

No. 680,997.

Patented Aug. 20, 1901.

A. LAUGHLIN & J. REULEAUX.
HEATING FURNACE.

(Application filed Feb. 15, 1901.)

(No Model.)

4 Sheets—Sheet 1.

FIG. 1.

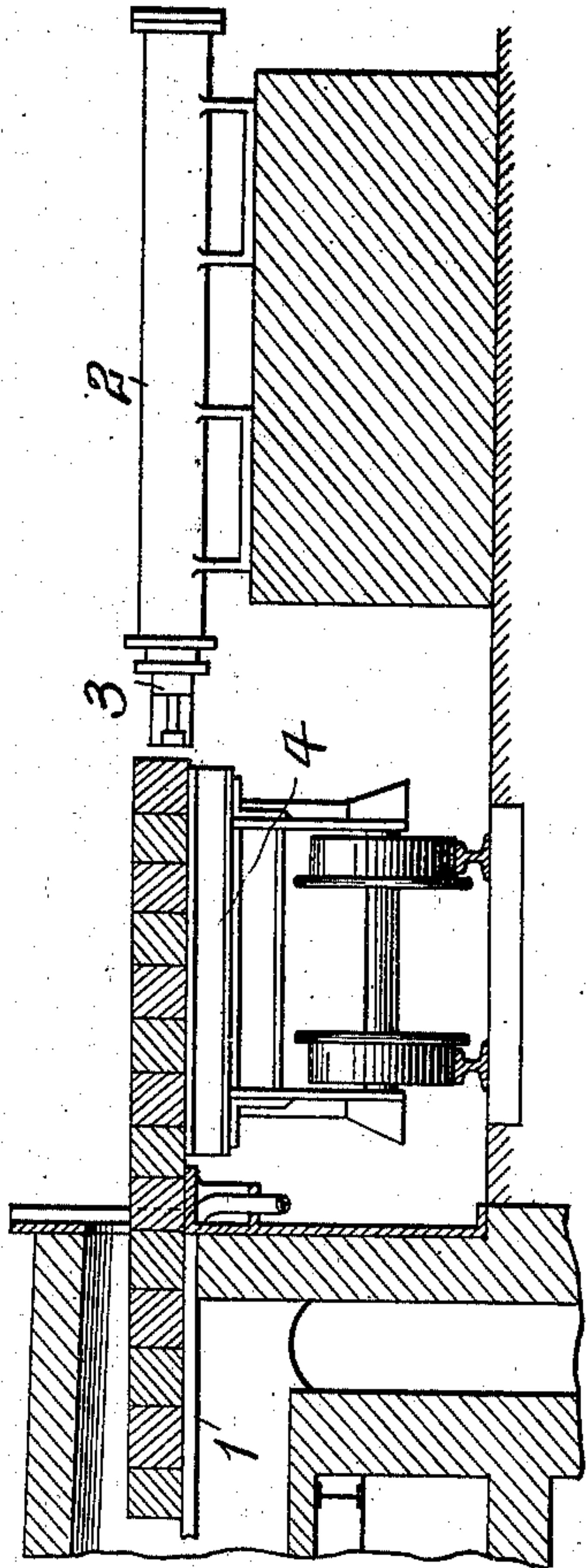
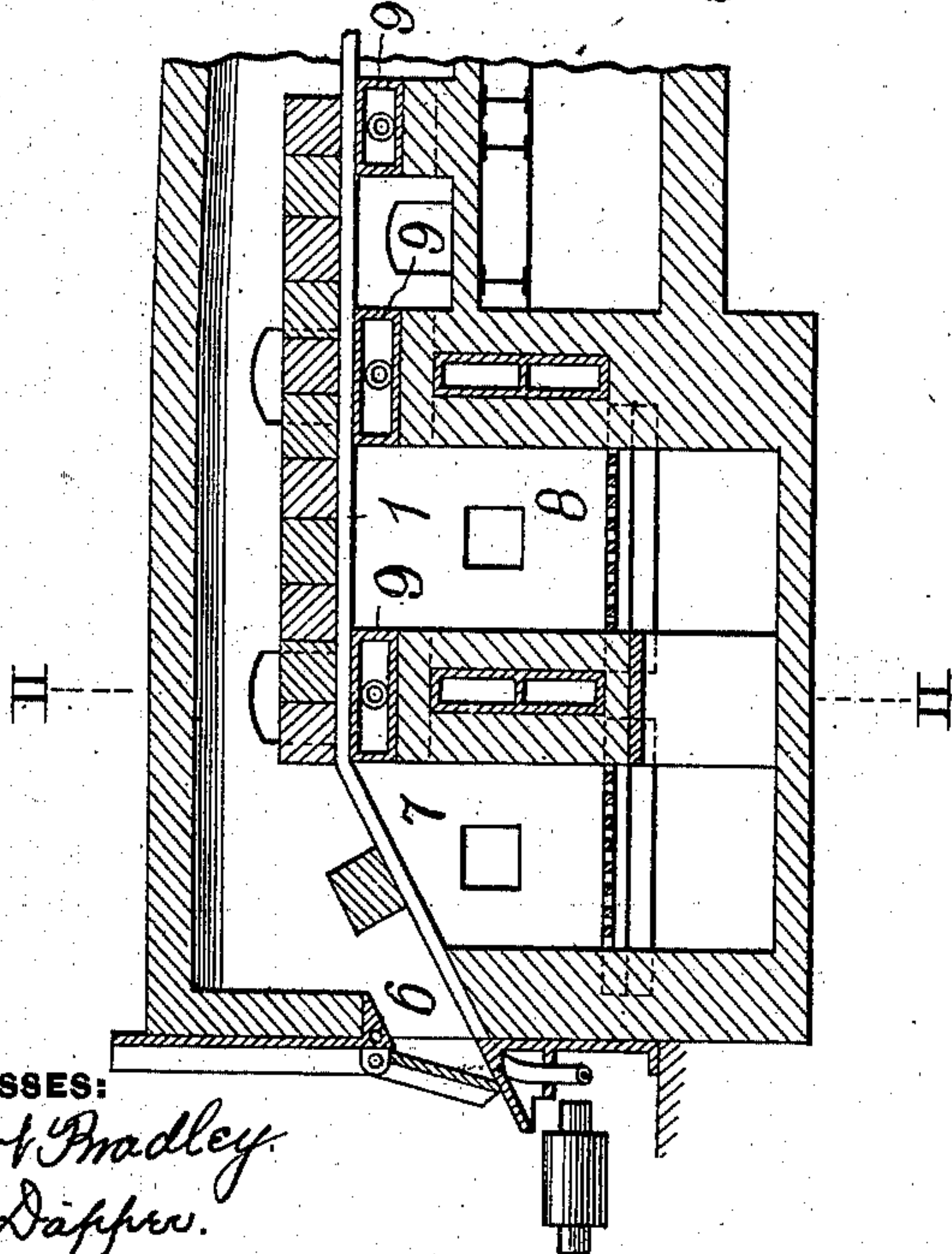
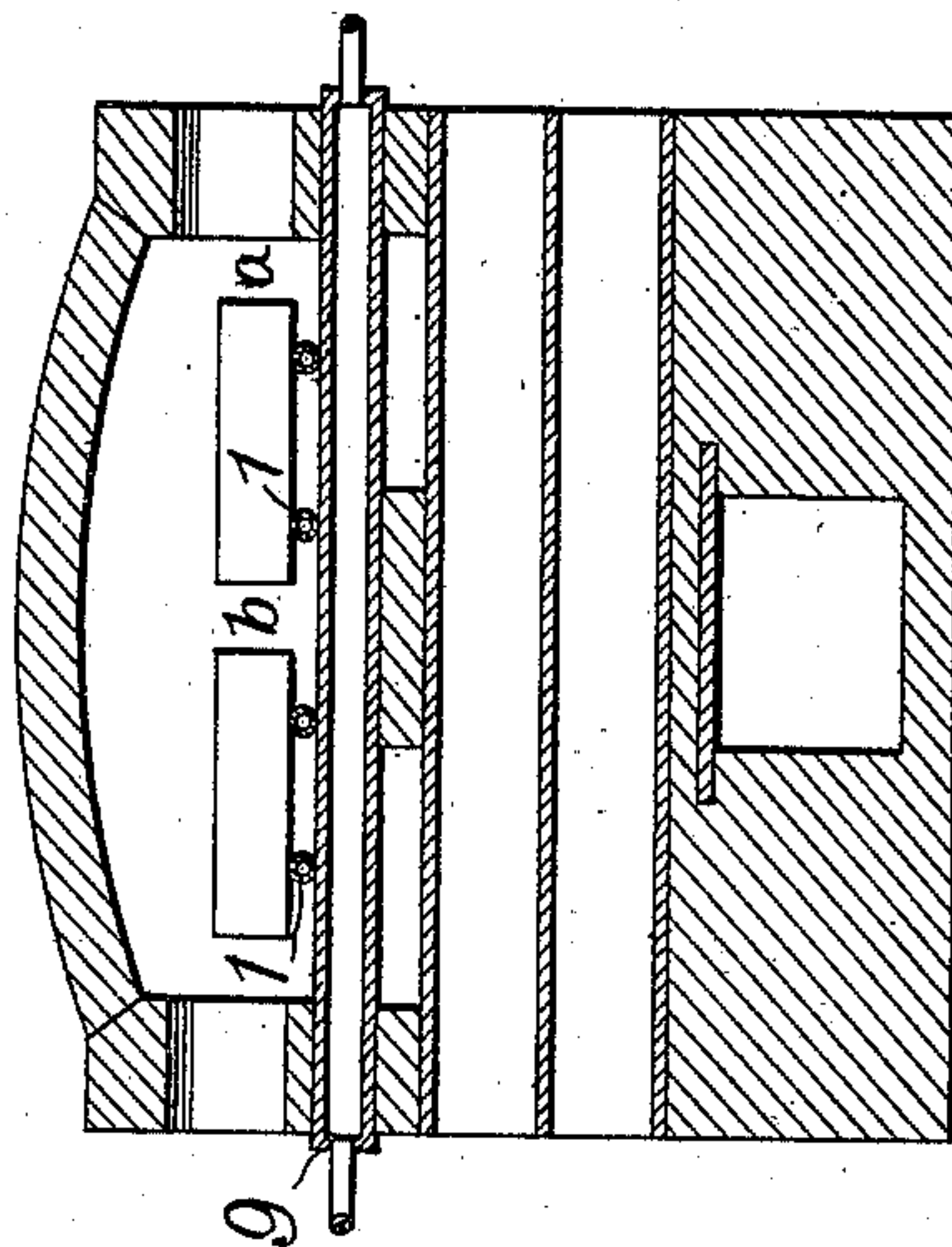


