No. 671,893. Patented Apr. 9, 1901.

A. LAUGHLIN.

CONTINUOUS HEATING FURNACE.

(Application filed Sept. 17, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 3

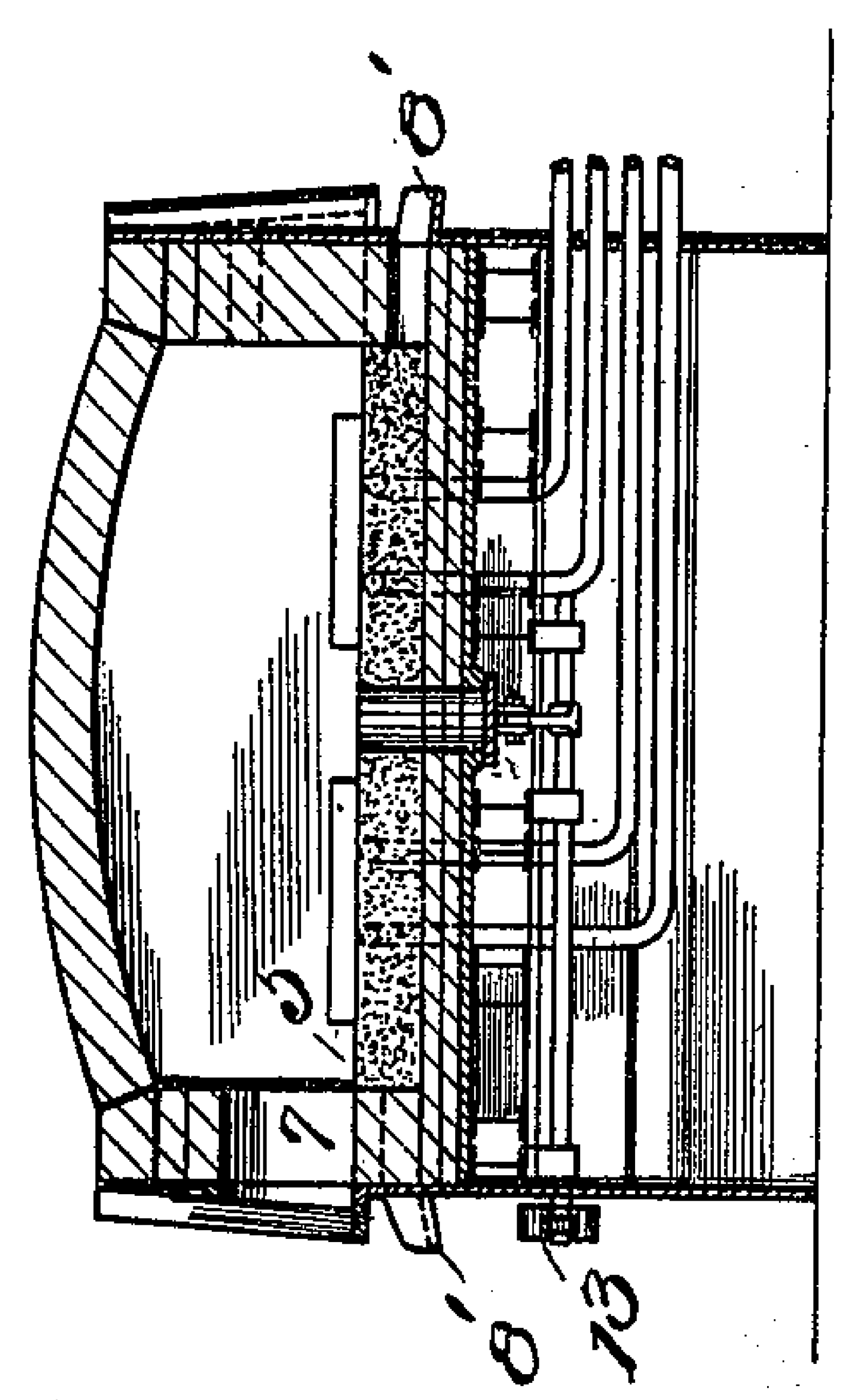


Fig. 2

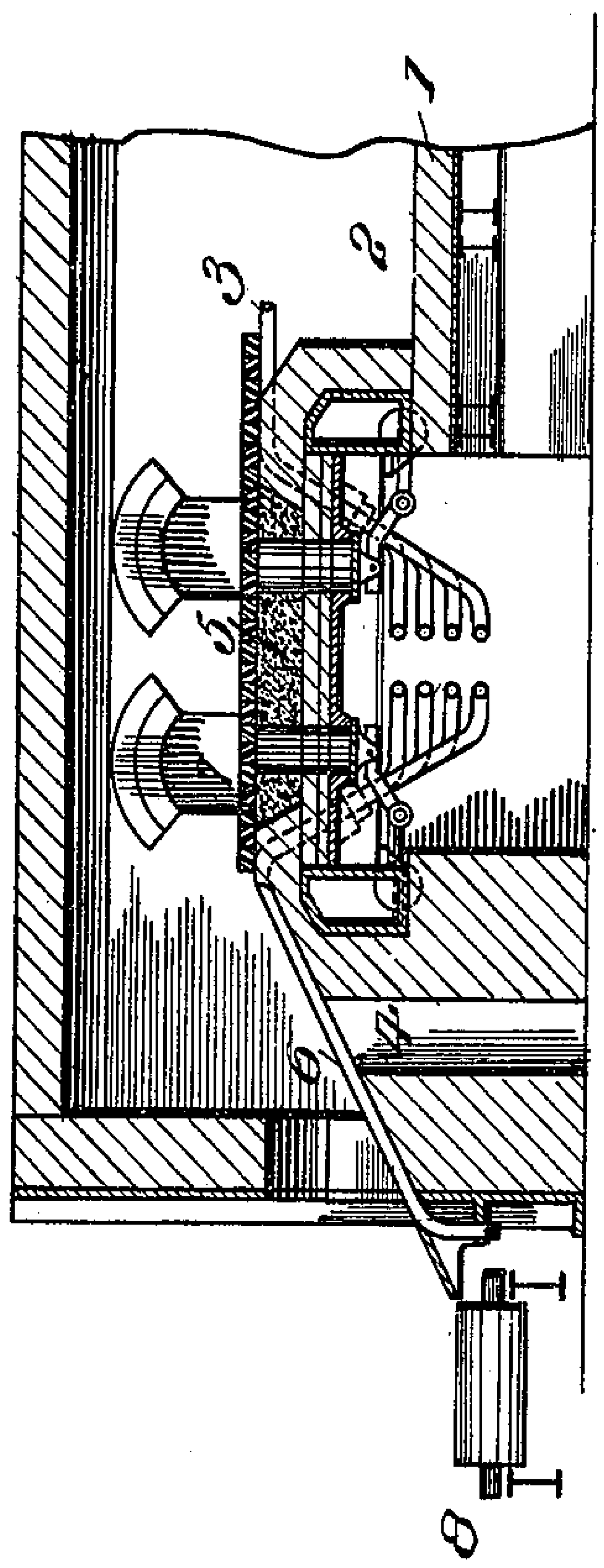
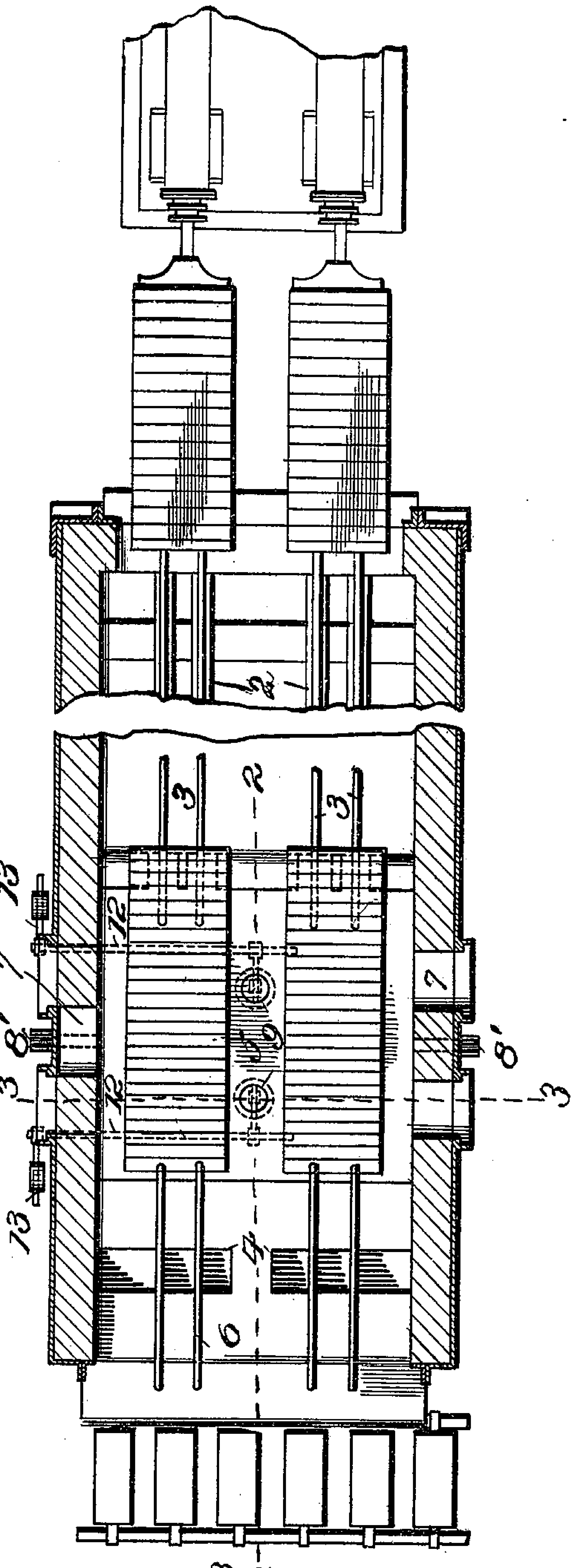


