

Dec. 27, 1960

F. A. HANSEN

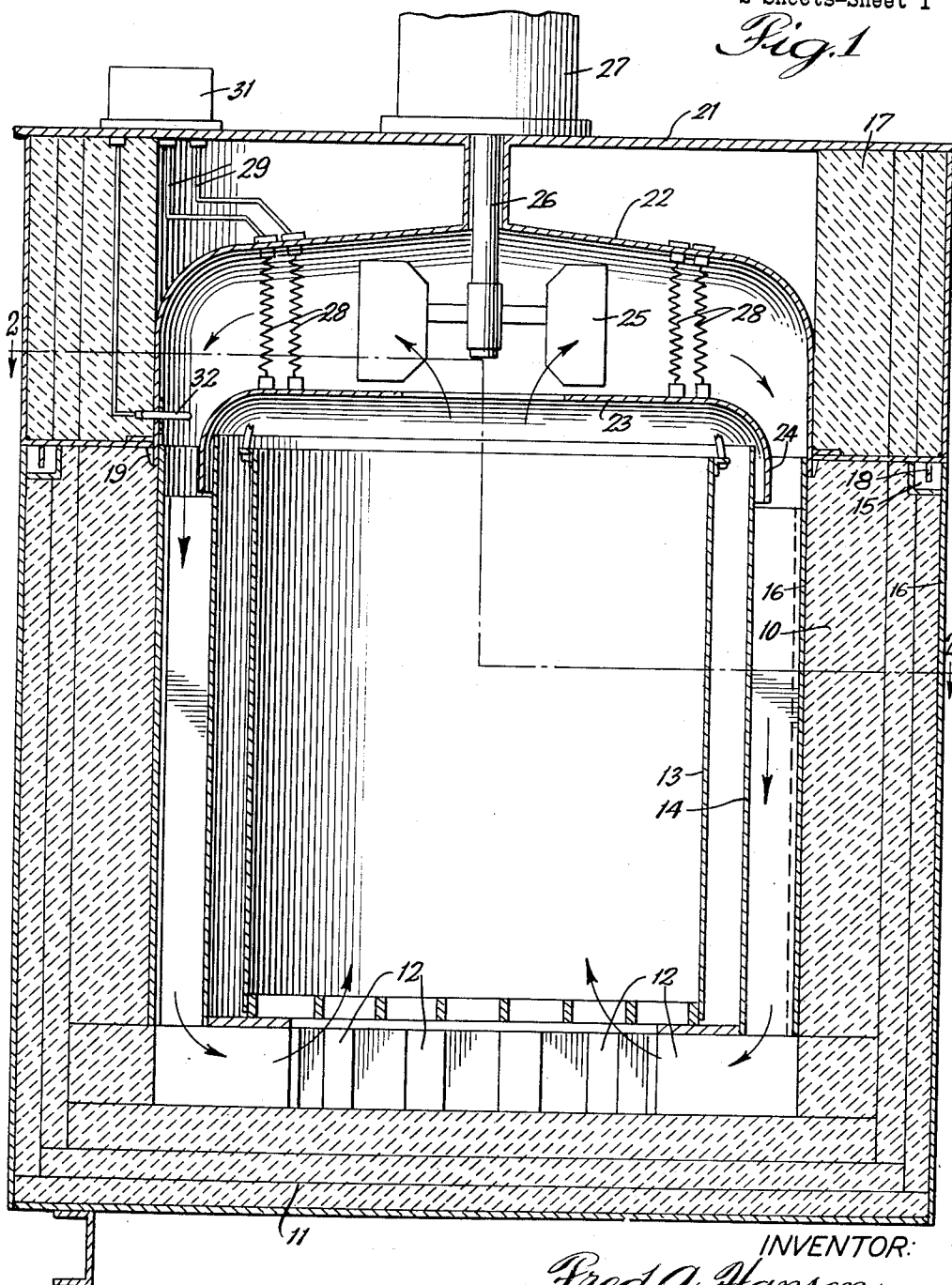
2,966,573

HEATING FURNACE

Filed July 28, 1958

2 Sheets-Sheet 1

Fig. 1



INVENTOR:

Fred A. Hansen,

BY *Bair Freeman + Molinare*
ATTORNEYS.

