

W. E. RENNER.
METHOD OF FURNACE HEATING.
APPLICATION FILED JULY 30, 1919.

1,332,684.

Patented Mar. 2, 1920.

2 SHEETS—SHEET 1.

Fig. 1.

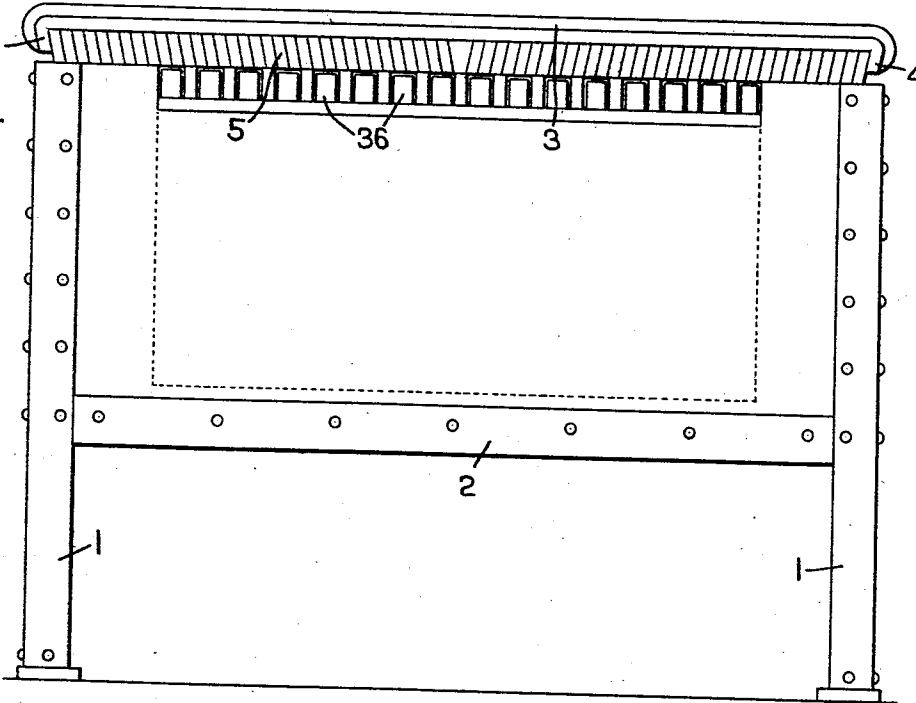
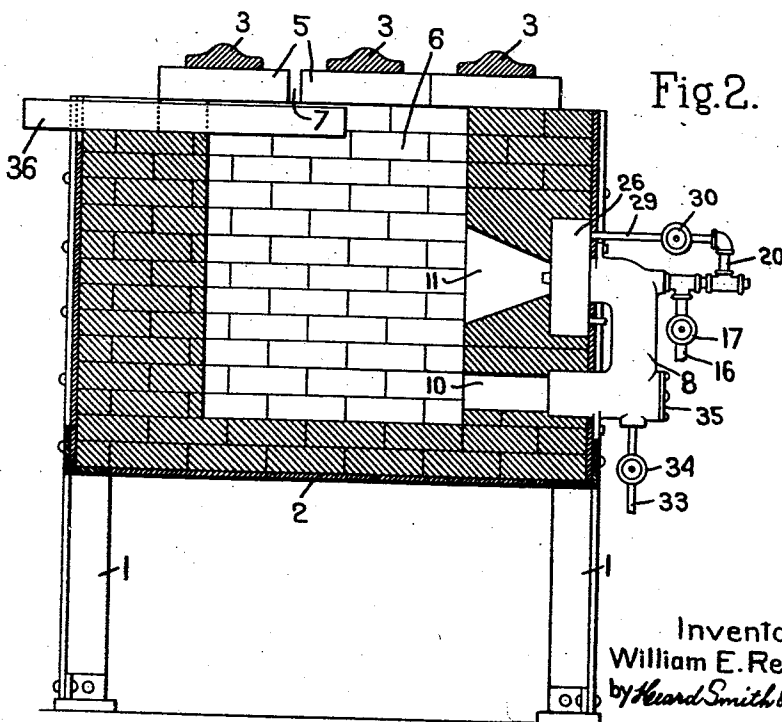


Fig. 2.



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Fig.3.

