F. H. DANIELS.

ANNEALING FURNACE.

APPLICATION FILED JUNE 26, 1909.

936,611.

Patented Oct. 12, 1909.

5 SHEETS—SHEET 1.

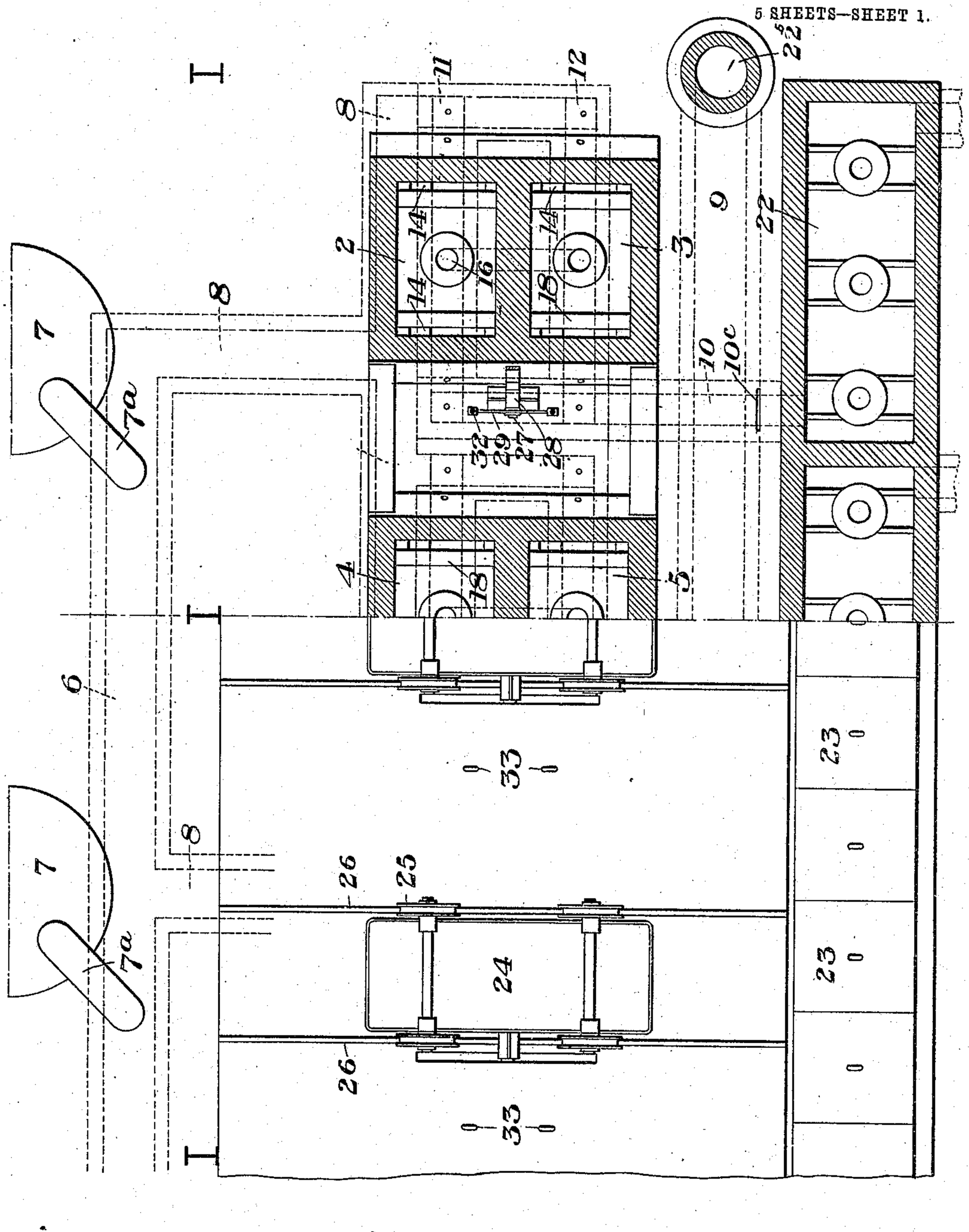

Fig. 1.

