A. SMALLWOOD.

FURNACE FOR HEATING OR ANNEALING.

APPLICATION FILED SEPT. 21, 1914.

1,226,266.

Patented May 15, 1917.

2 SHEETS—SHEET 1.

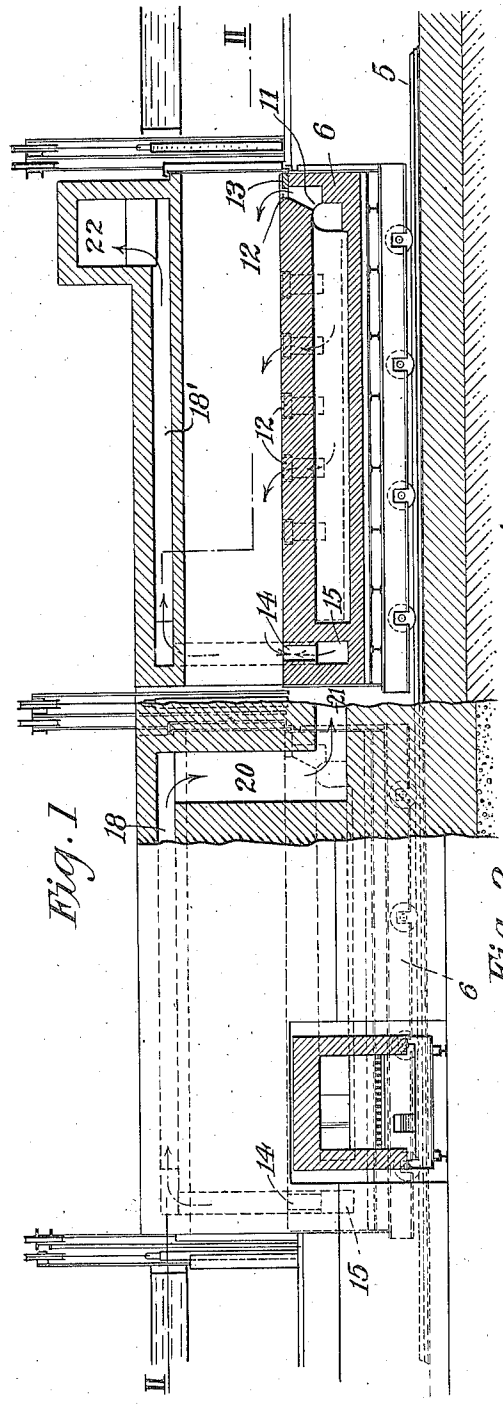


Fig. 1

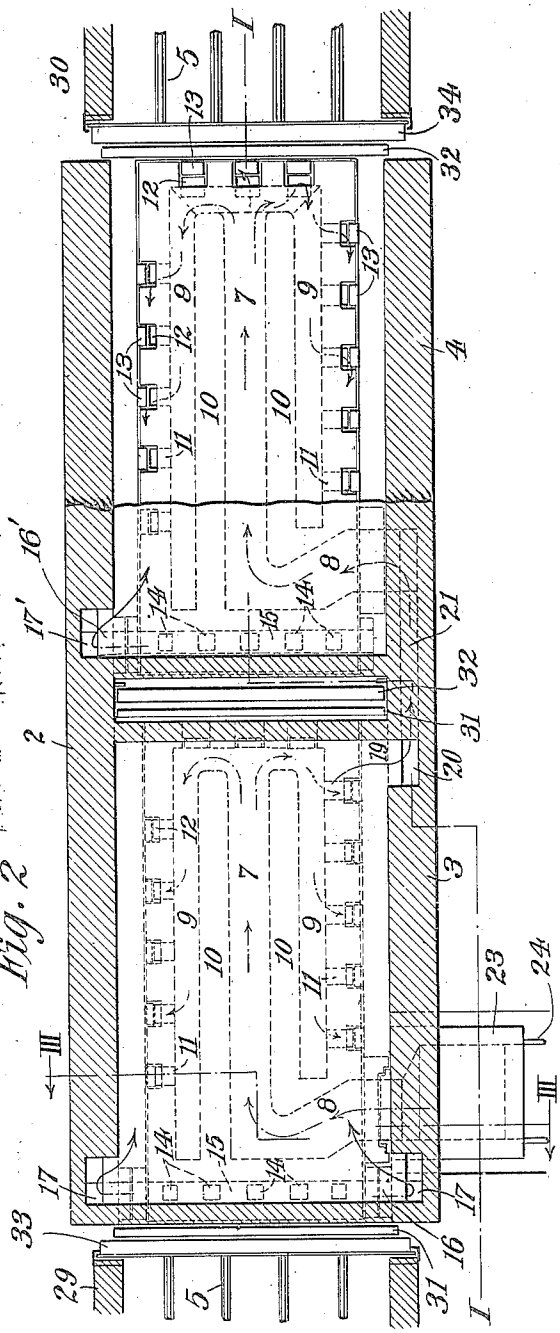


Fig. 2

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By his Attorney
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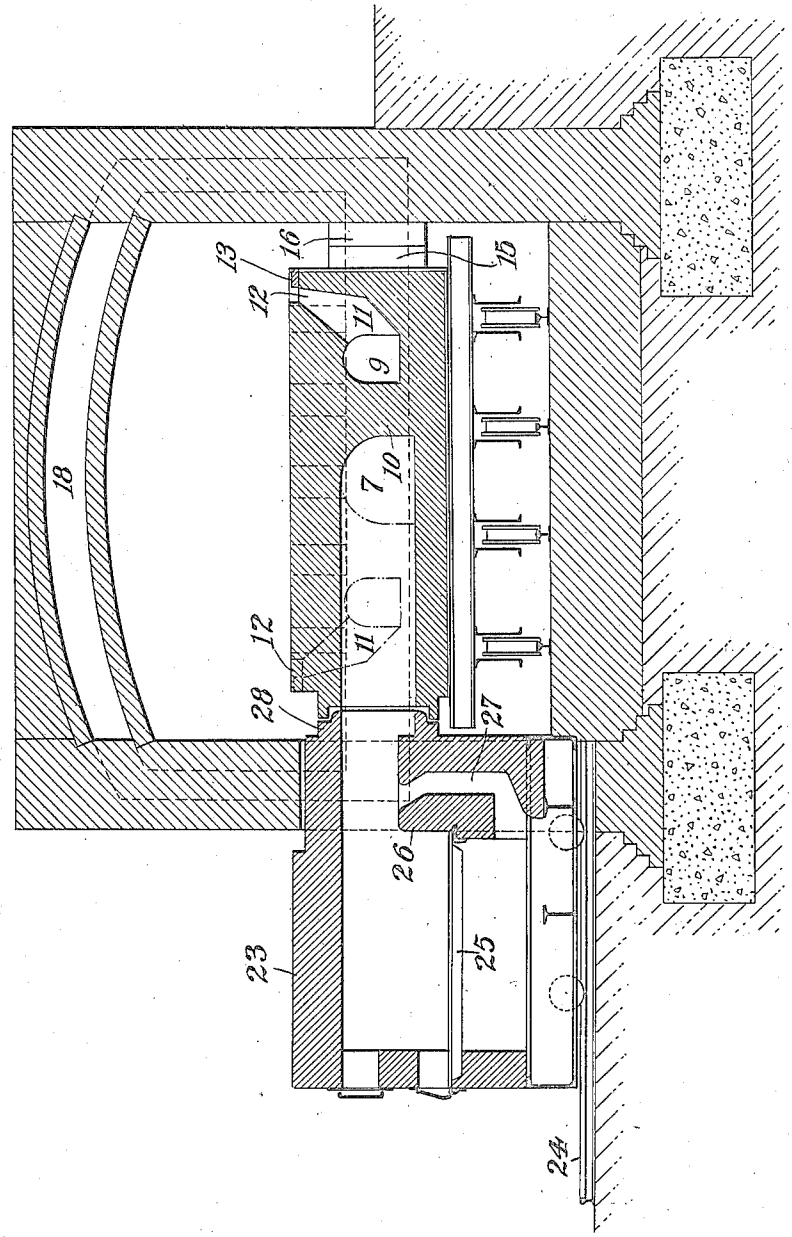
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2 SHEETS—SHEET 2.

Fig. 3



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UNITED STATES PATENT OFFICE.

ALFRED SMALLWOOD, OF LONDON, ENGLAND, ASSIGNOR TO AMERICAN INCANDESCENT HEAT COMPANY, OF PORTLAND, MAINE, A CORPORATION OF MAINE.

FURNACE FOR HEATING OR ANNEALING.

1,226,266. Specification of Letters Patent. Patented May 15, 1917.

Application filed September 21, 1914. Serial No. 862,753.

To all whom it may concern:

Be it known that I, ALFRED SMALLWOOD, a subject of the King of Great Britain, residing at 42 Hargrave Park, Highgate, London, N., in the county of Middlesex, England, have invented Improvements in or Relating to Furnaces for Heating or Annealing, of which the following is a specification.

