS FOR GENERATING AND APPLYING HEAT FOR STEAM BOILERS,
FURNACES, &c.

APPLICATION FILED OCT. 19, 1904.

2 SHEETS—SHEET 1

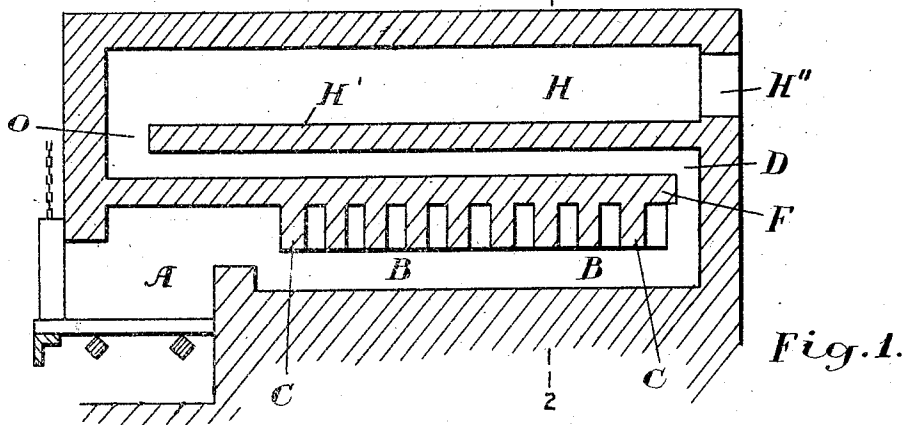


Fig. 1.

Fig. 2.

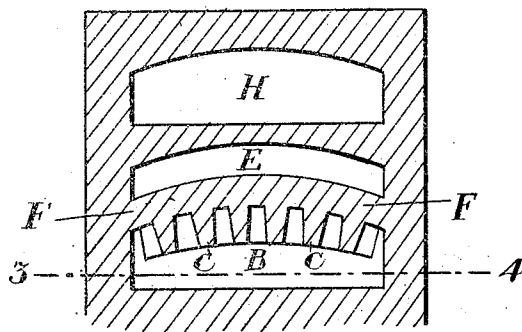
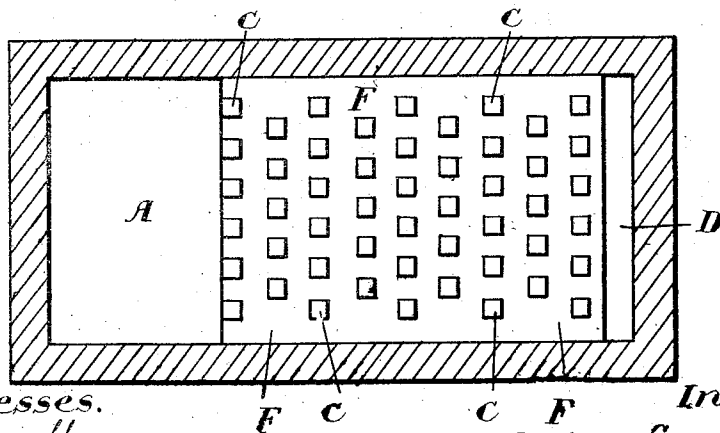


Fig. 3.



Witnesses.

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2 SHEETS—SHEET 2.

FIG. 5.

FIG. 6.