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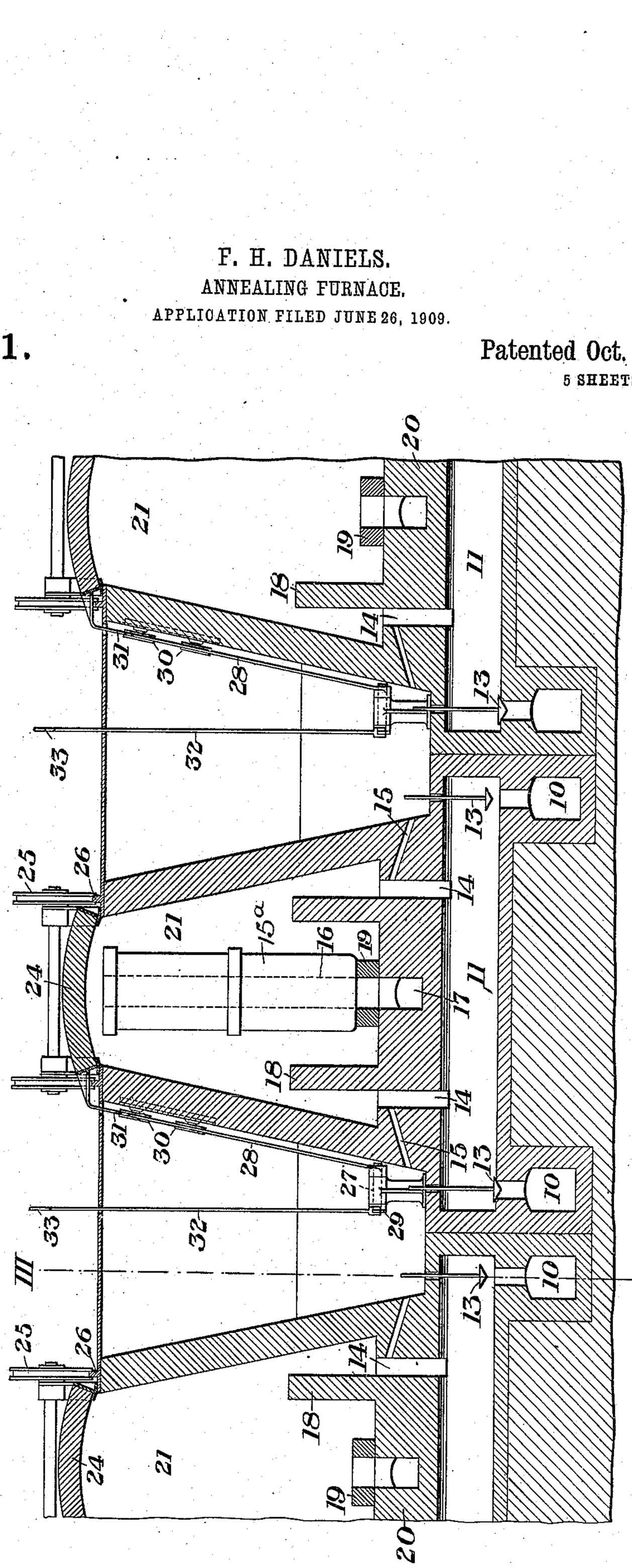
5 SHEETS—SHEET 2.

Fig. 2.



