Sept. 19, 1933. F. A. FAHRENWALD 1,927,634

FURNACE

Original Filed Feb. 19, 1929 2 Sheets-Sheet 1

Fig. 1

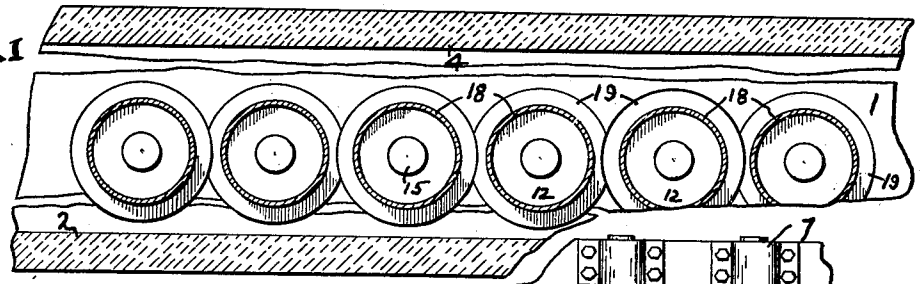


Fig. 2

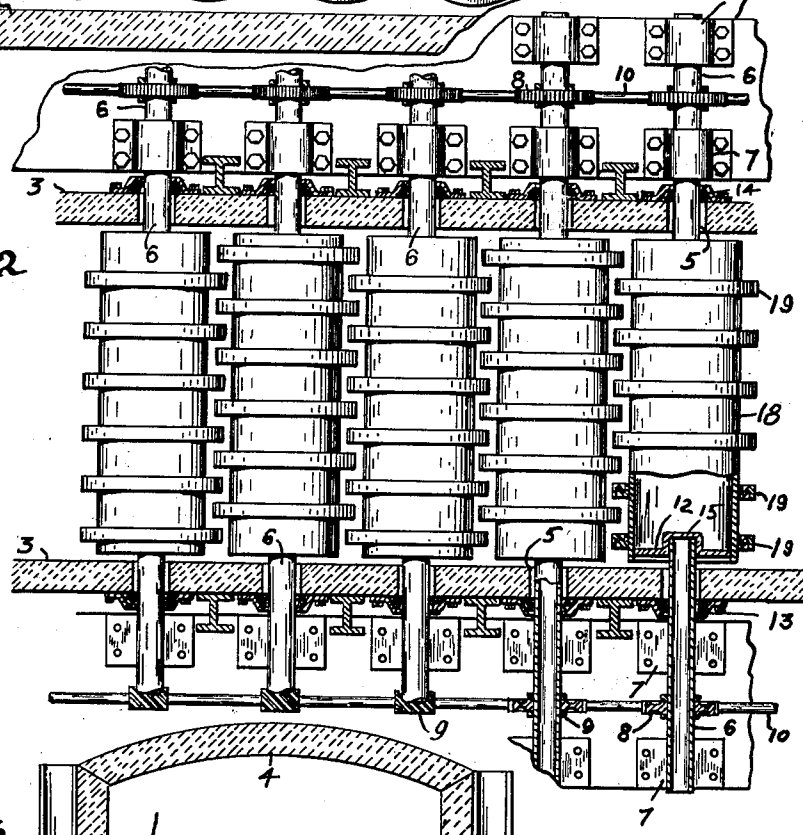
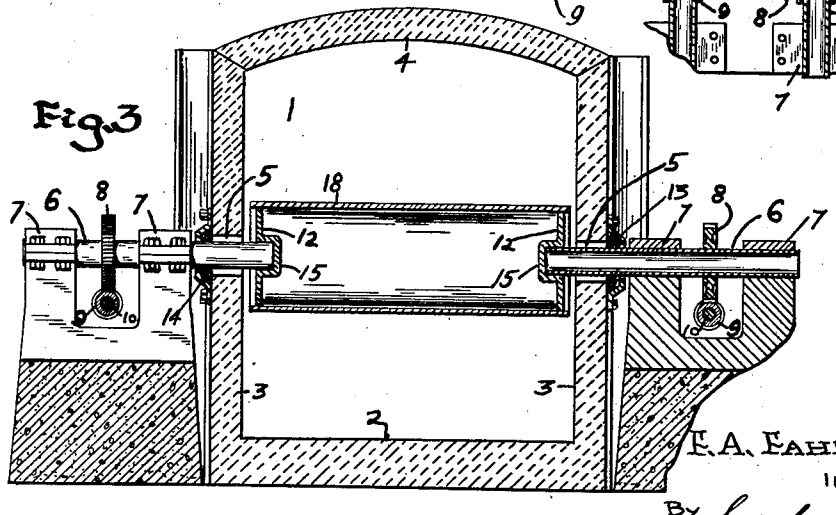