FIG. 2.



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FIG. 3

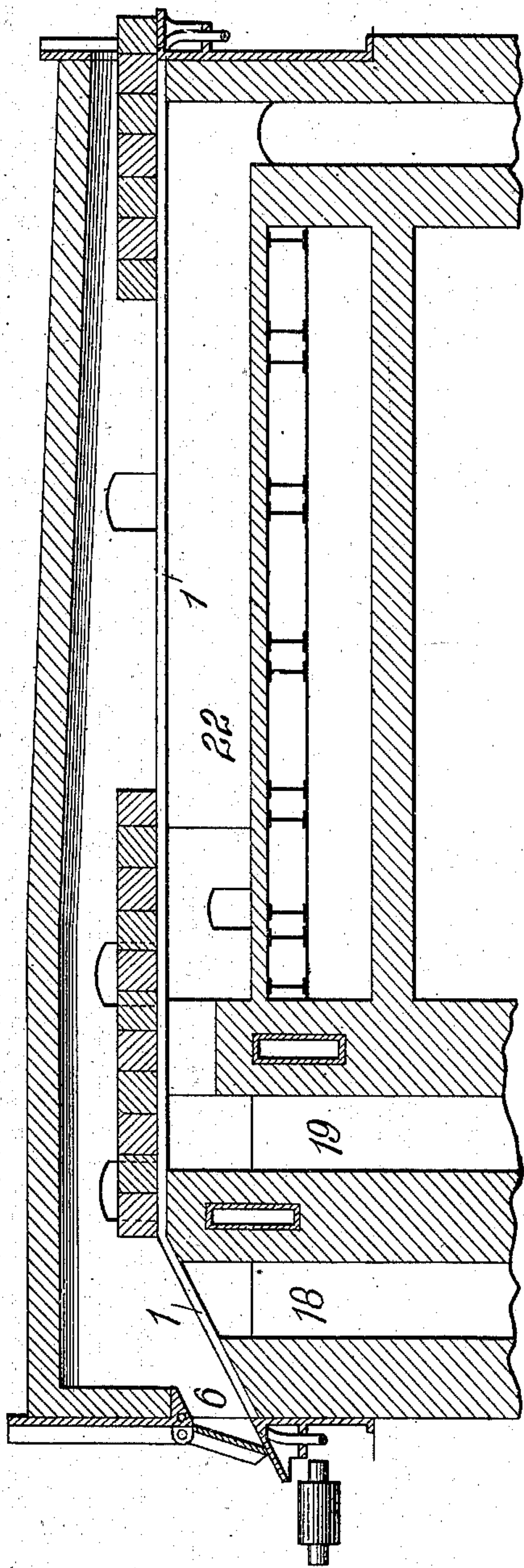


FIG. 5.

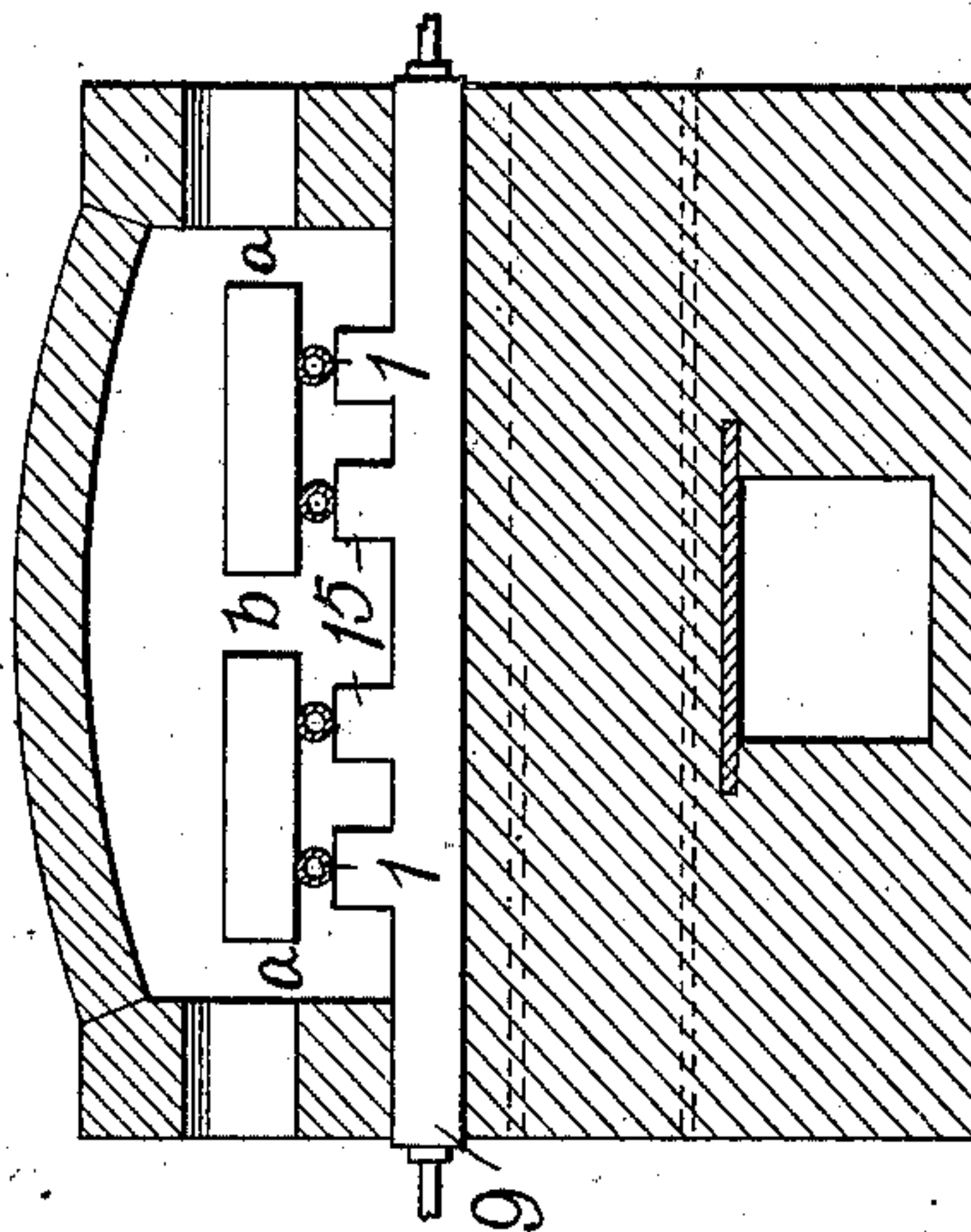
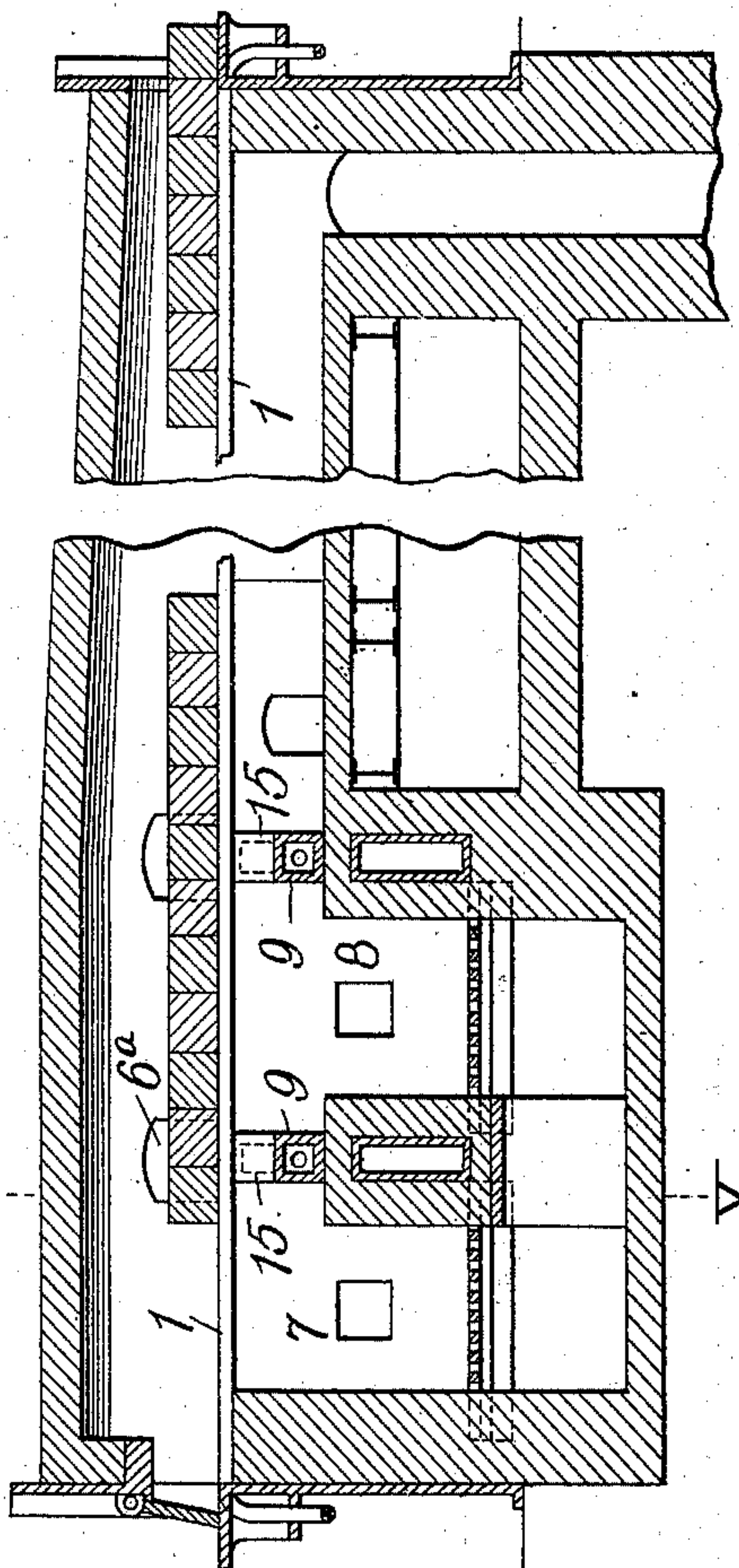


