March 24, 1931. C. A. DAVIS ET AL 1,797,902

FURNACE FOR HEATING SHEETS AND PAIRS

Filed March 16, 1929 5 Sheets-Sheet 1

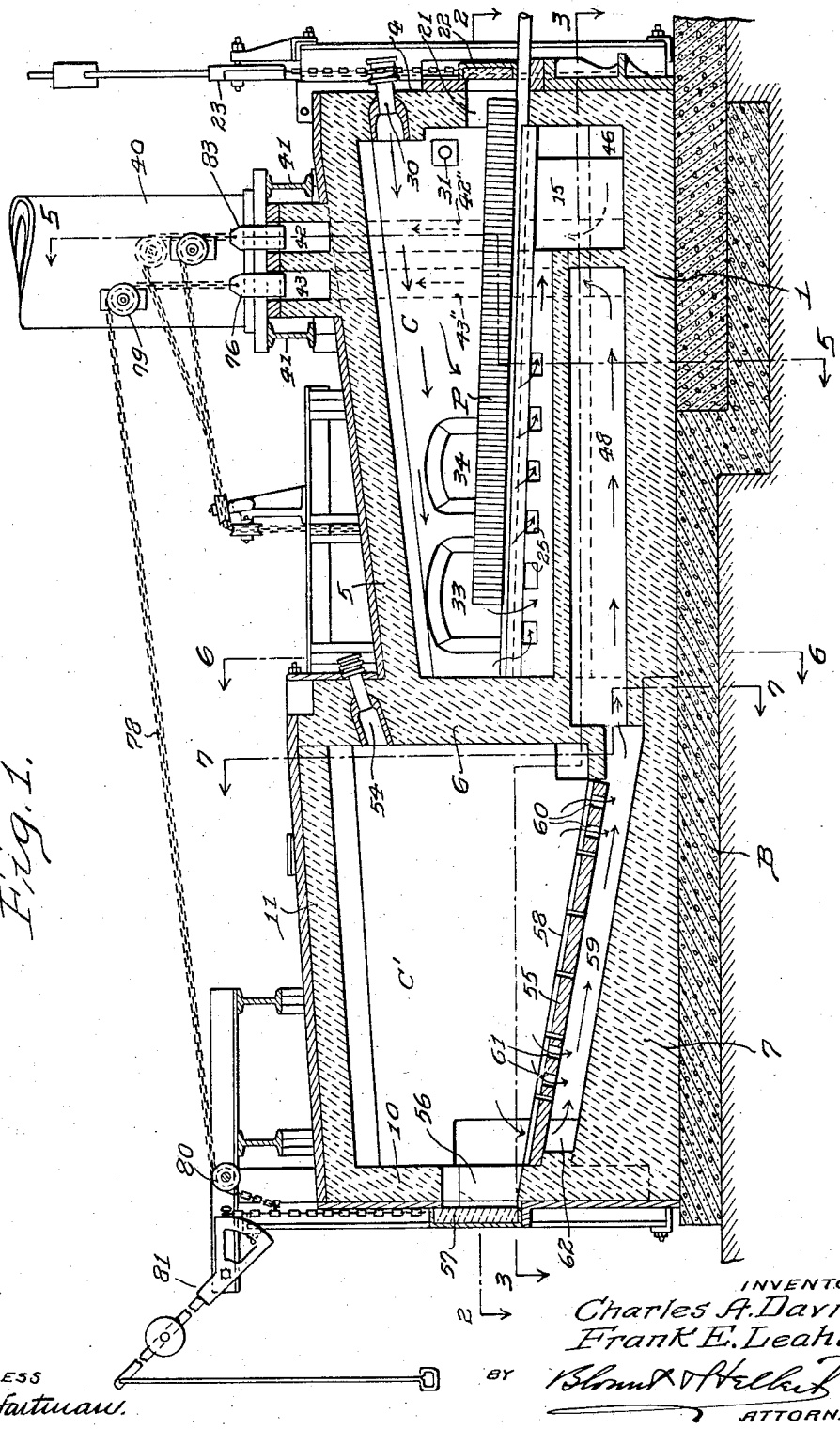


Fig. 1.