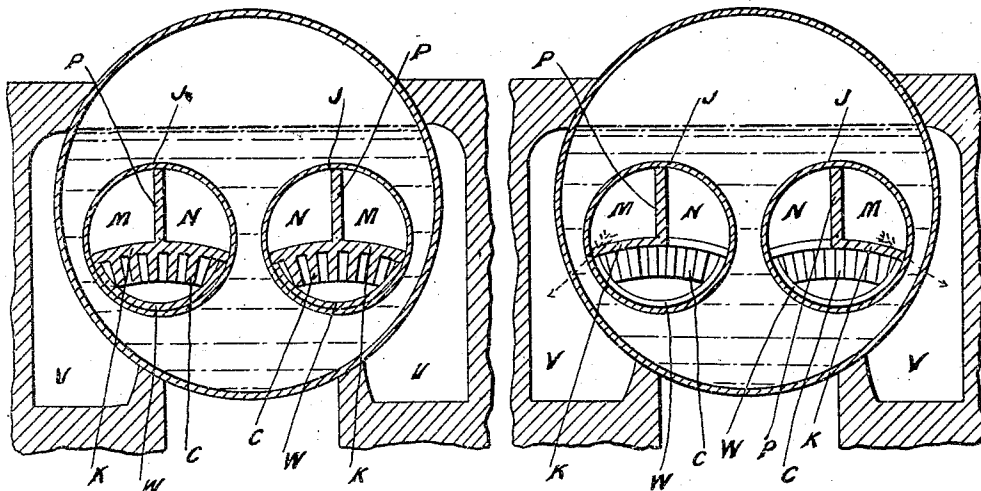
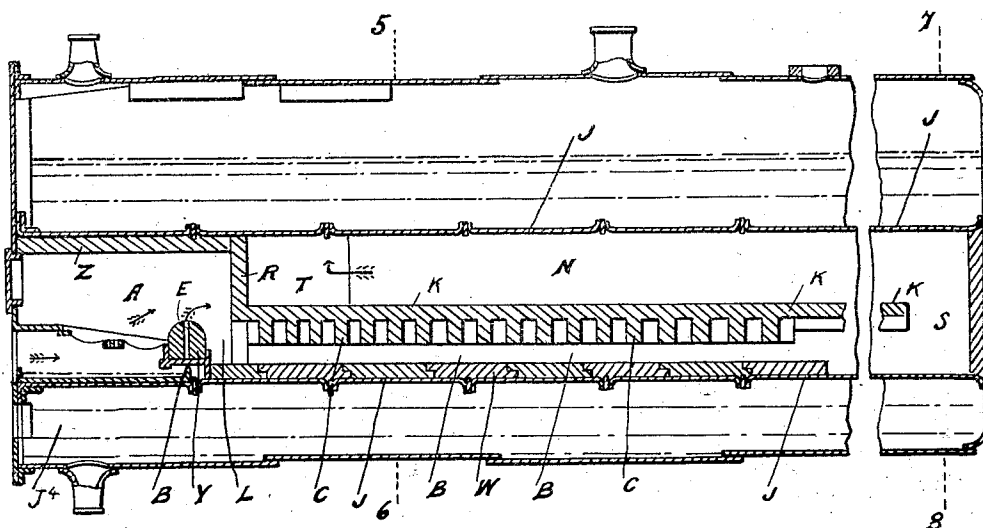


FIG. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

ALFRED SMALLWOOD, OF LONDON, ENGLAND, ASSIGNOR TO THE INCANDESCENT HEAT COMPANY LIMITED, OF LONDON, ENGLAND.

MEANS FOR GENERATING AND APPLYING HEAT FOR STEAM-BOILERS, FURNACES, &c.

No. 833,639.

Specification of Letters Patent.

Patented Oct. 16, 1906.

Application filed October 19, 1904. Serial No. 229,201.

To all whom it may concern:

Be it known that I, ALFRED SMALLWOOD, a British subject, and a resident of 52 Gracechurch street, in the city of London, in the county of Middlesex, England, have invented certain new and useful Improvements in Means for Generating and Applying Heat for Steam-Boilers, Furnaces, and the Like; and I hereby declare that the following is a full, clear, and exact description of the same.

I have been engaged in researches and practical and other tests and experiments with the object of obtaining practically perfect combustion in furnace systems for all purposes, and find that in order to obtain the best results from furnaces for generating heat it is necessary to provide a combination of means which will cause such an accumulation, absorption, retardation, circulation, and use of the heat which has been initially generated as shall insure a sufficiently high temperature as will effect a practically complete combination of the carbon and other materials of combustion with oxygen for ignition and conversion into heat and at the same time be satisfied with a more economical use of air in the supply of such oxygen.

