

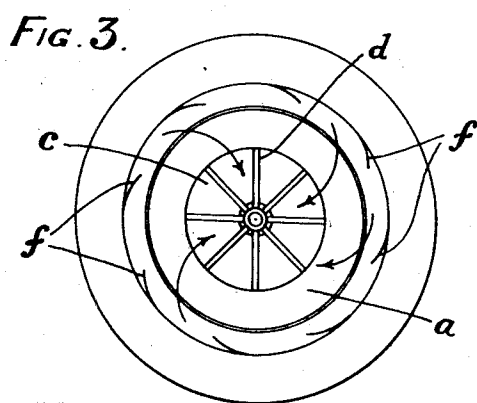
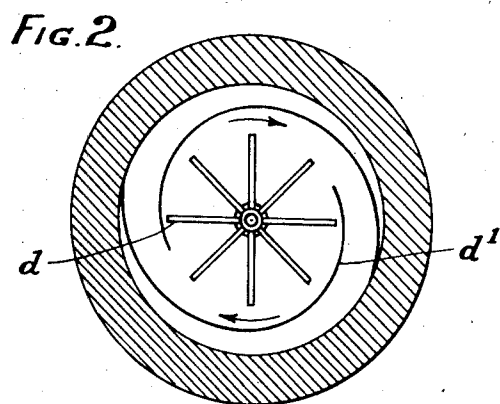
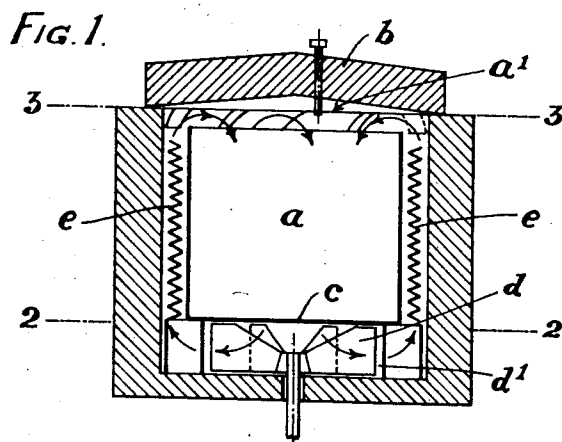
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A. G. LOBLEY

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ELECTRIC FURNACE

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Inventor:—  
Alfred G. Loble,  
By: Smith, Michael & Gardiner,  
Attorneys.

## UNITED STATES PATENT OFFICE

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## ELECTRIC FURNACE

Alfred Glynn Lobley, Erdington, Birmingham,  
England, assignor of one-half to Birmingham  
Electric Furnaces, Limited, Erdington, Bir-  
mingham, England, a British company

Application January 4, 1933, Serial No. 650,183  
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4 Claims. (Cl. 219—35)

This invention has reference to electric fur-  
naces for tempering or annealing metal products  
and performing similar heat-treatment opera-  
tions at relatively low temperatures, and con-  
sists in or comprises certain improvements, as  
hereinafter described, in resistance furnaces of  
the type wherein the treatment heat is conveyed  
from the electric resistance units or heating ele-  
ments to the work-charge by fan-circulated air-  
currents.

It has long been common practice in furnaces  
where the treatment or work-containing chamber  
also houses the resistance units, to provide within  
the said chamber, an open or un-cased propeller-  
type fan to "beat-up" the air, or to promote a  
circulation of air over the work and thus assist  
the transference of heat to the latter from the  
resistors.

It has also been proposed (as for example in  
British Specification No. 247,912) to use a rever-  
sible propeller-type fan which operates in a re-  
latively small orifice at one end of a treatment  
chamber whose other end is open to allow for  
the introduction of work; the said orifice and  
opening both having communication with an an-  
nular chamber which surrounds the treatment  
chamber and houses the resistor units. In this  
furnace, the heat-transferring air-circulation is  
periodically reversed by reversing the direction  
of rotation of the fan.

