June 26, 1923.

1,460,066

J. H. KNAPP

FURNACE

Filed Oct. 22, 1920

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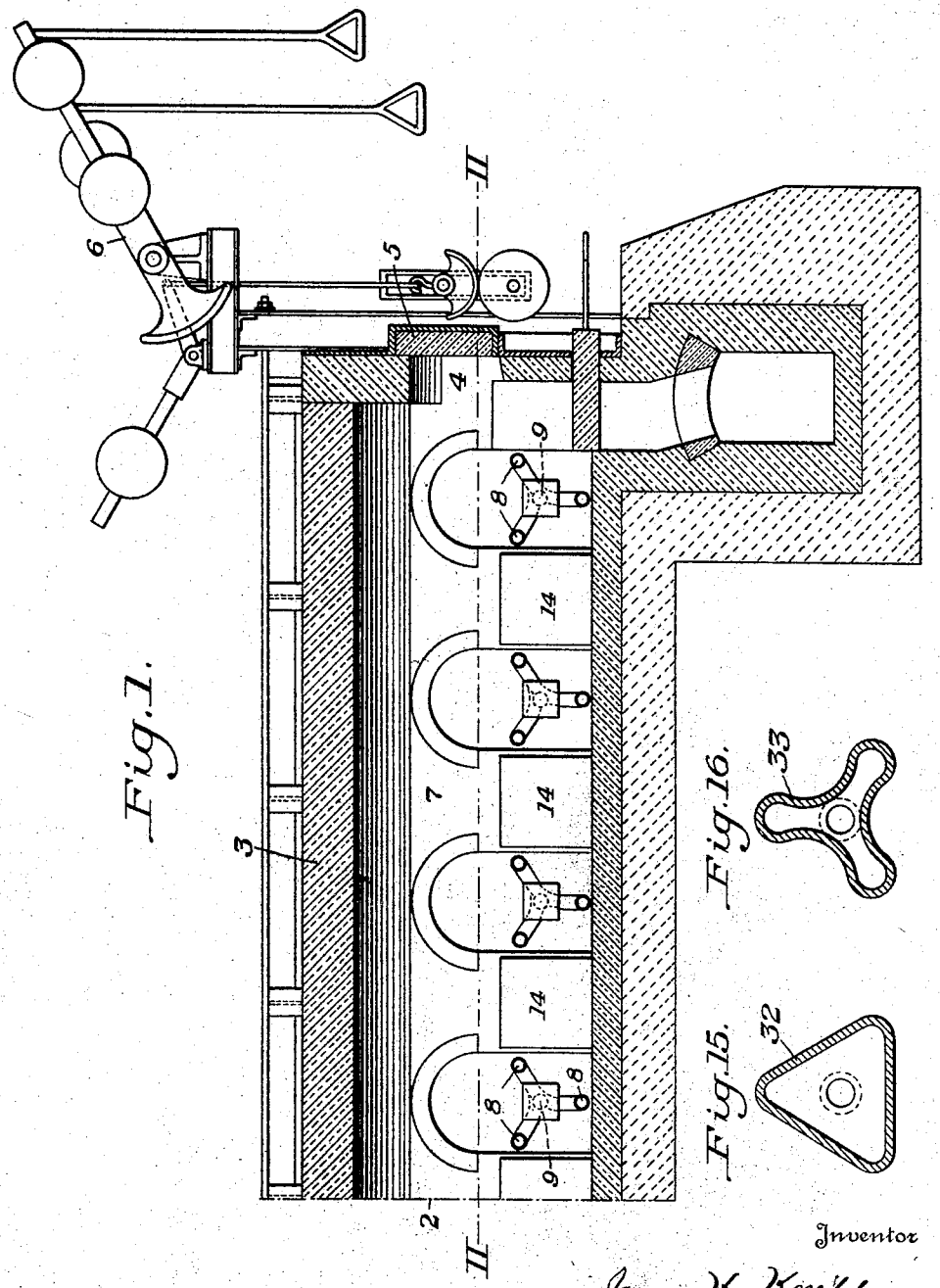


Fig. 1.

Fig. 16.

Fig. 15.