In order that my invention may be clearly understood and more easily carried into practice, I have appended hereunto drawings upon which I have illustrated the application of my said improvements to annealing-furnaces, and to Lancashire boilers, and from which its general application will readily be understood.

For a full understanding of the invention reference is to be had to the following description and to the accompanying drawings, in which—

Figure 1 is a longitudinal section through a heat-generating furnace suitable for heating, annealing, and like purposes. Fig. 2 is a vertical section through Fig. 1. on the line 1 2. Fig. 3 is an inverted plan through Fig. 1 2. Fig. 4 is a longitudinal section showing the application of the invention to a Lancashire boiler. Fig. 5 is a vertical cross-section through Fig. 4 on the line 5 6. Fig. 6 is a vertical section through Fig. 4 on the line 7 8.

Like letters of reference refer to like parts throughout the specification and drawings.

As shown in Figs. 1 and 2, the heat-generating furnace is constructed with a fire-

chamber A, a shallow combustion-chamber B, adjoining the fire-chamber and in the same horizontal plane therewith, but of greater capacity than the fire-chamber, and a heat-chamber H, located above the combustion-chamber B and separated from the combustion-chamber by a non-fusible partition F capable of becoming incandescent by the absorption of the calories from the gases generated in the fire-chamber A as they pass from the fire-chamber through the combustion and heat chambers to the outlet H". In the partition F, at the opposite end of the combustion-chamber to the fire-chamber A, is an aperture D, and in the heat-chamber H is a baffle H', so positioned therein as to leave a shallow passage for the gases between itself and the partition F, and in the baffle H' is an aperture O, at the opposite end of the heat-chamber to the aperture D, to form a tortuous course for the gases from the fire-chamber A through the combustion-chamber to the heat-chamber H and outlet H". The partition F is formed with a number of non-fusible obstructions C, made of the same material as the partition F and capable of becoming incandescent. The obstructions C project downwardly into the combustion-chamber to form an accumulator, retarder, absorber, and circulator of the calories by detaining them in the combustion-chamber for a sufficient time to enable them to become thoroughly ignited and mixed before they pass from the combustion-chamber into the heat-chamber. Owing to the incandescence of the obstructions and the partition F, the unconsumed gases which pass from the combustion-chamber into the heat-chamber are ignited therein and the heat generated by the combustion of the gases in the heat-chamber assists in effecting and maintaining the incandescence of the partition, being assisted in this respect by the location of the baffle H' contained within the heat-chamber.

It has been demonstrated in the field of actual operation that the unconsumed gases, by reason of their greater specific gravity resulting from their lower temperature, are to be found at the bottom of the combustion-chamber, and by providing the furnace with a comparatively shallow combustion-chamber and projecting the obstructions C into the chamber in the path of the gases, so that

they will be directed to the bottom thereof, a complete or substantially complete combustion is effected. * It has also been proved in the field of actual operation that while there is no extensive difference between the principle of the construction of the furnace forming part of the present application and that of known appliances, yet the difference in detail of the construction has resulted in an actual saving by this furnace of over twenty-five per cent. of the fuel used by the other known appliances to produce the same quantity of heat as can be produced by this furnace.