Dec. 27, 1960

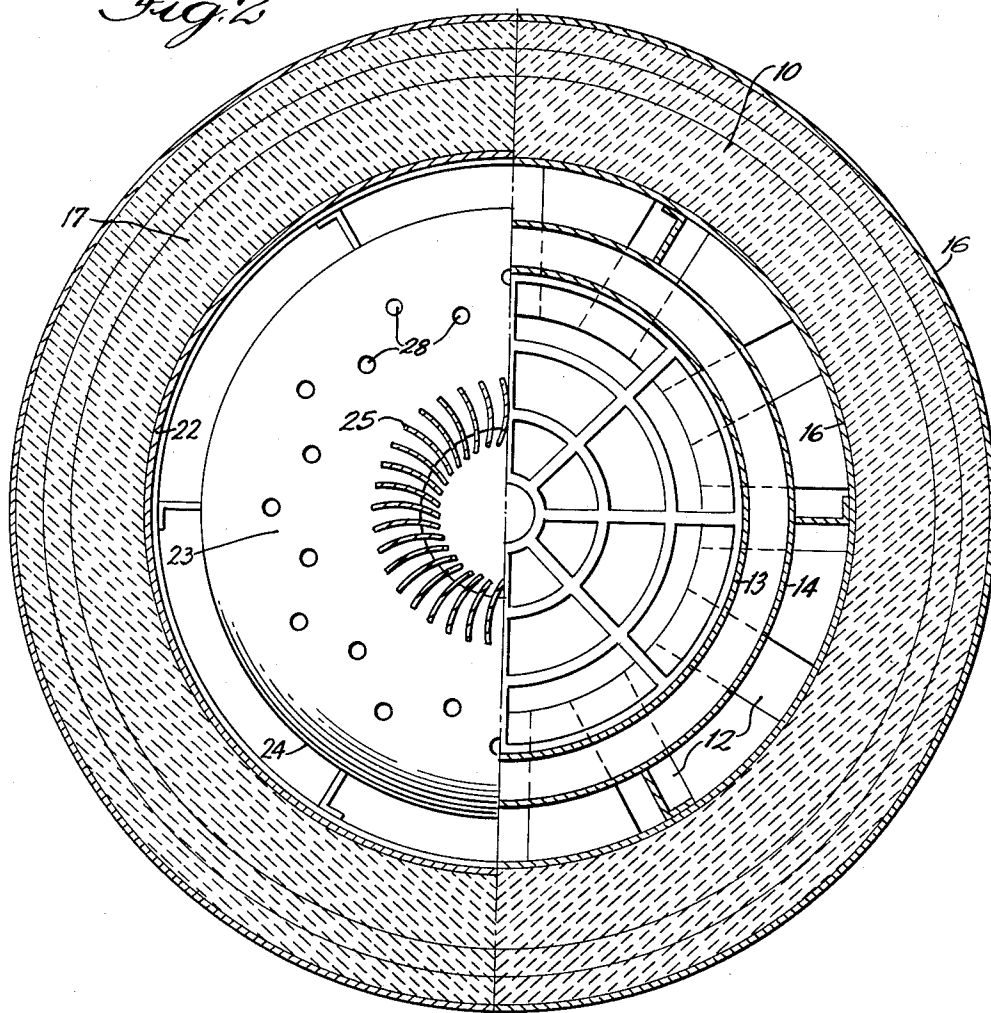
F. A. HANSEN
HEATING FURNACE

2,966,573

Filed July 28, 1958

2 Sheets-Sheet 2

Fig. 2



INVENTOR:

Fred A. Hansen,

BY *Bair Freeman & Malinore*
ATTORNEYS.

1

2,966,573

HEATING FURNACE

Fred A. Hansen, Chicago, Ill., assignor to Lindberg Engineering Company, Chicago, Ill., a corporation of Illinois

Filed July 28, 1958, Ser. No. 751,300

1 Claim. (Cl. 219—35)

This invention relates to a heating furnace and more particularly to a furnace of the gas circulating type for treating metal articles and the like.

