April 25, 1939. C. H. STEVENSON 2,155,691

TUBULAR HEATING ELEMENT FOR FURNACES OR THE LIKE

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Fig. 1

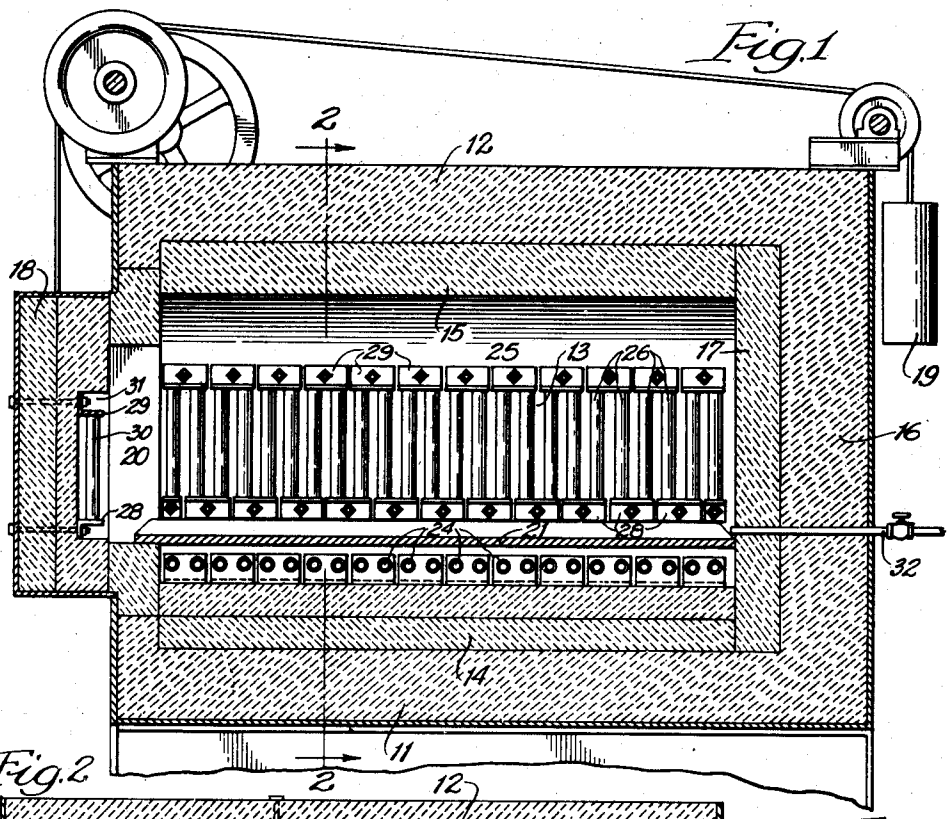


Fig. 2

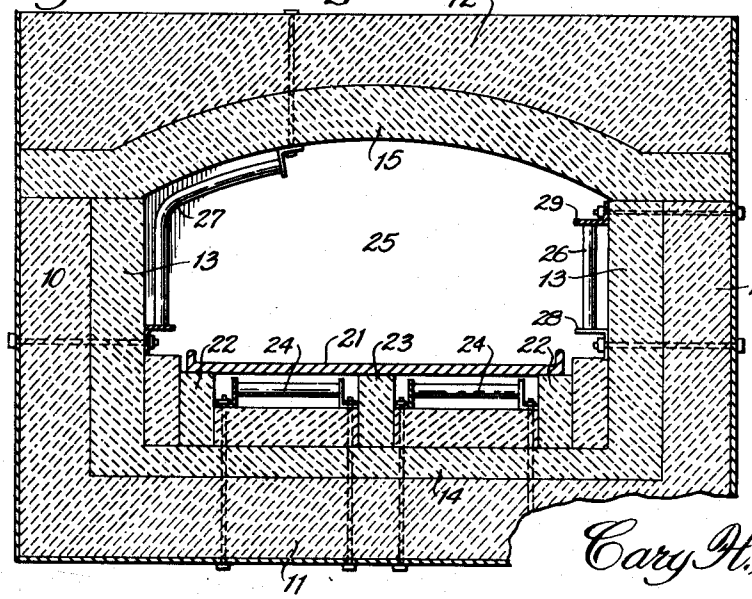
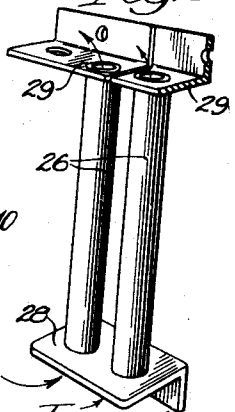


Fig. 3



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TUBULAR HEATING ELEMENT FOR FURNACES OR THE LIKE

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5 Claims. (Cl. 13—25)

The present invention is particularly directed to a type intended for use in the heat treating of metal products, although the heating elements hereafter described are adapted for use in connection with furnaces or heaters intended for other purposes.