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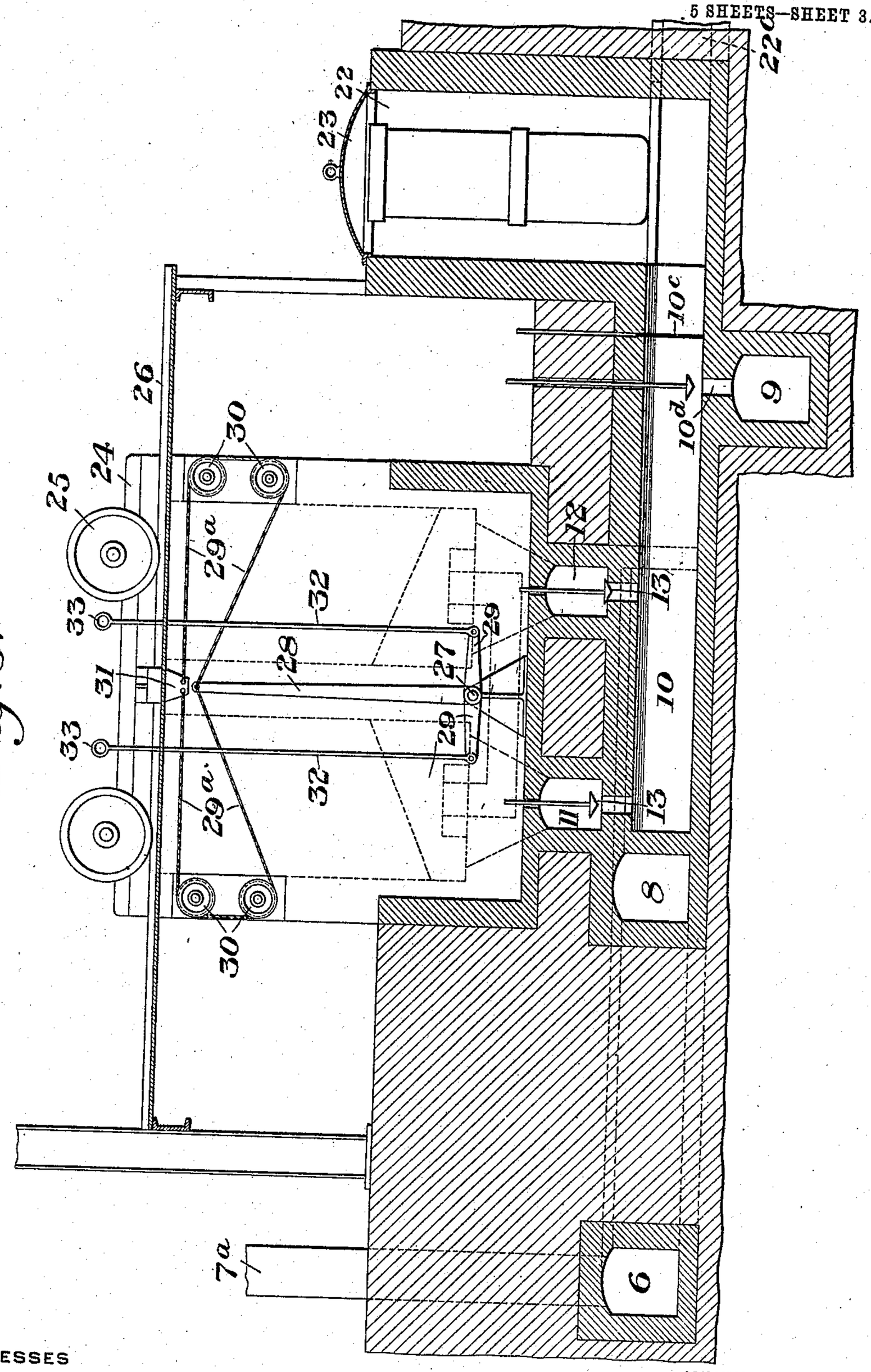
5 SHEETS—SHEET 3.

Fig. 3.



