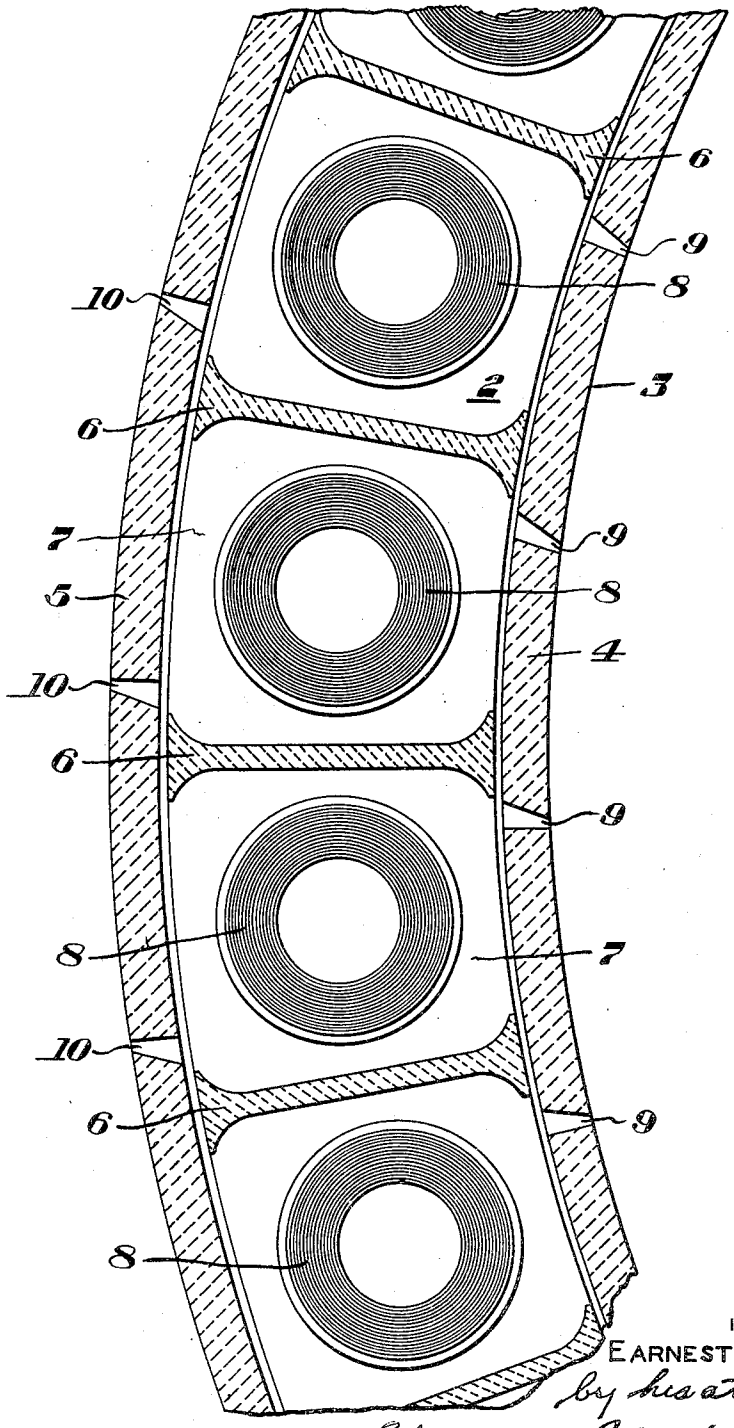
May 9, 1950 E. D. SEVENICH 2,507,274

FURNACE

Filed Jan. 23, 1947



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Patented May 9, 1950

2,507,274

UNITED STATES PATENT OFFICE

2,507,274

FURNACE

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Application January 23, 1947, Serial No. 723,766

4 Claims. (Cl. 263—7)

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This invention relates to furnaces and heating methods, particularly furnaces for heating material, as, for example, annealing furnaces, and methods of heat treating (e. g., annealing) material. It has to do with furnaces in which and methods in accordance with which a charge is advanced relatively to a series of heating means whereby the charge is subjected successively to the action of the respective heating means. In certain of its aspects the invention is concerned with furnaces of the type having a material support and a hood over the support, the heating or heat treatment being carried on continuously or progressively during relative movement between the material and the hood, and with methods of heating or heat treating material by use of furnaces of that type.

It has heretofore been known to dispose material to be heated on an elongated material support and move the support beneath a stationary hood of less length than the support to heat the material as it advances. In furnaces of the type used for such a procedure the elongated material support may be straight or curved; for example, it may be arcuate or even circular, and the hood is of course shaped to conform to the shape of the material support but is of smaller dimension in the direction of its length than the support. The words "elongated" and "length" as herein used apply to material supports and hoods of various shapes, even circular or arcuate, the length or direction of elongation of a circular or arcuate support or hood being the direction along the arc.