Inventor

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By Babcock, Byrnes & Parmelee

his Attorneys

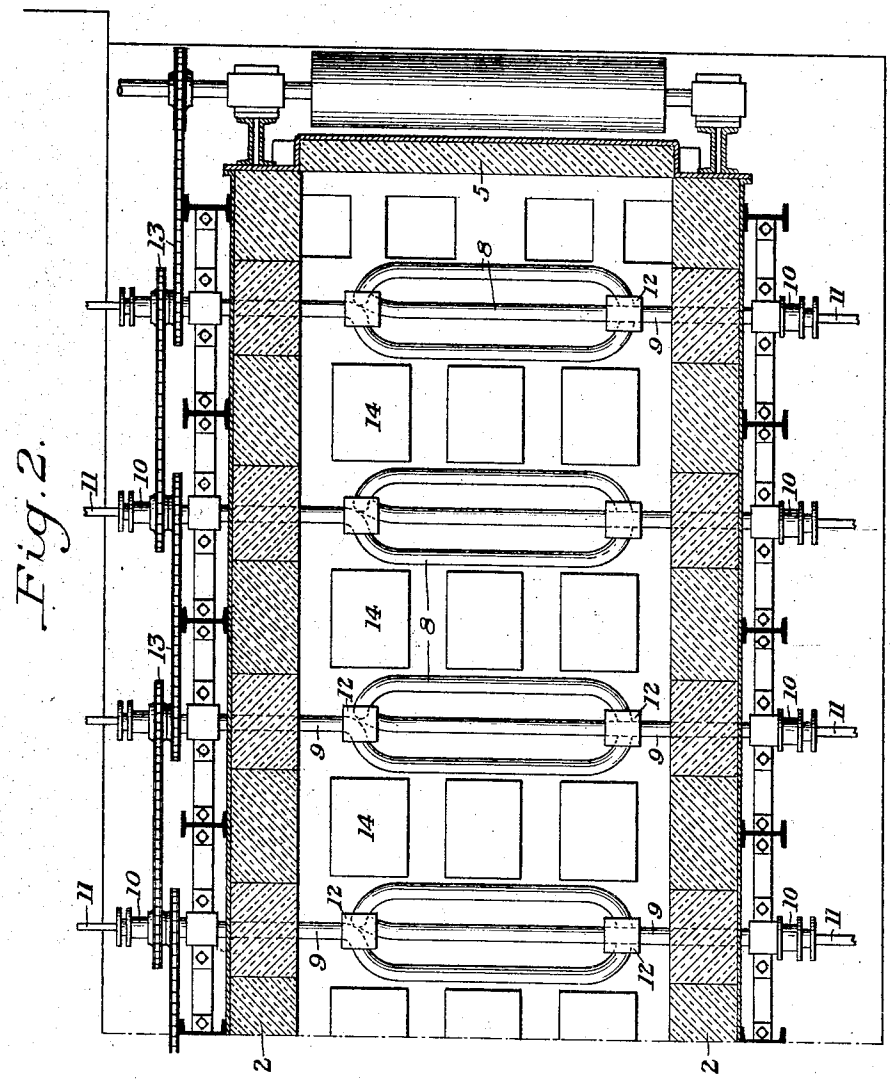
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Fig. 2.



