

Nov. 18, 1924.

1,515,852

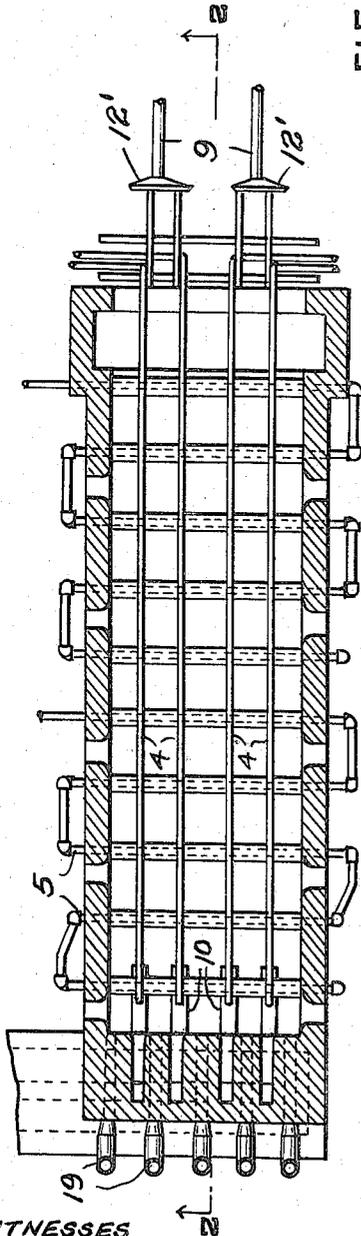
J. F. FERM

CONTINUOUS HEATING FURNACE

Filed May 2, 1923

2 Sheets-Sheet 1

FIG. 1.



WITNESSES
J. Herbert Bradley.

FIG. 3.

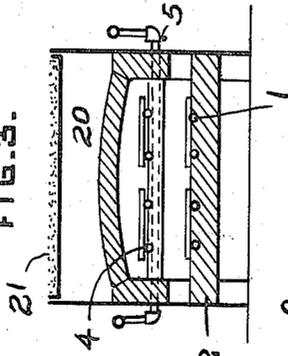
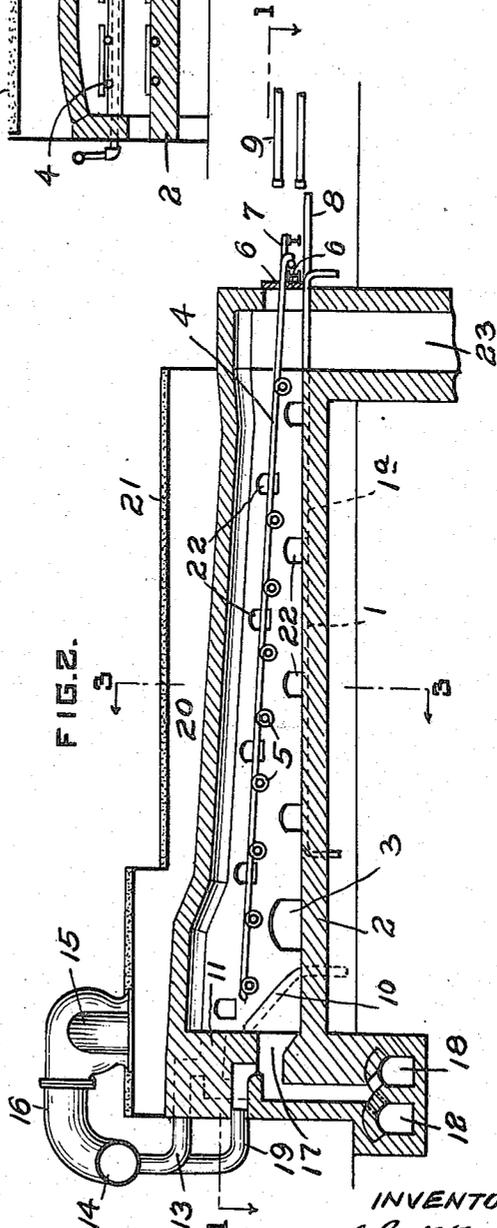


FIG. 2.



INVENTOR
John F. Ferm
by Green & McClellan
Attorneys

Nov. 18, 1924.

1,515,852

J. F. FERM

CONTINUOUS HEATING FURNACE

Filed May 2, 1923

2 Sheets-Sheet 2

FIG. 4.

