No. 714,710. Patented Dec. 2, 1902.

H. B. A. KEISER.

CONTINUOUS HEATING FURNACE.

(Application filed Sept. 8, 1900.)

(No Model.) 3 Sheets—Sheet 1.

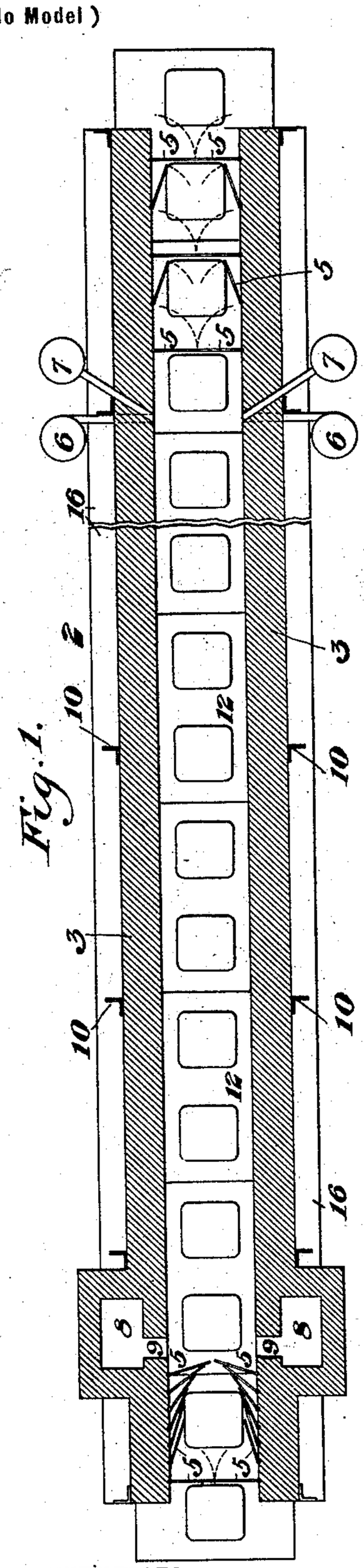

Fig. 1.

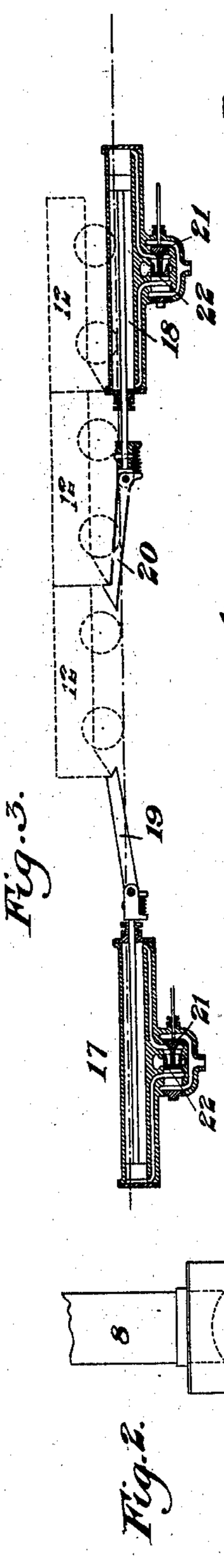

Fig. 3.

Fig. 2.

WITNESSES

L. A. Connell Jr.

L. M. Redman

INVENTOR

H. B. A. Keiser

by Bakewell & Bakewell

his attys.

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Fig. 4.