In the application of my improvements to boilers having smoke-tubes, such as those of the Lancashire and Cornish type, (shown in Figs. 4, 5, and 6,) the fire-chambers A are formed within or adjoining the front end of the tubes J and may be provided with a bridge Y, having a suitable cavity E, forming an air-inlet for the purpose hereinafter described. Beyond the bridge each tube J is divided by a horizontal partition K into two horizontal chambers, the lower one B of which is employed as a combustion-chamber and the upper of which is divided vertically into two heat-chambers M N, extending lengthwise along the tube J beyond the fire-chambers A. The horizontal partition K is made of fire-brick, fire-clay, or other heat-retaining material and is provided with non-fusible obstructions C, projecting into the combustion-chamber B, the front part L of which is open to the fire-chamber to allow the gases to pass therein from the fire-chamber A, while the second or vertical partition P, between the heat-chambers M and N, is of similar material. The upper chamber with its subdivisions is blocked at the end R, which is immediately behind the fire-chamber A, and on the one side the heat-chamber N is connected at the opposite end S of the tube J with the combustion-chamber B. The heat-chambers M and N have an opening T between them at the fire-chamber end of the tube and the heat-chamber M is connected at the back end with the external side flue or flues V in the ordinary manner, as shown by dotted arrows in Fig. 6. The heated gases after leaving the combustion B pass upward at the rear of the partition K and then return toward the fire-chamber through the heat-chamber N, and then return to the rear of the tube J by means of the other heat-chamber M. Both the horizontal and vertical partitions, which are made of fire-brick, fire-clay, or other suitable material, become incandescent throughout, the effect being that ignition and combustion of the unconsumed gases and material as they pass through the combustion-chamber from the fire-chamber is insured. In the case of the Lancashire boilers the above arrangement may be applied to one of the

tubes J only, in which case the other tube may be longitudinally divided into two parts only, the heated gases after passing from the first tube in such cases being conveyed up and down the second tube before passing to the external flues. The bridge Y may be constructed with a space intermediately between the under side of the bridge and the bottom of the tube; while the part J⁴ of the tube extending under the fire-chamber is arranged to contain water, over the surface of which the air passes before ascending through the bridge-cavity, by which means the air before combining with the unconsumed gases and material is at the same time heated and moistened. The upper part of the fire-chamber may be lined with fire-brick, fire-clay, or other such lining Z, while the lower part of the tube J, near the fire-chamber end of the combustion-chamber, may be lined with a similar internal lining W, of fire-brick, fire-clay, plumbago, or other material, the whole being arranged for the purpose of preventing the lower temperature of the boiler from retarding the ignition and combustion of the gases and material as they are produced in the fire-chamber and pass into and through the combustion-chamber B from the fire-chamber A. In this case the obstructions C on the lower side of the partition K are designed and constructed, as before described, so as to increase its capacity as an accumulator and retarder of the heat which has been generated in the combustion-chamber and otherwise to form a means whereby practically complete combustion can be obtained.

The plumbago or other casing and the aforesaid obstructions C are extended along the combustion-chamber B at selective places to provide a combustion-chamber of sufficient extent to ignite the unconsumed gases and material gases and transform them into heat.

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

1. The hereinbefore-described construction comprising a fire-chamber, a shallow combustion-chamber in rear of and in the same horizontal plane as the fire-chamber and in communication therewith, a comparatively shallow heat-chamber above the combustion-chamber with a refractory partition between them capable of becoming incandescent, and refractory obstructions capable of becoming incandescent projecting from the partition into the combustion-chamber to retard the circulation of the gases through the combustion-chamber and mix and ignite them while retarded therein, and means of communication between the combustion and heat chambers at the end thereof opposite to the fire-chamber.

2. The hereinbefore-described construc-

tion comprising a fire-chamber, a combustion-chamber in communication therewith, a heat-chamber above the combustion-chamber, a horizontal non-fusible partition capable of becoming incandescent between the combustion-chamber and heat-chamber, non-fusible obstructions capable of becoming incandescent projecting from the partition into the combustion-chamber whereby the gases are retarded, mixed and ignited in their passage from the fire-chamber through the combustion-chamber to the heat-cham-

ber and a vertical partition within the heat-chamber separating it into two longitudinal sections in communication with each other and with the combustion-chamber and gas-outlet.

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

ALFRED SMALLWOOD.

Witnesses:

WALTER H. E. BARTLAM,
JUSTUS JONES.