W. S. ROCKWELL.

FURNACE FOR ANNEALING, &c.

APPLICATION FILED SEPT. 16, 1911.

1,037,665.

Patented Sept. 3, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

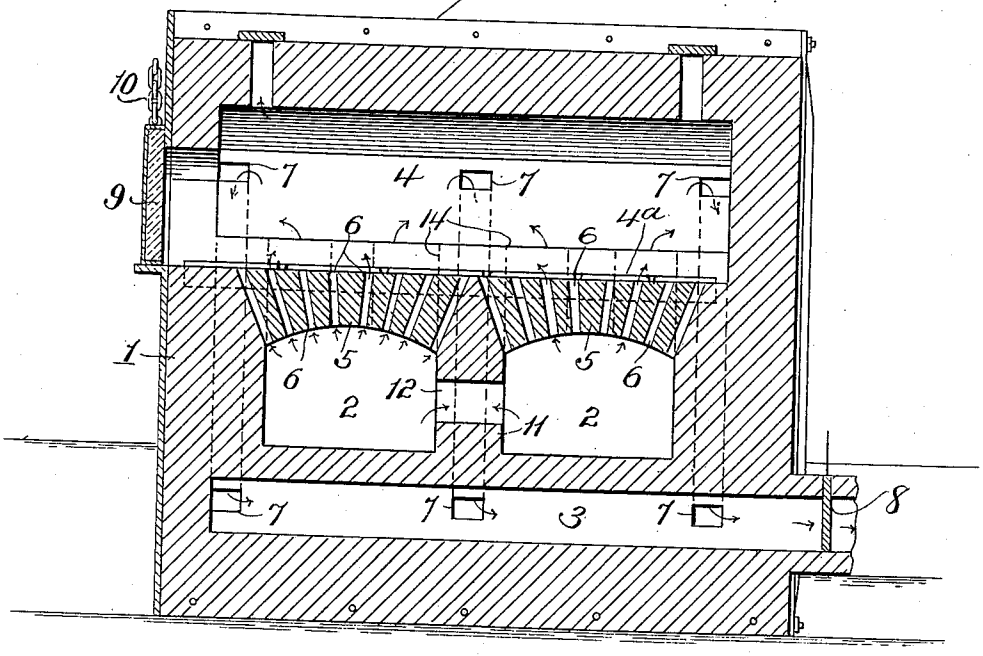
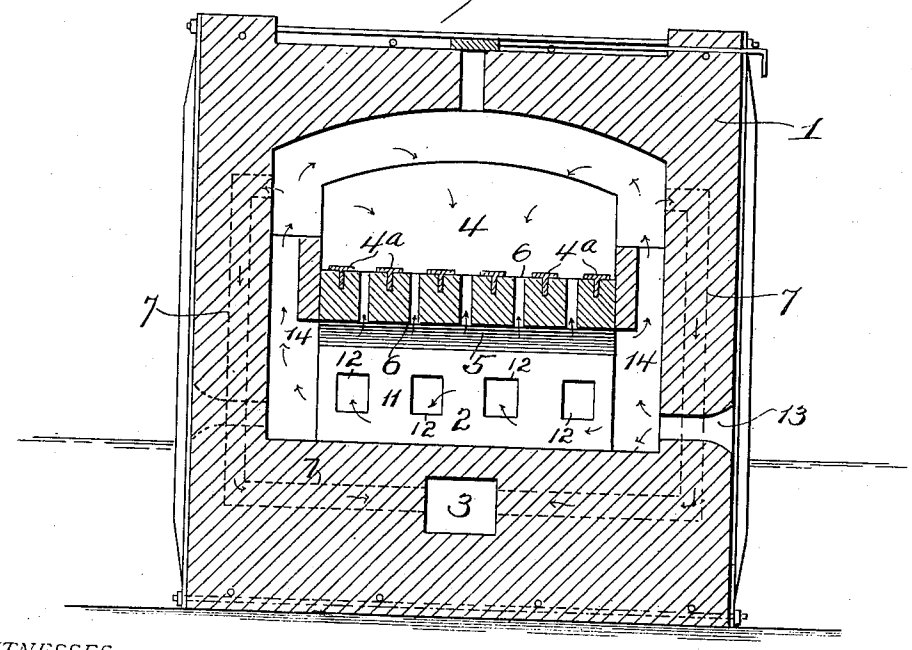


Fig. 2.



WITNESSES

E. L. Nottingham

G. F. Downing.

INVENTOR

W. S. Rockwell

By H. A. Seymour

Attorney

W. S. ROCKWELL.

FURNACE FOR ANNEALING, &c.