FIG. 4.



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FIG. 6.

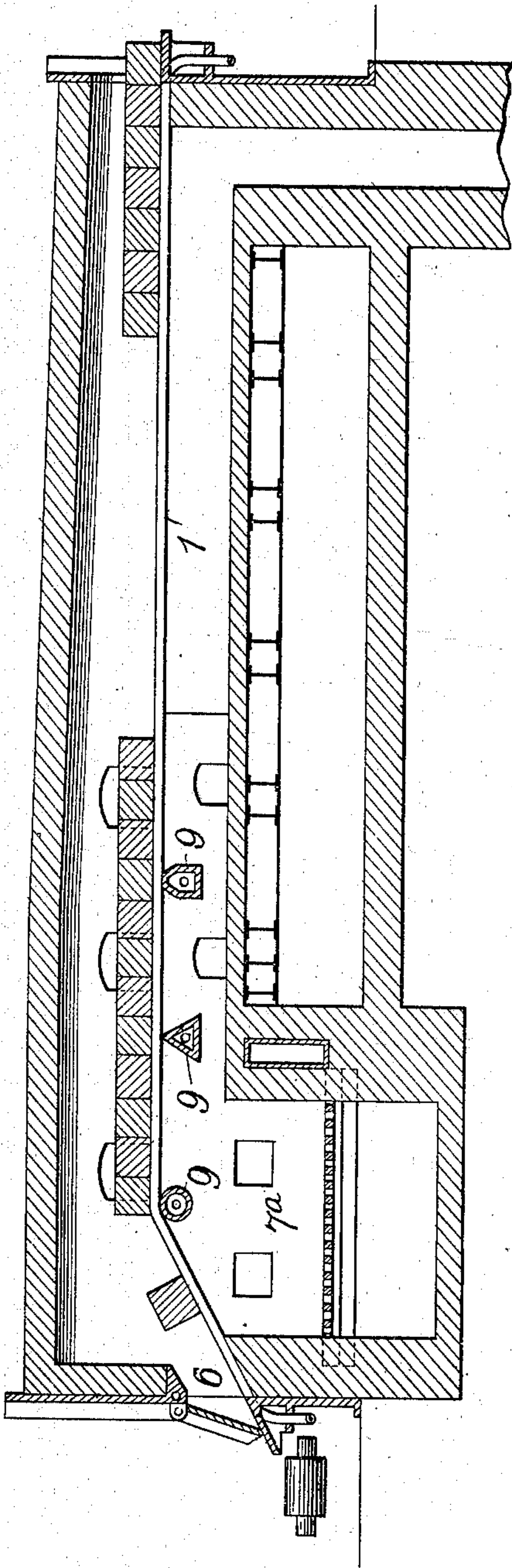
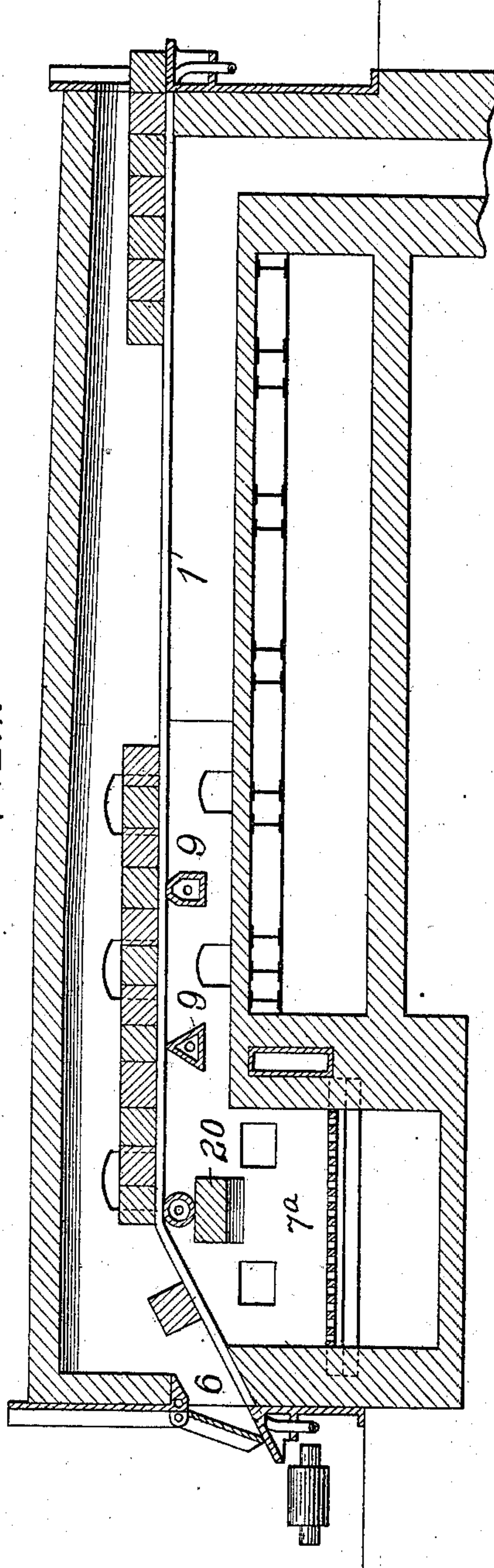