INVENTORS
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BY Blount & Walker
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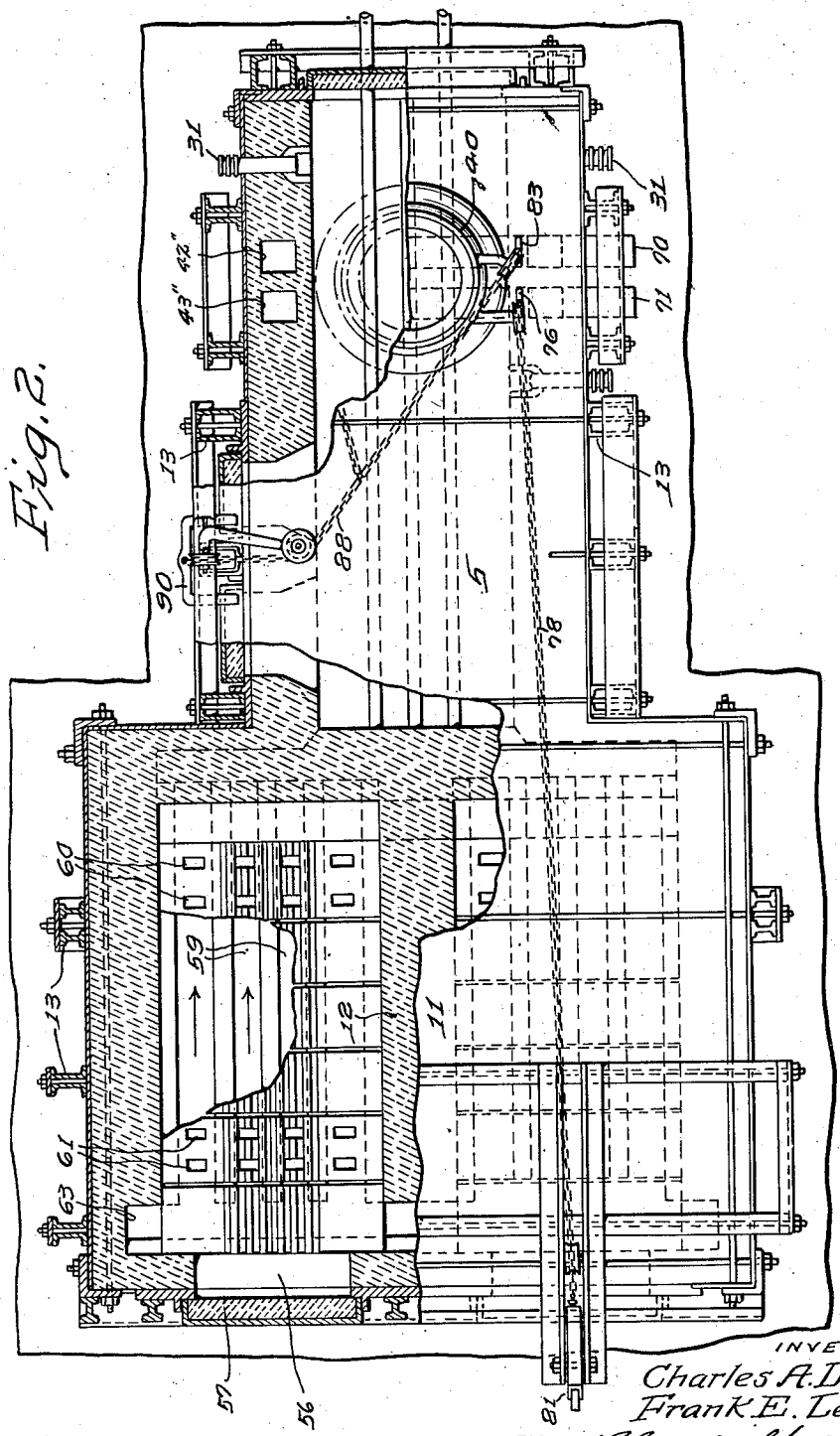
WITNESS
F. J. Hartman.

March 24, 1931. C. A. DAVIS ET AL 1,797,902

FURNACE FOR HEATING SHEETS AND PAIRS

Filed March 16, 1929 5 Sheets-Sheet 2

Fig. 2.



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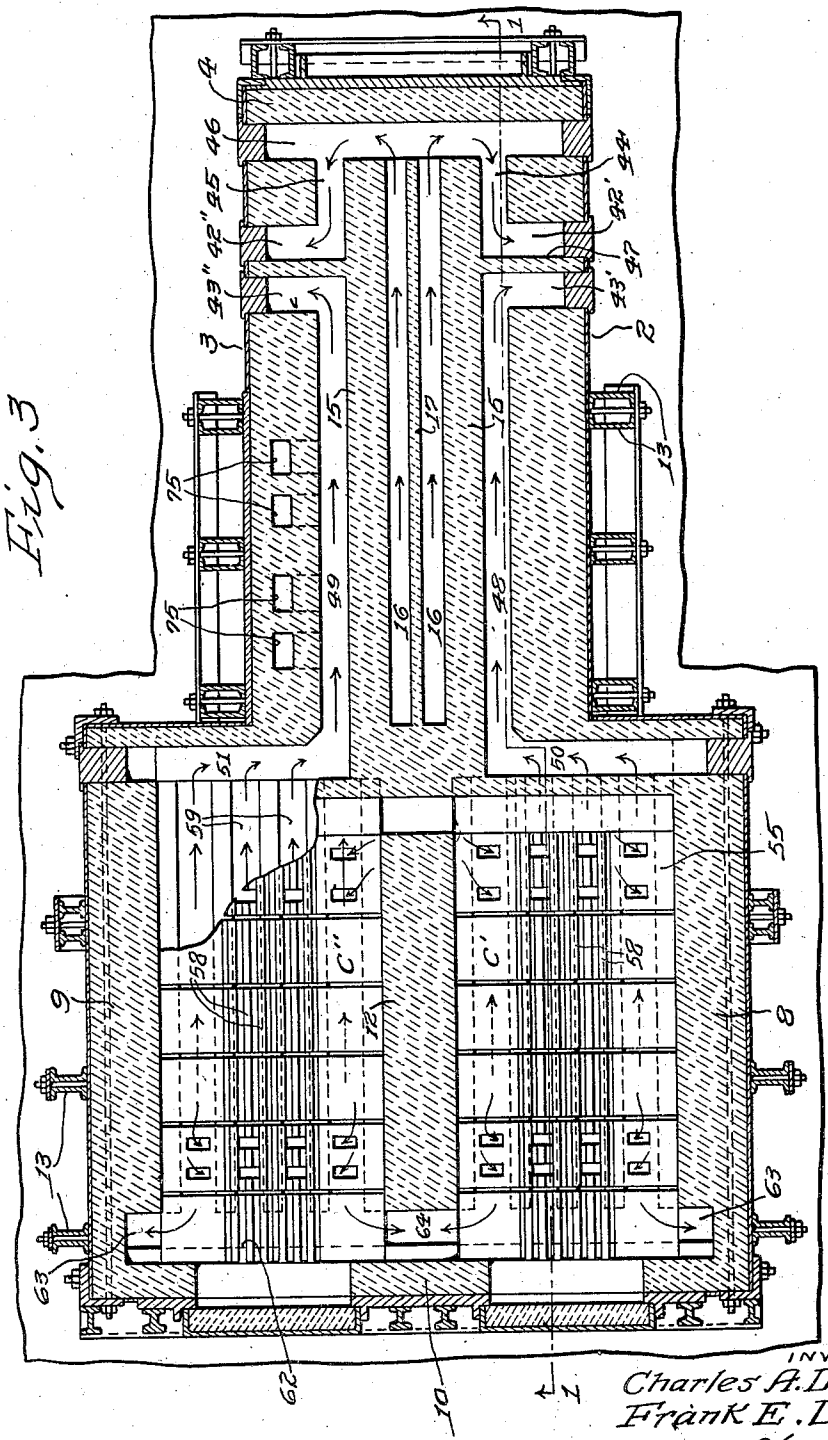
WITNESS
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March 24, 1931. C. A. DAVIS ET AL 1,797,902