Fig. 1



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Grafton L. McGill.

INVENTOR,

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by [signature]

Att'y.

No. 671,893. Patented Apr. 9, 1901.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 6.

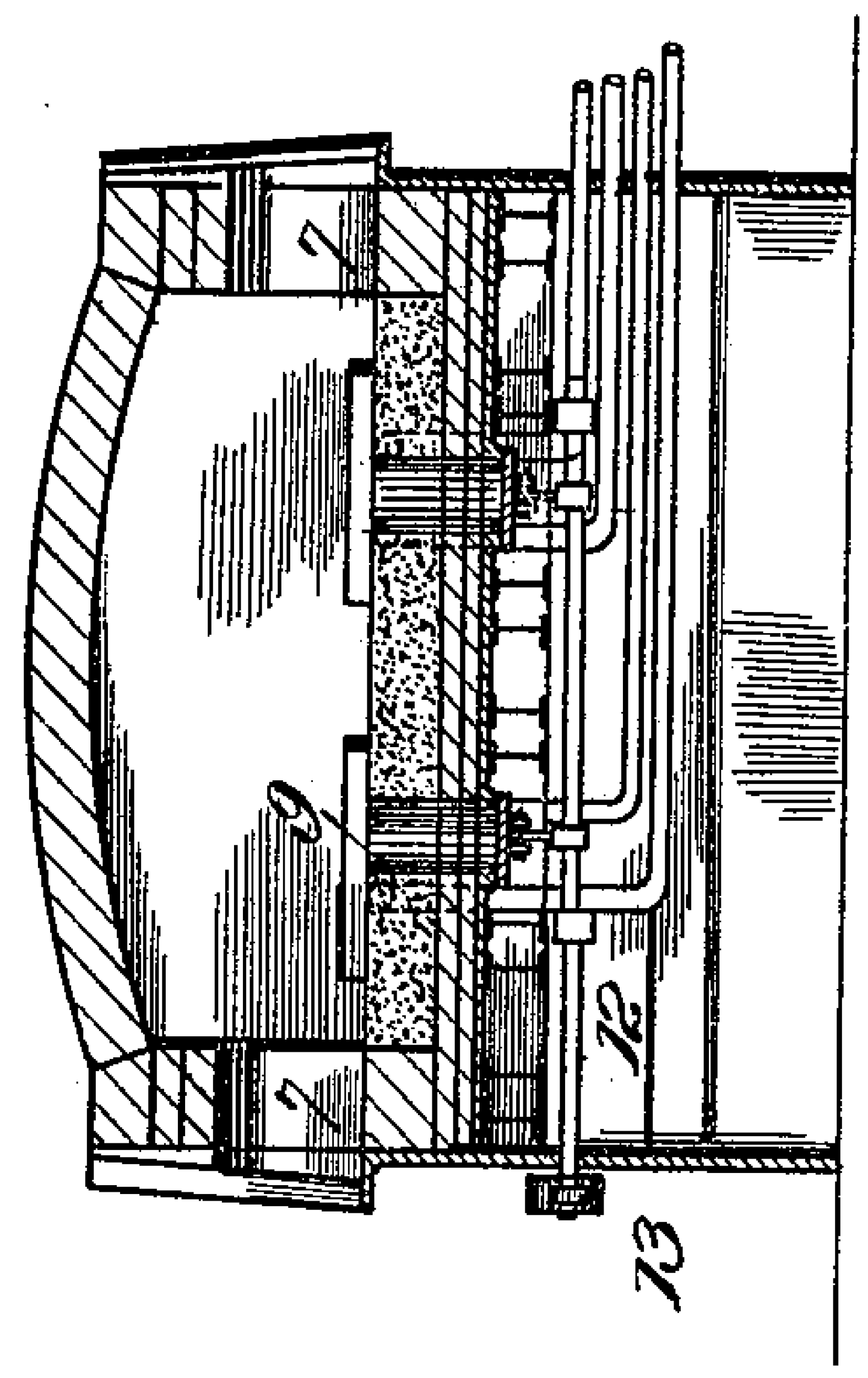


Fig. 5

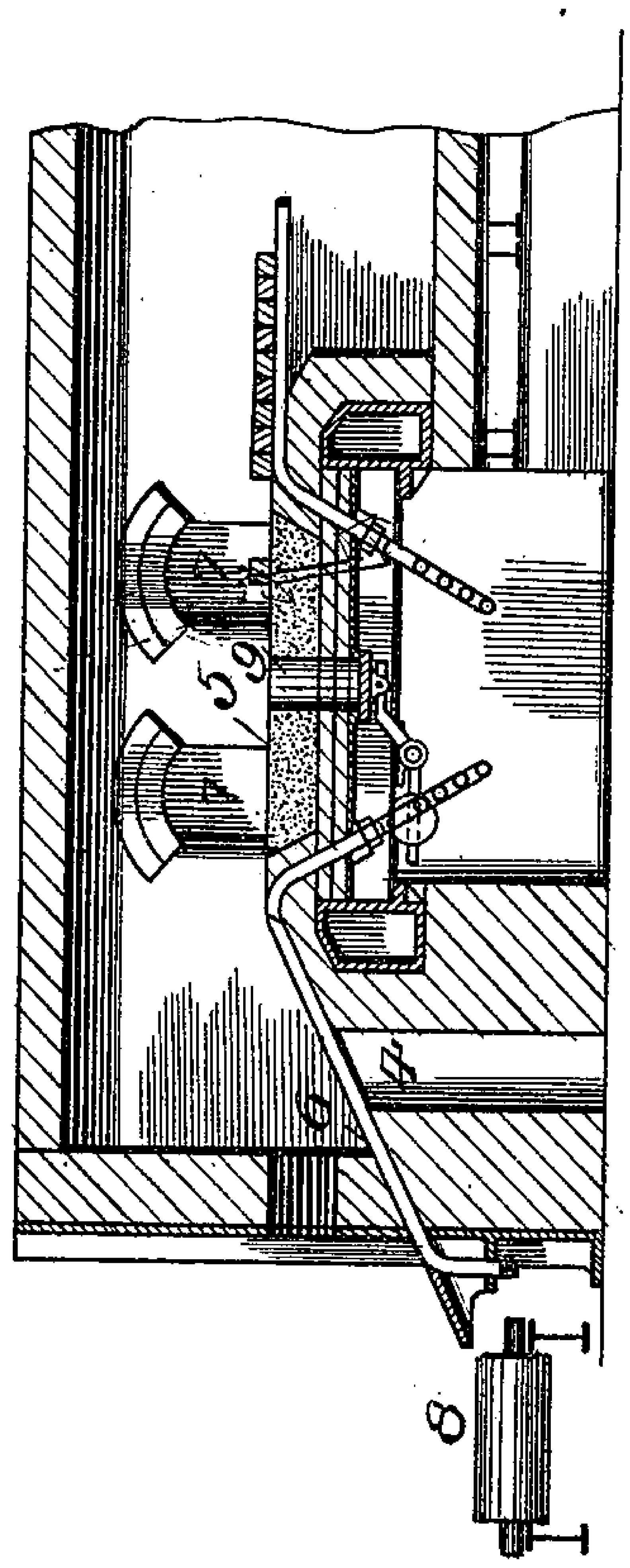
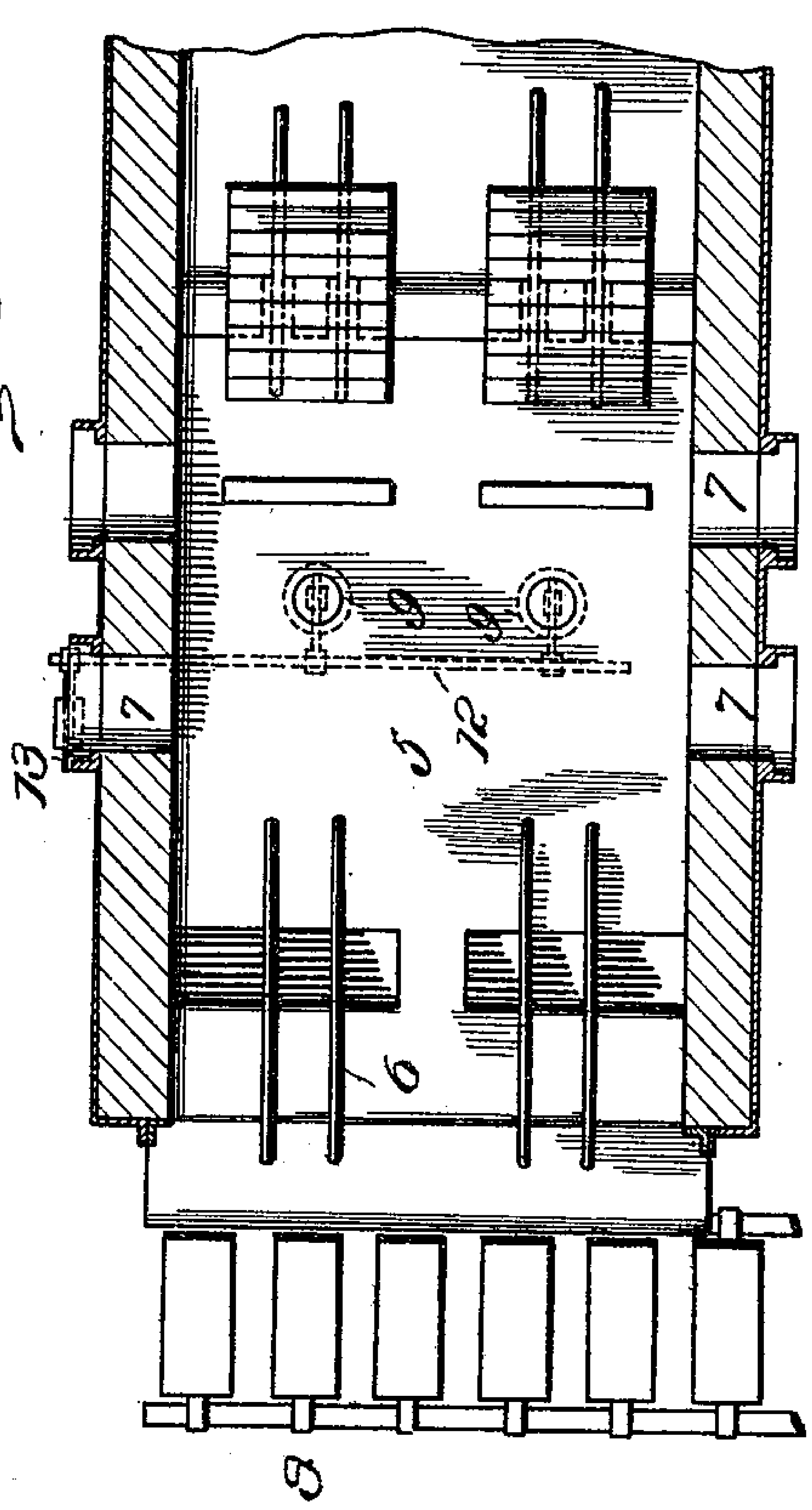


Fig. 4.



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(Application filed Sept. 17, 1900.)

(No Model.)