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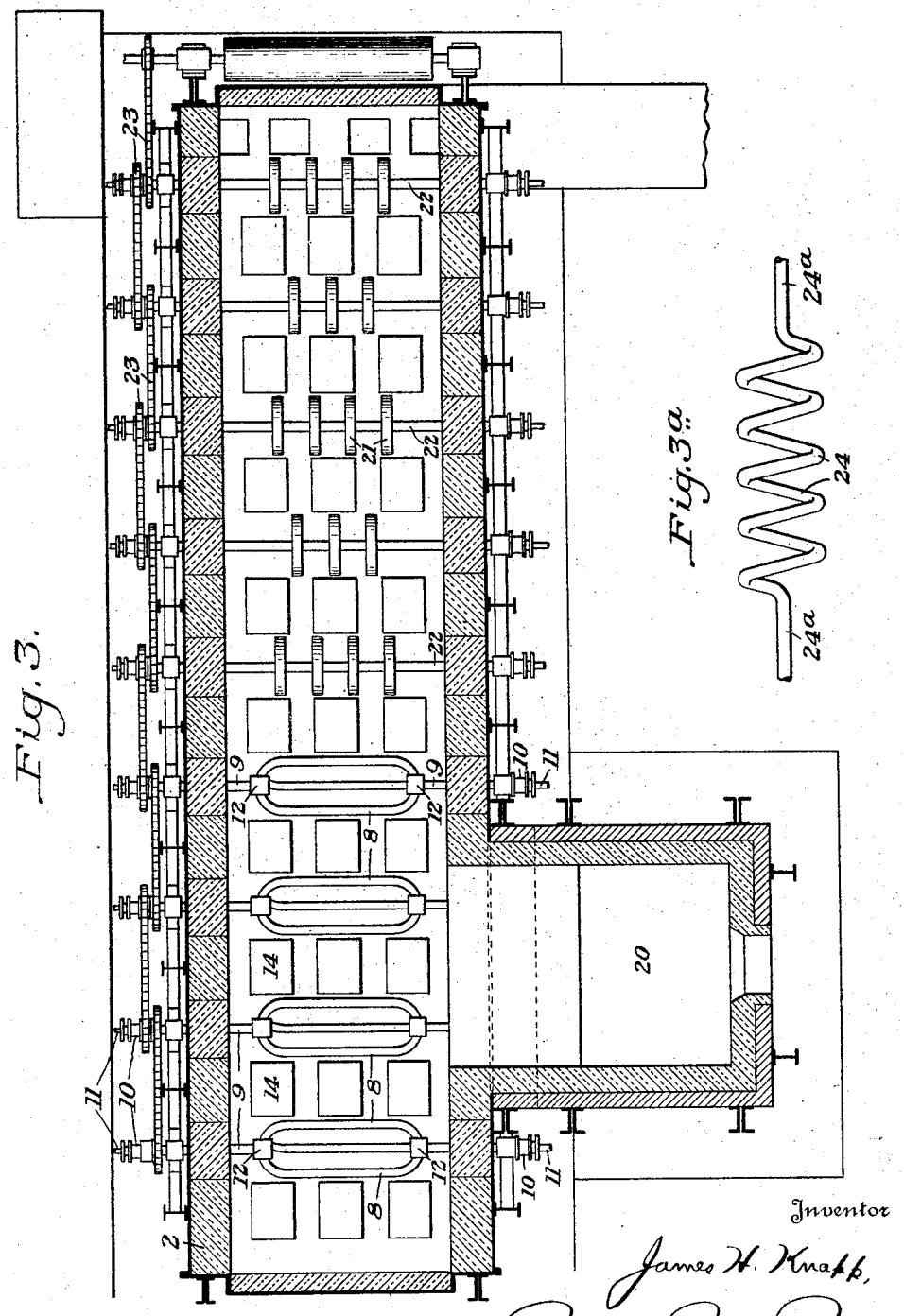


Fig. 3.

Fig. 3a.

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FURNACE

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Fig.4.

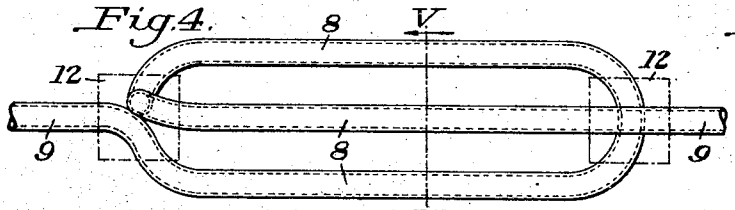


Fig.5.

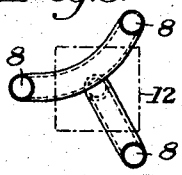


Fig.6.

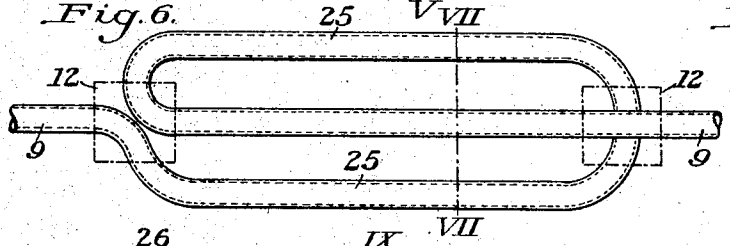


Fig.7.

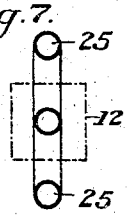


Fig.8.

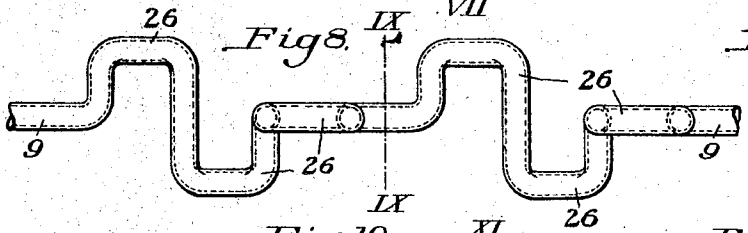


Fig.9.