FURNACE FOR HEATING SHEETS AND PAIRS

Filed March 16, 1929 5 Sheets-Sheet 3

Fig. 3



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March 24, 1931 C. A. DAVIS ET AL 1,797,902

FURNACE FOR HEATING SHEETS AND PAIRS

Filed March 16, 1929 5 Sheets-Sheet 4

Fig. 4

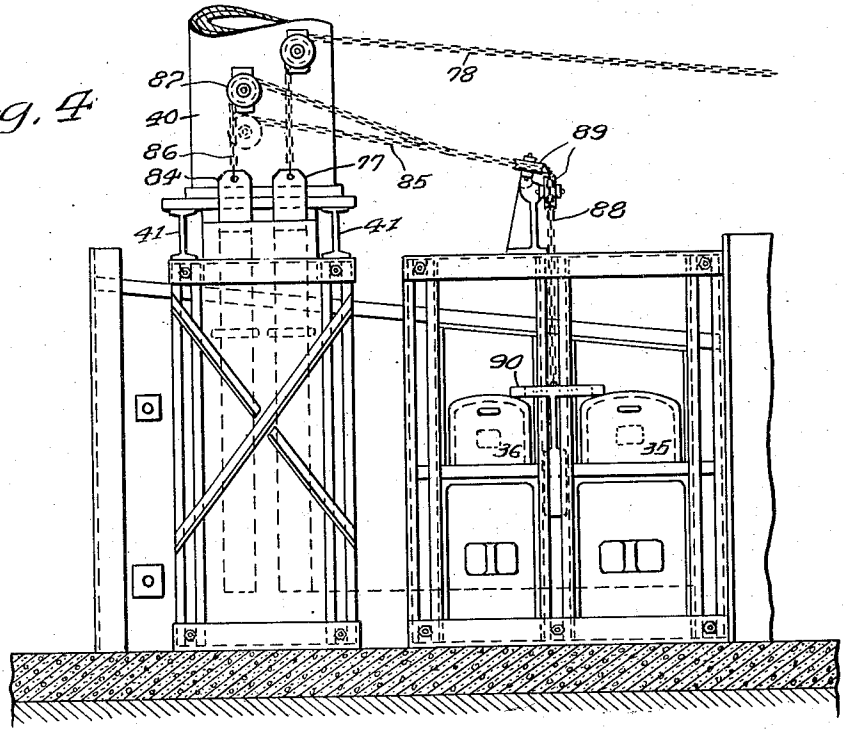
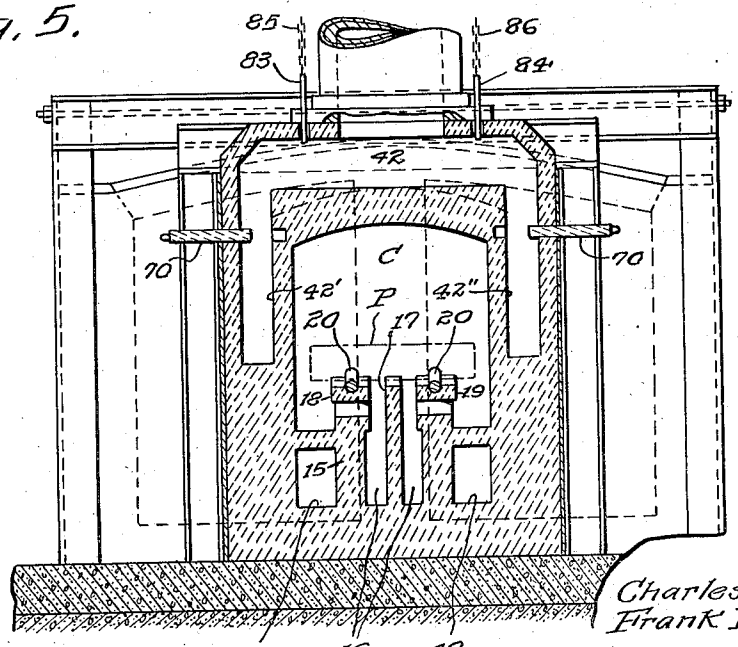


Fig. 5.



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WITNESS
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March 24, 1931. C. A. DAVIS ET AL 1,797,902

FURNACE FOR HEATING SHEETS AND PAIRS

Filed March 16, 1929 5 Sheets-Sheet 5

Fig. 6.