For purposes of explanation and illustration the invention will be described as embodied in a heat treating furnace having a generally circular material support and an arcuate hood of less than 360° over the support. Furnaces of this general type are disclosed in copending applications Serial No. 497,523, now Patent No. 2,417,063, and Serial No. 629,085, later abandoned. In the furnaces of those applications the arcuate hood or heating chamber of less than 360° is stationary and the circular material support moves therein. The charge to be heat treated, as, for example, coils of metal strip, is placed upon the material support or hearth at intervals therealong and as the hearth moves beneath the hood burners disposed in series at opposite sides of the hood heat the charge. The heat treatment is effected by predetermining the amount of heat supplied by the respective burners to the charge at various points along the path of the charge.

It is desirable to be able to predetermine with

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substantial accuracy the temperature of the charge being heat treated in a furnace of the type above referred to at each point along the path of the charge during the heat treatment, i. e., during preheating, soaking, slow cooling and rapid cooling. Accurate predetermination of the temperature of the charge at particular points in the furnace is difficult due to the fact that the hood is longitudinally open and temperature effects, either heating or cooling, from one zone in the furnace may be felt in unpredictable magnitude at other points or zones longitudinally removed therefrom. This may be due to various factors such as drafts, variations in outside temperature, variations in fuel or burner adjustment, etc.

I provide a furnace and a heating method overcoming the disadvantages above referred to. According to my heating method material to be heated is disposed in a travelable compartment, the compartment is moved successively into positions in which certain of a series of heating means supply heat to the material and the amount of heat supplied by the respective heating means is predetermined whereby to subject the material to desired temperatures as it advances. My method is especially well adapted for the heat treatment of coils of metal strip or the like. A coil or the like may be disposed in a travelable compartment, the compartment may be advanced intermittently and brought to rest successively in positions in which certain of a series of burners are directed to discharge into the compartment generally tangentially of the coil or the like to heat the coil or the like and the amount of heat supplied by the respective burners may be predetermined whereby to subject the coil or the like to desired temperatures as it advances. Burners may be disposed in opposed relationship to discharge from opposite sides into the compartment. The compartment may be advanced intermittently and brought to rest successively in positions in which opposed burners discharge from opposite sides into the compartment generally tangentially of the material.

I further provide a furnace comprising a sesies of heating means and a compartment adapted to contain material to be heated travelable relatively to the heating means so that the respective heating means successively heat material disposed in the compartment. The heating means are preferably burners arranged so that as the compartment travels the burners are successively directed thereinto. Desirably the burners are in opposed series, groups (as, for exam-

ple, generally opposed pairs) of burners being adapted successively to be directed into the compartment from generally opposite directions.

Desirably a series of compartments is provided, the heating means successively heating material disposed in the respective compartments. The furnace desirably comprises an elongated hood, a series of heating means arranged at intervals along the hood, an elongated material support movable within the hood and means connected with the support and cooperating with the hood for providing segregated compartments on the support adapted respectively to contain material to be heated, the respective heating means being adapted successively to heat material in the respective compartments as the support moves relatively to the hood. The heating means preferably comprise opposed series of burners arranged at intervals along the hood and the elongated material support desirably has thereon partition means cooperating with the hood to provide segregated compartments on the support adapted respectively to contain material to be heated, successive groups of opposed burners being adapted successively to heat material in the respective compartments as the support moves relatively to the hood.

Provision is preferably made for the discharge from the burners to swirl around the material in the compartments. Desirably opposed burners discharge into a compartment eccentrically thereof to cause the collective discharge from the burners to swirl around the material in the compartment. The compartment is also preferably shaped to assist in bringing about swirling action of the discharge from the burners.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof and a present preferred method of practicing the same proceeds.

In the accompanying drawing I have shown a present preferred embodiment of the invention and have illustrated a present preferred method of practicing the same in which the figure is a fragmentary horizontal cross-sectional view through the heating chamber and portions of the material support of a rotating annular hearth annealing furnace, the section being taken just above coils which are shown as being heat treated in the furnace.

Since the furnace is of the type fully disclosed in said copending applications it is unnecessary to show it in detail, the invention being fully illustrated in the single figure. There is provided a circular material support or hearth 2 adapted to turn within a stationary hood 3. The hearth is travelable within the hood, being advanced by any suitable mechanism such, for example, as concentric series of rollers underlying the hearth at least some of which are driven to advance the hearth. The hood has spaced generally vertical side walls, the inner side wall being designated 4 and the outer side wall 5. The hood also has a top or roof arch which is not shown in the drawing but which extends between the side walls 4 and 5 at their upper extremities and overlies the hearth and the charges disposed thereon to close the furnace at the top. The side walls 4 and 5 of the hood may be sealed to the traveling hearth by any suitable means, as, for example, sand or water seals.