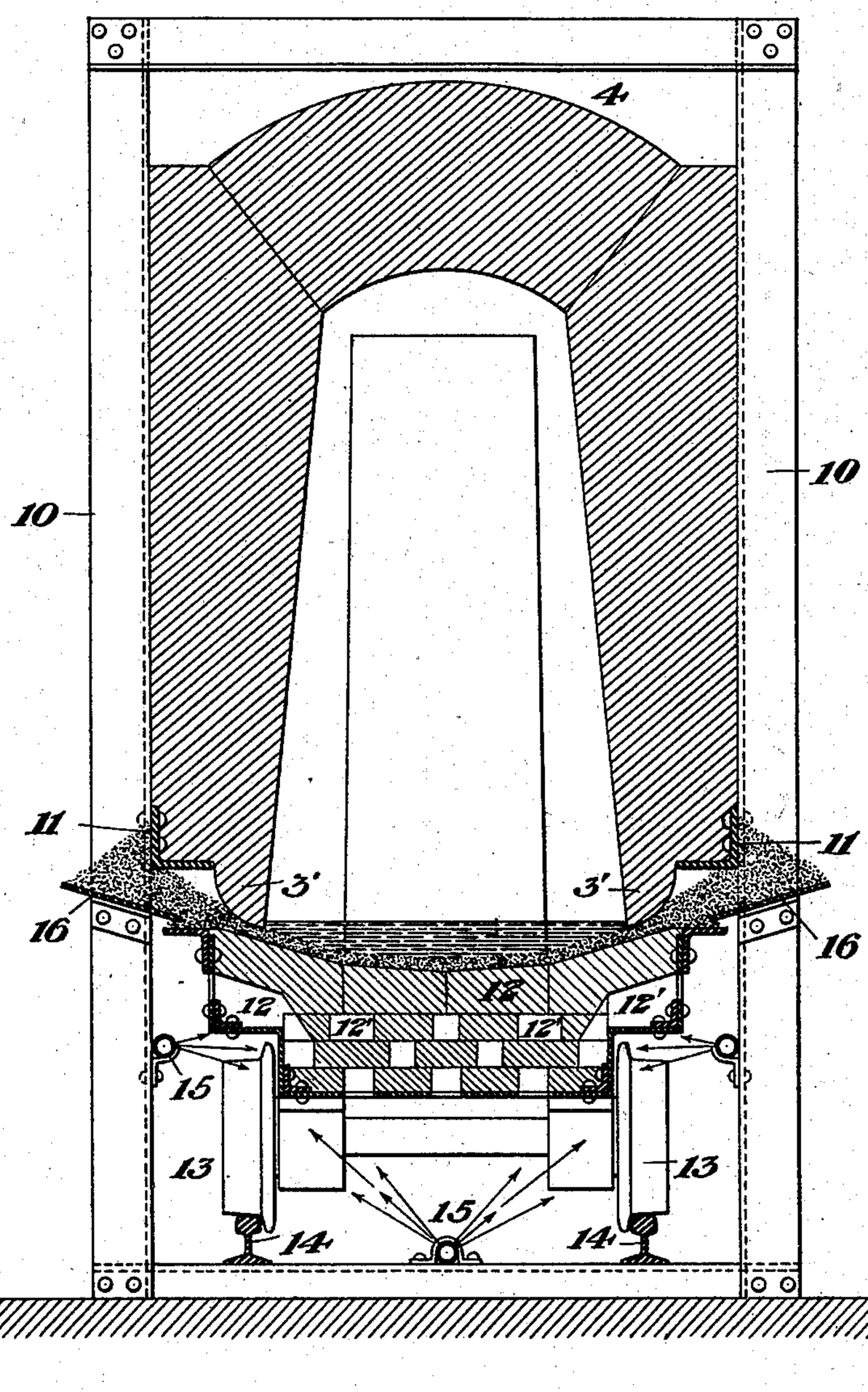

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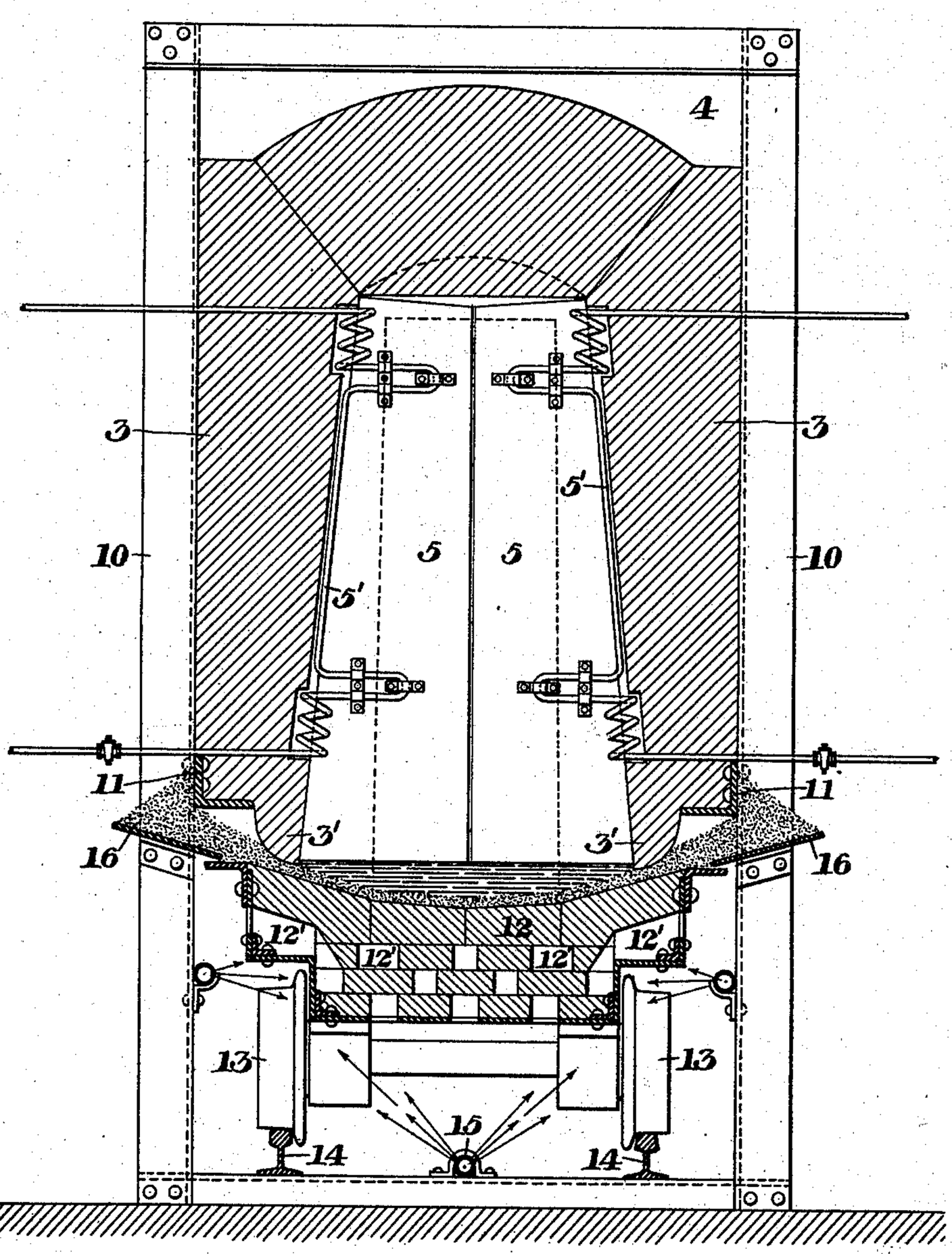
Fig. 5.



WITNESSES

Warren W. Swartz

H. M. Corwine

INVENTOR

H B A Keiser

by Bakewell & Bakewell

his attys.

UNITED STATES PATENT OFFICE.

HENRY B. A. KEISER, OF EDGEWOOD PARK, PENNSYLVANIA.

CONTINUOUS HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 714,710, dated December 2, 1902.

Application filed September 8, 1900. Serial No. 29,393. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. A. KEISER, of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Continuous Heating-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 sectional plan view of my improved continuous heating-furnace. Fig. 2 is a side elevation of the same, partly in section. Fig. 3 is a detail view of the mechanism for propelling the carriages or bottom. Fig. 4 is a cross-section, on a larger scale, showing the bottom provided with cooling-openings; and Fig. 5 is an enlarged cross-section showing the water-cooled hinges for the self-closing doors.

My invention relates to the class of furnaces, and particularly to continuous heating-furnaces, in which an ingot or the like is placed upon a traveling bottom or carriage, which is moved through the furnace in order to heat the ingots, and is designed to provide a furnace wherein the ingots are kept moving at the desired speed, which may be regulated to suit the conditions required by the ingots under treatment, and, further, to provide mechanism for accomplishing this movement, which I prefer shall be continuous for reasons hereinafter explained.