FIG. 7.



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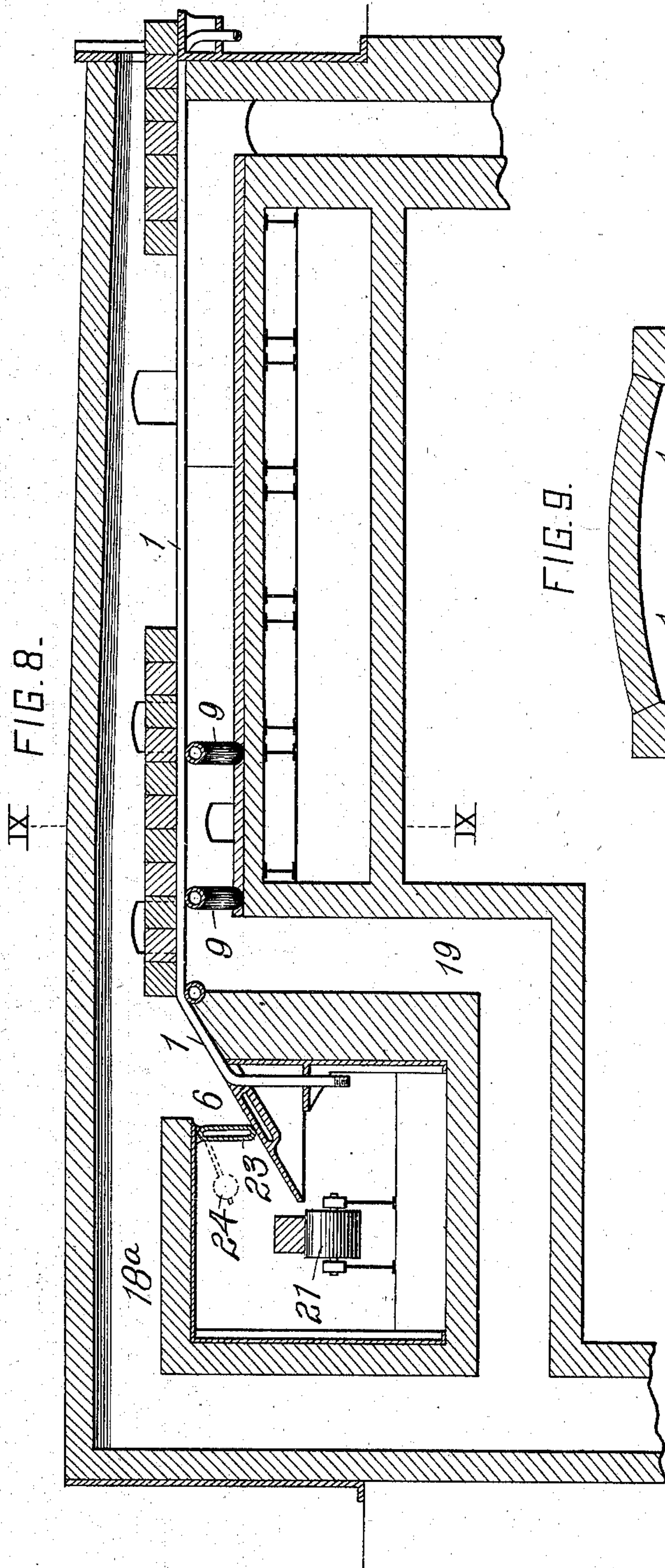
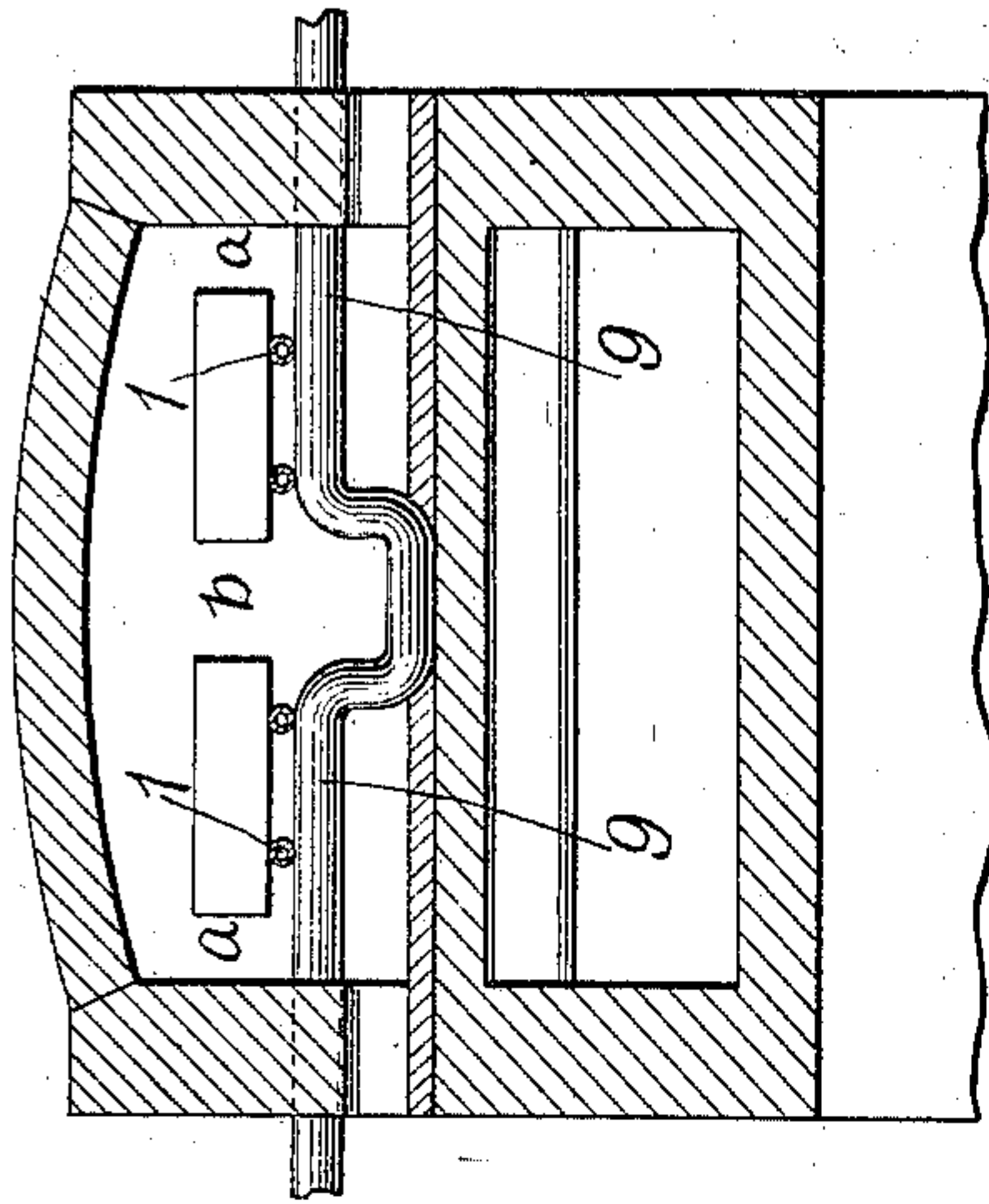