The particular feature which characterizes the present invention lies in the employment of resistance elements of tubular form, so mounted and arranged with respect to the furnace that they will not only serve as radiators of heat but will also act as flues for the convection and circulation of air or gases throughout the interior of the heating chamber, thereby promoting the equal distribution of heat to all points within the chamber and counteracting any tendency toward stratification within the chamber, which is of particular importance in cases where metallic objects are being subjected to heat treatment of a predetermined character and degree, and especially where gases are employed within the heating chamber to advantageously affect the results of the heat treatment.

Further objects and details will appear from a description of the invention in conjunction with the accompanying drawing, wherein—

Figure 1 is a longitudinal sectional elevation of a heat treating furnace embodying the features of the present invention;

Fig. 2 is a cross sectional elevation taken on line 2—2 of Fig. 1; and

Fig. 3 is a detail in perspective showing the tubular heating elements of the present invention.

As shown for purposes of illustration, the invention is applied to a heat treating furnace having outer side walls 10, a base 11, and a top 12. The heating chamber is provided with a lining which includes side facings 13, a base 14, and an arched roof 15. The furnace also includes a rear outer wall 16, a rear lining 17, and a door 18 connected with a counterweight 19 for opening and closing the forward aperture 20, which affords admission to the interior of the heating chamber.

The base 14 provides a support for a metallic floor plate 21 which is elevated above the base lining and mounted upon side blocks 22 and a center block 23, and beneath the floor are located heating elements 24, which may be of the tubular type hereinafter described or which may be of any conventional type, since the bottom of the heating elements 24 are not employed for purposes of convection, and are effective only as radiators for the purpose of applying heat beneath the metallic floor 21.

The heating elements which more particularly form the subject matter of the present invention are located within the heating chamber 25, and as shown are arranged along the side walls thereof and partially along the ceiling and within the door 18, although a different arrangement of these heating elements is within the scope of the present invention, and the particular number and location of the heating elements will be determined with due consideration to the degree of heat required and the particular purpose for which the furnace is intended. As shown, each of the heating elements is of open ended tubular form, and these elements may be of the straight vertical formation 26 or of the arched over formation 27.

As shown, one of the side walls of the heating chamber is lined with a multiplicity of the straight heating elements 26, which are formed of a suitable resistance alloy, as for instance 80% nickel and 20% chromium, which when energized will produce temperatures in the heating chamber up to 2100° F., or more for metal treating purposes. It will be understood also that the arched heating elements 27 are of a like composition and similar in all respects to the vertical heating elements 26 except in matter of configuration, the upper ends being bent over to follow the curvature of the arch, so that a more extended convection current flow of heated air or gas will result.

The straight vertical heating elements 26 and the arched heating elements 27 are electrically connected in staggered relation so as to operate in series in the conduction of the electric current, and with this end in view the lower ends of a pair of tubular heating elements are both welded to a lower conductive bracket plate 28, while the upper ends of the same adjoining tubes are welded to adjacent upper bracket plates 29, which are spaced or otherwise insulated from one another, with the result that the current flow will be in a sinuous path or series relationship throughout the entire set of tubular heating elements which constitute the group. The same arrangement obtains on each side of the heating chamber, although in the case of the arched over heating elements 27, the upper conductive bracket plates are secured to the ceiling of the chamber, rather than to the wall thereof as in the case of the straight heating elements 26.

In addition to the above, a group of straight tubular heating elements 30 is mounted within

a recess 31 on the interior face of the door 18 and welded to conductive lower and upper brackets 28 and 29 similar in all respects to those previously described. If desired, additional groups of tubular heating elements similarly supported and in conductive relation to one another can be secured to the rear wall of the heating chamber or the remainder of the ceiling thereof, depending upon the extent to which it is desirable to multiply the number and arrangement of such heating elements within the space contiguous to the interior walls of the heating chamber.

