June 30, 1942. G. E. SEIL 2,288,491

OPEN HEARTH FURNACE

Filed Dec. 14, 1940 3 Sheets-Sheet 1

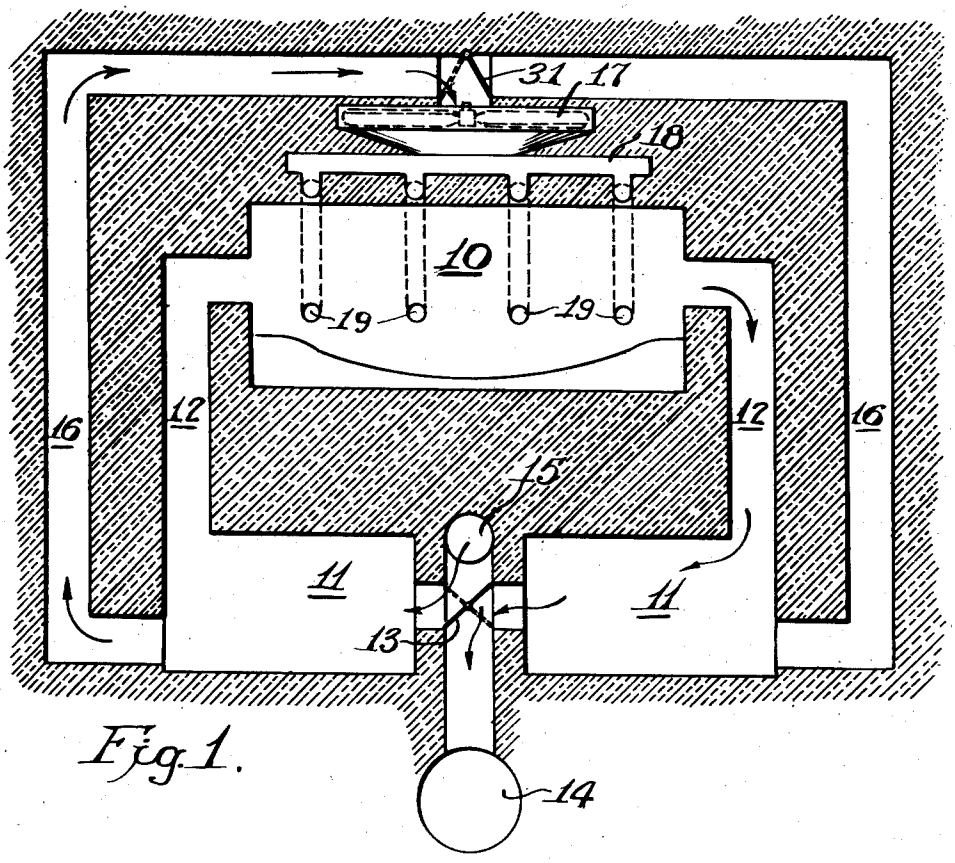


Fig. 1.

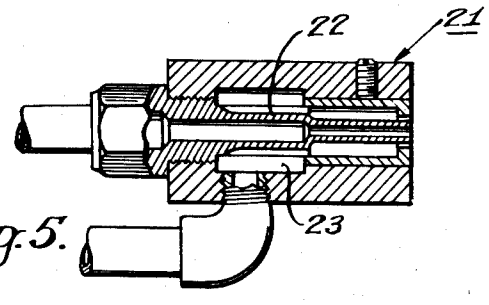


Fig. 5.

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Fig. 3.