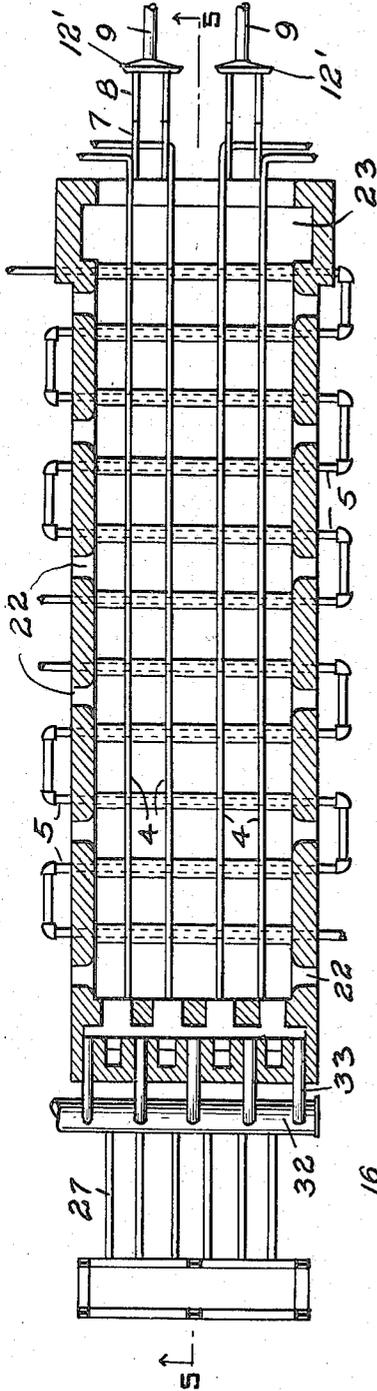
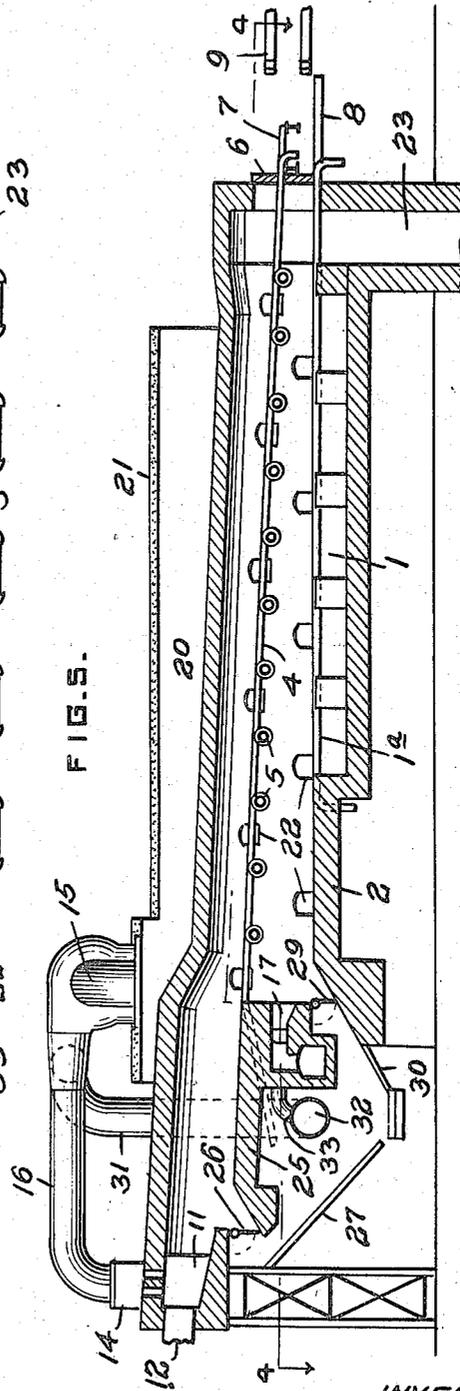


FIG. 5.



WITNESSES
J. Herbert Bradley

INVENTOR
John F. Ferm
by Green & Co. Collins
Attorneys

UNITED STATES PATENT OFFICE.

JOHN F. FERM, OF PITTSBURGH, PENNSYLVANIA.

CONTINUOUS-HEATING FURNACE.

Application filed May 2, 1923. Serial No. 636,056.