Further, in British Specification No. 334,621 of  
1929, it has been proposed to use, in a furnace  
wherein the treatment chamber or oven also  
houses the resistance units, an open or un-cased  
internal fan of the centrifugal type whereby the  
air within the oven is collected by the fan axial-  
ly and is projected horizontally outwards against  
the walls of the oven.

And in the specification of British Letters Pat-  
ent No. 343,529 of 1929 I describe and illustrate  
furnaces having a resistance chamber outside  
the treatment chamber and provided with an en-  
closed or encased centrifugal fan operating to  
extract air from below the work-containing re-  
gion of the treatment chamber and to force the  
said air through the resistance chamber and  
thence into the treatment chamber through an  
intake orifice of relatively small area located  
above the said work-containing region.

The furnaces described in said British Specifi-  
cation No. 343,529 are, however, of the "horizon-  
tal" type where the charging door or aperture is  
located at one side of the furnace structure, and  
makes it impossible to use a system of resistors  
that entirely surrounds the treatment chamber.

Further, the small area air-intake orifice of the  
treatment chamber tends to obstruct the circula-  
tion of air in the system and prevents the use-  
ful employment of a fan capable of circulating a  
relatively large volume of air at that high veloc-  
ity which has since been found to be essential  
to the rapid and uniform heating of the work.

According to the present invention, and in  
order to enable the advantageous use of a power-  
ful or high-velocity centrifugal fan in conjunc-  
tion with an efficient system of resistor elements  
having a high heat-input capacity, the furnace  
structure comprises a treatment chamber or oven  
having a charging-opening communicating with a  
resistance-housing chamber which surrounds the  
said treatment chamber, and an air-extraction  
orifice which opens into, or constitutes the eye  
of, a voluted casing wherein the fan operates;  
the said fan-casing being adapted to discharge  
the air into a region of the resistance chamber  
remote from that where the air is re-delivered,  
to the oven after having travelled over the ex-  
ternal resistors. This construction makes effec-  
tive use of the known higher efficiency of a  
volute-cased centrifugal fan as compared with  
that of an open or un-cased centrifugal fan.

Provision is made for supporting the work  
charges in the region of the oven intermediate  
the air-intake and the air-extraction orifice,  
whilst to assist or ensure a cyclonic movement  
of the fan-impelled air, a system of director  
baffles may be so located between the resistor  
chamber and the oven that the resistor-heated  
air is delivered into the said oven in a series  
of streams or currents that impinge tangentially,  
or cyclonically, upon the work charge.

The accompanying drawing represents, dia-  
grammatically, a vertical or top-charging tem-  
pering furnace constructed in accordance with  
one application of the present invention.

Figure 1 being a vertical section of the struc-  
ture.

Figure 2 a horizontal section on the dotted  
line 2—2, and

Figure 3 another horizontal section on the  
dotted line 3—3.

In this furnace, the cylindrical treatment  
chamber or oven *a* has an open top or mouth  
*a'* wherethrough a charge-containing basket  
may be passed or lowered and raised when the  
lid or cover *b* is removed. This top opening or  
charging orifice also constitutes the air-intake  
of the forced circulation system and is in direct  
communication with the open upper end of an  
annular chamber *e* which surrounds the treat-

ment chamber and in which a system of resistor units  $e^1$  is installed; these units being external to the oven whose walls  $a^2$  serve to direct the circulating air over the said resistors.

5 An air-extraction orifice  $c$  is formed in the bottom wall of the said oven, and below this is located a voluted fan-casing  $d^1$  in which a centrifugal fan  $d$  is housed and operates. The orifice  $c$  constitutes, in effect, the intake eye of  
10 the fan-casing whose outlets  $d^2$  are arranged to discharge the fan-impelled air upwardly into the resistance chamber, or into a region of the said chamber remote from the charging mouth  $a^1$  wherethrough the air is re-delivered into the  
15 top of the oven after having been forced over the external resistors.