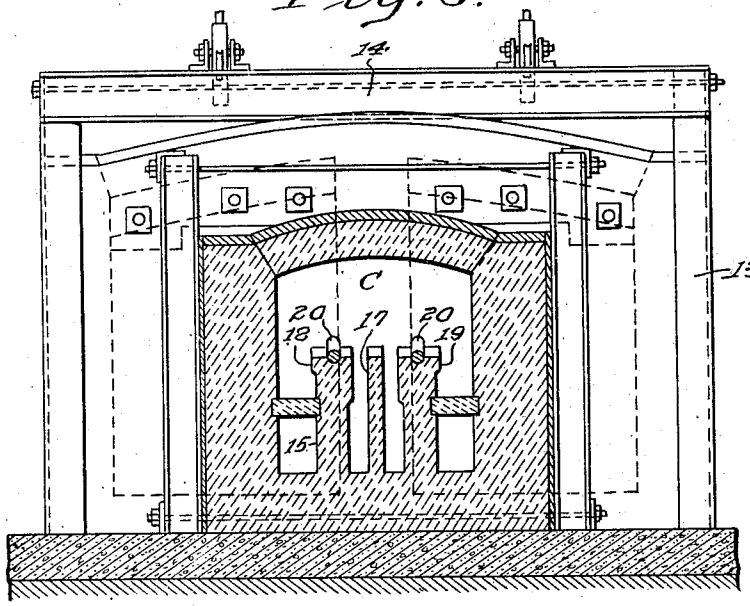
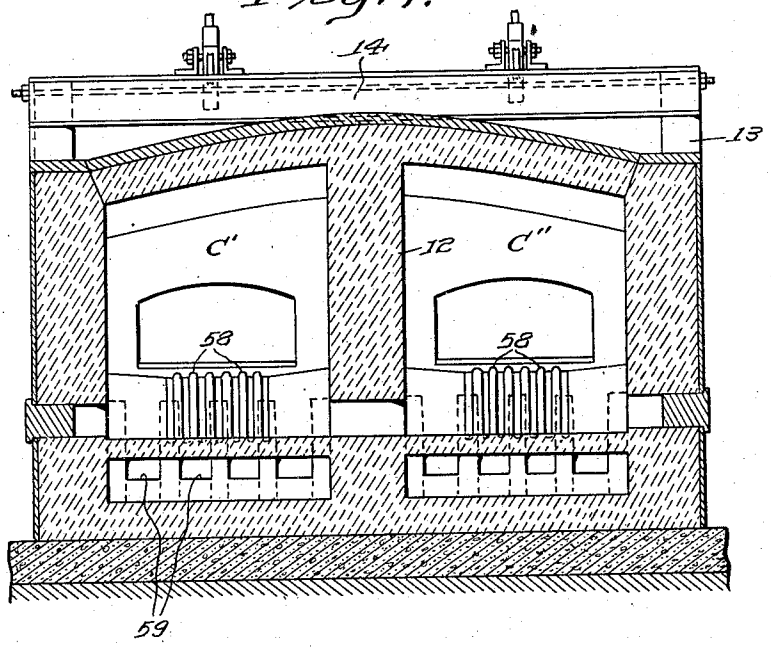


Fig. 7.



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WITNESS
F. J. Hartman.

Patented Mar. 24, 1931 1,797,902

UNITED STATES PATENT OFFICE

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FURNACE FOR HEATING SHEETS AND PAIRS

Application filed March 16, 1929. Serial No. 347,514.

Our invention relates to that class of furnaces employed for heating materials known in steel mill practice as "sheets" and "pairs", usually preparatory to subjection thereof to subsequent treatment in a rolling mill or the like, a principal object of the invention being to provide a furnace in which greater capacity, economy of operation, and more uniform heating of the material may be secured than in the furnaces heretofore usually employed for similar purposes.

Further objects of the invention are to provide a furnace in which the gases are recirculated in such manner as to effect a desirable control of the furnace temperature and a uniform heating of the material at the minimum possible furnace temperature and in which means are provided for automatically preventing air infiltration upon the opening of the furnace doors as far as possible as well as means for so directing any infiltrated air as to avoid oxidation and cooling of the material thereby.

Still further objects of the invention are to provide a furnace having in its preferred form but a single stack and embodying means whereby the passage of the gases through the furnace to the stack can be controlled in such manner as to secure an even temperature throughout the several chambers of the furnace; to provide a furnace in which the sheet heating chamber or chambers are substantially uniformly heated throughout their extent whereby the heated packs or sheets when edged against the side walls of the chambers or adjacent the rear of the hearth are uniformly heated throughout as well as when disposed at the center of the hearth with consequent elimination of what are known as "rash back ends"; to provide a furnace in which circulation of the gases is so effected so as to heat the furnace hearths and thus provide what is known in the industry as a "soft hearth" without an increase in fuel expense and in which, especially in the pair heating chamber of the furnace, the gases form an enveloping blanket or envelope about the pairs which is operative to protect them from the inimical effects any infiltrated air which in spite of precautions taken to prevent its entrance may, nevertheless, find its way into the furnace.

Our invention further contemplates the general improvement of furnaces of the class to which our invention relates, the recirculation of waste gases in such manner as to conserve and usefully employ a large proportion of the heat thereof which would otherwise be lost with a resultant economy in operation, as well as the provision of a furnace of such character and of such construction that its operation may be readily conducted and controlled so as to secure maximum uniformity in the heating of the material.

Our invention still further includes other objects and novel features of design, construction and arrangement hereinafter more particularly pointed out or which will be apparent to those skilled in the art from the following description of a furnace constructed in accordance with our invention and illustrated in the accompanying drawings.

While we have herein chosen to refer more particularly to a furnace of the tandem type, it will be understood we do not thereby desire or intend to confine ourselves thereto as our invention may be embodied in furnaces of other types if desired without departing therefrom or sacrificing the advantages thereof.