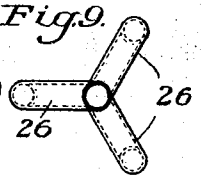


Fig.10.

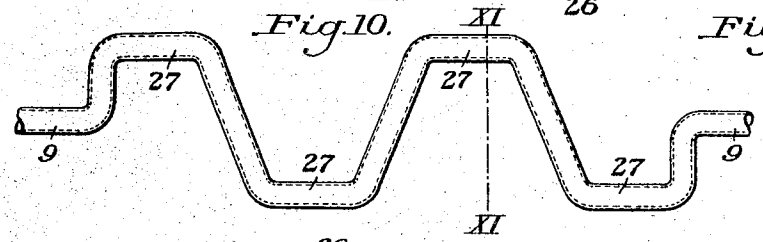


Fig.11.

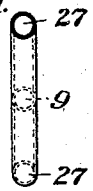


Fig.12.

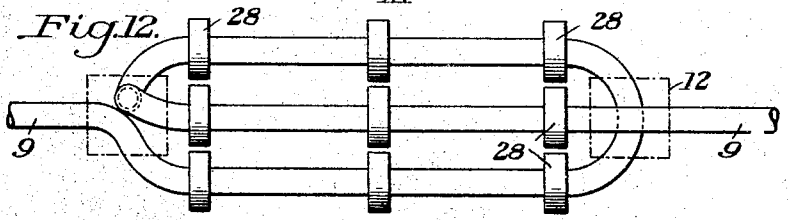


Fig.13.

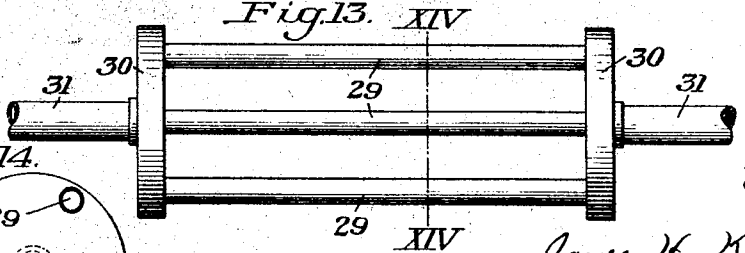
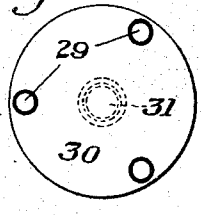


Fig.14.



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Patented June 26, 1923. 1,460,066

UNITED STATES PATENT OFFICE.

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FURNACE.

Application filed October 22, 1920. Serial No. 418,686.

To all whom it may concern:

Be it known that I, JAMES H. KNAPP, residing at Edgeworth, Allegheny County, Pennsylvania, have invented a new and useful Improvement in Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal vertical section of a portion of a furnace embodying my invention;

Figure 2 is a section on the line II—II of Figure 1;

Figure 3 is a horizontal section of a furnace illustrating a modification;

Figure 3ª is a plan view showing a modified form of one of the conveyor members;

Figure 4 is a plan view of the form of conveyor member shown in Figure 2;

Figure 5 is a section on the line V—V of Figure 4;

Figure 6 is a plan view showing still another modification;

Figure 7 is a section on the line VII—VII of Figure 6;

Figure 8 is a plan view of still another modification;

Figure 9 is a section on the line IX—IX of Figure 8;

Figure 10 is a plan view of still another modification;

Figure 11 is a section on the line XI—XI of Figure 10;

Figures 12 and 13 are plan views showing further modifications;

Figure 14 is a section on the line XIX—XIV of Figure 13; and

Figures 15 and 16 are transverse sections showing two other modifications.

My invention has relation to improvements in furnaces, and particularly to heating and annealing furnaces of the continuous type.

An object of my invention is to provide a furnace of this character with conveying means of novel form and arrangement by the use of which several important advantages are obtained in the operation of the furnace as hereinafter pointed out. A further object of the invention is to provide for a more efficient action of the heating medium within the furnace.

Referring first to that form of my invention shown in Figures 1 and 2, the numeral 2 designates the side walls of the delivery end portion of a continuous heating furnace of a type such as is employed for plate-heating or annealing work. 3 designates the roof wall of the furnace; 4 the delivery opening closed by the vertically movable door 5 and operated by any usual or suitable mechanism 6. The parts shown in connection with the delivery opening of the furnace form no part of the present invention.