4 Sheets—Sheet 3.

Fig. 9

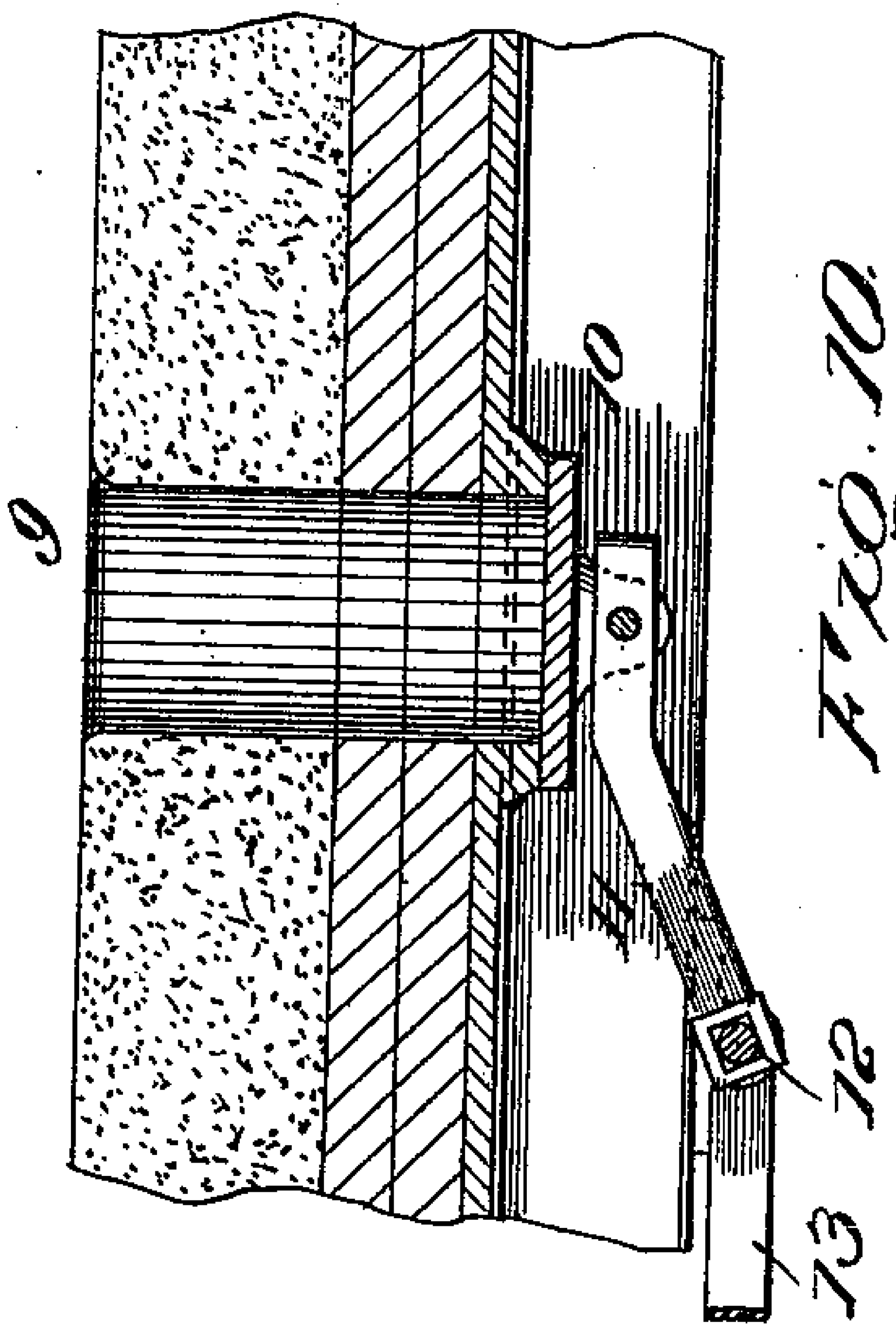


Fig. 10

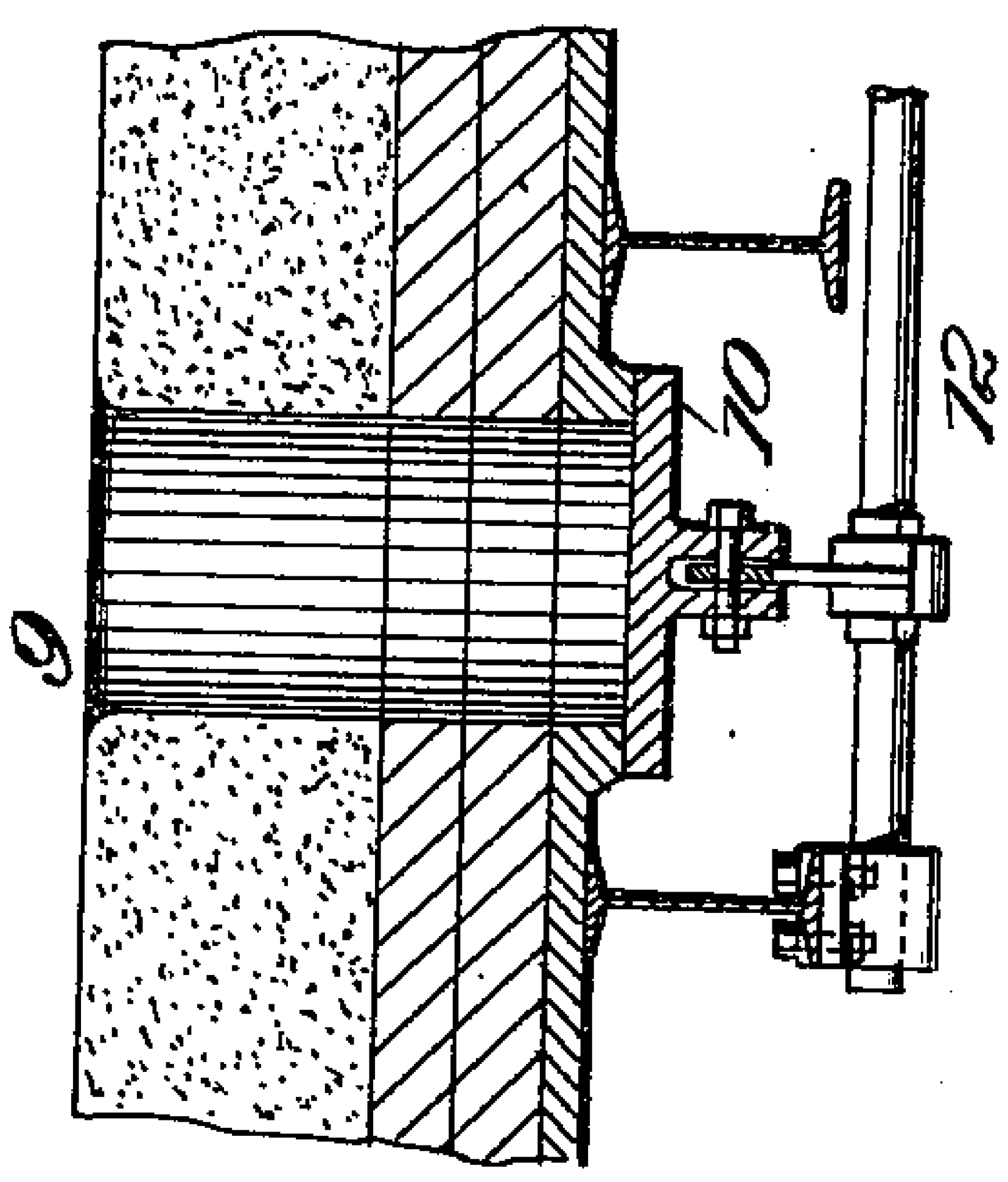


Fig. 8

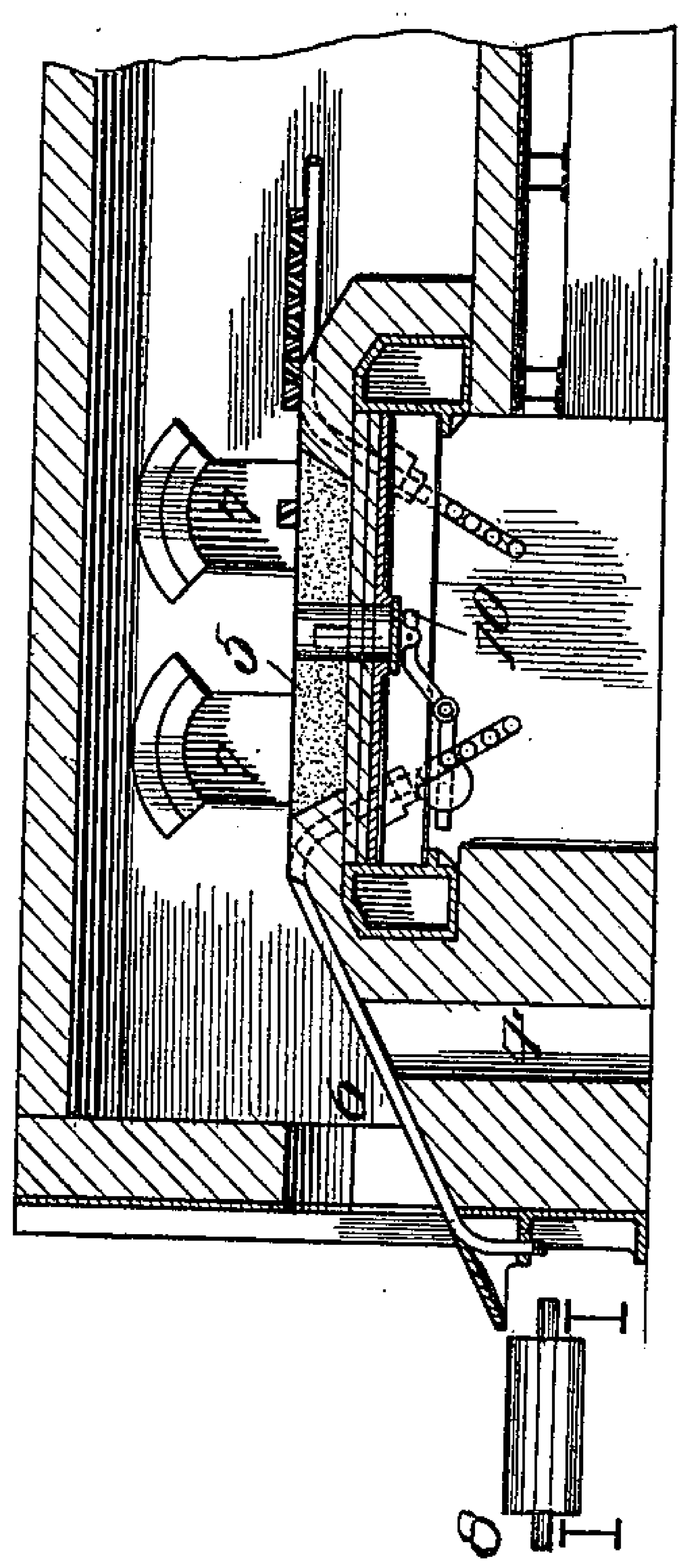