In the drawings, Fig. 1 is a vertical longitudinal staggered section through the furnace on line 1—1 in Fig. 3; Fig. 2 is a top plan view of the furnace partially in horizontal section on line 2—2 in Fig. 1 and Fig. 3 is a horizontal section on line 3—3 in said figure. Fig. 4 is a fragmentary side elevation of the rear end of the furnace showing the stack, drawing doors and adjacent parts; Fig. 5 is a fragmentary transverse section through the furnace on line 5—5 of Fig. 1, and Figs. 6 and 7 are respectively similar sections on lines 6—6 and 7—7 of said figure. The same characters of reference are used to designate similar parts in the several figures and the directions in which the several sections are taken are indicated by the arrows on the section lines.

The furnace which may be disposed on a base B of concrete or the like comprises at

its rear end the pair heating chamber C and at its front end a pair of sheet heating chamber C′, C″ disposed side by side symmetrically with respect to the pair heating chamber which is narrower than the combined width of the sheet heating chambers. The pair heating chamber comprises a bottom 1, side walls 2 and 3, end wall 4 and a roof 5 desirably transversely arched and inclined forwardly and downwardly from the end wall, all of said walls and roof, as well as the other walls of the furnace hereinafter mentioned, being constructed of brick or other suitable material. At its forward end the pair heating chamber is closed by a transversely extending partition wall 6 which separates it from the chambers C′, C″ which are bounded by a bottom 7, side walls 8 and 9. front wall 10, and a transversely arched roof 11, while the two chambers are separated longitudinally by a partition wall 12. While we have shown a furnace embodying two sheet heating chambers, it will of course be appreciated that in certain cases but a single sheet heating chamber may be provided in which case the partition wall 12 or its equivalent will be omitted. The several walls of the furnace are supported by suitably disposed buckstays 13 or the like disposed at intervals thereabout and connected at their upper extremities as and where required by tie beams 14 in the manner common to furnace construction and which therefore requires no further description.

The pair heating chamber hearth 15 extends rearwardly from the partition wall 6 to a point adjacent the end wall 4 and extended longitudinally through this hearth is a flue 16 centrally divided by a partition 17, while above the hearth on each side of the flue, walls 18 and 19 are respectively disposed, the upper surfaces of these walls being preferably inclined upwardly from the end wall toward the partition wall 6. Upon these walls 18 and 19 may be disposed longitudinally extending skids 20 for the reception of the pairs P which are charged into the furnace through a port 21 in the end wall 4, beyond which the skids are desirably continued so as to facilitate the charging, and which is closed by a vertically slidable door 22 operated by any convenient actuating mechanism generally designated as 23. Through the walls 18 and 19 below the skids ports 25 are provided at longitudinally spaced intervals to permit free circulation of the gases from those portions of the chamber lying outside of the said walls to the central flue 16 and thus around and about the pairs P supported on the skids to thereby form an enveloping blanket of gas thereabout to protect them from the oxidizing influence of any air which may enter the furnace during the charging or drawing operations.

For introducing the heating gases into the chamber C burners 30 are disposed in the end wall 4 preferably adjacent its top and other burners 31 are directed into the chamber through the side walls thereof adjacent said end wall so that the said gases are discharged into the chamber at that end thereof at which the material is charged, this arrangement permitting recirculation of the gases and facilitating uniform heating of the material at the minimum possible furnace temperature. The gases projected from these burners move through the chamber toward the partition wall 6 in the direction generally indicated by the arrows in Fig. 1 and thence pass down into the flue 16 at the center of the hearth and circulate in and about the material being heated through the ports 25 and through the flue which is open at the top and finally pass to the stack in a manner hereinafter more fully described.

For drawing the pairs when heated to the proper degree, one or more drawing ports 33 and 34 are provided in one of the furnace side walls adjacent the inner end of the hearth and are respectively arranged to be closed by vertically slidable doors 35 and 36 hereinafter more particularly mentioned.

For creating the requisite draft through the furnace and conveying the products of combustion therefrom a stack 40 is suitably mounted above the rear end of the roof 5 and supported in any convenient way as upon transversely extending beams 41 and communication from the various chambers with this stack is effected through two flues 42 and 43 which extend transversely across the furnace roof beneath the stack and connect with the latter, the flue 42 being operative to discharge the waste gases from the pair heating chamber into the stack and the flue 43 to similarly discharge thereinto the gases from the sheet heating chambers. At its opposite ends the flue 42 branches downwardly through the side walls of the furnace to form branch flues 42′, 42″ which at their lower ends are respectively connected by longitudinal ports 44 and 45 with a header flue 46 extending transversely across the furnace adjacent the bottom of the end wall 4 and with the center of which the hearth flue 16 communicates. The flues 42 and 43 as well as their respective branches are entirely separated by a wall 47 which extends transversely and oppositely from the hearth and is carried up on both sides of the furnace between the branch flues and then transversely across the top of the furnace beneath the stack. Thus the waste gases from the chamber C pass out of the hearth flue 16, separate in opposite directions in the header flue 46 and from thence pass into the branch flues 42′, 42″ through the ports 44 and 45 and from these branch flues into the main flue 42 and to the stack substantially as indicated by the arrows in Figs. 1 and 3.

The branch flues 43′, 43″ respectively communicate at their lower ends with longitudinally extending flues 48 and 49 formed adjacent the sides of the hearth and respectively communicating at their forward ends with transversely extending header flues 50 and 51 substantially below the wall 6 which are operative to collect the waste gases from the sheet heating chambers C′, C″ and direct them into the flues 48 and 49 from whence they are carried through the branch flues 43′, 43″ to the flue 43 and thence into the stack.