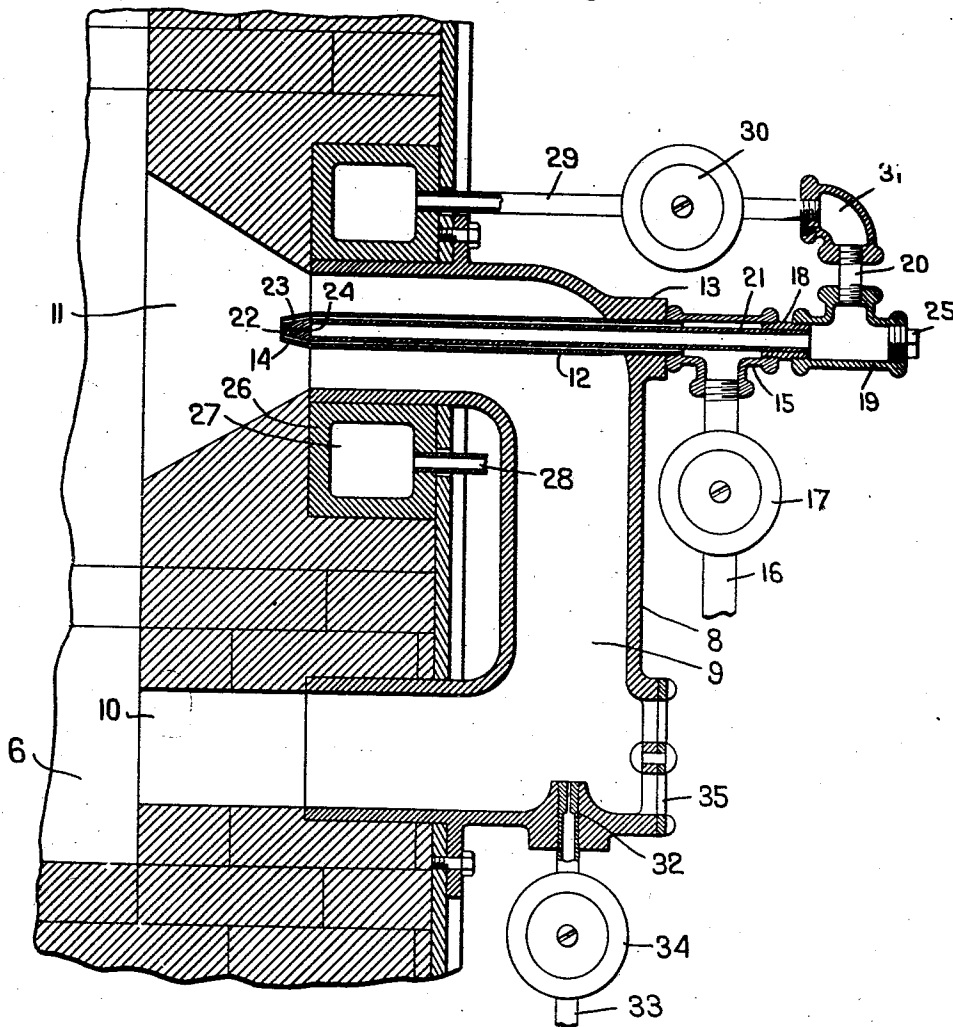
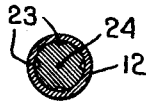


Fig.4.



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METHOD OF FURNACE-HEATING.

1,332,684.

Specification of Letters Patent.

Patented Mar. 2, 1920.

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To all whom it may concern:

Be it known that I, WILLIAM E. RENNER, a citizen of the United States, resident of Winter Hill, Somerville, Massachusetts, and
5 whose post-office address is 102 Sycamore street, Winter Hill, Massachusetts, have invented an Improvement in Methods of Furnace-Heating, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to a method of heating a furnace and is applicable to any type of furnace and particularly to industrial
10 furnaces such as are employed in the treatment of iron and steel.

The objects of the invention are to provide for a thorough and equal distribution of the heat throughout the combustion
20 chamber, to increase the efficiency of the combustion of the fuel, to conserve the fuel, to reduce the loss through the ventage from the combustion chamber, to minimize the oxidation of the material being heated, and
25 to secure the entrance of the fresh fuel into the combustion chamber in a slow moving draft similar to that produced by the burning of natural gas.

These and other objects of the invention
30 will appear more fully from the accompanying description and drawings and will be particularly pointed out in the claims.