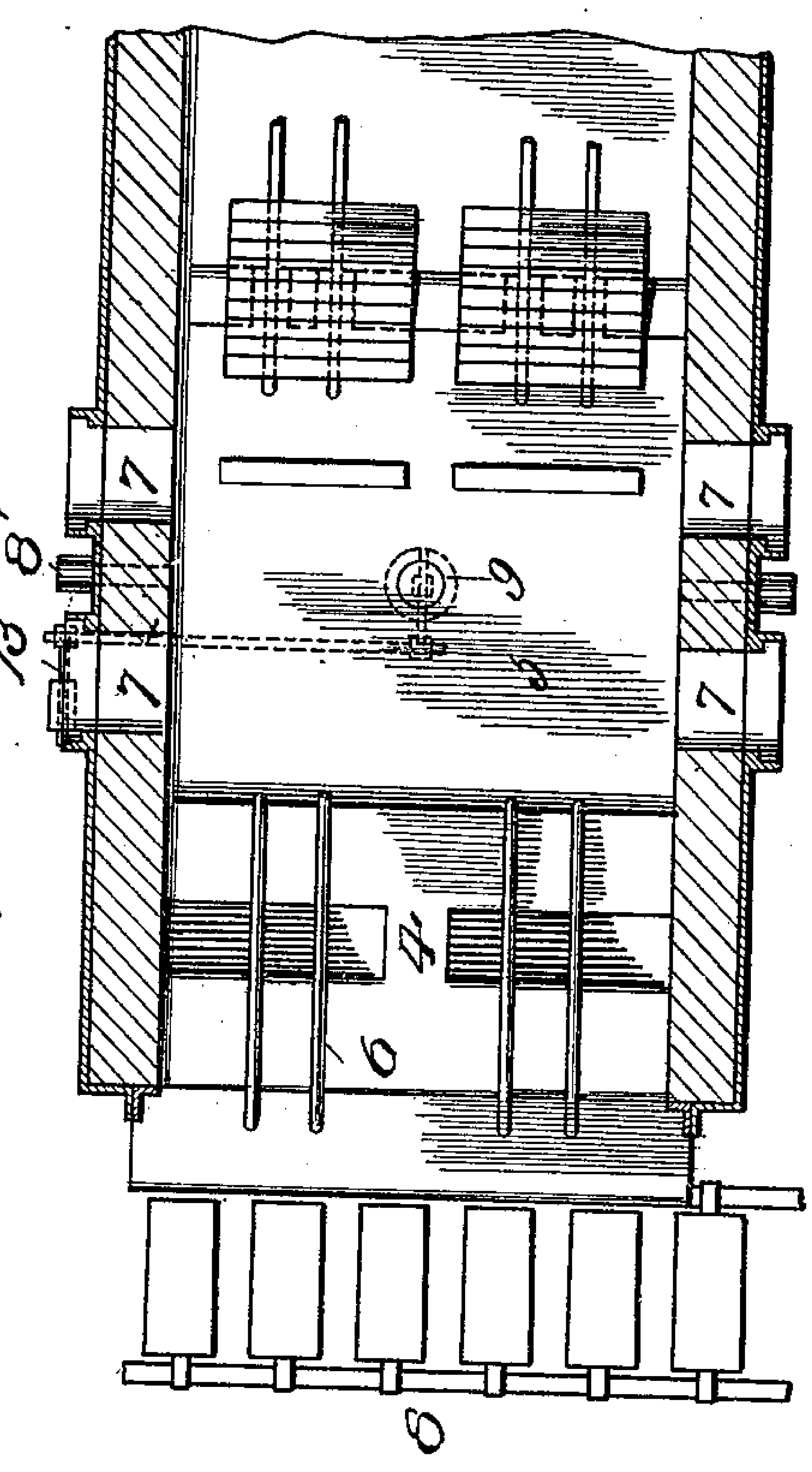


Fig. 7



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CONTINUOUS HEATING FURNACE.