In the construction of furnaces for various purposes it has, almost uniformly, been the aim of designers to cause combustion to take place at the point where the heat is to be utilized. Such procedure tends, however, to prevent complete combustion, for, if the substance being heated (and a notable example is found in the case of steam boilers) is below the flash point of the burning gases, such gases as come within the influence of the relatively cool substance will not be ignited. Accordingly, in the patents which have heretofore been issued to me, I have shown various arrangements of furnaces in which combustion can be more or less completed before the gases are brought in contact with substances at a temperature below their flash point. In these furnaces, however, as in all furnaces known to me before my present invention, the amount of heat available for use at any given time is very largely dependent on the amount of fuel being consumed. For example, if a charge of cold metal is put into such a furnace, which has been brought to a working temperature, the metal will at once absorb all the available heat and cool down the furnace, which must wait until new heat is generated before its temperature can reach the point necessary for the desired treatment.

By my present invention I am able to manufacture furnaces for a great variety of uses, in which the heat is poured steadily into a reservoir where it may be stored up ready for use and from which it may be drawn at any time or to any point desired. By accomplishing this storage of heat I have on hand, at all times, a reserve that may be utilized to meet extraordinary demands, whereby I am able to maintain the heat at an extraordinarily even level. This not only enables me to produce results far superior to those heretofore accomplished, but further, the fact that the heat can be poured uniformly into the reservoir greatly decreases the amount of fuel that need be consumed. At the same time the amount of labor necessary to operate the furnaces can be decreased, for, when desired, from a single heat reservoir, supplied by a single fire grate, heat may be drawn for use in a large number of independent furnaces, that may be used for different purposes and operated at different temperatures.

Broadly speaking, my invention consists in supplying the furnace with a grate or other place for initial combustion, preferably fitted with means for controlling the supply of air; a heat reservoir of sufficient volume so that the combustion of the generated gases may be completed within it and which may be supplied with a separate supply of air to assist combustion, if an oxidizing atmosphere is desired in the working chamber, but which should not be supplied with such additional air if it is desired to take advantage of the large combustion chamber to cause substantially all of the free oxygen present to combine with carbon and thus produce a non-oxidizing atmosphere in the working chamber, together with controllable means for distributing the heat from the reservoir to various points in the working chamber.

In practice, the distribution of heat is usually accomplished by splitting up the reservoir space into a main chamber well inclosed in firebrick or other material which will absorb a large volume of heat without transmitting the heat to the exterior of the furnace to any great extent, and a secondary chamber for each working chamber, separated from the working chamber by a partition through which the heat will radiate, giving a large amount of evenly distributed heat, in addition to that which may be transmitted directly to the working chamber through properly positioned and controlled ports.

By inclosing the main heat chamber in walls through which relatively little heat can penetrate to the exterior of the furnace, and by using with the working chamber a separate radiating chamber having controllable ports, great storage efficiency can be attained, for it is apparent that if the ports leading from the radiating chamber to the corresponding working chamber are closed, no gases will pass into the radiating cham-

ber, and the amount of heat that will penetrate into the radiating chamber and through to the working chamber will be very small. In the same way, if the working chamber is to be maintained at a temperature already reached, only a small amount of heat need be drawn from the main heat chamber to replenish that being taken from the radiating chamber, so the ports are kept open only a very little way. On the other hand, if a great amount of heat is needed at once, as when a new charge of materials is being treated, the furnace must be so built that a great amount of heat can be instantly drawn from the radiating chamber which, in turn, must be kept supplied from the main reservoir. To accomplish this result a forced draft can be used, but I prefer to have the various passages and ports so proportioned that a pressure of gases can always be maintained which will drive the heat into the radiating chamber as soon as the ports between the radiating chamber and working chamber are opened. The essential feature of such proportioning is that the main heat chamber be of sufficient size to permit substantially complete combustion of the gases generated by the normal operation of the grate, and that the passages in use gradually decrease in size as the gases advance from the point of final combustion, in order to maitnain the pressure while the volume of the gases decreases.

By "substantially complete combustion" I mean that substantially all of the oxygen and carbon present shall have been combined to as great an extent as may be possible with the mixture of these two substances that is used and the temperature that may be created, so that there will be only a small amount of combustion that will take place in the working chamber.

The particular embodiment of my invention which is given as an example of one of the many ways in which my invention may be used relates to furnaces for annealing and the like, having a carriage adapted to carry the material to be treated, which can be wheeled into and out of the furnace chamber, and in the floor of which carriage are flues for the distribution of heat. By my present invention I am able to make such a furnace of great efficiency.