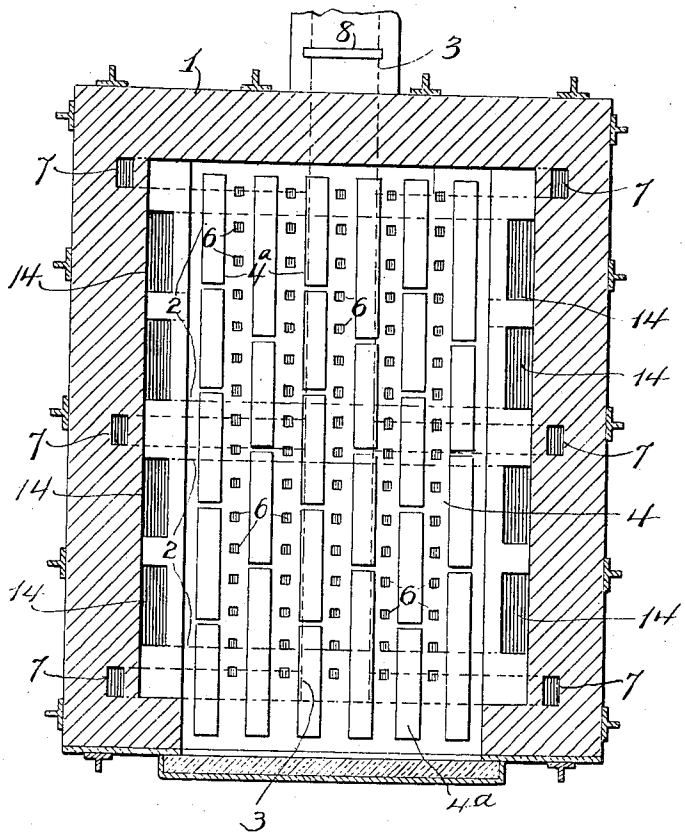
APPLICATION FILED SEPT. 16, 1911.

1,037,665.

Patented Sept. 3, 1912.

2 SHEETS—SHEET 2.

Fig. 3.



WITNESSES

E. L. Nottingham

G. F. Downing

INVENTOR

W. S. Rockwell

By A. A. Seymour

Attorney

UNITED STATES PATENT OFFICE.

WALTER S. ROCKWELL, OF NEW YORK, N. Y.

FURNACE FOR ANNEALING, &c.

1,037,665. Specification of Letters Patent. Patented Sept. 3, 1912.

Application filed September 16, 1911. Serial No. 649,661.

To all whom it may concern:

Be it known that I, WALTER S. ROCKWELL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Furnaces for Annealing, &c.; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in furnaces for annealing-tempering-enameling-baking and other heat treatments of metals or other materials.

The general practice at present, in the heating of metals and other material, especially for annealing, hardening, tempering, &c., is to place the charge upon the floor of the heating chamber of a reverberatory type of furnace so that the flame and hot gases of combustion from the burning fuel located in an adjoining fire chamber may pass over the charge and heat it from above downward. Such fire chamber is usually located on one or both sides or on the end of the heating chamber, on the same horizontal level, and separated therefrom by a partition called a "bridge wall." The bridge wall extends only part way from the chamber floor to the main arch, thus leaving room for the flame and hot gases to pass over into the upper part of the heating chamber where they heat the upper portions of the charge and also heat the under side of the main arch, which in turn reverberates heat down upon the charge. No radiant heat rays direct from the burning fuel enter the heating chamber, nor reach the charge therein, so that the advantage of direct radiant heat rays upon the charge is lost and the heating of the charge is accomplished mostly by convection, that is by the contact of hot gases on their way from the fire box to the open air through the chimney. The spent gases of combustion are usually carried out of the heating chamber downwardly to the chimney by one or more outlets located as far as possible from the fire-box. Often they are carried through flues under the heating chamber on their way to the chimney; but having parted with much of their heat in their travel over the cold charge they offer little advantage in heating upward from the lower flues. Thus practically all the heat entering the charge enters it from above downward. This is well known to be wrong in practice. Yet the practice is generally continued because it has been found difficult to maintain a suitable structure which would permit of the charge being located directly over the fire, both on account of the heat on the lower side of such structure and the wear and tear by travel on its upper side, it being apparent that in any structure of this character to be satisfactory, there must be room for the free passage of radiant heat and of hot gases from the fire chamber to the heating chamber and yet there must be body and strength of material at high temperature, sufficient to carry the load to be heated—such load often amounting to many thousands of pounds for a single charge. The selection of material and its disposition to form such structure or supporting floor between the fire chamber and the heating chamber are, therefore, matters of fundamental importance and constitute an essential part of my invention.

The object of my invention is therefore to provide a construction in which large quantities of metals or other material may be uniformly heated or subjected to any other heat treatment necessary in the course of manufacture.