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(No Model.) 4 Sheets—Sheet 4.

Fig. 13

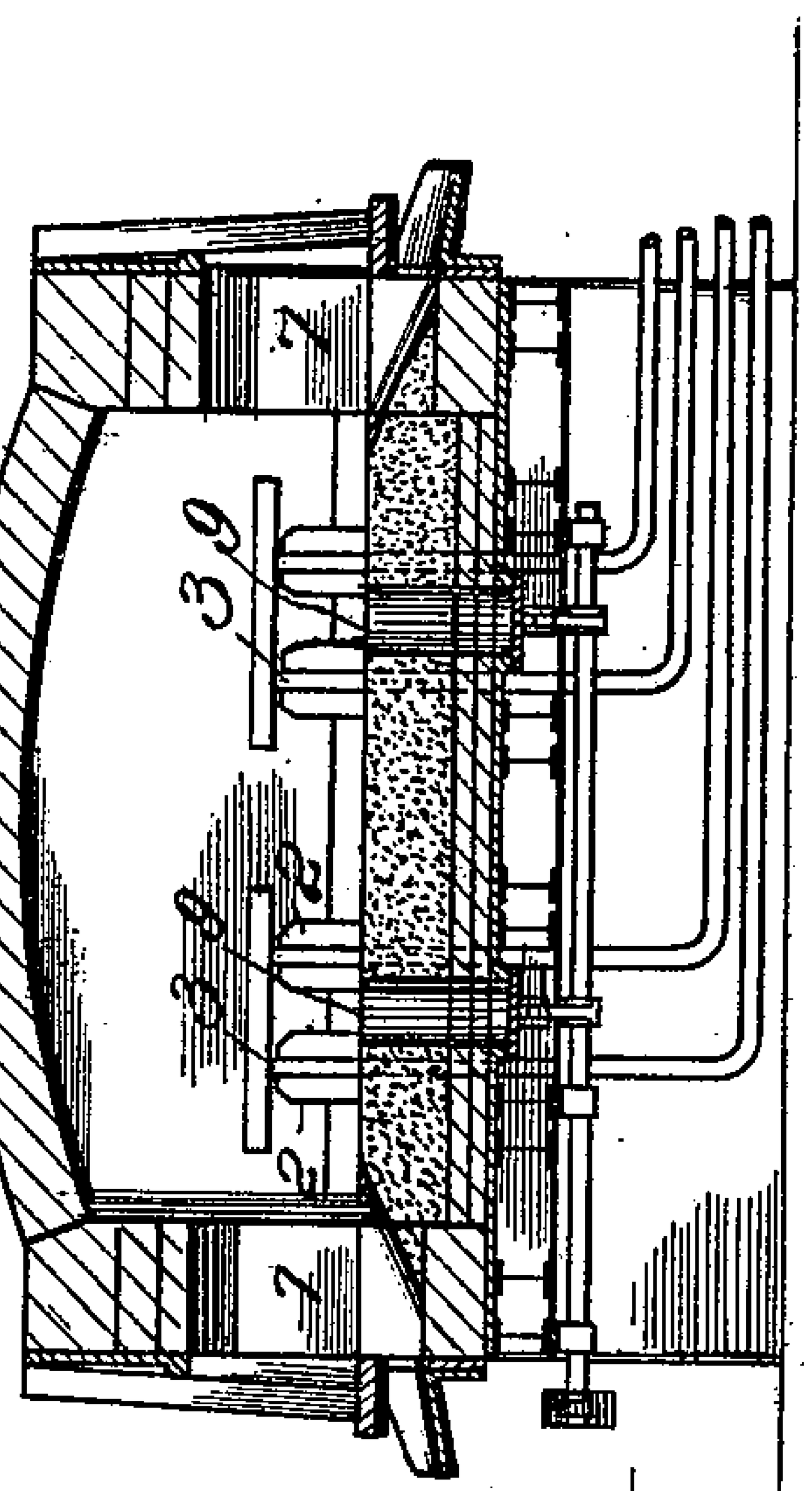


Fig. 12

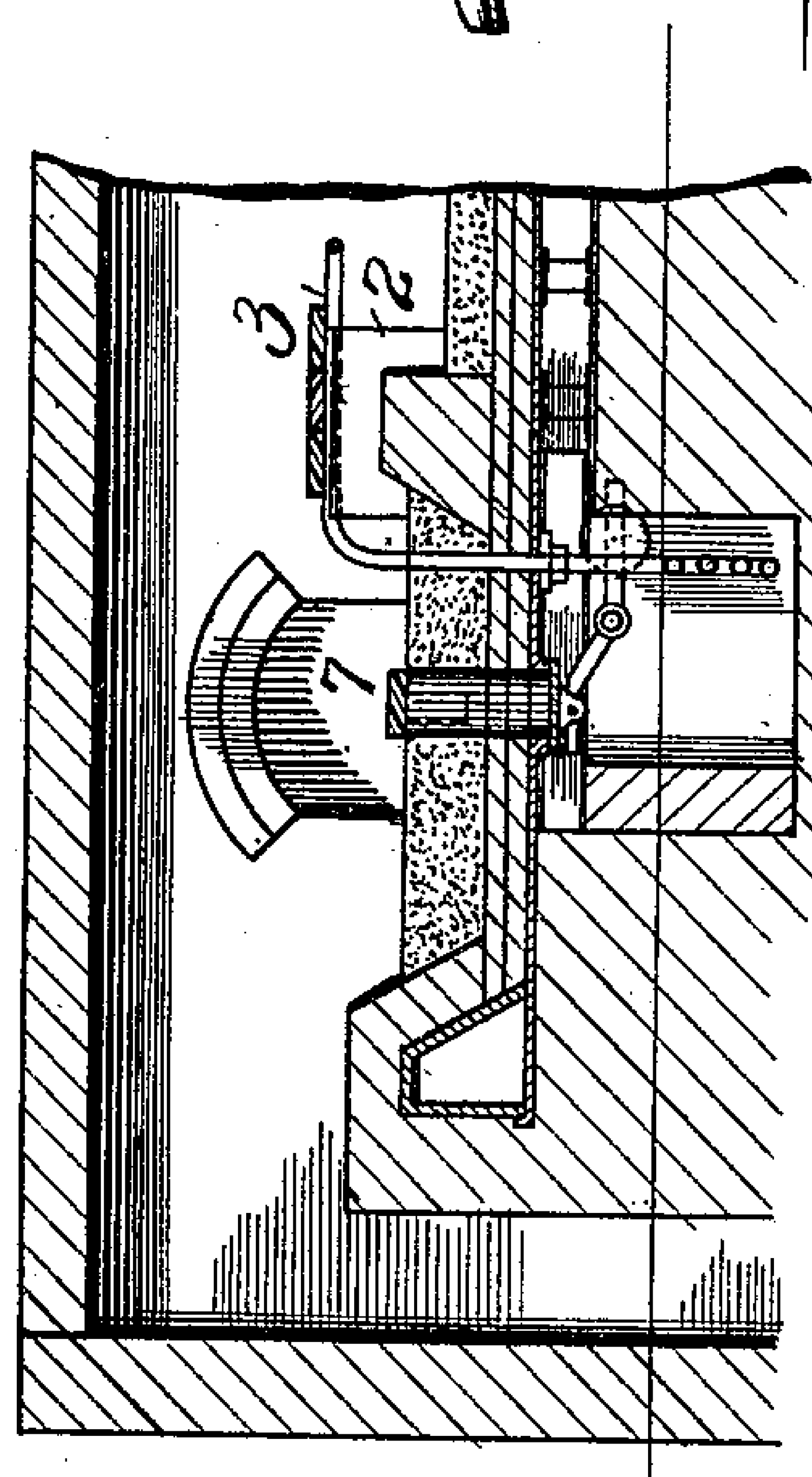
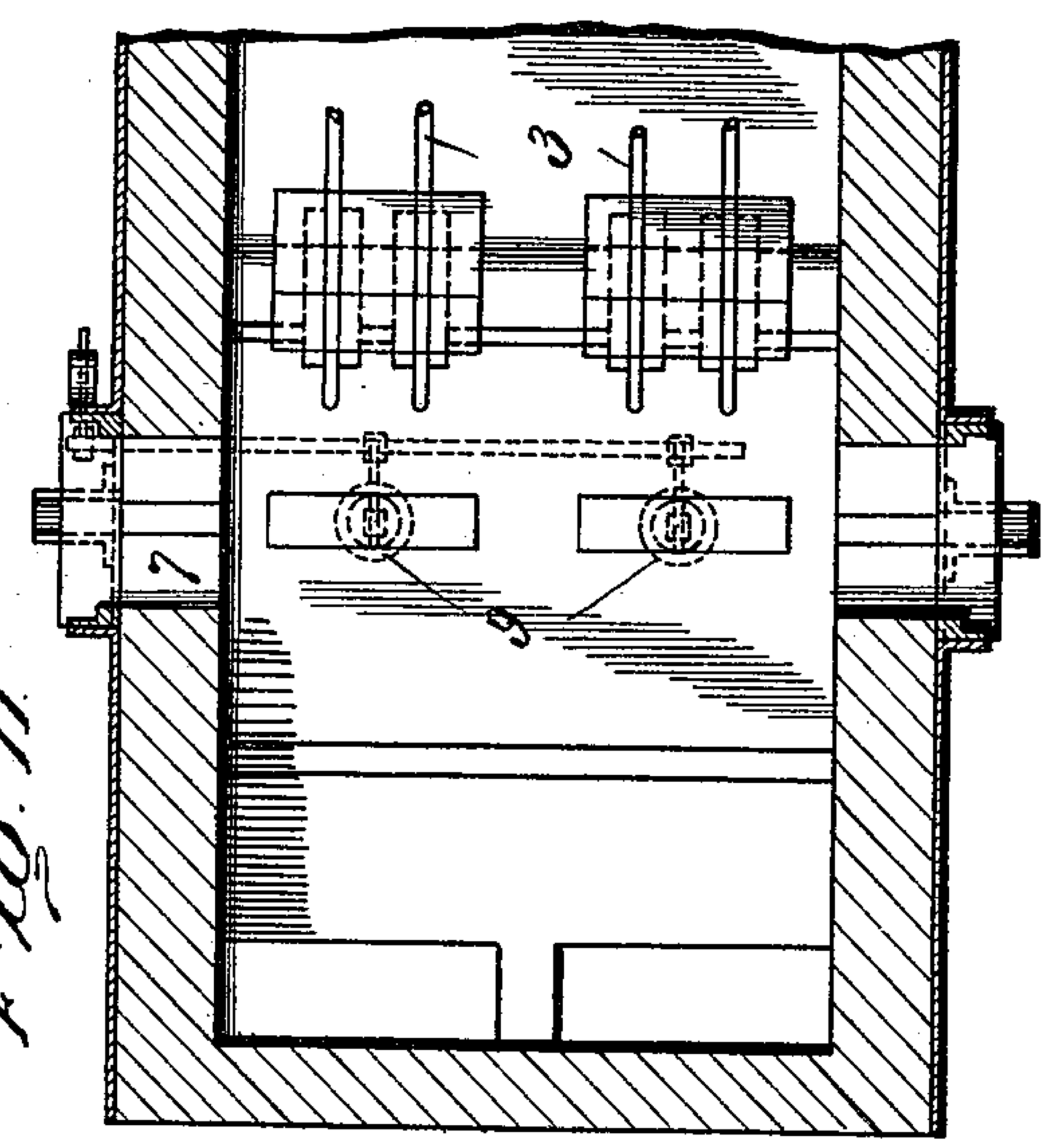


Fig. 11



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Alexander Laughlin,

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALEXANDER LAUGHLIN, OF SEWICKLEY, PENNSYLVANIA.

CONTINUOUS-HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 671,893, dated April 9, 1901.

Application filed September 17, 1900. Serial No. 30,281. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER LAUGHLIN, of Sewickley, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Continuous-Heating Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention has reference to continuous-heating furnaces. In these furnaces, as is well known, the slabs, billets, or other articles are charged into one end and are continuously heated as they travel toward the other end of the furnace, where they are discharged either automatically or by an attendant. The supports over which the slabs, &c., travel are usually equipped with pipes, through which the water is caused to circulate to prevent injury by the heat of the furnace. Furnaces thus constructed are satisfactory where employed for heating billets for rod-mills, bar-mills, and others where the billets are rolled down into very small sections; but when the furnace is used for heating slabs for plate-mills the dark spots left on the slabs by the water-pipes will, when the slab is rolled into a long wide strip, show in the finished plate. To obviate this and remove the dark spots, furnaces have been provided with intermediate hearths of