The hearth is provided with longitudinally spaced partition walls 6 which are mounted thereon and are of such shape so as to substantially fill the hood transversely. In other words, the partition walls 6 cooperate with the hood to provide segregated compartments 7 on the hearth adapted respectively to contain material to be heated. A coil of metal strip 8 is shown in each of the compartments 7.

An inner series of burners 9 and an outer series of burners 10 are provided in the walls 4 and 5 respectively of the hood for heating the material disposed in the compartments 7 as the hearth travels within the hood. The inner and outer burners are arranged in groups or generally opposed pairs so that when the compartments are in predetermined positions one inner burner and one outer burner will discharge into each compartment. This is shown in the drawing. The burners are let through the inner and outer walls 4 and 5 respectively at an angle to the radial direction and generally opposed burners are disposed relatively to each other so that they cooperatively discharge into a compartment when the compartment is predeterminately positioned with respect thereto so as to cause the collective discharge to swirl around the coil in the compartment. The burners may discharge at a level below the level of the coils so that the discharge therefrom swirls around the coils and also rises whereby a very effective heating of the coils is brought about. The swirling of the discharge from the burners is assisted by the shape of the partition walls 6. Each such wall as shown flares out in both directions at both ends so that there are no corners within the compartments and hence there is no substantial tendency to interfere with continuous swirling movement of the gases therein.

While the hearth may be advanced continuously it is ordinarily preferable to advance it intermittently, stopping it with a compartment disposed to receive the discharge from opposed burners so as to create therein a swirling mass of heating gases as above described.

The heat supplied by each burner is predetermined so that the material being heat treated may be subjected to rather accurate temperature control as it progresses through the furnace. The burners may be controlled manually or automatically. Desirably they are controlled so that each charge as it progresses through the furnace is first preheated, then soaked, then slowly cooled and then rapidly cooled.

While I have shown and described a present preferred embodiment of the invention and a present preferred method of practicing the same, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

I claim:

1. In a furnace comprising a movable hearth, a hood enclosing a space over said hearth, and walls on the hearth extending transversely of the hood to form an enclosure in which material may be heated when the hearth reaches a predetermined position relative to the hood, the improvement comprising burners set in the hood and opening into said enclosure to project flames into said enclosure, each of said burners being positioned adjacent one of said walls with the central axis of the burner extending toward said adjacent wall, whereby a swirling motion is imparted to the flames and heated gases in order to heat material in the enclosure with speed and uniformity.

2. In a furnace comprising a movable hearth,

a hood enclosing a space over said hearth, and walls on the hearth extending transversely of the hood to form an enclosure in which material may be heated when the hearth reaches a predetermined position relative to the hood, the improvement comprising burners set in the hood and opening into said enclosure to project flames into said enclosure, each of said burners being positioned adjacent one of said walls with the central axis of the burner extending toward said adjacent wall, and said walls each having a portion adjacent said hood curving toward the adjacent burner, whereby a swirling motion is imparted to the flames and heated gases in order to heat material in the enclosure with speed and uniformity.

3. In a furnace comprising a movable hearth, a hood enclosing a space over said hearth, and walls on the hearth extending transversely of the hood to form an enclosure, in which material may be heated when the hearth reaches a predetermined position relative to the hood, the improvement comprising burners set in the hood and opening into said enclosure to project flames into said enclosure, said burners being positioned diagonally across the hearth from each other in the enclosure and each of said burners being adjacent one of said walls with the central axis of the burner extending toward said adjacent wall, whereby a swirling motion is imparted to the flames and heated gases in order to heat material in the enclosure with speed and uniformity.

4. In a furnace comprising a movable hearth, a hood enclosing a space over said hearth, and walls on the hearth extending transversely of

the hood to form a series of enclosures in which material may be heated when the hearth reaches a predetermined position relative to the hood, the improvement comprising burners set in the hood and opening into said enclosures to project flames into said enclosures, said burners being positioned diagonally across the hearth from each other in each enclosure and each of said burners being positioned adjacent one of said walls with the central axis of the burner extending toward said adjacent wall, and said walls each having curved portions adjacent the hood on each side of the hearth to form rounded corners in the enclosures, whereby a swirling motion is imparted to the flames and heated gases in order to heat material in the enclosures with speed and uniformity.

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