To provide for a tangential direction of air into the top of the oven, or to ensure a cyclonic or eddying movement of air within the said  
20 chamber, the space immediately above the air-delivery end of the resistor-chamber is provided with a system of baffles  $f$ ; these baffles being of a tangential or voluted form or disposition so that they constrain the fan-propelled air-streams passing between them to enter the oven  
25 tangentially, or in a manner that ensures the desired cyclonic or eddying travel of the air in its passage through the said chamber, and over or in contact with the work charge, to the  
30 air-extraction orifice  $c$ . In the construction shown, the baffles or air-directors are mounted on an internal wall of the structure immediately above the outlet or air-delivery ends of the resistor chambers and are so arranged that they  
35 do not obstruct the charging aperture or mouth of the treatment chamber. Alternatively, the said directors may be suspended from the lid or cover of the furnace so that they depend into the air-circuit when the said lid is closed.

40 The construction of the fan as shown also provides a cyclonic or swirling movement of the air during its passage through the resistor chamber, whilst the use of a volute-cased fan is particularly advantageous from the point of view  
45 of efficiency and, where a large and powerful fan is employed, enables the attainment of a high-speed air circulation and a uniform temperature distribution, with a smaller temperature gradient as the air passes through the work  
50 charge.

In the furnaces above described, it is possible accurately to follow and observe the process of heat absorption in the work charge by arranging thermo-couples or pyrometers at the air delivery  
55 and air-extraction sides of the treatment chamber and noting the temperature differences at these points; the recording of substantially the same temperature by both instruments being an indication that the charge is no longer absorbing heat and that the treatment is finished. The temperature differences can be shown graphically by a recording instrument, or merely by an indicating instrument; or the instruments can be made  
60 to operate an audible or visible signal (such as a lamp or bell) when the treatment is finished.

65 Having described my invention what I claim and desire to secure by Letters Patent is:—

1. An electric furnace comprising an outer casing having a charging opening through one wall thereof, means for normally closing said opening, a treatment chamber within said casing having an air inlet and an air outlet at its opposite ends and having its side walls spaced from the inner walls of the casing to form a surrounding chamber communicating with the air inlet and air outlet of the treatment chamber, resistor units within said surrounding chamber, a volute fan casing within said outer casing having an intake communicating with the air outlet of the treatment chamber and a voluted outlet in direct communication with the surrounding chamber, a centrifugal fan within said volute casing, and  
15 means to drive said fan to draw the air through the treatment chamber and to force the same through the voluted outlet of the fan casing, spirally through the surrounding chamber past the resistor units therein and into the inlet at the opposite end of the treatment chamber.

2. An electric furnace as claimed in claim 1, including baffles positioned adjacent the air inlet of the treatment chamber, said baffles being tangentially disposed with respect to the inlet of the treatment chamber to cause the air entering the said inlet to enter the treatment chamber tangentially to insure the desired cyclonic or eddying travel of the air during its passage through said chamber.

3. An electric furnace comprising an outer casing having a charging opening through the top wall thereof, means for normally closing said opening, a treatment chamber within said casing having an air inlet spaced from the top of the casing and an air outlet spaced from the bottom of said casing, the side walls of the treatment chamber being spaced from the inner walls of the casing to form a surrounding chamber communicating with the air inlet and air outlet of the treatment chamber, resistor units within said surrounding chamber, a volute fan casing mounted within the outer casing at the bottom thereof and having an intake communicating with the air outlet of the treatment chamber and having  
45 a voluted outlet in direct communication with the lower portion of the surrounding chamber, a centrifugal fan within said volute casing, and means to drive said fan to draw air downwardly through the treatment chamber into the volute fan casing and to force the air from the fan casing through the voluted outlet of the fan casing, and spirally through the surrounding chamber toward the top thereof and past the resistor units therein and into the air inlet opening in the upper end of the treatment chamber.

4. An electric furnace as claimed in claim 3, including baffles positioned between the air inlet at the top of the treatment chamber and the upper end of the communicating surrounding chamber, said baffles being tangentially disposed with respect to the inlet of the treatment chamber to cause the air passing through said inlet to enter the upper end of the treatment chamber to insure the desired cyclonic or eddying travel of the air during its passage through said chamber.

ALFRED GLYNNE LOBLEY.