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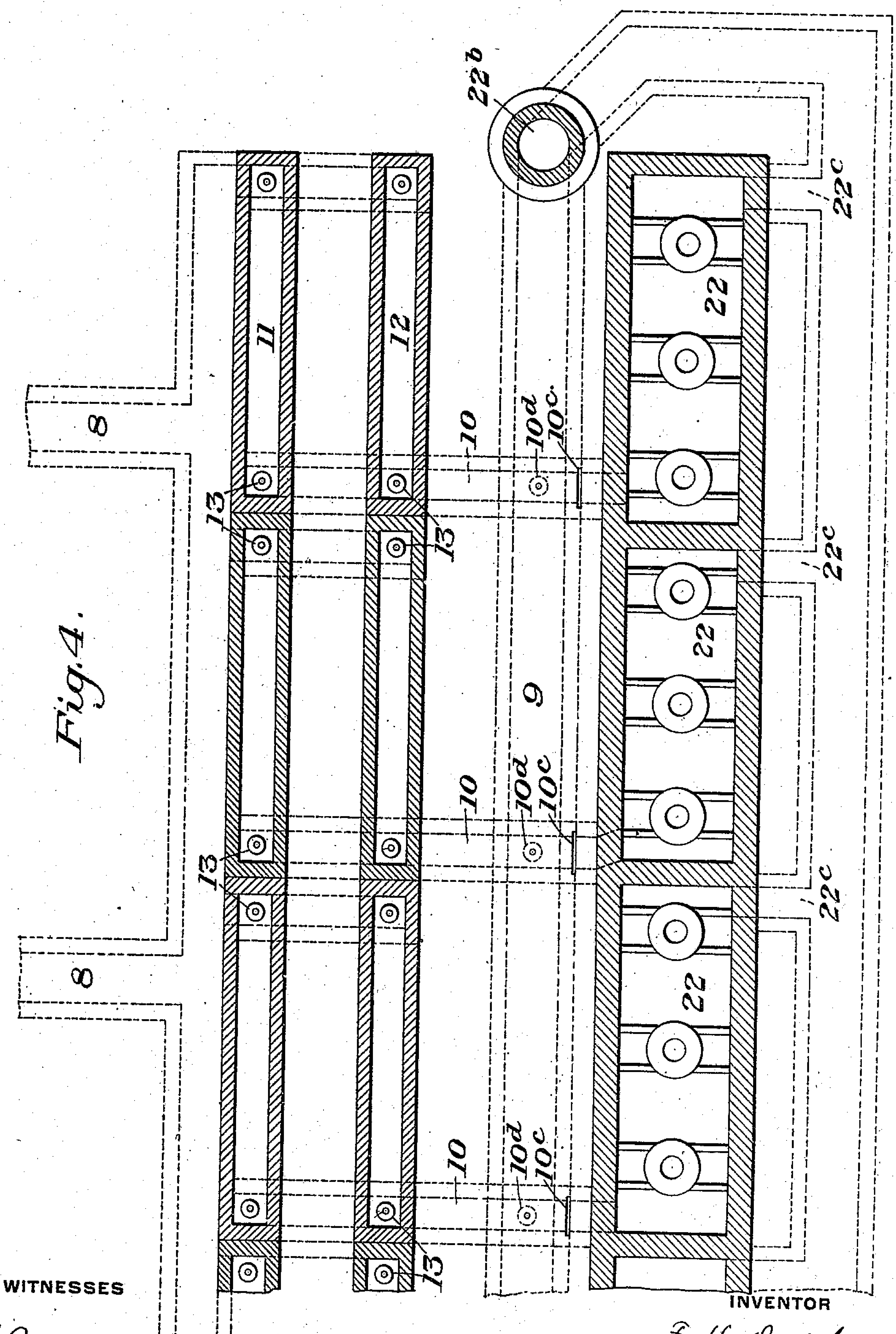

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5 SHEETS—SHEET 5.

Fig. 5.