The gases for heating the chambers C′, C″ are directed thereinto by burners 54 desirably disposed in the wall 6 above the roof 5 and preferably downwardly inclined, a sufficient number of burners being employed, of course, to secure the desired temperature within the chambers; as the arrangement and construction of both chambers are similar, a description of one of them together with its flue arrangement will suffice for the other. Thus each chamber is provided with a rearwardly, downwardly inclined hearth 55 extending from a charging door or port 56 in the front wall 10 adapted to be closed by a vertically slidable door 57. The hearth which is desirably provided with laterally spaced skids 58 for the reception of the packs of sheets, extends entirely across the chamber and terminates at its inner end adjacent the wall 6 while beneath the hearth are formed a plurality of laterally spaced flues 59 which communicate at their inner ends respectively with the header flues 50 and 51. Near the inner ends of each hearth a plurality of ports 60 spaced laterally and longitudinally are cut therethrough into the subjacent flues and in a similar way other ports 61 are cut through each hearth adjacent the charging door, while below the outer end of the hearth a transversely extending header flue 62 is provided and carried entirely across both chambers so as to connect with the forward ends of the flues 59. A port 63 is carried upwardly in the side wall of the furnace from each end of this header flue 62 to communicate with the adjacent chamber above the hearth and a vertically extending port 64 is also desirably formed in the partition wall 12 which separates the chambers and arranged to communicate with both chambers and with the subjacent header flue 62.

Thus the heated gases directed into each chamber from the burners initially move toward the front wall 10 and then pass downwardly in large proportion through the ports 61, 63, and 64 into the subjacent flues 59 either directly or through the header 62 so that a very effectual circulation of gases in and about the packs of sheets upon the hearth is secured. However when the burning gases are projected into the chamber, the heavier portions tend to sink more rapidly than the lighter portions and hence, in the absence of the ports 60, these heavier portions would gradually accumulate adjacent the inner end of the hearth and blanket the packs of sheets disposed adjacent thereto with resultant lack of uniformity in the heating of the various packs disposed throughout the chamber since the blanketed packs near the inner end of the hearth would be heated less effectually and less rapidly than those more nearly adjacent its front end. The ports 60, however, adjacent the inner end of the hearth effectually prevent this result by permitting the heavier gases to escape directly into the subjacent flues 59 so that irrespective of the particular position of a given pack within the heating chamber it is heated substantially uniformly and in conformity with all of the other packs therein as an even, substantially uniform temperature is maintained throughout the chamber.

The waste gases passing from the heating chambers are carried into the header flues 50 and 51 and from thence through the flues 48 and 49 to the branches 43′, 43″ of the stack flue 43 as above described and in their traverse of the flues 48 and 49 give up a large part of their heat to the hearth of the pair heating chamber thereby creating what is known as a "soft" or heated hearth without the expenditure of additional fuel. This is a very important feature of our invention as it is well known in the industry that a hearth of this character is distinctly preferable but has hitherto in furnaces of this general character been only obtainable by the expenditure of a considerable amount of fuel over that actually required for the heating of the material in the furnace; in accordance with our invention, however, we are able to obtain a soft hearth by the utilization of heat which would otherwise be wasted with resultant economy of operation.

In order to properly control the circulation of the gases in the furnace so that a substantially even temperature can be maintained throughout the different chambers thereof irrespective of variations in stack draft or other variant local conditions, we provide means for individually regulating the draft through the branches of the flues 42 and 43, said means conveniently comprising a manually operable damper 70 in each of the branch flues 42′ and 42″ and a similar damper 71 in each of the branch flues 43′ and 43″. These dampers may be of any suitable form, that shown consisting of a plate of refractory material so arranged that it can be slid in or out transversely of the flue to cut down or open up the draft therethrough. Thus by a suitable regulation of the dampers 70, the draft from each side of the chamber C to the stack can be controlled and in like manner the draft from each of the chambers C′, C″ can be similarly controlled through the dampers 71 in ac-

cordance with the particular operating conditions encountered.

In filtration of air into furnaces in which sheets, pairs or like material are being heated is extremely undesirable as it tends to cause oxidization of the material, this infiltration usually taking place when the furnace doors are open for charging or drawing; it has thus been customary to reduce air infiltration as much as possible by supplying an excessive amount of gases to the furnace which of course is a very uneconomical procedure. In accordance with our invention, however, the provision of the ports 61 and flues 62, 63 and 64 near the front ends of the hearths in the sheet chambers is effective to permit any air which may enter the furnace through the charging ports 56 when the doors 57 are open to escape into the flues beneath the hearth substantially as soon as it enters the furnace and for a similar purpose flues 75 may be arranged adjacent the drawing ports 33 and 34 to connect with the flue 49 so as to conduct thereto any air which may enter the furnace through the ports when their doors are open.

With the same end in view, that is, the prevention of air infiltration upon the opening of the furnace doors, we also preferably provide dampers respectively interconnected with the various furnace doors and so disposed and arranged as to automatically cut off the stack draft from the different furnace chambers in conformity with the opening of the doors thereof so that when the door of any given chamber is open a slight positive instead of a negative pressure is maintained therein so that the gases tend to rush out from the open door and thus oppose the entrance of air.

Thus for so controlling the draft from the chambers C′, C″ respectively, we provide a pair of vertically slidable dampers 76 and 77 in the flue 43 on opposite sides of the stack and respectively connect these dampers in any convenient way, as by chains 78 carried over sheaves 79 and 80, with the operating mechanism, generally designated as 81, of the doors 57 in such manner that when either door is opened the damper controlling the draft from the chamber with which that door communicates is automatically cut off through the flue 43 until the door is again closed. Consequently as soon as the draft is cut off from the particular chamber whose door has been opened a slight positive pressure builds up therein and some of the gas escapes outwardly through the door with consequent prevention of any material amount of air infiltration.