My invention further consists in providing the entrance and exit ends of the furnace with air-locks and the sides of the furnace with a sealing medium, of sand or other refractory material or slag, formed by the fusion of the refractory material and the heating of the steel, the air-locks closing the ends of the furnace and the sealing medium closing the spaces between the furnace-walls and the traveling carrier or bottom at the sides, thus preventing ingress of cold air or egress of the gases and heat. I believe I am the first to provide such means for excluding the cold air and preventing the waste of gases and heat upon the piece entering the furnace during its passage through the furnace and when it is removed or emerges from the same. This construction is made the subject of my broader claims and is not limited to use in a furnace of the particular type shown. I thus provide a furnace which is simple in construction, economical in the consumption of fuel, efficient in carrying out the purposes for which it is designed, and affords ready access to moving parts both for observation of its condition and for repairs. This construction permits the air to circulate freely about the moving bottom or carrier and allows the introduction of means for cooling these parts, thus greatly increasing their life.

In the drawings, 2 represents the furnace, which is in the form of a tunnel, having side walls 3 3 and a roof 4, which is arched, except over the doors 5 at the inlet and outlet ends of the furnace. At these points it is flat to fit the top edges of the doors. The doors 5 are preferably composed of asbestos or other suitable fireproof material and are provided with spring-hinges consisting of metal tubing 5′, having loops secured to the doors, as shown in Fig. 5, which normally hold the doors at right angles to the side walls, and thus close the opening between the same. I prefer to use a series of these doors, so that some of them are closed at all times.

The furnace is provided with suitable fuel-supply ports or pipes 6 7 for admitting air and gas, preferably located near the exit end of the furnace-tunnel. A stack 8 is located near the entrance to the furnace-tunnel, and ports 9, leading from the tunnel, communicate therewith. The side walls 3 3 of the furnace are supported upon suitable uprights 10, the brickwork resting upon an angle-iron 11, secured to said uprights. The bottom of the walls 3 3 extend somewhat below the angle-iron 11 and protect the metal from the action of the heat. This downwardly-projecting portion 3′ extends nearly into contact with the traveling bottom 12, which is formed, preferably, in sections and mounted on wheels 13, which run upon tracks 14.

The bottom 12 is preferably made slightly dished or concave, as shown in Fig. 4, and is provided underneath with suitable checker-work or ports 12′, which permit the free circulation of air through the bottom, thus preserving the same from rapid deterioration. Suitable cooling-pipes 15 are arranged in close proximity to the bottoms 12 and the trucks

on which they are mounted and are perforated, so that jets of air or water may be thrown on these parts to keep them cool.

Plates 16 extend along the furnace on both sides beneath the angle-irons 11 and in conjunction with the bottom 12, which they slightly overlap, and the projecting portion 3′ of the side walls form troughs for the reception of sand or other refractory material, which acts as a sealing medium. This sealing medium permits the bottom to move freely through the furnace and at the same time prevents the escape or waste of the gases and heat within the furnace. The slag formed by the heat of the steel and the refractory material also forms a seal in itself, and under some circumstances the slag thus formed may be used without the sand as the sealing medium, although I prefer to use the sand or other refractory material in conjunction therewith.

In order to prevent any liability of the slag freezing, and thus stalling the movement of the bottom or the destruction of the side walls of the furnace by forcing the bottom against such a resistance as would be offered by the partial or complete cementing of the bottom to the side walls by the frozen slag, I preferably keep the bottom moving continuously by suitable means, one form of which I show in Fig. 3. The speed may be very slow or may be accelerated at times, if desirable, and prevents the freezing of the slag above referred to and the evil results therefrom.

In the form shown I provide two hydraulic or other fluid-pressure cylinders 17 and 18, arranged near the entrance of the furnace-tunnel, and to whose pistons are secured suitable pushing and pulling devices 19 and 20, as shown. These pistons are set in such relation to each other that they work both independently and together to effect the continuous movement of the bottom. In the position shown in Fig. 3 the cylinder 18 has almost completed its stroke and the hook 20 has pulled the entire bottom about the length of one of the sections of which the bottom is composed. A new section has just been added and is being filled with ingots, the cylinder 17 has begun to push, and until the piston in cylinder 18 reaches the end of its stroke both pistons will act together. The piston of cylinder 18 is then returned to the other end of its stroke by shifting the valve 21 so as to admit pressure to the opposite end of the cylinder, and the hook 20 immediately begins to pull before the piston of cylinder 17 reaches the end of its stroke. The ingots are thus kept constantly moving through the furnace. The full fluid-pressure acts on the left-hand sides of both pistons, and the speed at which the bottom, with the superposed ingots, travel is determined by the size of the leakage-port 22 in the valves. If, however, the speed should be required to be increased at any time, the valve can be moved so as to open the exhaust more, and a quicker movement takes place. When brought back to its original position, with only the leakage-port in communication with the exhaust, the slow speed is again restored.