In order to illustrate the invention the drawings disclose a type of furnace particularly adapted for the heat treatment of steel
35 forge articles, but it is to be understood that this disclosure is simply for the purpose of illustration, and is in no way restrictive of the wide range of applicability of the
40 method.

In the drawings:—

Figure 1 is a front elevation of the furnace.

Fig. 2 is a view in side elevation and
45 chiefly in vertical cross section of the furnace shown in Fig. 1.

Fig. 3 is a view in vertical cross section showing in detail a preferred form of burner employed together with a preferred
50 method of preheating the fuel and of securing the circulation in the combustion chamber.

Fig. 4 is a detail in transverse cross section of the burner.

55 The furnace herein selected for disclosing the principles of this invention is one particularly

designed for the heat treatment of steel forged articles. The framework of the furnace is composed of iron standards and cross beams. The four vertical standards 1
60 are shown as angle irons resting upon the floor and support a horizontal bed plate 2. The walls and bottom of the furnace are shown as made of fire brick built up and resting against and upon the standards 1
65 and the bed plate 2. The top of the furnace is shown as formed of a series of parallel arches. Each of these arches is composed of a metal beam 3 having depending
70 converging ends 4 between which is supported a flat fire brick arch 5. These arch members rest upon and extend across opposite walls of the furnace entirely covering the combustion chamber 6 except for such
75 ventage 7 as may be desired and which is formed by slightly separating the parallel arches.

A passageway is formed in one of the said walls of the furnace preferably extending from a point near the bottom of the combustion chamber 6 out through the wall and
80 back into the combustion chamber at a point near the top thereof. This passageway together with the burner and connections is preferably formed chiefly of iron or steel
85 construction and built into the wall of the furnace. For this the metal casing 8 may be employed having therein a passageway 9 of general U shape with the limbs of the U
90 extending horizontally and built in to the vertical wall of the furnace. The lower limb connects with a section of the passageway 10 formed in the furnace wall and opening into the combustion chamber 6 near the
95 bottom, while the upper limb connects with a frusto-conical section 11 of the passageway opening into the combustion chamber 6 near the top.

The type of furnace illustrated is particularly designed for burning a combustible
100 mixture formed by mixing fuel oil and air at the mouth or nozzle of a burner. This burner is shown as projecting horizontally and centrally through the upper limb of the passageway 9 and terminating at the outer
105 end of the frusto-conical section 11. This burner is shown as formed of a metal tube 12 supported in a horizontal boss 13 formed on the casing 8. At its inner end it is tapered as shown at 14 and at its outer
110 end there is secured thereto a T head 15, to which is connected a pipe 16 controlled

by a valve 17 and extending to a suitable source of compressed air supply. The outer end of the T head 15 is connected by a hollow union 18 with a second T head 19.

5 The fuel oil is fed from a suitable source of oil supply through a pipe 20 extending into the T head 19 and passes therefrom into a pipe 21 extending within and concentrically of the pipe 12. At its outer end
10 this pipe is supported in the union 18 and at its inner end is tapered at 22 to fit snugly against the interior of the tapered nozzle 14 of the air pipe 12. A plurality, as four, of small grooves 23 are formed in
15 the exterior of the tapered nozzle of the pipe 21, and an oil feeding aperture 24 is formed centrally of the tapered nozzle of the oil pipe. The outer end of the T head 19 is movably closed by a plug 25 thus en-
20 abling access to be had to the burner for cleaning.

Preferably the oil and air forming the combustible mixture are preheated. In the case of the oil this is effected by passing
25 the oil through a chamber from which it absorbs the heat of the furnace. This result is secured in the form illustrated by providing an annular chambered casing in the wall of the furnace surrounding the
30 upper limb of the casing 8. This annular casing 26 presents the annular chamber 27 to which the oil is supplied by a pipe 28 leading to a suitable source of oil supply under pressure and from which the oil
35 passes through a pipe 29 controlled by a valve 30 to an elbow 31 connecting it to the pipe 20. In the case of the air, the heat is absorbed from the gaseous contents of the furnace circulating exteriorly of the pipe
40 12 as will hereinafter be set forth, and from the heated oil passing through the pipe 21 inside of the pipe 12.

In this invention a continuous circulation of the gaseous contents of the combustion
45 chamber is maintained, this circulation passing from the bottom of the combustion chamber through the passageway 9 back into the combustion chamber at the top around the burner. As a simple and effective way of securing and maintaining this
50 circulation a nozzle 32 is inserted in the bottom of the casing 8 in line with the vertical axis of the vertical portion of the passageway 9, and to this nozzle 32 is connected a pipe 33 controlled by a valve 34
55 extending to a suitable source of compressed air supply.