To all whom it may concern:

Be it known that I, JOHN F. FERM, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and the State of Pennsylvania, have made a new and useful Invention in Continuous-Heating Furnaces, of which the following is a specification.

My invention relates to a continuous heating furnace for heating ingots, blooms, slabs, or billets prior to rolling or forging.

An object of my invention is to construct a multiple hearth furnace having any desired capacity and which occupies no more floor space than is necessary for a single hearth furnace of the old type. Another object is to provide a multiple hearth furnace of any desired capacity, which will require less labor than the number of furnaces of the old type required for a like capacity, and to decrease the fuel necessary by decreasing the radiating surface and at the same time to decrease the first cost of installation.

My invention is shown as a double hearth furnace of either the side door or the end door discharge type in the drawings, in which, Figure 1 is a longitudinal horizontal section of a furnace on the line 1—1 of Fig. 2 looking in the direction of the arrows. Fig. 2 is a longitudinal vertical section through the furnace on the line 2—2 of Fig. 1 looking in the direction of the arrows, and Fig. 3 is a vertical cross section on the line 3—3 of Fig. 2 looking in the direction of the arrows. Fig. 4 is a view similar to Fig. 1 showing the invention applied to an end door discharge continuous furnace taken on the line 4—4 of Fig. 5. Fig. 5 is a vertical section on the line 5—5 of Fig. 4 looking in the direction of the arrows.

Describing first a double hearth furnace of the side door discharge type as is shown in Figs. 1 to 3, the furnace comprises a lower hearth 1 having water cooled skids 1^a which corresponds to the usual hearth in a single hearth furnace. Formed by a continuation of this hearth 1 is the uncooled finishing hearth 2 adjacent to which is the discharge door 3. Above the lower hearths 1 and 2 are skids 4 supported on water cooled pipes 5 forming an upper or second preheating hearth. The water cooled supports 5 for the upper hearth may be covered with a refractory insulation to prevent heat loss, if desired. At the entrance end of the pre-

heating hearths are provided the charging doors 6 outside of which are the skids 7 and 8 where the cold stock is placed for charging the preheating hearths 4 and 1 respectively. A double ram pusher 9 is provided for shoving cold stock into the furnace.

Two or more charging rams 12' are provided for each hearth. Each charging ram is independently operable so that if there is more than one row of material on a preheating hearth each row can be independently advanced.

At the opposite end of the furnace from the charging doors and adjacent the upper preheating hearth are provided inclined skids 10 which are set in the brick work and are for the purpose of directing the preheated material such as billets or ingots from the upper hearth to the finishing hearth below. The skids 10 may be water cooled if desired.

Combustion ports 11 are provided for the upper hearth and leading to the ports 11 are the gas flue 12 and air supply pipes 13. These air supply pipes 13 are connected to an air header 14 which distributes the air from the fan 15 received through a connecting pipe 16 to the air supply pipes 13, there is also provided combustion ports 17 for the lower hearth and leading thereto are the gas flue 18 and air supply pipes 19 which latter are also connected to the air header 14.

The fan or blower 15 draws air through a preheating chamber 20 which is formed above the furnace roof by an upper metallic roof 21 which may be covered with sand and forms the top of the preheating chamber. In this manner the air supplied to the combustion ports is preheated by radiation from the hottest part of the furnace.

I provide the usual peep holes 22 which enable the operator to inspect the material during the heating thereof.

Turning now to the application of my invention to a furnace of the end door discharge type which is illustrated in Figs. 4 and 5 I provide the same lower hearth 1 with the adjacent finishing hearth 2. The upper hearth 4, which is supported by water cooled pipes 5 as above described, has adjacent thereto a second finishing hearth 25 which, like the lower finishing hearth 2, is uncooled. This upper finishing hearth 25 has a swinging door 26 at the end opposite the preheating hearth 4. This end discharge

door 26 leads to inclined skids 27 on which the hot billets etc. slide on to the roller table from the upper hearth. The lower finishing hearth has a swinging end discharge door 29 leading to incline skids 30 down which the hot billets etc. slide to the roller table from the lower hearth.

In this furnace the air fan 15 forces the air through the connecting pipe 16 to the air header 14 for the combustion ports 11 for the upper hearth and through the connecting pipes 31 to a second air header 32 which is connected by an air supply pipe 33 to the lower combustion ports 17.