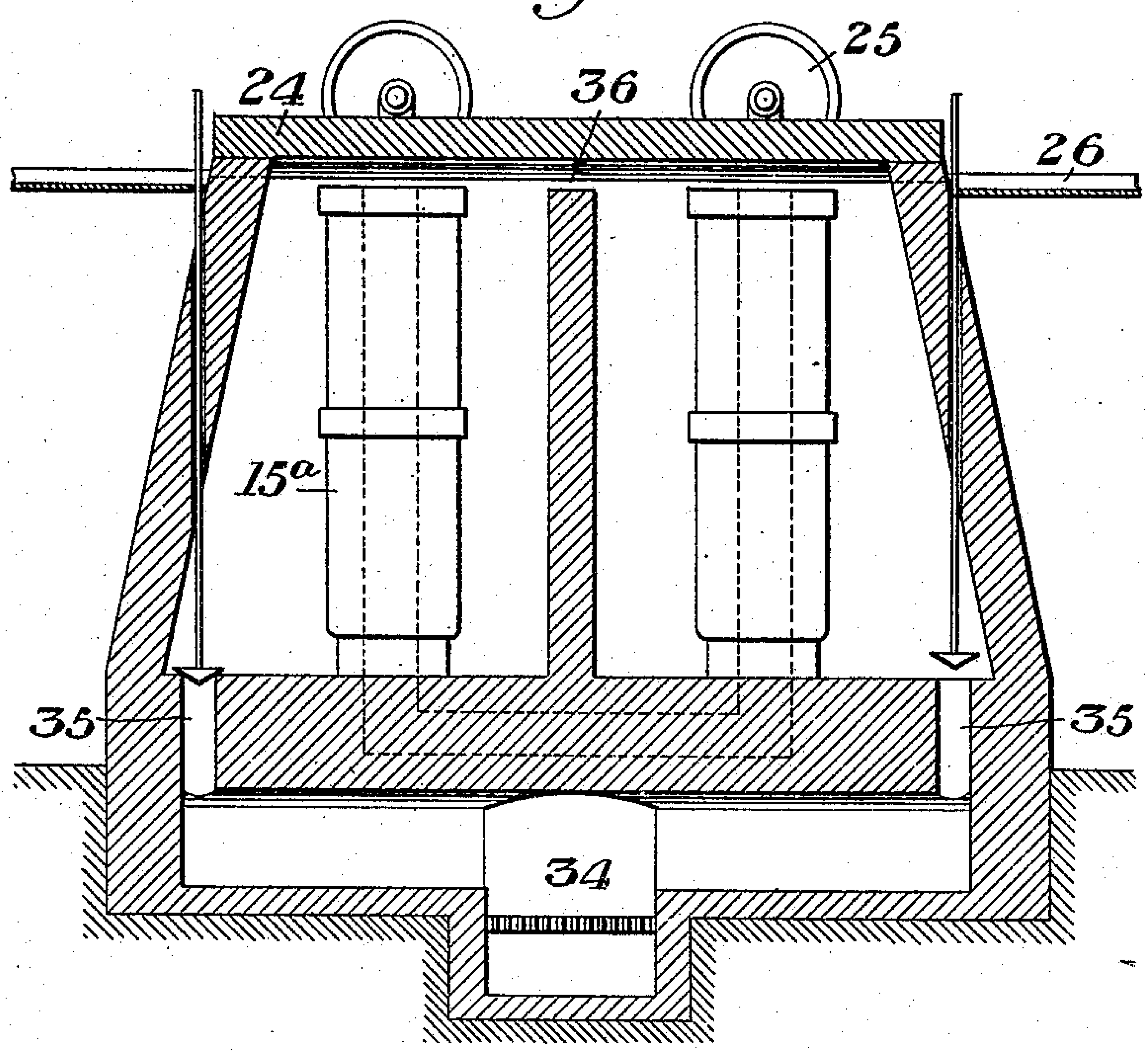
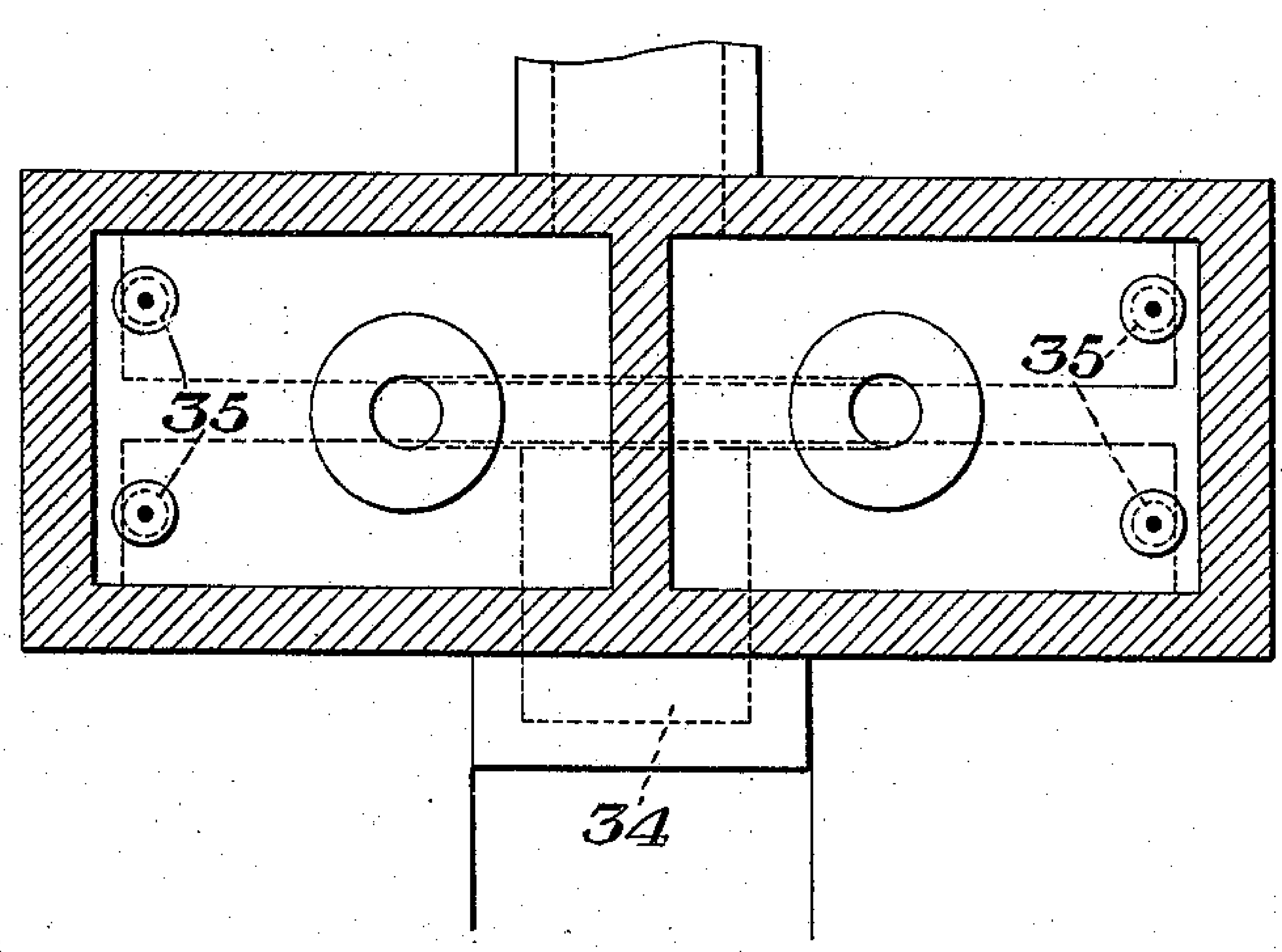