In accordance with my invention, I provide the furnace with a plurality of transversely arranged conveyor members which are designed to effect a step-by-step movement of the plates to be heated through the heating chamber 7 of the furnace. These conveyor members may take various forms. In the form shown in these figures, each of these conveyor elements consists of a water-cooled pipe which is bent upon itself to form the three equally spaced transversely extending arms 8, the end portions of the pipe being extended, as shown at 9, to form journals which are mounted in suitable bearings in the side wall structure of the furnace. These journal portions are provided at their outer ends with suitable stuffing boxes 10 into which extend pipes 11 for the circulation of water or other liquid-cooling medium through the device. Preferably, the structure is stiffened by casting blocks or masses 12 of cast iron or the like at the junctions of the arms 8 with the journal portions 9.

Any suitable gearing may be provided for rotating the conveyor members, such as the sprocket gearing shown at 13 in Figure 2.

Intermediate adjacent conveyor members I provide the hearth of the heating chamber of the furnace with blocks or piers 14, which are spaced from each other transversely so as to provide for free circulation of the heating medium between the blocks or piers and underneath the plates being heated. These blocks or piers are also preferably spaced away from the lateral walls of the heating chamber for a similar purpose. The conveyor members are journaled so that when in the positions shown in Figure 1, all three of the pipe arms 8 are below the plane of the upper surfaces of the blocks or piers 14. When, however, the conveyor members are rotated, the pipe arms move through arcs which extend above said plane.

In the operation of the furnace, these conveyor devices will be intermittently rotated, each movement thereof serving to advance the plates being heated and move them forward any desired distance. Owing to the fact that a continuous circulation of water is kept flowing through the pipe arms at all times, they can be stopped in any position and no damage done to them. During the intervals when the conveyors are at rest, the plates are supported on the blocks or piers 14. This intermittent operation is of particular advantage in furnaces where it is desired to deliver the plates at given intervals and deliver each plate as quickly as possible. Where the plate is to be delivered to some operating mechanism such as a press, it is desirable that it be removed from the furnace as fast as possible. With the conveyor and pier arrangement described with the plates resting on the piers, when it is desired to deliver a plate, the conveyors are set in motion to be driven at a high speed, and thus rapidly deliver a plate through the door opening 4 to the press or other apparatus. This, of course, moves all the plates in the furnace forward a distance equal to the length of the plate before the conveyor stops. When the conveyors are stopped, the plates again all rest on the blocks or piers ready for the discharge of the next plate.

In Figure 3, I have shown a modification, such as would be employed in continuous annealing practice in furnaces where powdered coal is used as a fuel in the fire box 20. In such a furnace, the conveyor members similar to those shown in Figures 1 and 2 may be provided adjacent to the fire box and the balance of the furnace may be provided with conveyor means of a different type, such as a series of spaced disks 21, mounted on shafts 22, and arranged by the sprocket gearing 23, to be rotated in unison with the pipe conveyors. In a furnace of this character, it is not practicable to use disk conveyors adjacent to the fire box, owing to the fact that they can not stand the intense heat at this portion of the furnace.

The pipe conveyors may be constructed in various ways, some of which I have illustrated in Figures 3ª to 14, inclusive. In the construction shown in Figure 3ª, the pipe, instead of being bent back and forth upon itself to form a three-armed structure, is bent into a helix 24, whose end portions 24ª form the journals. In this form of the device, some portion of the pipe surface is at all times in contact with the plates or other articles being heated.

In Figures 4 and 5, I have illustrated in detail the manner of bending the pipe to form a three-armed conveyor, such as shown in Figures 1, 2 and 3.

In the modification shown in Figures 6 and 7, the pipe is bent to form a conveyor structure having only two arms 25.

In the form shown in Figures 8 and 9, the pipe instead of being bent back and forth longitudinally upon itself is bent to form three equally spaced cranks 26.

Figures 10 and 11 show a form in which the pipe is bent to form the two opposite cranks 27.

In the form shown in Figure 12, a three-armed structure, such as shown in Figures 4 and 5, is further provided with guard pieces 28 of metal cast or otherwise secured thereto and which are for the purpose of preventing any of the plates getting between the arms of the conveyor.