The oxygen necessary to promote combustion is supplied from the atmospheric
60 air and is in the form shown admitted to the passageway 9 through a regulating damper 35 at the lower side of the passageway 9.

The parts are so proportioned and the
65 pressures so regulated that the fuel oil issues

from the opening 24 in a small stream and is impinged upon by the converging streams of compressed air issuing through the openings formed by the grooves 23. This serves to atomize the fuel oil and cause it at a
70 slight distance from the nozzle to be mixed with the compressed air in a finely atomized or practically gaseous state, the preheating of the oil and the air facilitating this result.

The gaseous contents of the combustion chamber under the action of the jet of compressed air passing out through the nozzle
32 are drawn into the passageway 9 and pass out at the upper end concentrically of the
80 burner. During the passage of the gaseous contents through the passageway fresh air is drawn in through the regulating damper 35 sufficiently to give the required amount of
85 oxygen for combustion. Owing to the friction losses caused by the bends in the passageway and the addition of the volume of air through the regulating damper 35 and the regulation of the compressed air through
90 the jet 32, the velocity of flow from the passageway 9 adjacent the nozzle of the burner is so reduced that as the gaseous contents and commingled air mingle with the atomized mixture issuing from the burner the
95 draft back into the furnace out of the opening 11 takes place slowly and evenly so that the flame reenters the furnace much as it would from a burner supplied with natural gas. The circulation thus produced extends
100 throughout the combustion chamber and the heat produced is thus evenly and uniformly distributed throughout the entire combustion chamber. The admission of air to the passageway 9 also serves materially to reduce the temperature of the gaseous
105 contents drawn from the combustion chamber through the passageway thus preventing destruction of the burner. The ventage, as at 7, is regulated so that the products of combustion may pass off with the loss of as little
110 heat as possible.

Combustion thus effected is highly efficient, the tendency of oxidation of the articles being treated is reduced to a minimum, and the distribution of the heat is even and
115 regular.

In the type of furnace illustrated the articles being treated are shown as bar like forgings 36 projecting into the combustion chamber through openings at the upper part of
120 the vertical wall, but any form of articles may be introduced in the combustion chamber in any desired manner.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is—

1. The method of heating a furnace which consists in effecting a circulation of the gaseous contents of the furnace, feeding an atomized combustible mixture into said circu-
130

lation at a given point, and supplying to said circulation at a prior point sufficient air to insure efficient combustion.

2. The method of heating a furnace which
5 consists in effecting a circulation of the gaseous contents of the furnace, feeding an atomized combustible mixture into said circulation at a given point, supplying to said circulation at a prior point sufficient air to
10 insure efficient combustion, and maintaining a slow and even movement of said circulation at the point of ignition.

3. The method of heating a furnace which consists in feeding an atomized combustible
15 mixture to the furnace, providing a passageway for the gaseous contents of the furnace out from the furnace and back into the furnace past the point at which said mixture is fed, injecting compressed air into said pas-
20 sageway and thereby effecting a circulation of the gaseous contents of the furnace through said passageway past the point at which said mixture is fed, and supplying to said gaseous contents during its circulation
25 and prior to its reentry into the furnace sufficient air to insure efficient combustion.

4. The method of heating a furnace as defined in claim 3 together with the step of maintaining a slow and even movement of

said circulation at the point of ignition 30 whereby the hot blast enters and is distributed through the furnace slowly and evenly.

5. The method of heating a furnace which consists in effecting a circulation of the gas- 35 eous contents of the furnace, feeding an atomized combustible mixture into said circulation at a given point, and supplying to said circulation at a prior point sufficient air to insure efficient combustion, and sup- 40 plying to said circulation at a prior point sufficient air of a lower temperature to reduce the temperature of said circulation and to insure efficient combustion.

6. A heating furnace comprising a com- 45 bustion chamber, a passageway out from and back into said chamber, means for feeding an atomized combustible mixture into said passageway near its exit, a compressed air jet in said passageway acting to maintain 50 a circulation through the combustion chamber and the passageway, and an opening in the wall of said passageway to the atmosphere permitting air to be drawn into and mingle with said circulation. 55

In testimony whereof I have signed my name to this specification.

WILLIAM E. RENNER.