In constructing this particular type of furnace I use a furnace shell having an appropriate chimney flue, and adapted to receive a carriage on which the materials to be treated may be placed and by means of which heat may be distributed in the furnace. The grate or other place for initial combustion may be either made integral with the shell of the furnace or preferably be made movable in the manner hereinafter described. The furnace shell may either be made to open at one end with an ordinary door, or it may preferably be made with doors at both ends, and extensions beyond the doors, in one of which the carriage and materials to be treated may be given a preliminary warming and in the other of which the materials which have been treated may be allowed to cool slowly. The carriage is provided with an internal chamber of a volume sufficient to allow practical completion of combustion, and connected with this internal chamber is a heat distributing chamber which should be covered by partition sufficiently thin to allow heat to radiate through to the material which is being carried by the carriage. Flues to permit the direct flow of heat from the body of the carriage to the material to be treated are positioned at various points around the edges of the carriage, and are connected by appropriate ports with the heat distributing chamber. I also find it is advantageous under some circumstances to take the waste gases that have passed through the carriage in the furnace proper and lead them to the preliminary heating chamber and allow them to pass through another similar carriage on which work waiting to be treated is being warmed.

A typical embodiment of my invention is shown in the accompanying drawings, in which—

Figure 1 is a section on line I—I of Fig. 2; Fig. 2 is a section on line II—II of Fig. 1; and Fig. 3 is a section on line III—III of Fig. 2, looking in the direction designated by the arrows shown in Fig. 2.

In these drawings the numeral 2 represents the permanent portion of the furnace or shell, which comprises a heating portion 3 and a warming portion 4. Within this shell are tracks 5, on which run the carriages 6. In the body of each of the carriages 6 is a main combustion chamber 7, into which unconsumed gases may pass through the passage 8. Connected with the main combustion chamber 7 is the heat distributing chamber 9, which is separated from the main combustion chamber 7 by the baffle walls 10. Leading from the heat distributing chamber 9 are ports 11, which open into flues 12. The flues 12 are controlled by dampers 13, which may be adjusted from the outside of the carriage 6. The egress of the consumed gases is provided for by the flues 14, which are positioned across the end of the carriage at the same end as the passage 8. The flues 14 open downwardly into the passage 15. The ends of the passage 15 are adapted to register with passages 16 in the permanent shell 2. Leading upwardly from the passages 16 are flues 17, which conduct the waste gases to the return flue 18 which extends through the roof of the heating portion 3 of the permanent shell 2. From the return flue 18 the gases may be allowed to

pass in any convenient way to the stack but I prefer to utilize them for warming a second charge of material in the manner shown in Figs. 1 and 2. To accomplish this the hot gases are allowed to pass from the return flue 18 by port 19 to the passage 20. In passage 20 the gases flow down to passage 21 and through passage 21 to passage 8 in the second carriage 6 in the warming portion 4 of the permanent shell 2. The gases flow through second carriage 6 in the same direction as described in connection with the first carriage 6. From the passage 15 of the second carriage 6 the gases pass to the single passage 16′ in the permanent shell 2, and then through passage 17′ to the return flue 18′ to the flue 22 from which they pass to the stack (not shown).

The numeral 23 represents that portion of the furnace in which is positioned the grate or fire chamber. While this fire chamber may be made integral with the furnace shell 2, I prefer to have it movable on tracks 24. Within the member 23 is a grate 25, of ordinary construction, at the rear end of which is a bridge wall 26. Through the bridge wall 26 runs a passage 27, for the admission of air, in addition to that which passes through the grate 25. In order that a tight joint may readily be made between the grate portion 23 and the passage 8, through which the gases are admitted to the truck 6, the grate portion 23 is provided with an extension 27, which is adapted to fit into the opening of the passage 8, as shown in Fig. 3.

In addition to the permanent furnace or shell 2, permanent extensions thereof may be provided, as indicated by the numerals 29 and 30. The extension 29 may conveniently be used as a cooling chamber for the materials which have been heated, and the extension 30 may be used as a preliminary chamber for the introduction of the carriages bearing the goods. The various portions of the furnace are preferably equipped with proper gates. For example, the heating portion of the furnace is provided with gates 31. The warming portion is provided with gates 32. The extension 29 is provided with gates 33, and the extension 30 is provided with gates 34. These gates should preferably be so constructed that they may be opened to allow a truck 6 to pass from one portion of the furnace to the next without admitting outside air.

In operation a truck 6, bearing material to be treated, which may be either open or covered, depending on the requirements of the work, is brought into the heating portion 3 of the shell 2. At the same time a second truck 6, likewise bearing material to be treated, is brought into the warming portion 4 of the shell 2. The grate member 23 is then moved forward until the extension 28 enters the outer end of the passage 8 and this joint is sealed with clay. At the same time the connection between the passage 15 and the passage 16, the connection between the passage 21 and the passage 8 in the second truck 6, and the connection between the passage 15 in the second truck 6 and the passage 16′ are sealed in a similar manner. The gates 31 and 32 are closed, and the fire is started in the grate member 23.