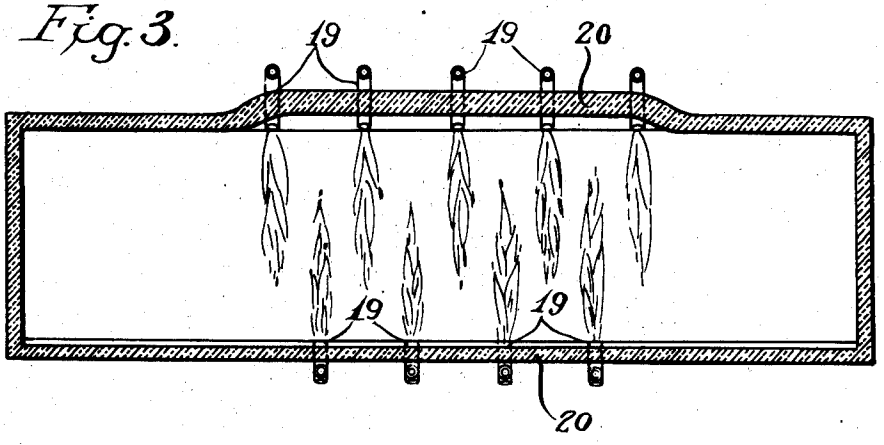
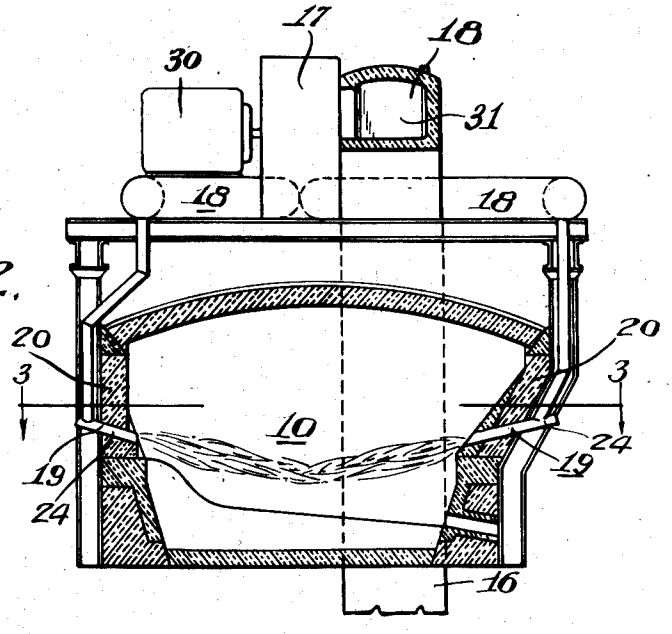


Fig. 2.



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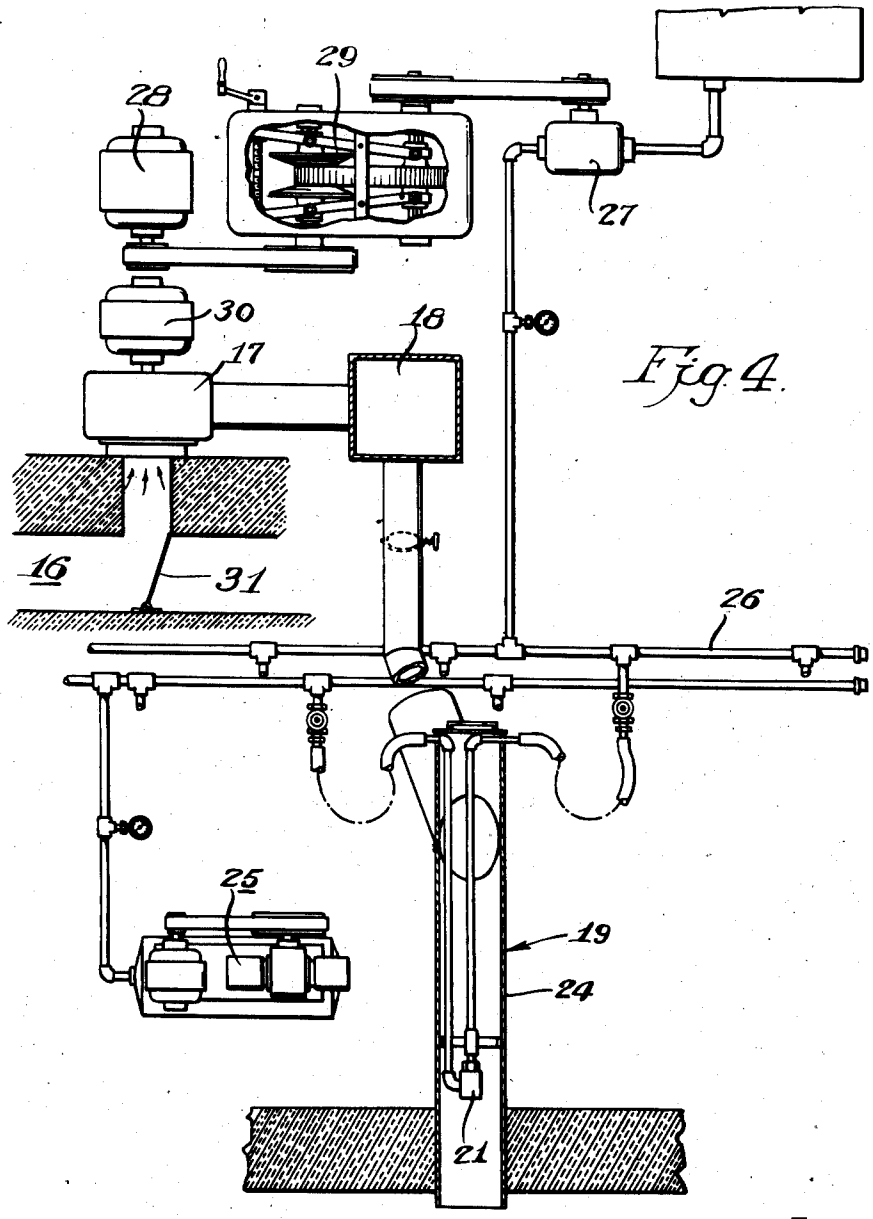