sand, over which the slabs, &c., are caused to travel before being discharged. The successful operation of furnaces having hearths of sand or other refractory material requires that all cinder dropping on the hearth be quickly removed. Otherwise its accumulation prevents the pushing of the slabs or billets in a horizontal line over the hearth, or where they are otherwise moved thereover objection arises from the fact that the sand or other material forming the hearth soon becomes spongy and it is impossible to keep the hearth hard and smooth, which latter is essential to good heating. Where, as is most generally the case, two lines of slabs or billets are worked in a single furnace, the tendency is for the ends of the slabs or billets toward the longitudinal center of the furnace to get hotter than the ends toward the sides, and in consequence the cinder will be running more freely from the slabs or billets at their inner than at their outer ends. The slabs or billets being constantly passed over the hearth, either in solid lines or one at a time, it is not practicable to remove the cinder by means of grooves running transversely of the hearth to openings in the side walls of the furnace, especially when it is necessary to keep the hearth-surface practically horizontal for the passage of a continuous line of slabs or billets.

The object of my present improvements is to provide means for insuring the removal of cinder from the hearth. This I accomplish by running the cinder through the bottom of the hearth. Cinder holes or pockets are formed in the body of the hearth, and the accumulated cinder is periodically discharged preferably through doors which normally close the lower ends of the pockets.