Describing first the operation of the furnace, illustrated in Figs. 1 to 3, and assuming that both hearths are filled with one or two rows of billets or slabs, depending upon their length, and also, assuming that a cold slab has been placed on the skids 7 and 8 in front of the pusher rams 9, the operator as soon as a hot slab or billet is discharged from the finishing hearth 2 through the discharge door 3 by means of an ordinary pinch roller as is usual, inspects the upper and lower hearths and then has the rams 9 opposite the hearth with the hottest material racked forward. If the hottest material is on the lower hearth the billets on the lower hearth are moved forward by the rams and the billet nearest the discharge door is moved to a point on the finishing or uncooled hearth which was previously occupied by the billet just discharged from the furnace. If the hottest material is on the upper hearth the billets on this hearth are moved forward by the rams and the first billet on the hearth drops from the end of the skids 4 onto the inclined skids 10 and slides down these to the uncooled finishing hearth in front of the discharge door where it remains until discharged from the furnace and where the black spots or unheated portions caused by the water cooled skids are removed. As soon as a billet is discharged from the furnace the operation is repeated.

In the case of the end door discharge furnace, illustrated in Figs. 4 and 5, each preheating hearth has a separate non-cooled section forming separate finishing hearths. The operation of this furnace is the same as that of the side door discharge furnace except that billets from the upper preheating hearth 4, instead of dropping down on to the lower finishing hearth 2, are forced on to the separate upper finishing hearth 25 and from there pass through the discharge door 26 on to the inclined skids 27 down which they slide to the roller table. The billets on the lower finishing hearth 2, when the black spots have been removed, are forced through the discharge door 29 and down the inclined skids 30 to the roller table.

In both types of furnaces, the upper hearth being made of skids, the exposed sur-

face of the billets is increased and an even temperature is maintained by radiation from the hotter hearth. The products of combustion sweep along the billets or hearths and finally at the charging end of the furnace pass down the common flue 23 leading to the stack.

The furnaces illustrated are shown as equipped for gas firing but I desire it to be understood that my invention is equally applicable to furnaces using other fuel such, for example, as oil, tar or powdered coal.

Having thus described my invention what I claim as new is:—

1. A continuous heating furnace having a plurality of hearths, a charging opening for each hearth, discharge openings for each hearth, independent combustion ports for each hearth and a common flue for the products of combustion.

2. A continuous heating furnace having a plurality of super-imposed hearths and independent combustion ports for each hearth.

3. A continuous heating furnace having a plurality of super-imposed hearths, an independent combustion port for each hearth and a common flue.

4. A continuous heating furnace having a plurality of super-imposed hearths, a charging opening for each hearth, a discharging opening for each hearth, independent combustion ports for each hearth and a common flue.

5. A continuous heating furnace having two super-imposed hearths, independent combustion ports for each hearth and a common flue for products of combustion.

6. A continuous heating furnace having two super-imposed preheating hearths, a finishing hearth adjacent one of the preheating hearths for receiving material therefrom and means for directing material from the other preheating hearth on to said finishing hearth.

7. A continuous heating furnace having two super-imposed preheating hearths, a finishing hearth adjacent the lower preheating hearth for receiving material therefrom and means for directing material from the upper preheating hearth downwardly on to said finishing hearth.

8. A continuous heating furnace having two super-imposed preheating hearths, a finishing hearth adjacent to the lower preheating hearth for receiving material directly therefrom and skids for directing material from said upper hearth downwardly on to said finishing hearth.

9. A continuous heating furnace having a cooled upper hearth, a lower hearth having cooled and uncooled sections said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth.

10. A continuous heating furnace having

a cooled upper hearth, a lower hearth having cooled and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth and means for directing material from said upper hearth downwardly on to said finishing hearth. 70

11. A continuous heating furnace having a cooled upper hearth, a lower hearth having cooled and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth and skids for directing material from said upper hearth downwardly on to said finishing hearth. 75

12. A continuous heating furnace having an upper hearth composed of skids supported on water cooled pipes, a lower hearth including a section having water cooled skids and an uncooled section, said uncooled section constituting a finishing hearth for receiving material from the said cooled section and from said upper hearth, skids for directing material from said upper hearth downwardly on to said finishing hearth, charging openings for each of said cooled hearths and a discharge opening for said finishing hearth. 80