For a like purpose we also provide similar dampers 83 and 84 in the flue 42 and interconnect these dampers with the doors 35 and 36 so that when either door is open the stack draft from both sides of the chamber C will be cut off by the lowering of both dampers in the flue. The connections between the dampers and the doors may be of any suitable form for effecting this result, those shown comprising chains 85 and 86 respectively extending from the dampers over sheaves 87 on opposite sides of the stack to a single chain 88 which is carried over suitably positioned sheaves 89 and downwardly to a T-shaped weight 90 whose arms extend in opposite directions into the paths of the doors and which is arranged to slide vertically between them. Thus when either door is raised by its appropriate elevating mechanism (not shown) the T-shaped weight is carried up with it and both of the flue dampers are lowered so as to close off the draft until the door is again lowered when the weight follows it down and raises the dampers, whereby, as hitherto explained, a positive pressure is maintained in the chamber C while either door is open with resultant escape of gas from the chamber instead of air infiltration. While under ordinary conditions it is unnecessary to interconnect the charging door 22 with the stack draft dampers 83 and 84 so as to operate the latter upon the opening of the former, such interconnection may be effected in any convenient way if desired; usually, however, the infiltration of a certain amount of air at the charging end of the chamber where the pairs are introduced cold or relatively so is not particularly objectionable, especially as the major portion of it immediately passes into the header 46 just inside the door and from thence to the stack.

We have thus provided a furnace in which by suitable recirculation of the gases we are able to heat the hearths of both the pair and sheet heating chambers without the expenditure of fuel additional to that actually required for the heating of the pairs and sheets to the desired temperature and by the use of which, through the uniformity in the heating of the pairs, the subsequent rolling operations thereon are facilitated, a better quality of sheets is produced and roll breakage lessened, while through the uniform heating of the sheets, irrespective of their particular position in the sheet heating chambers, the sheet packs are readily opened after withdrawal from the furnace and rash back ends and other imperfections substantially eliminated. By suitable manipulation of the dampers 70, the operator is at all times able to control the draft through the pair heating chamber in such manner as to maintain an even, substantially uniform temperature throughout the same, while in like manner the draft from the sheet heating chambers can be individually controlled and regulated by manipulation of the dampers 71 with a like end in view whereby, although but a single stack is provided for carrying off the

waste gases from the furnace as a whole, the desired temperature condition can be maintained in each chamber individually irrespective of variations in stack draft and other local conditions. Additionally, since infiltration of air is substantially prevented during the charging or drawing of the furnace and the material being heated is at all times substantially enveloped or surrounded by blankets of gas, but little or no oxidation of the material takes place and, on the other hand, economy of operation is enhanced by the avoidance of the customary practice of supplying an excessive amount of gases to the furnace to prevent oxidization of the material, while through the use of but a single stack for the combined pair and sheet heating furnace the initial cost of installation is usually reduced over that of separate pair and sheet heating furnaces of like capacity each provided with its own stack.

While we have herein shown and described with considerable particularity a furnace constructed in accordance with a preferred embodiment of our invention, we do not thereby desire or intend to confine ourselves thereto as the principles of our invention may be utilized in furnaces of other forms and embodying any desired constructional details without sacrificing the advantages of our invention or departing from the spirit and scope thereof as defined by the appended claims.

Having thus described our invention we claim and desire to protect by Letters Patent of the United States:

1. A furnace of the class described, comprising separate pair and sheet heating chambers each provided with a hearth, means for introducing heating gases to each chamber, a stack, means for circulating the gases in the sheet chamber beneath the hearth thereof, thence beneath the hearth of the pair heating chamber, and thence to the stack and means for circulating the heating gases in the pair chamber through the hearth thereof and thence to the stack.

2. A furnace of the class described, comprising separate pair and sheet heating chambers each having a hearth, a stack adapted to carry waste gases from the furnace, means for introducing heating gases separately to each chamber, flues for con lucting said gases beneath the hearth of the sheet heating chamber, then beneath the hearth of the pair chamber and thence to the stack, and means for effecting circulation of the gases in the pair chamber through the hearth thereof and thence to said stack.

3. A furnace of the class described, comprising separate pair and sheet heating chambers each provided with a hearth, a stack adapted to carry the waste gases from the furnace, means for separately introducing heating gases to each chamber, a plurality of flues beneath the hearth of the sheet heating chamber adapted to conduct said gases beneath the hearth and toward the pair heating chamber, a flue communicating with said first mentioned flues and extending adjacent the hearth of the pair heating chamber and a flue extending from said last mentioned flue to said stack.

4. A furnace of the class described, comprising separate pair and sheet heating chambers, each having a hearth and a port for charging or drawing the material to be heated therein, movable doors for opening and closing said ports, a stack adapted to carry waste gases from the furnace, means for separately introducing heating gases to each chamber, a plurality of flues beneath the hearth of the sheet heating chamber adapted to conduct said gases beneath the hearth thereof and toward the pair heating chamber, a flue communicating with said first mentioned flues and extending adjacent the hearth of the pair heating chamber, a flue extending from said last mentioned flue to the stack, means for conducting the heating gases introduced to the pair heating chamber through the hearth thereof, flues on opposite sides of the chamber operative to then conduct said gases to the stack, and means interconnected respectively with said doors operative to prevent the flow of gases from each chamber to the stack when the door of such chamber is open and comprising dampers disposed in the flues leading from the several chambers to the stack.

5. A furnace of the class described, comprising a pair heating chamber and a plurality of sheet heating chambers each provided with a hearth, a stack adapted to conduct waste gases from the furnace, means for introducing heating gases separately to each chamber, a plurality of flues beneath the hearth of each sheet heating chamber, ports extending through said hearth into said flues, a flue communicating with each group of flues beneath the hearth of each sheet heating chamber extending adjacent the hearth of the pair heating chamber and adapted to conduct the gases from said flues and a flue communicating with each of said last mentioned flues extending to said stack.