Fig. 3



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Original Filed Feb. 19, 1929 2 Sheets-Sheet 2

Fig. 4

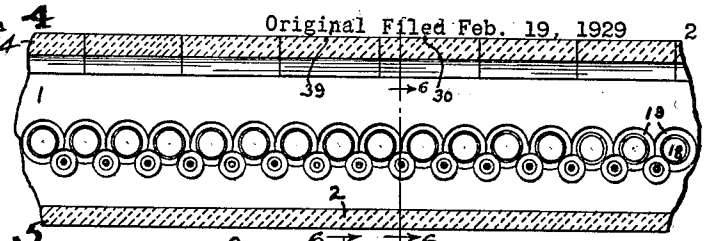


Fig. 5

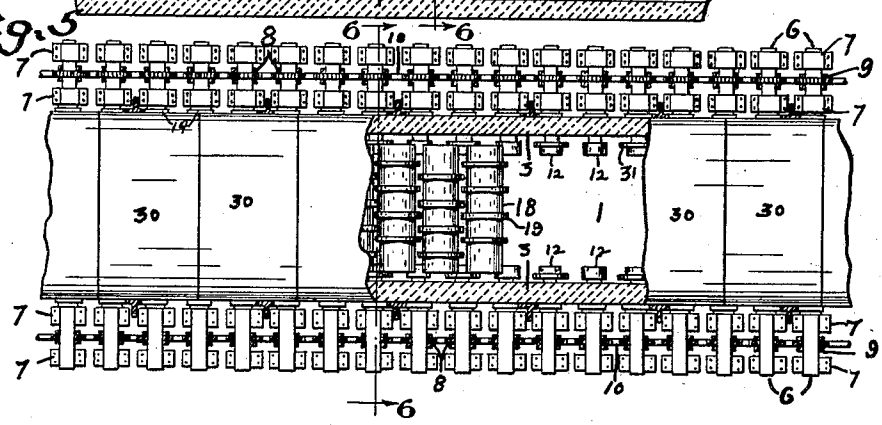


Fig. 6

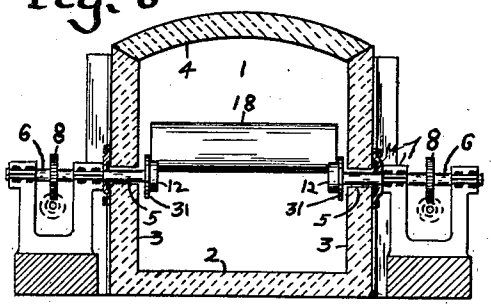


Fig. 7

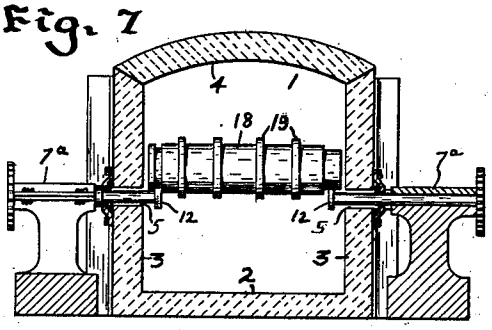
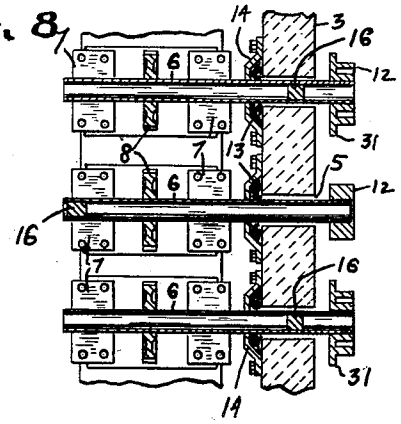


Fig. 8



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Patented Sept. 19, 1933 1,927,634

UNITED STATES PATENT OFFICE

1,927,634

FURNACE

Frank A. Fahrenwald, Chicago, Ill.