A further object is to provide a construction which will permit the radiant heat rays, as well as the hot gases of combustion to rise in free, natural, unobstructed flow from the combustion chamber into practically every part of the heating chamber and to impinge directly upon the lower side or bottom of the charge of material to be heated, thereby raising the temperature of the charge and the entire heating chamber uniformly to the desired degree, the upper part equaling but never exceeding in temperature the lower part thereof, as is the case in the ordinary reverberatory furnace.

With these and other objects in view my invention consists in the parts and combination of parts as will be more fully described and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in longitudinal section; Fig. 2 is a view in transverse section and Fig. 3 is a view in horizontal section of my improved furnace.

1 represents the furnace in the foundation of which and centrally below the combustion chamber 2 is the draft flue 3, which extends from the front end of the furnace rear-

wardly to a suitable stack or flue, not shown. In the present instance the annealing or heating chamber 4 is heated from a plurality of combustion chambers 2, located under the floor of the heating chamber, which floor also forms the roof of the combustion or fire chambers. I may however, in small furnaces have only one combustion chamber. These combustion chambers may be independent of or in communication with each other as desired, and the number of them depends entirely upon and varies with the length of the annealing or heating chamber. The combustion chambers 2 extend transversely of the furnace from side to side thereof, and are closed at their bottoms, sides and ends, except the draft and fuel openings at the sides of the furnace, the arched tops 5 of the combustion chambers being provided at intervals throughout their areas with openings 6 which permit of direct communication between the combustion chamber 2 and heating chamber 4. The tops 5 of the combustion chamber 2, are flat on top and arched on their underside, so as to form a floor on which the material can be conveniently handled while in the heating chamber, and at the same time possess body and strength of material to carry the load to be heated.

To provide additional strength and to prevent undue wear by charges of material passing over the heating chamber floor, the floor is grooved parallel to the travel of the charges and transversely to the arch over the fire chamber, and the grooves are inlaid with iron or other heat-resisting and non-abrading rails 4[a], which may also act as trusses over the fire chamber, and prevent abrasion of the refractory floor material. These rails or trusses also provide means for supporting the charges somewhat above the chamber floor and facilitate the travel of the hot gases under the charge and into the upper parts of the heating chamber.

The arch or floor is perforated as at 6 so as to provide means for radiant heat rays as well as the hot gases of combustion to rise radially in free, natural and unobstructed flow from the fire chamber 2 into practically every part of the heating chamber 4 and to impinge directly upon the lower side or bottom of the charge of material to be heated; such radiant heat rays and gases of combustion at the same time raising the temperature of the charge and the entire heating chamber uniformly to the desired degree, the upper parts equaling but never exceeding in degree of heat the lower parts thereof as is the case in the ordinary reverberatory furnace. The material to be treated is therefore supported directly over and in close relation to the arch 5 so that the heat and spent gases which pass from the combustion chamber into the heating chamber 4, pass in direct contact with the articles or material being treated before reaching the exhaust or draft flues 7. These flues 7 are formed in the two sides of the furnace at regular distances apart, and communicate with the heating chamber 4, well above the floor of the latter as clearly shown in Figs. 1 and 2, and extend downwardly and communicate with the central draft flue 3, which is provided with a damper 8 located adjacent to the rear of the furnace. The heating chamber 4 is preferably closed at its sides and rear end and open at the front, the latter being closed by the sliding door 9, but it may be open at both ends if desired. This door is suitably guided by ways at the front of the furnace, and is suspended from the chain 10 which latter passes upwardly over segments or pulleys in the usual and well known manner.

For large furnaces I prefer to divide the combustion or fire chamber into a series of compartments, separated by partitions 11. These partitions extend transversely of the furnace from one side wall to the other as shown in Figs. 1 and 2 and are preferably provided with openings 12 so as to permit of free communication between the several chambers 2. The arched tops of the fire chambers 2 also extend transversely of the furnace, and are partly supported by the partitions as clearly shown in Fig. 1. If more than two combustion chambers be used the arch of all intermediate chambers would be sprung from the top of the partitions. Each fire chamber 2 is provided at one or both ends with a burner opening 13 through which the air and fuel are introduced. I prefer to use oil or gas as the fuel, but solid fuels may be used, in which latter event grates and fire doors would be necessary.

For large furnaces requiring more than one fire chamber the temperature in the heating chamber may be varied so as to distribute the heat to suit the charge. If it is desired to have the temperature slightly higher at one end or at the center of the furnace it can be made so. Or it can be made perfectly uniform throughout. Combustion occurs directly under practically the whole area of the heating chamber and the radiant heat rays and hot gases are so evenly and widely distributed in their passage from the fire chamber through the perforated partition or floor into the heating chamber that they cannot impinge injuriously upon any part of the charge, which is ordinarily supported in a pan or other carrier.