FIG. 9.



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UNITED STATES PATENT OFFICE.

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HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 680,997, dated August 20, 1901.

Application filed February 15, 1901. Serial No. 47,453. (No model.)

To all whom it may concern:

Be it known that we, ALEXANDER LAUGHLIN, residing at Sewickley, and JOSEF REULEAUX, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, citizens of the United States, have invented or discovered certain new and useful Improvements in Heating-Furnaces, of which improvements the following is a specification.

The invention described herein relates to certain improvements in continuous heating-furnaces of the class or kind shown and described in reissued Letters Patent No. 11,666, granted to us May 31, 1898. This type or construction of furnace is highly efficient for heating billets about four inches square or smaller, but as it is characteristic of the form of billet-furnaces now in use that nearly all the heat is applied to the upper surfaces of the billets it becomes necessary in order to heat articles of larger cross-section, such as blooms or ingots in such furnaces, to make them longer or reduce the speed of movement of the blooms or ingots through the furnace to insure their proper heating by the time they reach the point of discharge from the furnace. Both of these methods are objectionable, and in order to avoid the objectionable features we have invented and designed a construction of furnace whereby heat may be applied directly to the under and upper sides of the articles as they are moved through the furnace, and especially as they approach the point of discharge.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a longitudinal vertical section of a furnace having our improvements applied thereto. Fig. 2 is a transverse section of the same, the plane of section being indicated by the line II II, Fig. 1. Figs. 3 and 4 are views similar to Fig. 1, illustrating modifications of our improvement. Fig. 5 is a transverse section on a plane indicated by the line V V, Fig. 4. Figs. 6, 7, and 8 are vertical longitudinal sections illustrating further modifications of our improved furnace, and Fig. 9 is a transverse

section on a plane indicated by the line IX IX, Fig. 8.

It is characteristic of billet-furnaces now in use that the supports—i. e., the pipes or rails for the billets as they move through the furnace—are raised from the bottom of the heating-chamber for the purpose of allowing a portion of the heat and products of combustion to pass under the row of billets which form a continuous horizontal partition, but the arrangement of the fire-chamber or gas-inlet flue or flues a distance in the rear of the point to which the billets are shifted by the charging mechanism permits the heated gases to flow up past the entrance to the space under the row of billets, and hence a comparatively small proportion of heat is drawn to and through such space or passage under the row or rows of billets. Hence nearly all the heat is applied to the upper surfaces of the billets. These furnaces are effective for heating small sizes of billets—i. e., four or five inches square or less—especially if the billets be subjected on all sides to a very high heat during the latter part of their movements through the furnace, as set forth in the patent referred to, but they are not effective in heating the larger sizes of billets or blooms or ingots.

In the practice of our invention the front portion of the furnace is constructed substantially as shown and described in the Letters Patent referred to. One, two, or more pairs of pipes or rails 1 are arranged longitudinally of the furnace and the billets are placed on and pushed along said pipes or rails by any suitable mechanism—such, for example, as that shown in Fig. 1—consisting of a fluid-pressure cylinder 2 and piston 3, arranged in line with the furnace and adapted to push the billets or ingots from the truck 4 and along the pipes or rails 1. These pipes or rails extend, preferably, with a slight upward inclination toward the rear end of the furnace. If it is desired to effect an automatic discharge of the billets from the furnace, the rails or supports are given a downward inclination from a point or points adjacent to the rear end of the furnace, so that the billets will slide automatically from the point of in-

clination down through the discharge-opening 6. If, however, no automatic discharge is desired and the billets or blooms or ingots are to be pushed or pulled from the furnace, the supporting rails or pipes 1 extend horizontally or with a slight upward inclination from the charging-opening at the front end of the furnace to a point adjacent to the discharge-opening 6 or 6^a, which may be formed in the rear wall or the side wall near the rear end of the furnace, as shown in Fig. 4.