Original applications February 19, 1929, Serial Nos. 341,178 and 341,179. Divided and this application July 7, 1930. Serial No. 465,811

6 Claims. (Cl. 263—6)

This invention relates to furnaces of the roll-bottom type such as are used for the continuous-process heat-treatment of steel sheets and plates in the so-called "normalizing" process. The objects of the invention are the provision of certain improvements in the conveyor rolls, enabling them to be made peculiarly simple, light, and inexpensive; the provision of a construction of conveyor rolls which does not require to be artificially cooled, and can still be made comparatively light and inexpensive; and the provision of a construction of furnace roll which can be made with thinner walls and less expensive alloy and less machine work than heretofore; while further objects and advantages of the invention will become apparent as the description proceeds. The embodiment of the present invention illustrated in Figs. 4 to 7, inclusive, is a division of my application Serial No. 341,178, filed February 19, 1929, and since issued as Patent No. 1,791,404 under date of February 3, 1931, in which I have claimed broadly a metallurgical furnace having apertured side walls, a row of shafts having their ends projecting outward through the apertures of said walls and journaled outside of the same, said shafts having circular carrying portions close inside of said walls, and a horizontal conveyor roll having an end received between and supported by the carrying portion of each adjacent pair of shafts, the diameter of the roll being greater than the distance between the peripheries of adjacent carrying portions of the shafts; an embodiment of such a furnace specifically claimed in said patent also including the feature of having the roll supporting shafts traverse the furnace chamber with their extremities projecting through apertures in the walls. As compared with this, the present invention proceeds upon the principle of terminating the supporting shafts at the inside of the walls through which they project, with the advantage of producing a more economical construction and rendering the shafts more durable.

That part of the present invention illustrated in Figures 1 to 3, inclusive, constitutes a division of my application Serial No. 341,179, filed February 19, 1929, in that it covers the subject-matter of Figure 6 of said application.

In the accompanying drawings I have shown certain specimen embodiments of my inventive idea. Fig. 1 is a vertical longitudinal sectional view through a furnace containing my present improvements; Fig. 2 is a horizontal sectional view through such furnace showing the construction and arrangement of the driving-shafts and rolls; and Fig. 3 is a transverse sectional view through the axis of a roll of modified form. Fig. 4 is a vertical longitudinal sectional view through a furnace containing a modified form of my invention; Fig. 5 is a top plan view of the furnace shown in Fig. 4 with a part of the roof removed and also some of the rolls; Fig. 6 is a sectional view on the lines 6—6 of Figs. 4 and 5; Fig. 7 shows a modified form of roll, and Fig. 8 is a detail view of the bearings showing modified disks and stoppers.

Such a furnace ordinarily comprises an elongated chamber 1, defined between a floor 2, a pair of spaced side-walls 3—3, and a roof 4, each of the side-walls being provided with horizontally spaced apertures 5 registering with similar apertures in the opposite side-wall. Projecting through these apertures into the heated chamber are the horizontal shafts 6—6 journaled in bearings 7—7 located outside the furnace walls. Each shaft 6 extends only a short distance inside the respective furnace wall, and the bearings are of such a type as to hold said shaft in proper position without the need of any support at its inner end. The preferable arrangement is to provide two bearings for each shaft, spaced one outside of the other at unequal distances from the furnace wall, and also spaced apart for the reception of the driving mechanism, which here takes the form of a worm-wheel 8 secured to each shaft and meshing with a worm 9 carried by a longitudinal drive shaft 10, one of which is located at each side of the furnace. The shafts 6—6 upon opposite sides of the furnace are arranged in substantial alignment. Other bearing arrangements such as a single long bearing 7ª as shown in Fig. 7 could obviously be employed.

Rigid with the inner ends of these shafts are supporting disks 12 which engage the hollow cylindrical drums 18 in supporting and driving relation. The disks are located close inside the side walls so as to expose as little as may be of their shafts to the heat. The shafts 6 and disks 12 are made of metallic alloy having a sufficiently high melting point and rigidity under high temperature to enable them to be operated without artificial cooling. Inasmuch as numerous alloys of this nature are well known and on sale on the market I do not consider it necessary to suggest any formula therefor. Any one of numerous expedients can be employed to restrict the conduction of heat along these shafts so as to keep the bearings sufficiently cool for successful operation. To this end it is desirable to make the end portions of the shaft hollow, thus cutting down the cross section of the metal available for heat conduction; and also to prevent transfer of heat by outflow of the furnace gases around the shaft by providing suitable packing 13 around the same, held in place if desired by means of metal plates 14. When the shafts are hollow, stoppage of gas flow from the furnace chamber can be effected by suitable caps 15 which may be made integral with the disks 12 as shown in Figs. 2 and 3, or by separate stop-

pers such as the plugs 16 shown in Fig. 8, which may be located anywhere in the entire length of the shafts.

These precautions, especially when taken in conjunction with the low heat-conductivity of these high-temperature alloys and with the heat dissipating effect of the bearings which are generally made quite massive, prevent any overheating of the bearings. Owing to the fact that these shafts terminate close inside the furnace wall their absorption of heat is much diminished, and besides the load-carrying portions of the shaft are very largely shielded from the furnace heat, added to which is the fact that the load is carried close to the furnace wall and reduces the stresses which the shafts are compelled to carry.