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ANNEALING-FURNACE.

936,611. Specification of Letters Patent. **Patented Oct. 12, 1909.**

Application filed June 26, 1909. Serial No. 504,503.

To all whom it may concern:

Be it known that I, FRED H. DANIELS, of Worcester, Worcester county, Massachusetts, have invented a new and useful Annealing-Furnace, 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 view partly in plan and partly in horizontal section of an arrangement of annealing furnaces embodying my invention; Fig. 2 is a longitudinal section; and Fig. 3 is a transverse section on the line III—III of Fig. 2. Fig. 4 is a sectional plan showing the flue arrangement. Figs. 5 and 6 are, respectively, vertical and horizontal sections showing a modified form of furnace.

My invention has relation to annealing furnaces, and more particularly to furnaces designed for annealing flats or wire.

The present methods of annealing flats or wire are either continuous or in coil. In the continuous method, the coils are placed on reels or blades located at one end of a tube-annealing furnace, through which the wire from the coil passes singly and at the proper speed to be annealed. It then passes on to a rewinding reel or coil-forming take-up, or else to a system of shears, where it is cut into lengths. Annealing in coils is a more common method. In this method, a number of coils are placed in a cylindrical pot which is usually sealed, and placed in a suitable annealing furnace. After the wire is properly annealed, the pots are taken out and allowed to cool down, while another filled pot is annealed. There are some serious disadvantages connected with this way of annealing, as heretofore practiced. In the first place, a large amount of heat is lost, due to the short period of time the flame is in contact with the pots. In the second place, the bundles are not heated uniformly throughout, on account of their compactness. This is especially noticeable with flat shapes, reeled ribbon fashion, as there is practically no air space between the different layers, the bundle being almost as difficult to heat uniformly as if it were a solid piece of metal.

My invention is designed to provide annealing furnaces having a long passageway for the hot gases around the pots, the pots and annealers being arranged in pairs, and the gases passing from one annealer to the other. In this manner, I provide means whereby the second pot may be slowly heated up before being subjected to the greatest heat, or this pot may be the one which has previously been in the hottest flame, and which is now gradually cooling off in the escaping gases from the first pot. A further feature of the invention consists in making the flame travel both interiorly and exteriorly of the pots, so that the length of the pass of the flame is very greatly increased, and the coils are heated from the inside as well as from the outside. Further features and advantages of the invention will hereinafter appear.

Referring to the drawings, the numerals 2, 3, 4 and 5 designate annealers arranged in pairs.

6 is a main gas flue, connected with the gas producers 7 by the down-take pipes 7^a, and having branches 8, one branch for each pair of annealers.

9 is a stack flue and 10 designates the outlet flues for the several pairs of annealers. Above the branch flues 8 and 10 are cross flues 11 and 12, which communicate with the flues 8 and 10, through the mushroom valves 13. The flues 11 and 12 communicate with the interior of the annealing chambers through the ports 14.