The operation is as follows: The ingots are placed upon one of the sections that make up the traveling bottom, which is brought up to the entrance end of the furnace and into position to be engaged by the pusher 19 of the cylinder 17. When the end of the bottom next the pusher is engaged thereby, the other end abuts that of the adjoining section of the traveling bottom. This latter is also engaged by the hook 20 of the cylinder 18, the two cylinders acting in conjunction and by suitable manipulation of their respective valves cause the bottom to travel slowly and preferably continuously. The ingot engages the doors 5, which form the air-lock, and as each of the series is engaged it folds back toward the walls 3 far enough to let the ingot pass through. As the ingot passes, the doors, being actuated by their spring hinges, fly back into position to close the opening between the side walls. The outgoing ingots, which have become heated to the desired degree, in like manner engage the doors at the exit end of the furnace, which open and close as just described. All the external air which would tend to cool the furnace on the entrance and exit of the ingot or other piece to be heated is practically excluded by these doors. The temperature of the furnace gradually increases toward the exit end, so that the ingot is gradually heated to the desired degree. The space between the lower edge of the side walls 3 and the traveling bottom 12 is sealed with sand or other suitable refractory material, which is supplied from time to time as it is needed.

The advantages of my invention arise from the use of the seal between the car and the side walls and from the air-lock by which the rapid reduction of the temperature during the operating of the furnace is eliminated, thus making the furnace more efficient and economical than has been possible with previous constructions. Another advantage is accessibility of the air to parts of the furnace which it is desirable to keep as cool as possible and the spraying of the moving bottom with a cooling jet of water or air, also the checker-work formation of the traveling bottom. The open construction below the side walls also allows free access to the parts of the moving bottom and the track, so that they can be kept in order. The continuous movement of the bottom greatly increases the life of the furnace, and, as before explained, the mechanism by which the movement of the bottom is effected may be controlled so as to give the desired speed, and thus enables the ingot to be given the requisite period of time within the furnace which is best suited to its proper heating. The placing of the ingots upon separate sections of a traveling bottom which carry them through the furnace out of

contact with each other gives the heat access to all sides of the ingot, thus preventing unequal heating of the same.

Many changes may be made in the form and arrangement of the furnace, the means of sealing same, the traveling bottom, and the means for moving the bottom without departing from the spirit and scope of my invention, since

What I claim is—

1. A furnace having an opening through which the same is charged or drawn, a carrier extending through the opening, and arranged to support an ingot in vertical position, and doors arranged to form an air-lock, said doors having means for causing them to normally close the opening, and arranged to contact with the ingot and be opened thereby; substantially as described.

2. A furnace having inlet and outlet openings, and a traveling bottom arranged to support ingots in vertical position, and air-locks for the openings, comprising yielding doors or flaps arranged to contact with the ingots; substantially as described.

3. A furnace having inlet and outlet openings through which the furnace is charged and drawn, and a plurality of doors at each end of the furnace arranged to form air-locks, said doors having means for causing them to normally close both the entrance and exit openings and allow the free insertion and withdrawal of the piece to be treated, but substantially preventing the escape of the heat and gases from the furnace during such charging and drawing, said doors being arranged to contact with and be opened by the metal passing through the openings; substantially as described.

4. A continuous furnace having inlet and outlet openings at opposite ends of the furnace, automatic air-locks at both ends composed of doors closing said inlet and outlet, but permitting the free entrance and withdrawal of the piece to be treated, said air-locks substantially preventing the escape of the heat and gases from the furnace during the entrance and exit of the piece, and arranged to be operated by the metal carried through the furnace, and carriages movable through said furnace; substantially as described.