13. A continuous heating furnace having a cooled upper hearth, a lower hearth having cooled and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth, fuel ports for said upper hearth, fuel ports for said lower hearth and a common flue for the products of combustion. 85

14. A continuous heating furnace having a cooled upper hearth, a lower hearth having cooled and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth, fuel ports for said upper hearth, fuel ports for said lower hearth, a common flue for the products of combustion and means for directing material from said upper hearth downwardly on to said finishing hearth. 90

15. A continuous heating furnace having a cooled upper hearth, a lower hearth having cooled and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth, fuel ports for said upper hearth, fuel ports for said lower hearth, a common flue for the products of combustion and skids for directing material from said upper hearth downwardly on to said finishing hearth. 95

16. A continuous heating furnace having a cooled upper hearth, a lower hearth having cooled and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth, fuel ports 100

for said upper hearth, fuel for said lower hearth, a common flue for the products of combustion, skids for directing material from said upper hearth downwardly on to said finishing hearth and an air preheating chamber above said upper hearth and communicating with said fuel ports. 70

17. A continuous heating furnace having a cooled upper hearth composed of skids supported on water cooled pipes, a lower hearth including a section having water cooled skids and uncooled sections, said uncooled section constituting a finishing hearth for receiving material from said cooled section and from said upper hearth, skids for directing material from said upper hearth downwardly on to said finishing hearth, combustion ports for said upper hearth, combustion ports for said lower hearth, a common flue for the products of combustion, an air preheating chamber above said upper hearth and communicating with said fuel ports, charging openings for each of said cooled hearths adjacent said flue and a discharging opening for said finishing hearth. 85

18. A continuous heating furnace having a plurality of preheating hearths, a separate finishing hearth adjacent each preheating hearth, charging openings for each preheating hearth and a discharge opening for each finishing hearth leading to a common exit. 90

19. A continuous heating furnace having a plurality of super-imposed preheating hearths and a finishing hearth adjacent each preheating hearth. 100

20. A continuous heating furnace having a plurality of super-imposed preheating hearths, a finishing hearth adjacent each preheating hearth, charging openings for each preheating hearth and a discharge opening for each finishing hearth leading to a common exit. 105

21. A continuous heating furnace having an upper water cooled preheating hearth, an uncooled finishing hearth adjacent thereto, a lower water cooled preheating hearth and an uncooled finishing hearth adjacent thereto. 110

22. A continuous heating furnace having an upper water cooled preheating hearth, an uncooled finishing hearth adjacent thereto, a lower water cooled preheating hearth, an uncooled finishing hearth adjacent thereto, a charging opening for each preheating hearth a single discharge exit leading from the furnace and a discharge opening leading from each finishing hearth to said exit. 115

23. A continuous heating furnace having an upper water cooled preheating hearth, an uncooled finishing hearth adjacent thereto, a lower water cooled preheating hearth, a lower uncooled finishing hearth adjacent thereto, fuel ports for said upper hearths, fuel ports for said lower hearths 120

and a common flue for the products of combustion.

24. A continuous heating furnace having an upper water cooled preheating hearth, an uncooled finishing hearth adjacent thereto, a lower water cooled preheating hearth, a lower uncooled finishing hearth adjacent thereto, fuel ports for said upper hearth, fuel ports for said lower hearth, a common flue for the products of combustion and an air preheating chamber above said upper hearth and communicating with said fuel ports.

25. A continuous heating furnace having two super-imposed preheating hearths comprising water cooled skids, an upper and lower uncooled finishing hearths, combustion ports for said upper hearths, combustion ports for said lower hearths, an air preheating chamber above said upper hearth and communicating with said fuel ports and a common flue for the products of combustion, charging openings for said preheat-

ing hearths adjacent said flue and discharging openings for each finishing hearth leading to a common exit.

26. A continuous heating furnace having a plurality of preheating hearths, a finishing hearth adjacent each preheating hearth, charging openings for each preheating hearth, a single discharge exit from the furnace and means for directing material from each finishing hearth to said exit.

27. A continuous heating furnace having a plurality of preheating hearths, a finishing hearth adjacent each preheating hearth, charging openings for each preheating hearth, a single discharge exit from the furnace and skids for directing material from each finishing hearth to said discharge exit.

In testimony whereof, I have hereunto subscribed my name this 26th day of April, 1923.

JOHN F. FERM.