15 designates the air inlet passages, which communicate with the ports 14 near the point where they discharge into the annealing chambers, these passages being connected to suitable supply pipes, not shown. Combustion takes place at the air inlets, the flame passing upwardly from the ports 14, and around the pot or pots 15^a. The pots are provided with central vertical flues 16, which communicate at their lower ends with passages 17, connecting the flues 16 of the pots of the two annealers of one pair. The gases, therefore, pass down through the central flue 16, in the pot of one annealer, thence through the passages 17, thence up through the center of the pot or pots in the other annealer, and then down around the pot, and finally out to the stack. By reversing the valves 13, the gases are made to travel in the opposite direction, the regulating valves in the air supply pipes for one annealer being closed and those of the supply pipes for the other annealer of the pair being open.

18 designates baffle walls, placed adjacent to the lower portions of the ports for protecting the pots against the greatest heat.

19 is a support preferably of cast iron

which protects the brick-work 20 from injury in setting the pot.

The partition wall between the annealers of each pair can be opened up at the point indicated at 21, in Fig. 2, and by opening up this wall at this point and closing the cross flue 17, the gases are made to travel directly from one annealer to the other, without passing centrally through the pots. This will make the total passageway for the gases only about one-half as long, but still provides for practically doubling the heating surface, as compared with the old method.

22 designates a pit which runs along one side of the annealer and which is provided with suitable removable covers 23. This pit is shown as being divided into a number of compartments to each of which leads one of the flues 10 from one pair of annealers, so that tne escaping gases from the annealers are made to pass through this pit on their way to the stack or chimney 22^b, which is connected with the compartments of the pit by the flues 22^c. Each of these flues 10 is shown as having a controlling damper 10^c and also a valve controlled port 10^d which connects said flue with the flue 9 leading direct to the stack. The pots, after having been properly annealed, are placed in this pit 22; and owing to the fact that they are surrounded by the escaping gases, they do not cool off so rapidly, but time is allowed for the initial heat to spread and equalize itself over the material, this process being called soaking. After the pots with their contents have been properly annealed and soaked, the gases can, by means of the dampers 10^c be cut off from this compartment of the pit, and be caused to pass through the port 10^d and direct to the stack 22^b. The pots are then allowed to cool off more rapidly until they reach a temperature at which they can be discharged. The pit 22, therefore, serves the two purposes of soaking, when found necessary, and cooling. Separate cooling pits may be provided for this, but this would necessitate transferring the pots from the soaking to the cooling pits. The pit 22 may also be used to serve the purpose of preheating the pots by means of the escaping gases. After the pots have absorbed all the heat possible from the escaping gases, they can be transferred to the annealers for further annealing.

Each pair of the annealers is provided with a brick-lined cover 24, which is mounted on a wheeled truck 25, running on rails 26, across the top of the annealers.

27 designates a rock shaft, provided with a vertical arm 28, at one end, and with a cross arm 29 at the opposite end. Connected to the upper end of the arm 28 is a chain 29^a running around the series of wheels 30, and having its ends connected to the frame of the cover-supporting truck at 31.

32 designates two rods or links, connected to opposite ends of the cross arm 29, and having each an eye or hook 33 at its upper end. By engaging one or the other of these eyes or hooks with the hoist of a crane, it will be readily seen that the cover-supporting truck will be actuated to move one way or the other over the top of the furnace, this being accomplished without the use of hydraulic cylinders or other complicated machinery, such as is usually employed. The pots are preferably lifted by means of a suitable grapple, carried by an overhead crane, the manipulation being done by the man in the crane cage.

Owing to the increased length of the passageways provided for the flame and the consequent increase in heating surface, the amount of fuel required is very considerably reduced. The invention also makes it possible to gradually heat up the metal or to gradually cool it, before it is finally cooled in the specially provided cooling pit 22. The arrangement of flues, valves, etc., gives great flexibility to the annealing process. This is a feature of special importance, where the product to be annealed varies as to grade and size. The arrangement as a whole and also in the details is extremely simple and effective.