5. A continuous furnace having a traveling bottom adapted to support the ingot or piece to be treated, entrance and exit openings for the ingot or piece, air-locks comprising doors or flaps arranged to close said openings and to be engaged successively by the metal being heated permitting the free insertion and exit of the piece to be treated, but preventing the escape of the heat and gases during such entrance and exit, at least a portion of said doors being closed at all times; substantially as described.

6. An ingot-heating furnace having side walls carried upon spaced-apart supports, a movable bottom accessible through the spaces of said supports, said bottom being arranged to support the ingots in a vertical position, and mechanism for moving the bottom continuously in the same direction through the furnace from the entrance to the exit end; substantially as described.

7. A heating-furnace having side walls carried upon open-work supports, a traveling bottom accessible through said supports and having a dish-shaped cross-sectional form arranged to contain a sealing medium and coacting with the sides of the furnace to seal the bottom, and means for moving the bottom through the furnace from the inlet to the exit end; substantially as described.

8. A continuous heating-furnace having a traveling bottom formed in sections supported upon wheels, a source of liquid under pressure, and pipes connected with said source and arranged to spray the wheels and bearings with liquid; substantially as described.

9. A continuous heating-furnace having a traveling bottom formed of trucks each having a bed of dish-shaped cross-sectional form arranged to contain sealing material to coact with the side walls and seal the bottom, each truck having a checker-work body portion and liquid-spray pipes arranged to spray the wheels and bearings with cooling liquid; substantially as described.

10. A continuous furnace arranged to receive metal in a vertical position, and having side walls carried above the bottom on open-work supports, a traveling bottom for said furnace having supporting-wheels, and accessible pipes for spraying said wheels with a cooling medium; substantially as described.

11. A continuous furnace having a traveling bottom, and motive cylinders provided with pushing and pulling devices arranged to move said bottom continuously through the furnace; substantially as described.

12. A continuous furnace having a traveling bottom, motive cylinders provided with pushing and pulling devices arranged to move said bottom continuously through the furnace, and valves controlling said cylinders and arranged to regulate the speed of the traveling bottom; substantially as described.

13. A furnace having a source of heat at one end, an offtake-flue at the other end, a movable bottom for the furnace having dish-shaped accessible outer sealing portions coacting with the lower edges of the side walls, the sealing portions opening exterior to the furnace to allow the feeding of sealing medium, and mechanism for moving the bottom through the furnace; substantially as described.

14. A continuous furnace having air-locks at its entrance and exit ends, a traveling bottom, and an exteriorly-exposed, and accessible sealing medium between the traveling bottom and the side walls, said air-locks and seal largely preventing the ingress of cold air or the egress of gas and heat; substantially as described.

15. A continuous furnace having a traveling bottom slightly separated from the side walls, and an exteriorly-accessible open trough adjacent to said joint and containing a sealing medium; substantially as described.

16. A continuous furnace having a traveling bottom slightly separated from the side walls, a shelf or trough at the joint slightly overhanging the furnace-bottom, and a sealing medium in the trough arranged to prevent the escape of heat or ingress of air; substantially as described.

17. A continuous furnace having a straight tunnel portion, a traveling bottom or car arranged to move through said tunnel, and accessible sealing-joints between the side walls of the furnace and the traveling bottom, the joints being exteriorly opened to allow replenishing during the operating of the furnace; substantially as described.

18. A continuous furnace having side walls carried on suitable supports, and a traveling bottom for the said furnace having a dished form with its outer edges higher than the middle portion, said bottom being arranged to contain a liquid seal in the dish portion arranged to seal the side joints; substantially as described.

19. A continuous furnace having side walls carried on open-work supports, a traveling bottom slightly separated from said side walls, and open troughs at the joints on the bottom and side walls, said troughs being exteriorly accessible and arranged to receive a sealing medium, the side walls extending below the open-work supports to protect it, and forming a narrow slot with the bottom, closed by the seal; substantially as described.

20. A continuous furnace having a traveling bottom formed in separated sections, carried on trucks, a source of heat at one end of the furnace, an outlet-flue at the other end, joints between the side walls and bottom arranged to contain molten material, said joint being accessible from the outside of the furnace, and mechanism for giving the bottom a continuous forward movement, whereby chilling of the sealing medium is prevented; substantially as described.

In testimony whereof I have hereunto set my hand.

H. B. A. KEISER.

Witnesses:
JOHN J. WALKER,
H. W. MCKALIP.