Preferred forms of embodiment of the invention will be hereinafter fully set forth and the invention itself particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a horizontal sectional view, parts being broken away, of a furnace equipped with my present improvements. Fig. 2 is a vertical section on line 2 2, Fig. 1. Fig. 3 is a transverse section on line 3 3, Fig. 1. Figs. 4, 5, and 6 are respectively horizontal, vertical, and transverse sectional views of a furnace, showing a slight modification. Figs. 7 and 8 are respectively horizontal and vertical sections of a furnace, showing a second modification. Figs. 9 and 10 are enlarged vertical sectional views at right angles to each other of portions of the hearth through a cinder-hole. Figs. 11, 12, and 13 are respectively horizontal, vertical, and transverse sections of a furnace, showing a third modification.

The general construction of the furnace may be after any preferred form—such, for instance, as is shown in reissued Letters Patent No. 11,666, of May 31, 1898, or Letters Patent No. 582,477, of May 11, 1897, or Letters Patent No. 588,702, of August 24, 1897, each issued to me.

On the bed 1 are supports 2, upon which are the rails or bearing-surfaces 3, over which the slabs or billets pass transversely from the charging end of the furnace, being moved gradually through the furnace toward the discharge end by any suitable means. The rails

3 preferably consist of tubes, through which water is caused to circulate. The fuel, such as gas and air, is admitted through ports 4 at or near the discharge end of the furnace. The present improvement is equally applicable to furnaces fired direct with coal or any other fuel.

A hearth or receiving-bed 5 is located in the line of passage of the slabs and is preferably on the same horizontal plane as the adjacent ends of the bearing-rails; but such hearth may be considerably below the elevated supports, as shown in Figs. 12 and 13. Inclined bearing-surfaces 5 may extend from the hearth over the ports 4 and through an end opening to effect the quick automatic movement of the slabs past the ports and onto a conveyer 8, as shown and described in said reissued Letters Patent No. 11,666. In the sides of the furnaces are door-openings 7, and adjacent to these in some instances (see Figs. 1, 7, and 11) there may be the ordinary outlets 8′ for the cinder which accumulates on the hearth. To enable all cinder to be removed from the hearth, I form the latter with tapping holes or pockets 9, which extend vertically through the hearth and its support and are normally closed at their bottoms or lower ends by doors 10, mounted on arms 11, secured to counter-shafts 12, extended to one side of the furnace. On these shafts 12 are weighted arms 13, which serve to keep the doors closed, save when it is desired to empty cinder from the holes. These cinder-holes may be formed on the same longitudinal line between the two rows of slabs (see Fig. 1) or they may be on the same transverse line directly beneath the line of passage of the slabs, (see Fig. 4,) in which event one counter-shaft will suffice for both doors, or a single cinder-hole may be employed, as shown in Figs. 7 and 8.

The slabs may be moved over the hearth in a continuous line until they reach the inclined rails, when they will be discharged automatically onto the conveyer, (see Figs. 1 and 2,) or each slab as it reaches the forward ends of the rails 3 may be rolled over the hearth by the heater or attendant until it reaches the inclined rails, as seen in Figs. 4, 5, 7, and 8, or, as shown in Figs. 11, 12, and 13, the slabs after they fall from the elevated rails onto the hearth may be withdrawn by tongs in the usual manner through door-openings 7, the inclined discharge-rails being omitted.

The cinder running from the slabs will be gathered in the holes, allowing continuous lines of slabs to be moved over the hearth and preventing the sand or other refractory material of which the hearth is composed from becoming spongy and uneven on its upper surface. These cinder-holes may, if desired, be used in addition to the ordinary side outlets; but as they alone serve the intended purpose by being in the bottom of the hearth such side outlets are not necessary. The cinder-holes being normally closed, cold air, which would otherwise have a tendency to oxidize the slabs, is excluded, and the cinder is prevented from being chilled while in the holes, thus insuring its free running when the doors are removed for that purpose.

I claim as my invention—

1. In a continuous-heating furnace, a hearth or receiving-bed, onto which the slabs or billets are moved before being discharged, having a cinder-tapping hole extending upwardly therethrough in which cinder is designed to be received, the slabs or billets being caused to travel over or in proximity to said hole before being discharged, means for so moving the slabs or billets, means for normally closing said hole at its lower end, and means for actuating said closing means for emptying said hole, as set forth.

2. In a continuous-heating furnace, a hearth or receiving-bed, onto which the slabs or billets are moved before being discharged, having a cinder-tapping hole extending upwardly therethrough for the accumulation of cinder, means for so moving the slabs or billets, a door or cover for said hole, and means for opening said door or cover for emptying the accumulated cinder, as set forth.

3. In a continuous-heating furnace, a hearth or receiving-bed onto which the slabs or billets are moved before being discharged, said hearth having a cinder-tapping hole extending upwardly therethrough wherein cinder is designed to accumulate, means for so moving the slabs or billets, a door or cover for said hole, and means at the side of the furnace for opening such door to discharge the accumulated cinder, substantially as set forth.

4. In a continuous-heating furnace, a hearth or receiving-bed onto which the slabs or billets are moved before being discharged, said hearth having a cinder-tapping hole extending upwardly therethrough, means for so moving the slabs or billets, a door or cover for closing said hole, means at the side of the furnace for opening such door, and means for normally holding the latter closed, substantially as set forth.

5. In a continuous-heating furnace, a hearth, onto which the slabs or billets are moved before being discharged, having vertically-disposed cinder-tapping holes extending upwardly therethrough in which holes cinder is designed to accumulate, means for so moving the slabs or billets, doors normally closing said holes at the lower ends, said doors being designed to be periodically opened to empty the cinder from the holes, shafts to which said doors are connected, and weighted levers on said shafts for normally holding the doors in one position, substantially as set forth.

6. A continuous-heating furnace having a charging-opening at one end, discharge-openings at or near the other end, means for moving slabs from the charging end to the discharge end, a hearth or receiving-bed having a cinder-tapping hole formed therein for the reception of cinder, means for moving the slabs

in proximity to said hole, and means whereby the latter may be periodically emptied of accumulated cinder, substantially as set forth.

7. A continuous-heating furnace having a charging-opening at one end, discharge-openings at or near the other end, bearing-rails extending longitudinally of the furnace, means for moving slabs over said rails, and a hearth between the charging and discharge ends in line with said bearing-rails, said hearth having cinder-tapping holes extending upwardly therethrough, doors normally closing said holes at their lower ends, and means controllable at the side of the furnace for opening said doors, substantially as set forth.

8. A continuous-heating furnace having a charging-opening at one end, discharge-openings at or near the other end, two series of supports for the slabs extending longitudinally of the furnace, means for moving the slabs over said supports, a hearth between the charging and discharge ends over which the slabs are designed to be moved, cinder-tapping holes formed in said hearth between the lines of passage of the slabs wherein cinder is designed to accumulate, means for normally closing said holes, and means whereby said closing means may be periodically operated to empty said holes of accumulated cinder, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALEXANDER LAUGHLIN.

Witnesses:
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NEWMAN GROVES.