Heating furnaces of the gas circulating type have heretofore been constructed with heating elements mounted in the furnace side walls. The charge to be heated has been placed in a tubular liner within the furnace and gas in the furnace was circulated over the charge and the heating elements by a fan.

With such furnaces a relatively large space must be left between the liner and furnace wall to accommodate the heating elements and access to the heating elements for repair or replacement is very difficult. More seriously, heat is radiated from the elements to the sides of the charge to result in uneven heating. Also gas flow over the elements is not uniform with the result that hot spots may develop and supply of current to the elements must be limited to obtain satisfactory life. The elements are also positioned where they are apt to be damaged during loading and unloading of the furnace.

It is one of the objects of the present invention to provide a heating furnace which requires a minimum amount of floor space for a given size of furnace chamber and in which the parts are readily accessible for servicing.

Another object is to provide a heating furnace in which the heating elements are mounted closely adjacent to the gas circulating means and are so positioned that gas flows directly and uniformly thereover from the gas circulating means to cool the heating elements uniformly.

According to a feature of the invention, the furnace is formed by a hollow base to receive the material to be treated and the heating elements and gas circulating means are mounted in a removable cover for the base. Preferably the gas circulating means is in the form of a radially bladed blower mounted centrally of the cover and the heating elements are uniformly spaced around the blower closely adjacent to the blade tips for circulation of gas uniformly thereover at relatively high velocity. Additionally the cover may carry a baffle to confine the gas flow to a desired path and a control for the heating elements may be provided on the cover, including a temperature sensing device mounted in the gas stream between the cover and baffle.

According to another feature of the invention, the same cover may be utilized on bases of different sizes and may be removed from one base and used on another while the charge in the first base is being cooled slowly.

The above and other objects and features of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which:

Figure 1 is a vertical sectional view through a heat treating furnace embodying the invention; and

Figure 2 is a horizontal section on the broken line 2—2 of Figure 1.

The furnace, as shown, comprises a base which may, if desired, be mounted in a pit or which may be mounted above the floor level. The base is preferably cylindrical

2

in shape with a circular insulated side wall 10 extending vertically and closed at its bottom by an insulated bottom wall 11. The bottom wall may carry a plurality of spaced piers 12 formed of ceramic blocks, or the like, which may support a basket or the like holding the charge, as indicated at 13, and which may also support a shell 14 spaced from the inner surface of the side wall to define a definite path for gas flow.

The base terminates at its upper edge in a flat annular surface and is preferably provided with an annular channel 14 open at the upper surface and adapted to contain a loose sealing material 15, such as sand, to provide an effective seal for the cover. The base may be formed in any desired manner, but is preferably formed of a metal shell 16 with a liner or filler of refractory material.

The base is closed at its top by a cover having a cylindrical insulated side wall 17 which may be formed in a manner similar to the side wall of the base and which is substantially the same diameter. The side wall 17 is adapted to rest on the top of the base side wall is formed with an annular projecting flange 18 which will extend into the sealing material 15 to form a seal between the cover and base. Additionally, the cover may have a downwardly projecting annular flange 19 at its inner edge to fit within and against the inner shell 16 of the base side wall for further improved sealing.

The cover is closed at its top by a top plate 21 and an inner cover 22 spaced below the top plate 21. The space between the plates 21 and 22 may be filled with heat insulating material, such as refractory material, if desired. The inner plate 22 curves downwardly in a relatively smooth curve adjacent to its periphery to terminate in the flange 18 so that air will be directed smoothly into the base thereby during furnace operation. Preferably an annular baffle 23 is mounted in the cover spaced from the plate 22 and curves downwardly at its periphery to terminate in a flange 24 which will fit over the sleeve 14 when the cover is assembled on the furnace.