Incompletely burned gases from the grate 25 flow through the passage 8 into the main combustion chamber 7, together with additional air, which is passed through the bridge 26 by means of the passage 27. These gases are substantially consumed in the combustion chamber 7 with the generation of a great amount of heat which is transmitted to the heat distributing chamber 9. This heat causes the walls of the heat distributing chamber 9 and the baffle walls 10 to become incandescent and the great amount of heat which is thereby absorbed insures an abundant amount of heat being present as a reserve, so that an even temperature may be maintained throughout the material which is being treated. In addition to the heat which is tranmitted to the material to be treated through the roof of the covered chamber 7, and the heat distributing chamber 9, heat is transmitted directly through the flues 12. After the consumed gases have passed completely around the material to be treated they flow through the various passages indicated into the second truck 6, which is positioned in the warming chamber, and serve to warm it to a considerable degree. After one batch of material has been treated the carriage 6 which was in the heating chamber 3 is moved on into the extension 29, the carriage 6 which was in the warming chamber 4 is moved into the heating chamber, and an additional carriage 6 is moved into the warming chamber 30, whereupon the operation is repeated.

Owing to the great amount of heat which has been absorbed by the truck 6, additional heating of the extension 33 to prevent too rapid cooling of the material is ordinarily unnecessary, and it will usually be found sufficient if the truck 6 is allowed to cool normally.

It is apparent that many changes may be made in the details of such a furnace without departing from the spirit of my invention, since what I claim is:

1. In a furnace, a working chamber, a place for initial combustion, a heat reservoir having an extended surface for the absorption of heat, adapted to distribute heat to the working chamber both directly and by radiation, said heat reservoir comprising a main heat chamber in which combustion

can continue and a heat-distributing chamber, a plurality of flues connecting such heat-distributing chamber and said working chamber, and means for controlling the passage of gases through said flues.

2. In a furnace, a working chamber, a place for initial combustion of fuel, a heat reservoir comprising a main heat chamber and a secondary heat chamber adapted to transmit heat to the working chamber by radiation, a plurality of flues leading from the secondary heat chamber to the working chamber, the arrangement of the heat reservoir and flues being such that the heated gases must pass in proximity to the working chamber for substantially the length of such chamber before entering such chamber through said flues.

3. In a furnace, a working chamber, a place for initial combustion of fuel, a heat reservoir comprising a main heat chamber and a secondary heat chamber adapted to transmit heat to the working chamber by radiation, a plurality of flues leading from the secondary heat chamber to the working chamber, said heat reservoir being so constructed as to supply an extended surface for the absorption of heat and to lengthen the flow of substantially all of the hot gases so that they may heat such extended surface before passing through said flues.

4. In a furnace, a working chamber, a place for initial combustion, a heat reservoir comprising a primary heat chamber in which combustion can be continued and a secondary heat chamber in proximity to said working chamber, adapted to transmit heat from said main heat chamber and distribute it in the working chamber both directly and by radiation, and having an extended surface to hold heat until absorbed in the working chamber, a plurality of flues leading from said secondary heat chamber to said working chamber, and means for controlling the passage of gases through said flues.

5. In a furnace, a working chamber, a place for initial combustion, a heat reservoir comprising a primary combustion chamber and a heat-distributing chamber, so arranged as to supply extended surfaces for the absorption of heat, and an extended passage for gases within which combustion can be substantially completed, said heat reservoir being adapted to give an even distribution of heat to the working chamber both directly and by radiation.

6. In a furnace, the combination of a shell, a place for initial combustion, a truck adapted to move in said shell and to carry material to be treated, a chamber in said truck adapted to receive unconsumed gases from said place for initial combustion, said chamber having an extended surface adapted to act as a heat reservoir and comprising a main combustion chamber and heat distributing chambers, and flues adapted to conduct the heat from said heat distributing chamber to the material carried by said truck.

7. In a furnace, a shell inclosing two chambers, a truck in each of said chambers, said trucks being adapted to carry materials to be treated and to move from one of said chambers to the other, a combustion chamber in each of said trucks, a place for initial combustion adapted to supply unconsumed gases to one of said combustion chambers, and means whereby the heat generated in said combustion chamber may be utilized to warm the other truck.

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

ALFRED SMALLWOOD.

Witnesses:
ARTHUR H. BROWN,
CHARLES R. RIGBY.