In the form shown in Figures 13 and 14, instead of making the structure of a single pipe, I have shown it as composed of a plurality of separate pipes 29, secured between hollow headers 30, with which they communicate and which headers are provided with hollow journals 31.

In Figure 15, I have shown the conveyor member as consisting of a hollow metal body 32 of triangular form in cross section, the three corner portions thereof being adapted to successively and intermittently engage the articles to be moved.

In Figure 16, there is also shown a member formed by a casting or from sheet metal, and having the three arms 33, through which water can be circulated and which intermittently engage and move the articles being heated.

It will be understood that in all the forms shown, as well as in various other modifications which may be constructed, means will be provided for insuring the circulation of water or other cooling liquid through the device.

The advantages of my invention will be apparent to those skilled in the art, since it provides a simple and effective form of conveyor which can be protected against injury from the heat of the furnace, which can be constructed and operated to give the desired intermittent feed to the objects being heated, and in which the construction and arrangement is such as to allow for a free circulation of the heating medium underneath the objects being heated.

It will be readily understood that my invention is applicable to various types of furnace, other than those shown, and that many modifications can be made within the spirit and scope of the appended claims.

I claim:

1. Conveyor mechanism for furnaces, comprising a plurality of transversely arranged rotatable conveyor members, each member having a plurality of lifting portions extending transversely of the furnace arranged to successively and intermittently engage

the articles to be heated and move them step by step longitudinally of the furnace chamber, and means other than said members for supporting the articles between successive movements thereof, substantially as described.

2. Conveyor mechanism for heating and annealing furnaces, comprising a plurality of transversely arranged rotatable conveyor members, each of said members having a plurality of lifting portions arranged to successively and intermittently engage the articles to be heated and move them step by step longitudinally of the furnace chamber, means whereby cooling fluid may be circulated through said members, and means other than said members for supporting the articles between successive movements thereof, substantially as described.

3. In a furnace, a transversely arranged rotatable conveyor device having a plurality of spaced arms, placed at an angle to each other and adapted to intermittently and successively engage the articles being heated and move them longitudinally of the furnace chamber, substantially as described.

4. In a furnace, a transversely arranged rotatable conveyor device having a plurality of spaced arms placed at an angle to each other and adapted to intermittently and successively engage the articles being heated and move them longitudinally of the furnace chamber, together with means whereby a cooling fluid may be circulated through said arms, substantially as described.

5. In a furnace, a transversely arranged rotatable conveyor device, having a plurality of spaced arms, placed at an angle to each other and adapted to intermittently and successively engage the articles being heated and move them longitudinally of the furnace chamber, the furnace having other means for supporting the articles between successive movements thereof, substantially as described.

6. A conveyor, comprising a rotatable member having a plurality of angularly spaced portions adapted to engage the articles being handled, said conveyor having means for the circulation of a cooling fluid therethrough, substantially as described.

7. A conveyor device formed from pipe shaped to constitute a plurality of arms at an angle to each other and having means for a continuous circulation of a cooling fluid therethrough, substantially as described.

8. A conveyor device comprising a pipe bent upon itself to form a plurality of conveyor arms, the end portions of said pipe being extended to form journals and also having means for the circulation of a cooling fluid through said arms, substantially as described.

9. A conveyor device comprising a pipe bent upon itself to form a plurality of conveyor arms, the end portions of said pipe being extended to form journals and also having means for the circulation of a cooling fluid through said arms, said arms having connecting means adjacent to said journal portions, substantially as described.

10. In a furnace, the combination with a plurality of transversely arranged rotatable conveyor members, each member having a plurality of material engaging members extending transversely of the furnace, of spaced apart piers arranged between adjacent conveyor members, substantially as described.

11. A furnace having a plurality of transversely extending article engaging and rotatable conveyor members, transversely arranged spaced piers between said members, and means for rotating said members, substantially as described.

12. A furnace having a plurality of transversely extending rotatable conveyor members, spaced piers between said members, and means for rotating said members, some at least of said members being formed of pipes having means for the circulation of a cooling fluid therethrough, substantially as described.

13. Conveying means for furnaces, comprising a plurality of rotatable article engaging members having different portions thereof extending different distances from the axis of rotation, whereby the members will be effective upon rotation for engaging, lifting and longitudinally moving material placed in the furnace, water cooling connections for said members, and means other than said members for supporting the material between successive movements thereof, substantially as described.

In testimony whereof, I have hereunto set my hand.

JAMES H. KNAPP.