In Figs. 5 and 6 I have shown a modified form of the annealers in which they are direct fired. That is to say, they are provided with a fire-box 34 in which combustion takes place; and by means of the short ports 35 the products of combustion are led directly into the annealer. One of these ports is shown as leading from the combustion chamber to each compartment of the annealer. The partition wall between the two annealers is also shown as having a port or passage 36 at the top through which the gases may pass directly from one side to the other. This port or passage may, however, be closed up, in which case the gases will pass down through one compartment and thence across and up through the pot in the other compartment, as in the form first described.

It will be obvious that various changes can be made in the details of construction and arrangement. Thus, any suitable form of valves may be employed, other means may be provided for operating the annealer covers, and the exact arrangement of the flues may be departed from, without departing from the spirit and scope of my invention. It will also be understood that any suitable number of the annealers may be provided, the action of each pair being similar to that of the pair above described.

I claim:

1. In an annealing furnace, annealing chambers arranged in pairs, an annealing receptacle adapted to be supported in each of said chambers, and a flue or passage con-

necting the annealing receptacles, together with means whereby the heating medium may be first introduced into either one of said receptacles, and then passed through said flue or passage into the other receptacle; substantially as described.

2. In annealing apparatus, a pair of annealers arranged adjacent to each other, gas and air supply ports communicating with the lower portion of each annealer, and a passage connecting the two annealers at their lower portions; substantially as described.

3. In annealing apparatus, a pair of annealers arranged adjacent to each other, gas and air supply ports communicating with the lower portion of each annealer, and a passage connecting the two annealers, together with valve means whereby combustion may be produced in either annealer and the products of combustion then passed through the two annealers in series; substantially as described.

4. In annealing apparatus, annealing chambers arranged in pairs, annealing pots adapted to be supported in said chambers and having central vertical flues, passages arranged to communicate with said flues and connecting the annealing chambers, gas and air ports communicating with each chamber, and an outlet port also communicating with each chamber; substantially as described.

5. In annealing apparatus, annealing chambers arranged in pairs, annealing pots adapted to be supported in said chambers and having central vertical flues, passages arranged to communicate with said flues and connecting the annealing chambers, gas and air ports communicating with each chamber, and an outlet port also communicating with each chamber, together with valve means for reversing the direction of the products of combustion through the two chambers; substantially as described.

6. In annealing apparatus, two annealing chambers arranged side by side with an intervening partition wall, a circulating passage connecting the lower portion of the two chambers, gas and air supply ports for each chamber, and an outlet port for each chamber, together with valve means for controlling the fire; substantially as described.

7. In annealing apparatus, a pair of annealers arranged adjacent to each other, a flue or passage connecting the annealers, means for supplying heat to either one of the two annealers and for causing the products of combustion to pass through the two annealers in series; substantially as described.

8. In an annealing furnace, a pair of annealers arranged adjacent to each other, a partition wall between the two annealers, a flue connecting the annealers at the top and bottom portions thereof and means whereby heat may be introduced into either of said annealers and caused to escape from the other annealer; substantially as described.

9. In annealing apparatus, an annealing chamber having an outlet flue, a pit adjacent to the annealer with which said flue is connected, and means for controlling the passage of the waste gases from the annealing chamber to said pit; substantially as described.

10. In annealing apparatus, an annealing chamber, a combined soaking and cooling pit adjacent to the chamber, a flue for the waste gases passing from the annealing chamber into the soaking and cooling pit, and means for controlling the passage of the gases through said flue; substantially as described.

11. In annealing apparatus, an annealing chamber, a pit adjacent to said chamber, a flue connecting the outlet of the chamber with the flue, means for controlling the flow of gases in said flue, and means for diverting the gases from said flue; substantially as described.

12. In annealing apparatus, a plurality of annealing chambers, a pit adjacent to said chambers and divided into compartments, a flue connecting each annealing chamber with a compartment of the pit, means for separately controlling each of said flues, and means for diverting the gases from each flue to a stack or chimney; substantially as described.

13. In annealing apparatus, an annealing chamber, a cover for the chamber, a wheeled truck supporting the cover, a rock shaft, means for rocking said shaft in either direction, and an actuating connection between the shaft and the truck; substantially as described.

14. In annealing apparatus, an annealing chamber having a movable cover, a wheeled truck supporting the cover, a rock shaft, an arm connected to said shaft, flexible connections between said arm and the truck, and means for rocking said shaft in either direction; substantially as described.

In testimony whereof, I have hereunto set my hand.

FRED H. DANIELS.

Witnesses:
GEO. SIEURIN,
WM. A. BACON.