6. A furnace of the class described, comprising a pair heating chamber and a plurality of sheet heating chambers each provided with a hearth and a port for the passage of the material to be heated therein, movable doors for opening and closing each of said ports, a stack adapted to conduct waste gases from the furnace, means for introducing heating gases separately to each chamber, a plurality of flues beneath the hearth of each sheet heating chamber, ports extending through said hearths into said flues, a flue communicating with each group of flues beneath the hearth of each sheet heating cham-

ber extending adjacent the hearth of the pair heating chamber and adapted to conduct the gases from said flues, a flue communicating with each of said last mentioned flues and extending to said stack, a damper in each of said last mentioned flues operable to control the draft from the sheet heating chamber with which such flue is in communication, and means connecting each damper with the door of that chamber whose flue is thereby controlled adapted to close said damper when said door is open to thereby cut off the draft from such chamber to the stack.

7. A furnace of the class described, comprising a pair heating chamber and a plurality of sheet heating chambers each provided with a hearth, a stack adapted to conduct waste gases from the furnace, means for introducing heating gases separately to each chamber, a plurality of flues beneath the hearth of each sheet heating chamber, ports extending through said hearth into said flues adjacent the front and adjacent the rear ends of the latter, a flue communicating with each group of flues beneath the hearth of each sheet heating chamber extending adjacent the hearth of the pair heating chamber and adapted to conduct the gases from said flues so as to heat said last mentioned hearth and a flue on each side of the pair heating chamber respectively communicating with each of said last mentioned flues and extending to said stack.

8. A furnace of the class described, comprising a plurality of different chambers respectively adapted for heating sheets and pairs and each having a port for charging or drawing the material to be heated therein, movable doors for opening and closing said ports, a stack for conveying the products of combustion from the furnace, flues leading from said chambers to said stack, dampers disposed in said flues and means respectively interconnecting said dampers with said doors whereby when said doors are opened said dampers are operated to cut off the draft from the respective chambers to the stack.

9. A furnace of the class described, comprising a pair heating chamber and a sheet heating chamber each provided with a port for the passage of the material to be heated therein, a movable door adjacent each port, a stack for conveying the products of combustion from the furnace, a flue extending from each of said chambers to said stack, a draft-controlling damper in each of said flues, and means connecting each damper with the door of that chamber whose flue is thereby controlled adapted to close said damper when said door is open to thereby cut off the draft from such chamber to the stack.

10. In a furnace of the class described comprising a pair heating chamber, means for introducing heating gases to said chamber, a hearth in said chamber, a flue extending longitudinally in the hearth, a stack, flues communicating with said first mentioned flue and extending to the stack on opposite sides of the chamber, and a plurality of ports formed in the hearth to permit circulation of said gases between the chamber and said first mentioned flue.

11. A furnace as specified in claim 10 and having a partition extending longitudinally in the flue in the hearth and provided with a damper in each flue extending to the stack whereby the draft through said hearth flue from each side of the chamber may be separately controlled.

12. A furnace of the class described, comprising separate pair and sheet heating chambers each having a port for the passage of the material to be heated therein, means for introducing heating gases to each of said chambers, a stack, a hearth in each chamber, means for conducting the spent gases from the sheet heating chamber adjacent the hearth in the pair heating chamber to assist in heating said hearth and thence to the stack, means for conducting the heating gases in the pair heating chamber adjacent its hearth and thence to the stack, and means automatically operative to cut off the passage of the gases from each chamber to the stack upon the opening of the port to said chamber and to permit said circulation upon the closing of said port.

13. A furnace of the class described, comprising separate pair and sheet heating chambers each provided with a port for the passage of the material to be heated therein, a door for each of said ports, means for introducing heating gases to each chamber, a stack, a hearth in each chamber, flues for permitting circulation of the heating gases introduced to the sheet heating chamber through the hearth thereof, thence adjacent the hearth of the pair heating chamber and thence to the stack, flues for permitting circulation of the heating gases introduced to the pair chamber through and about the hearth thereof and thence to the stack and means interconnected respectively with said doors operative to prevent the flow of gases from each chamber to the stack when the door of such chamber is open.

14. A furnace of the class described, comprising separate pair and sheet heating chambers each provided with a port for the passage of the material to be heated therein, a door for each of said ports, means for introducing heating gases to each chamber, a stack, a hearth in each chamber, flues for permitting circulation of the heating gases introduced to the sheet heating chamber through the hearth thereof, thence adjacent the hearth of the pair heating chamber and thence to the stack, flues for permitting circulation of the heating gases introduced to the pair chamber through and about the hearth thereof and

thence to the stack including separate flues leading to the stack on each side of the pair heating chamber, and means interconnected respectively with said doors operative to prevent the flow of gases from each chamber to the stack when the door of such chamber is open and comprising dampers disposed in the flues leading from the several chambers to the stack, the dampers in the flues leading thereto from the pair chamber being simultaneously operable.

15. A furnace of the class described, comprising separate sheet and pair heating chambers, means for introducing heating gases to each of said chambers, a stack, a hearth in each chamber, means for circulating the heating gases introduced to the sheet heating chamber through the hearth thereof, means for thereafter conducting said gases adjacent the hearth of the pair heating chamber to assist in heating said hearth and thence to the stack, means for effecting circulation of the heating gases introduced to the pair heating chamber in and about the hearth thereof and then conducting said gases to the stack, said means including a longitudinally divided port in said hearth, separate flues on each side of the furnace leading to the stack and means for individually regulating the draft through said flues and also from said sheet heating chamber.

In witness whereof we have hereunto set our hands this 13th day of March, A. D. 1929.

CHARLES A. DAVIS.
FRANK E. LEAHY.