Fig. 4.

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UNITED STATES PATENT OFFICE

2,288,491

OPEN HEARTH FURNACE

Gilbert E. Seil, Cynwyd, Pa.

Application December 14, 1940, Serial No. 370,203

2 Claims. (Cl. 263—15)

This invention relates to regenerative and recuperative furnaces and, more particularly, to open hearth furnaces.

An important object of the invention is the provision of an open hearth furnace construction wherein a maximum heat transfer may be obtained without such dispersion of the flame as will result in destruction of the furnace walls.

Another object of the invention is the provision of a means whereby the type of flame employed in the furnace may be very readily regulated.

Still another object of the invention is the provision of a construction whereby an increased B. t. u. release may be effected in a given area and wherein the release will be comparatively rapid as respects the usual open hearth construction.

Another object of the invention is the provision of a construction whereby the B. t. u. release during combustion will occur closely adjacent to the final bath level thus insuring preheating of the superimposed portions when melting down a cold or a mixed charge.

A still further and important object of the invention is to provide a construction such that a constant volume of fuel may be delivered to the furnace under all circumstances and the concentration of this content may be varied as desired.

A still further object of the invention is the provision of a construction enabling attainment of the above objects without the necessity of alternating the fuel flow between two burners supplying the furnace as in the usual construction.

These and other objects I attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention and wherein:

Fig. 1 is a diagrammatic vertical sectional view of an open hearth furnace constructed in accordance with my invention;

Fig. 2 is a vertical sectional view through the furnace;

Fig. 3 is a section on line 3—3 of Fig. 2;

Fig. 4 is a diagrammatic view showing the fuel and air supply means employed with the burner system; and

Fig. 5 is a detailed longitudinal sectional view through a burner head.

Referring now more particularly to the drawings, the numeral 10 generally designates the hearth chamber of an open hearth furnace, and 11, a pair of checkers connected with the hearth by downtake flues 12. By means of a butterfly valve 13 the checkers 11 are selectively and alternately connectable with a stack 14 and an air intake 15. As described, the mechanism is identical with that ordinarily employed in an open hearth furnace.

In accordance with my invention, checkers 11 are connected by ducts 16 through a blower 17 with a manifold 18. Hearth chamber 10 is equipped with a plurality of burners 19 which may be of any desired number and are directed through opposite side walls 20 of the hearth chamber. The burners at either side of the hearth are staggered with relation to those of the opposite wall in their spacing longitudinally of the hearth and have their inner ends disposed at or slightly above the bath level of the hearth. Burners 19 are of the type shown in my prior Patent No. 2,137,185, granted November 15, 1938, for "Multiple burner arrangement," and each comprises a burner head 21 having a central fuel tube 22 and an annular chamber 23 surrounding this tube and supplying oxygen either through the medium of compressed air or steam to support combustion. The head 21 is arranged within a burner tube 24 through which secondary air may be supplied to the burner. As shown in Fig. 4, primary air is supplied to the annular chambers 23 of the burners through a compressor generally designated at 25. Fuel is supplied to these burners through a common supply line 26 to which the fuel is delivered from a suitable supply by means of a fixed delivery pump 27 operated from a constant speed motor 28 through an infinitely variable transmission 29 such as that known as the Reeves drive. The pump 27 has its sole discharge to the burners 19 with the result that the quantity of fuel measured by pump 27 and delivered to the burner system will be discharged into the furnace without regard as to whether one or more of the burners becomes clogged.