In order to effect a thorough heating of the blooms or ingots, we cause a considerable portion of the heat and products of combustion to pass under and along the row or rows of blooms or ingots lying on the supporting rails or pipes 1. To this end the heat and products of combustion and heating-gases are introduced into the heating-chamber of the furnace through one or more ports or openings so located with reference to the movement of the blooms or ingots through the furnace that the latter will operate as a deflector for the heat and products of combustion or heating-gases and cause a considerable proportion of the latter to pass under and along the row or rows of blooms or ingots. The fire-chambers 7 and 8 are preferably located as shown in Figs. 1 and 4; but their location relative to other portions of the furnace is immaterial, provided the port or ports through which gas or products of combustion and heat enter the heating-chamber are so located that the billets, blooms, or ingots will deflect a portion of the heat or gases, as stated. When employing two fire-chambers, the outlet of one of them, as 8, is located at such a point near the rear end of the furnace that the row or rows of blooms, &c., resting on the pipes or rails 1 will not entirely cover the outlet from this fire-chamber, so that heat and products of combustion or gases will flow up and cover the row or rows of ingots, blooms, or billets. The outlet from the second or auxiliary fire-chamber 8 is arranged in front of the points to which the blooms, &c., are pushed by the feed mechanism, so that the row or rows of blooms, &c., will cover the outlet from the auxiliary fire-chamber, thereby preventing any material portion of the heat and products of combustion or gases passing above the row or rows of blooms, &c., but deflecting such gases or heat into the passage or passages whose upper wall or walls are formed by the row or rows of blooms, ingots, or billets.

It will be observed that the row or rows of blooms, ingots, or billets form a nearly complete top or covering over the second fire-chamber, the only openings through such covering being the spaces *a* between the blooms, &c., and the side walls of the furnace and the space *b* between the inner ends of the billets of the two rows, as shown in Figs. 2, 5, and 9, so that nearly all the heat entering the furnace from the second or auxiliary fire-chamber will be effective in heating the under sides of the blooms, &c. The outlet

from the main fire-chamber is, however, wholly uncovered, or practically so, at all times, so that the heat and products of combustion therefrom will pass to the upper part of the heating-chamber and thence back over the blooms and stack. The outlets from the fire-chambers 7 and 8 are preferably so constructed that the fuel may be charged from each end thereof, thus reducing the labor required in firing such long fire-chambers from one end.

The supporting pipes or rails 1 for the ingots, blooms, &c., are preferably supported by water-cooled pipes or boxes arranged transversely of the furnace, as described in application Serial No. 725,121, filed July 26, 1899. It is preferred to so construct the supporting pipes 9 that the products of combustion entering the furnace, especially from the second or auxiliary furnace 8, may flow forward to the stack in a passage or flue whose upper wall is formed by the row or rows of blooms, &c. This function or mode of operation can be attained in many ways—as, for example, in the construction shown in Fig. 1 the supporting pipe or box 9 in the rear of the secondary or auxiliary furnace 8 is in turn supported by the side walls of the furnace and by piers intermediate of such side wall. In the construction shown in Fig. 3 the supporting pipes or rails 1 are supported for the portion in front of the secondary furnace by small piers 22, running longitudinally of the furnace. In the construction shown in Figs. 4 and 5 the water-box 9 is provided with lateral projections 15, suitably spaced to form supports for the pipes or rails 1. In the construction shown in Figs. 6 and 7 the supporting pipes or boxes 9 are made of sufficient transverse strength to support the pipes or rails 1 and the blooms or ingots resting thereon without any intermediate support, the boxes 9 resting merely on the side walls of the furnace. As shown in Fig. 7, the supporting box or tube 9 above the fire-chamber may be supported by a brick arch 20, resting at its ends on end walls of the fire-chamber. In Figs. 8 and 9 the supporting pipe or box is so bent or formed that the end portions will rest upon the side walls, while the intermediate portion between the two lines of rails 1 will rest upon the floor of the furnace.

In lieu of two independent fire-chambers we may employ a single fire-chamber 7^a of a width approximately equal to the combined widths of the fire-chambers 7 and 8, as shown in Figs. 6 and 7. While we have shown in Fig. 6 the wide fire-chamber in connection with bridge-rails for effecting the automatic discharge of the blooms, ingots, &c., from the furnace, it will be readily understood by those skilled in the art that such wide fire-chamber may be advantageously used in connection with supporting pipes or rails 1, extending in the manner shown in Fig. 4 from the front end of the furnace to the discharge-opening 6 in the rear wall of the furnace or opening

6^a in the side wall near the rear end of the furnace. It will be understood that when the bloom-supporting pipes 1 extend, as shown in Fig. 4, from the front to the rear end of the furnace in, or approximately in, a common plane the blooms, ingots, &c., are pushed along such supporting-pipes to convenient proximity to the discharge-opening and are then pulled or pushed through such opening by tongs or a pusher arranged opposite the discharge-opening, care being taken that the row or rows of blooms or ingots are not pushed sufficiently far to prevent a free discharge of a portion of the heat or products of combustion passing above the row or rows of blooms, &c.

Where provision is made for the free flow of products of combustion and heat both above and below the lines of blooms or billets the fire-chamber need not extend toward the front end of the furnace any considerable distance beyond the vertical plane passing through the point to which the billets are moved by the feed mechanism at the front end of the furnace, especially where small sizes of blooms or billets are to be heated.