Air or gas is circulated in the furnace by gas circulating means shown as a blower having a plurality of radially extending blades 25 lying between the plate 22 and the baffle 23. The blower rotor is mounted on a shaft 26 extending vertically upward through the central part of the cover and connected to a driving motor 27 on top of the cover. The blower rotor may be made of any desired configuration such that when the blower rotor is turning it will draw air or gas upwardly through the central opening in the annular baffle 23 and will discharge the gas radially outward through the open space between the plate 22 and baffle 23.

In order to heat the air a series of heating elements 28 are mounted in the space between the plate 22 and baffle 23. As best seen in Figure 2, the elements 28 are uniformly and symmetrically spaced adjacent to the tips of the rotor blades 25 and around the rotor blades. The elements 28 may be energized through leads 29 extending through the cover, as shown, and the temperature thereof may be controlled by a controller 31 mounted on the cover. The controller 31 includes a temperature sensing device 32, such as a thermocouple or fluid filled bulb projecting into the space between the plate 22 and baffle 23 anterior to the heating elements in the direction of gas flow.

In operation, material to be treated, such as loose pieces or the like, may be placed in the basket 13 and dropped into the base, as shown, to rest on the piers 12. The basket preferably terminates at or slightly below the top of the sleeve 14 so that it will not interfere with positioning of the cover on the base. With the basket in place the cover may be placed on the base as shown in Figure 1 and the heating elements may be energized and the motor 27 started. At this time, the blower will

3

cause a circulation of gas upward through the basket and the articles therein outward over the heating elements, downward between the sleeve 14 and inner shell 16 of the base, around the piers and up through the basket and the material therein in a closed path. It will be noted that the heating elements are so positioned that the gas immediately upon leaving the blower flows thereover at a relatively high velocity and uniformly over all of the heating elements. The heating elements may therefore be operated at an extremely high current density without danger of developing hot spots so that heating elements which are small relative to the power consumed thereby may be employed without shortening the life of the furnace. The controller 31 which is responsive to the temperature sensed by the bulb 32 may maintain the power input to the heating elements at the necessary level to produce a desired temperature within the furnace.

Upon completion of a treating operation the cover may be removed from the base and may be placed on another similar base containing a charge of material to be treated. Where it is desired to allow the material to cool slowly a blank cover such, for example, as a flat sheet of heat insulating refractory may be placed over the base. In this way a single cover can serve a large number of bases which may be of the same or different sizes by varying the vertical height thereof. Furthermore, since all of the operating parts are in the cover itself they are readily accessible for servicing without the necessity of tearing down a complete furnace.

Since the space between the shell 14 and the inner wall of the base is completely unobstructed it may be made of minimum width to accommodate the desired volume of gas flow so that the furnace may be made of minimum size for a given capacity. The charge will be heated uniformly by substantially pure convection which is highly desirable. What little radiation heating does occur is at the top of the charge where it compensates for the heat loss through the cover which normally

4

exists and helps to heat the top of the charge which is normally the last part to heat.

While one embodiment of the invention has been shown and described herein, it will be understood that it is illustrative only and not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claim.

What is claimed is:

- A heating furnace comprising a hollow base open at its top, a liner in the base spaced from the side wall and above the bottom thereof and terminating substantially level with the top of the base, means within the liner to support articles to be heat treated for circulation of gas therethrough, a cover fitting detachably on the base, and closing the open top thereof, a gas circulating unit carried by the cover above the top of the liner to circulate heated gas radially outwardly in the cover and in closed circuit downwardly between the liner and base and upwardly through the liner and over the articles therein, heating elements carried by the cover around the circulating unit in the path of the circulating gas to heat the gas, and an annular baffle carried by the cover underlying the gas circulating unit and heating elements and having a central opening registering with the gas circulating unit and a downturned peripheral flange telescopically interfitting with the top of the liner to confine the circulating gas to said closed circuit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,721,840	Smith	July 23, 1929
1,827,194	Grothe	Oct. 13, 1931
1,986,088	Wild	Jan. 1, 1935
1,996,680	Lobley	Apr. 1, 1935
2,376,174	Munning et al.	May 15, 1945
2,412,103	Spooner	Dec. 3, 1946
2,523,796	Weeks	Sept. 26, 1950