The motor 30 operating blower 17 is a variable speed motor, thus serving as a means for controlling the amount of secondary air delivered to the chamber 10 through the manifold 18. The structure obviously lends itself to automatic control.

Burners 19, as hereinbefore noted, have their inner ends located immediately above the bath level in the hearth and are disposed at a slight angle to the horizontal. I have found that this angle should be below 22° to the horizontal since, otherwise, there is "mushrooming" of the flame against the charge throwing the flame tips back against the wall of the furnace and tending to

destroy the same. It is preferred in practice that this angle be approximately 15°, although it may be made lower than this without any noticeable change in operation as long as the burner is kept above 3° to the horizontal.

It will be obvious that in a construction of this character there is no necessity for periodical reversal of the fuel supply as is necessary in the ordinary open hearth construction. The use of a multiplicity of small burner flames instead of a single long flame results in a high concentration of the B. t. u. content of the combustible mixture in the area where it can accomplish the most work. Since the concentration of the flame will be at the bath level of a cold or mixed charge, the greatest heat will be applied to the charge at this point, and the rising heat will serve to preheat the upper portions of the charge to an extent such that they are substantially at the melting point at the time that they reach the bath level.

The construction illustrated is, furthermore, highly advantageous in that it enables ready control of the B. t. u. concentration. It will be noted that if the air supplied through the manifold 18 is insufficient to supply the needs of burners 19 the down-take flue of the active checker will supply additional air to the hearth chamber to meet the demands of stack 14, thereby resulting in a dispersion of the flames of the individual burner tips to an extent proportionate to the supplies delivered from the manifold and the flue 12. Obviously, this will permit a close regulation of the furnace conditions.

I am aware that it has been heretofore proposed to employ a plurality of burners discharging simultaneously and continuously into the hearth chamber. In all such constructions with which I am familiar, however, the burner flames are directed against the charge from above and at a very high angle with the result that the flame "mushrooms" against the charge and is reflected against the furnace walls to rapidly destroy the same. As a matter of fact, tests with such furnaces indicate that they cannot be practically operated with any of the present-day refractories. Furthermore, with such constructions the molten metal has to flow downwardly over the unmelted charge in the furnace and there is no actual bath formed until the entire charge has been heated to the melting point. In my furnace, all of these objectionable characteristics are eliminated.

While I have illustrated and described my invention as specifically applied to a regenerative furnace, it will be obvious that the same principle of construction and operation may, likewise, be applied to recuperative furnaces.

Since the construction illustrated is essentially diagrammatic and capable of considerable modification without in any manner departing from the spirit of my invention, I do not wish to be understood as limiting myself thereto except as hereinafter claimed.

I claim:

1. In a regenerative furnace, a furnace chamber, a pair of regenerators communicating therewith, a plurality of continuously operating burners directed through opposed walls of the furnace chamber and against a charge contained therein, the burners of each wall being staggered with relation to those of the opposite wall, a manifold to supply air to said burners, a stack, means to alternately connect said regenerators to said stack, and means to selectively and alternately connect said regenerators to said manifold.

2. In a regenerative furnace, a furnace chamber, a pair of regenerators, a continuously open duct connecting each of said regenerators and said furnace, a plurality of continuously operating burners directed through opposed walls of the furnace chamber and against a charge contained therein, the burners of each wall being staggered with relation to those of the opposite wall, a manifold to supply air to said burners, ducts connecting said manifold and said regenerators, a stack, means to alternately connect said regenerators to said stack and to a source of air, and means to selectively and alternately connect said regenerators through the last-named ducts to said manifold.

GILBERT E. SEIL.