Suitable electrical connections are provided for supplying the necessary current for circulation through the conductive bracket supports and the tubular heating elements, and such connections can be suitably arranged to simultaneously energize all of the heating elements or to energize one or more groups thereof, depending upon the degree of heat required within the interior of the heating chamber; and gases required in maintaining a gaseous atmosphere may be admitted through a tube 32.

In use, the current supply will be regulated to energize the heating elements in the number and to the extent required to secure the desired temperature, and as the temperature of the heating elements is elevated they will begin to radiate heat both from the exterior and interior surfaces of the tubes, which quickly tends to establish convection currents through the tubes which act in the capacity of flues to direct the currents of air or gas upwardly from a point near the floor toward the ceiling of the heating chamber, thereby not only promoting dissemination of heat but also preventing stratification, thereby maintaining equality of conditions throughout the heating chamber, so that metallic objects deposited therein for heat treatment will be subjected at all times to a degree and quality of heat which can be predetermined and maintained throughout the heating period. This is of particular importance in cases where the natural air is commingled with certain gases which it may be desirable to employ in the creation of a special atmosphere best calculated to influence the heat treatment, and in which it is necessary to thoroughly and uniformly commingle gases with the air in order to maintain uniform conditions, both as to the degree of heat and the quality of the atmosphere throughout the heating chamber.

The means employed for mounting the tubular heating elements not only subserve the function of supporting the open ended tubes in position but also act as conductors, so that in the event it becomes necessary to replace any tube or its mounting, the effected parts may be sawed out and removed preliminary to the substitution of new parts, without disturbing the remainder of the system. At the same time the arrangement of the tubes is one which does not in any substantial degree obstruct the interior of the chamber or otherwise complicate the furnace as a whole.

Although the tubular heating elements of the present invention have especial value in a heat treating furnace of the character heretofore described, it is not the intention, unless otherwise indicated in the claims, to limit the use of such elements to a furnace of this particular character, since advantageous results may be obtained from the employment of such heating elements in other locations in which it is desirable to provide for heating by convection as well as by radiation, and in which the maintenance of air circulation throughout a room or chamber is desired.

I claim:

1. In combination with a chambered structure, a plurality of tubular heating elements adapted to be heated when electrically energized and in communication at different elevations with the interior of the chamber for disseminating heat thereinto by radiation and convection, and electrically conductive bracket means secured to the structure and to the heating elements for supporting the heating elements in series arrangement at vertically separated points and supplying current thereto, in series through the bracket means and tubes.

2. In combination with a chambered structure, a multiplicity of tubular heating elements mounted along the inner wall of the chambered structure and having openings communicating at differing elevations with the interior of the chamber to provide for convective heating currents through the tubular heating elements, said elements being adapted to be heated when electrically energized, and upper and lower conductive mountings for supporting and energizing the heating elements, the upper and lower mountings engaging adjacent tubes in staggered relation to provide for a series flow of the current.

3. In combination with a heating furnace, a multiplicity of open ended tubular heating elements arranged in parallel spaced relation along the interior wall of the furnace and having their open ends positioned at differing elevations to induce convective heating currents, and upper and lower bracket means supporting and connecting adjacent tubular heating elements in staggered relation at the upper and lower points of connection to provide for a series current flow of electricity through the heating elements and bracket means.

4. In combination with a heating furnace having side walls and an arched ceiling, a multiplicity of vertically disposed tubular heating elements open at their ends and adapted to be heated when electrically energized, and conductive bracket means for supporting the upper and lower ends of the heating elements adjacent the walls of the heating chamber and supplying current thereto, some of the tubular heating elements being extended in arching relation and in close proximity to the ceiling of the furnace.

5. In combination with a heating furnace having side walls and an arched ceiling, a multiplicity of vertically disposed tubular heating elements open at their ends and adapted to be heated when electrically energized, and conductive bracket means for supporting the upper and lower ends of the heating elements adjacent the walls of the heating chamber and supplying current thereto, some of the tubular heating elements being extended in arching relation and in close proximity to the ceiling of the furnace, and means for admitting gases to the interior of the chambered structure.

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