In addition to the openings 6 through the partition 5 separating the heating chamber from the combustion chamber, I provide additional flues or passages 14 which latter extend from the ends of the combustion

chamber or chambers 2 up through the side walls of the furnace and terminate above the floor of the heating chamber but below the draft openings 7, and thus discharge heat and products of combustion above and over the material being heated. As all the heat on its natural course upward must pass the charge on the chamber floor, it must follow that the temperature can never be higher in the upper part of the heating chamber than at its bottom, therefore the top of the charge can never be overheated in an effort to heat the bottom as is so often the case in the reverberatory type of furnace where the heat is first admitted to the chamber above the charge. But owing to the natural effort of the heat to rise when admitted to the heating chamber from below the upper portion of the charge will be fully heated. On the contrary in the ordinary reverberatory furnace where the heat is admitted to the chamber over the charge its same effort to rise prevents it from fully heating the bottom of the charge.

It is evident that many slight changes might be resorted to in the relative arrangement of parts shown and described without departing from the spirit and scope of my invention. Hence I would have it understood that I do not wish to confine myself to the exact construction and arrangement of parts shown and described, but

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

1. A furnace comprising a plurality of combustion chambers, and a heating chamber over the combustion chambers, the said combustion chambers extending at right angles to the length of the heating chamber, each combustion chamber having a top arched on its underside and flat on top, the said flat tops of the arches being continuous and forming the flat floor of the heating chamber, and having openings for the passage of radiant heat and products of combustion into the heating chamber.

2. A furnace comprising a plurality of combustion chambers and a heating chamber over the combustion chambers and extending at right angles to the direction of the lengths of the combustion chambers, the partition between the heating chamber and the combustion chambers being arched on its underside over each combustion chamber and flat throughout its entire top, and having radially disposed openings through same for the passage of heat and products of combustion into the heating chamber.

3. A furnace comprising a plurality of combustion chambers and a heating chamber over the combustion chambers and extending at right angles to the direction of the lengths of the combustion chambers, the partition between the heating chamber and the combustion chambers being arched on its underside over each combustion chamber and flat throughout its entire top, and having openings for the passage of heat and products of combustion into the heating chamber, and floor rails supported on the flat top of said arches or partition and projecting above the same to form seats or supports for the material being treated.

4. A furnace comprising a plurality of communicating combustion chambers and a heating chamber over said combustion chambers, each combustion chamber having a top arched on its underside and flat on top, the said flat tops of the arches being continuous and forming the floor of the heating chamber, and the said floor having openings for the free and unrestricted passage of heat and products of combustion into the heating chamber, from the several combustion chambers.

5. A furnace comprising a combustion chamber, a heating chamber above the combustion chamber, the partition separating the two chambers having uniformly spaced openings therein, a draft flue below the combustion chamber and extending throughout the length of the furnace, and series of flues leading from the sides of the heating chamber down around the combustion chamber to the draft flue.

6. A furnace comprising a combustion chamber, a heating chamber above the combustion chamber, the floor of the heating chamber having openings at intervals therein through which the heat passes from the combustion chamber, a draft flue below the combustion chamber and extending throughout the length of the furnace, a damper in the draft flue, and a series of flues leading from the sides of the heating chamber above the bottom thereof, down around the combustion chamber, to the draft flue.

7. A furnace comprising a combustion chamber, a heating chamber above the combustion chamber, and separated therefrom by a perforated arch, seats in the heating chamber above the arch, a draft flue below the combustion chamber, and flues leading from both sides of the heating chamber at a point above the seats, to the draft flue.

8. A furnace comprising a plurality of combustion chambers, and a heating chamber over the combustion chambers, the partition between the combustion and heating chambers being arched over the combustion chambers on its underside and flat on top and having openings for the passage of radiant heat and products of combustion into the heating chamber, and heat flues leading from the ends of the combustion chambers into the heating chamber.

9. A furnace comprising a combustion chamber and a heating chamber over the combustion chamber, the partition between

said chambers being arched on its underside and flat on top and having openings for the passage of radiant heat and products of combustion into the heating chamber, draft flues leading from said heating chamber, and heat flues leading from the combustion chamber into the heating chamber above the floor of the latter, but below the inlets to the draft flues.

10. A furnace comprising a plurality of combustion chambers and a heating chamber over said combustion chambers and extending at right angles to the direction of the lengths of the combustion chambers, each combustion chamber having a top arched on its underside and flat on top, the said flat tops of the arches being continuous and forming the floor of the heating chamber, and the said floor having openings for the free and unrestricted passage of heat and products of combustion into the heating chamber from the several combustion chambers.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

WALTER S. ROCKWELL.

Witnesses:
R. S. Ferguson,
A. W. Bright.