Carried by these disks are the cylindrical drums 18, which likewise are made of such an alloy as will withstand the full furnace temperature, and may either have a plain cylindrical exterior as shown in Figs. 3 and 6 or may be provided with circumferential ribs or hoops 19 as shown in Figs. 1, 2, 5, and 7. These rolls are wholly confined within the furnace chamber, merely overlapping the disks to a sufficient extent to be carried and driven thereby. Owing to their short length, their simplicity, and their freedom from bearing parts, they can be made very light and inexpensive. This simplicity, especially when they are made plain as shown in Figs. 3 and 6 enables them to be made of alloys which are too hard to be readily machined, which therefore enables the employment of less expensive compositions, or compositions having increased hardness and rigidity. Furthermore, being wholly enclosed within the furnace chamber and hence subjected at all times to a fairly uniform temperature, they are not subjected to any severe thermal strains, which further enables a lighter structure and a cheaper composition, or enables the use of materials which will stand higher temperatures.

When the exteriors of the drums are provided with interfitting hoops or flanges, these are preferably so spaced, as shown in Figs. 2 and 5, as to enable all the drums to be made identical, successive drums being reversed end for end, which becomes possible because of the fact that the carrying portions are no longer integral with the bearing portions. In view of the many high-temperature alloys available upon the market I do not consider it necessary to suggest any formula for these drums, except to point out that the requirements of rigidity and strength at high temperature of conductions are not complicated in my construction by the necessity of also employing an alloy which can be machined to make a successful bearing.

These rolls or drums can be applied to the disks 12 either in the manner shown in Figs. 1 to 3, inclusive, or in that shown in Figs. 4 to 7 inclusive; in the former case the disks 12 are introduced inside the open ends of the rolls or drums in supporting and driving relation. In the form of the invention shown in Figs. 4 to 7, inclusive, each roll rests upon and between two adjacent disks, the outside diameter of the roll being therefore greater than the distance between the peripheries of adjacent disks and smaller than the distance between the centers of the adjacent disks. In the former case the rotation of each drum is in the same direction as that of the disks which support it; in the latter case the rotation is in the opposite direction from that of the supporting disks. In neither case does the drum have any duty of keeping the shaft portion in line since this is performed entirely by the bearings.

Furthermore owing to the lack of any direct mechanical connection between the rolls and the shafts, any roll which fails can be quickly removed and replaced, this being particularly easy with the form of the invention shown in Figs. 4 to 7 inclusive where the drum merely rests on the top of the disks. The furnace roof is preferably made in separate sections 30—30 for this purpose.

The endwise position of each drum or roll inside the furnace chamber can be fixed by forming the disks 12 with peripheral flanges 31 at the edge next the furnace wall. When the rolls are applied to the disk as shown in Figs. 4 to 6, inclusive, it is sufficient that every other disk be flanged as illustrated in Figs. 5 and 8. It is also within my invention, however, to employ plain disks and to groove the drums as shown in Fig. 7, or in any other manner.

I have not illustrated any mode of heating or arrangement of heating elements, since my invention is not limited in this respect; and while I have set forth with some detail the embodiments which I now prefer I do not limit myself to any of the details or arrangements or constructions herein set forth except as the same are specifically recited in my several claims which I desire may be construed broadly, each independently of limitations contained in other claims.

Having thus described my invention what I claim is:

1. A metallurgical furnace of the class described, having spaced apertured side walls, horizontal shafts located in the apertures of said side walls and journaled outside of the same, said shafts terminating immediately inside said walls and having their inner ends constructed to provide conveyor roll supports, and hollow conveyor rolls extending across the furnace but terminating short of its said walls and separate from, carried by, and in driven relation to said shafts.

2. A furnace as described in claim 1, in which the shafts journaled outside of said walls are of cantilever type.

3. A metallurgical furnace as described in claim 1, in which each shaft is journaled outside of the said walls in two bearings located one beyond the other in relation to the wall and maintaining the position of the shaft independently of the roll that rests upon it within the furnace.

4. A metallurgical furnace as described in claim 1, in which the inner ends of the shafts are provided with roll supporting disks, and each end of each hollow conveyor roll surrounds and is supported by a disk upon a shaft adjacent to the inner wall of the furnace.

5. A furnace of the character described in claim 1, in which the hollow rolls comprise each a single integral piece extending from side to side of the furnace, and the shafts constitute in effect extensions from the end of said rolls, separate from the rolls and from each other.

6. A metallurgical furnace of the kind described in claim 1, in which means are provided for reducing outward transfer of heat by fluid convection around said shafts.

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