In lieu of fire-chambers for the combustion of solid fuel are improvements to be applied to furnaces where gaseous fuel is employed, as shown in Figs. 3, 8, and 9. In the construction shown in Fig. 3 the flues 18 and 19 for the introduction of gas and air are substituted for the fire-chambers and have their discharge ports or openings located in substantially the same relation to the line of movement of the blooms or ingots and their automatic discharge from the furnace as the outlet ports or openings from the fire-chambers heretofore described. As shown in Fig. 3, the flues 18 and 19 are arranged one in the rear of the other or in substantially the same relative position as the fire-chambers 7 and 8. Where provision is made for the free flow of heat and products of combustion above and below the line or lines of blooms or ingots, only one line of gas and air flues 18 will be necessary, especially for the small sizes of billets.

As shown in Figs. 8 and 9, the gases for heating the upper portion of the furnace or that portion above the planes of movements of the blooms or ingots may be introduced through port or ports 18^a, entering the furnace above the planes of movements of the blooms or ingots. When so introducing the gas and air for heating the upper portion of the furnace, it is preferred if the blooms or ingots are to be automatically discharged to form an opening through the bottom of the furnace, through which the blooms or ingots will drop onto an inclined apron or pipes for guiding the blooms or ingots to the conveyer 21. This opening through the bottom of the furnace is held normally closed by a swinging door 22, held in closed position, as shown, by arms 23, having weights 24.

No claim is made herein to the construction of the rail-supports illustrated in Figs.

4, 5, 8, and 9, as such constructions are the sole invention of one of the applicants and form the subject-matter of an application filed by him.

We claim herein as our invention—

1. A continuous heating-furnace having in combination, a discharge-opening at or near the rear end of the furnace, bloom or ingot supports extending from the front end of the furnace to a point adjacent to the discharge-opening, bearings for the bloom or ingot supports constructed to hold the supports above the bottom of the furnace, means for shifting the blooms or ingots to a point near the discharge-opening, and ports or openings for the admission of heating-gases arranged near the rear end of the furnace and under the path of movement of the blooms or ingots along the supports, and extending forward beyond the point to which the blooms or ingots are moved by the shifting mechanism, whereby the line of blooms or ingots will serve to deflect a portion of the heating-gases entering through the ports or openings, substantially as set forth.

2. A continuous heating-furnace having in combination, a discharge-opening at or near the rear end of the furnace, bloom or ingot supports extending from the front end of the furnace toward the rear end thereof, means for shifting the blooms or ingots along the supports, means for effecting the automatic movement of the blooms or ingots from such supports through the discharge-opening of the furnace, means for applying heat to the upper sides of the blooms, or ingots, &c., while moving through the furnace, and means for applying heat directly to the under sides of the blooms or ingots while being shifted along the supports and during their automatic movement, substantially as set forth.

3. A continuous heating-furnace having in combination, openings adjacent to its ends for charging and discharging blooms or ingots, two or more ports or openings for the introduction of heating-gases into the furnace, arranged one in front of the other and adjacent to the opening for the discharge of blooms or ingots from the furnace, and an open-topped flue or passage extending from one of the ports or openings underneath the bloom or ingot line of travel toward the front end of the furnace and adapted to be covered by the row or rows of blooms or ingots being heated, substantially as set forth.

4. A continuous heating-furnace having in combination, openings adjacent to its ends for charging and discharging blooms or ingots, bloom or ingot supports extending from the front end of the furnace to a point adjacent to the discharge-opening, bearings for the bloom or ingot supports constructed to raise the bloom or ingot supports above the bottom of the furnace, means for shifting the blooms or ingots to a point adjacent to the discharge-opening and two or more ports or openings for the introduction of heating-gases

into the furnace arranged one in front of the other adjacent to the opening for the discharge of blooms or ingots from the furnace and extending forward beyond the point to which the blooms or ingots are moved by the shifting mechanism, whereby a portion of the heating-gases entering through the inlet ports or openings is caused to flow forward under the line of blooms or ingots, substantially as set forth.

5. A continuous heating-furnace having in combination, openings for charging and discharging blooms or ingots, main bloom or ingot supports extending from the front end of the furnace toward the rear end thereof, inclined supports extending from the main supports to the discharge-opening, ports or openings for the introduction of heating-gases arranged below the inclined supports and auxiliary ports or openings for the introduction of heating-gases arranged in front of the other ports or openings and extending forward below the main bloom or ingot supports, substantially as set forth.

6. A continuous heating-furnace, having in combination openings for charging and discharging blooms or ingots, a port or opening near its rear end for the admission of heating-gases into the furnace, bloom or ingot supports arranged above the bottom of the furnace and extending from the charging-opening to a point beyond the front wall of the port or opening for the admission of gases, thereby forming an open-topped flue adapted to be closed by a continuous line of blooms or ingots resting on the supports, said flue extending from the inlet-port toward the front of the furnace, and means for shifting the blooms or ingots along the supports, substantially as set forth.

7. A continuous heating-furnace having in combination, openings for charging and discharging blooms or ingots, bloom or ingot supports extending from the front end of the furnace toward the rear end thereof, means for shifting the blooms or ingots along said

supports to a point adjacent to the discharge-opening, two fire-chambers located below the path of movement of the blooms or ingots, one of said chambers arranged forward from a plane passing through the point to which the blooms or ingots are shifted by the shifting means, and the other chamber in the rear of the first chamber, substantially as set forth.

8. A continuous heating-furnace, having in combination, a heating-chamber, bloom or ingot supports raised above the bottom of the heating-chamber and extending along the heating-chamber from the front end of the furnace toward the rear end thereof, means for pushing the blooms or ingots along said supports and a fire-chamber located below the plane of the bloom or ingot supports and connected to the heating-chamber in front and in the rear of the point to which the blooms or ingots are shifted by the pushing means, that the heating-gases will flow from the fire-chamber above and below the line of blooms or ingots resting on the bloom or ingot supports, substantially as set forth.

9. A continuous heating-furnace, having in combination, bloom or ingot supports extending from the front end of the furnace toward the rear end thereof and raised above the bottom of the furnace, means for moving the blooms or ingots along said supports to a point from which the blooms or ingots can be removed from the furnace, and a fire-chamber located below the plane of the bloom or ingot supports and extending forwardly from a vertical plane passing through the point to which the blooms or ingots are moved by the shifting mechanism, substantially as set forth.

In testimony whereof we have hereunto set our hands.

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Witnesses:

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