No. 699,533. Patented May 6, 1902.

J. E. & B. JONES.

SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 1.

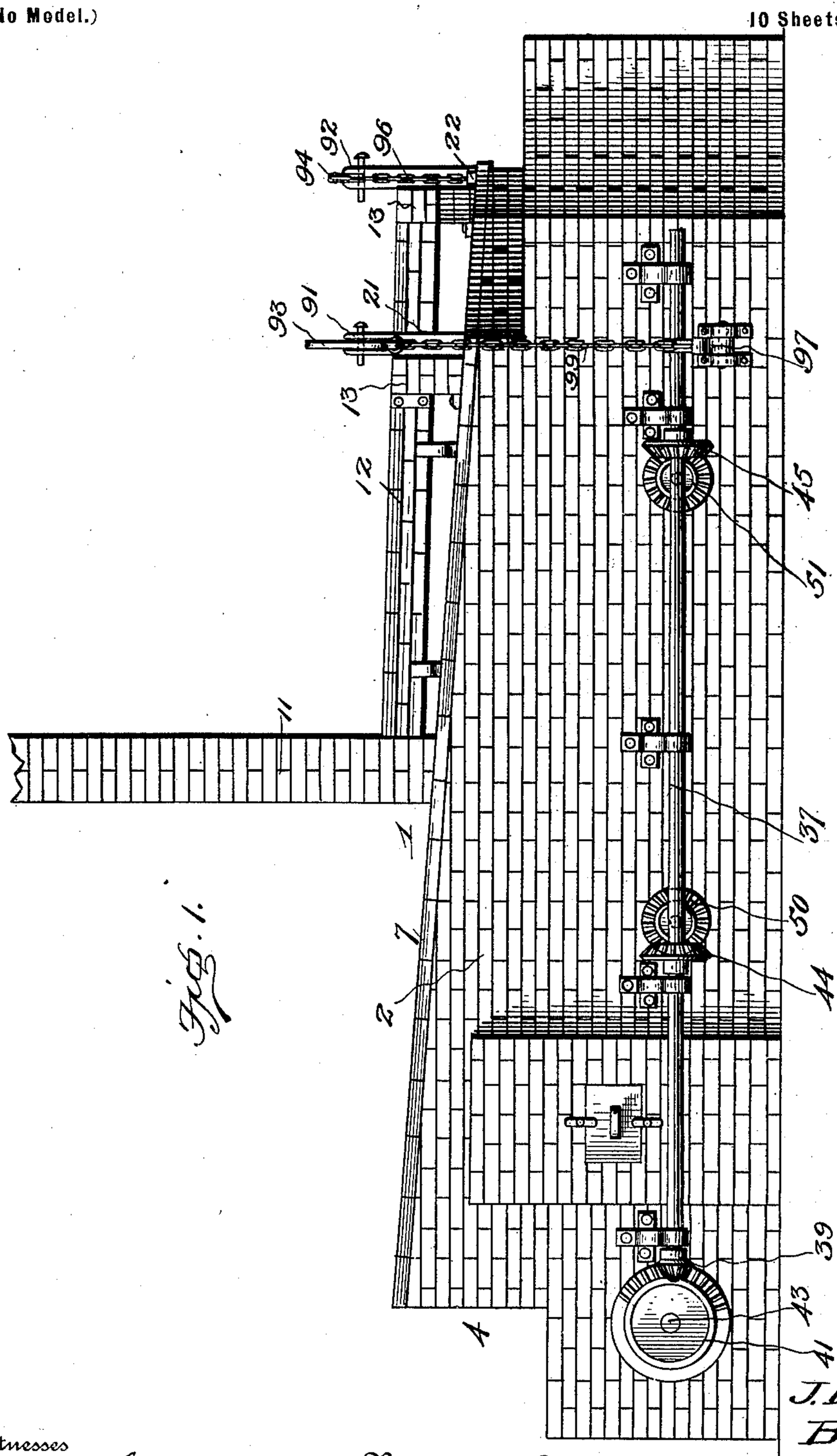

Fig. 1.

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SHEET METAL HEATING FURNACE.

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(No Model.) 10 Sheets—Sheet 2.

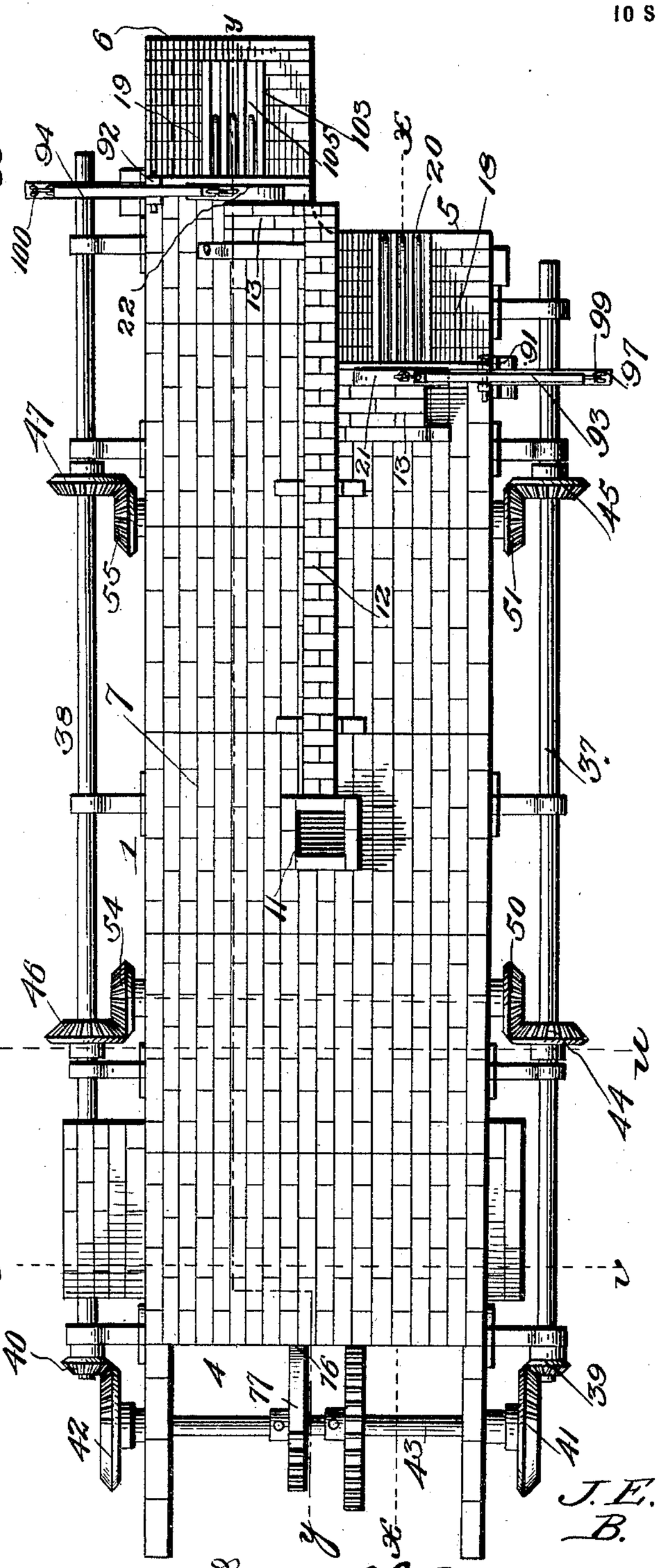

Fig. 2.

Witnesses
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No. 699,533. Patented May 6, 1902.

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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 3.

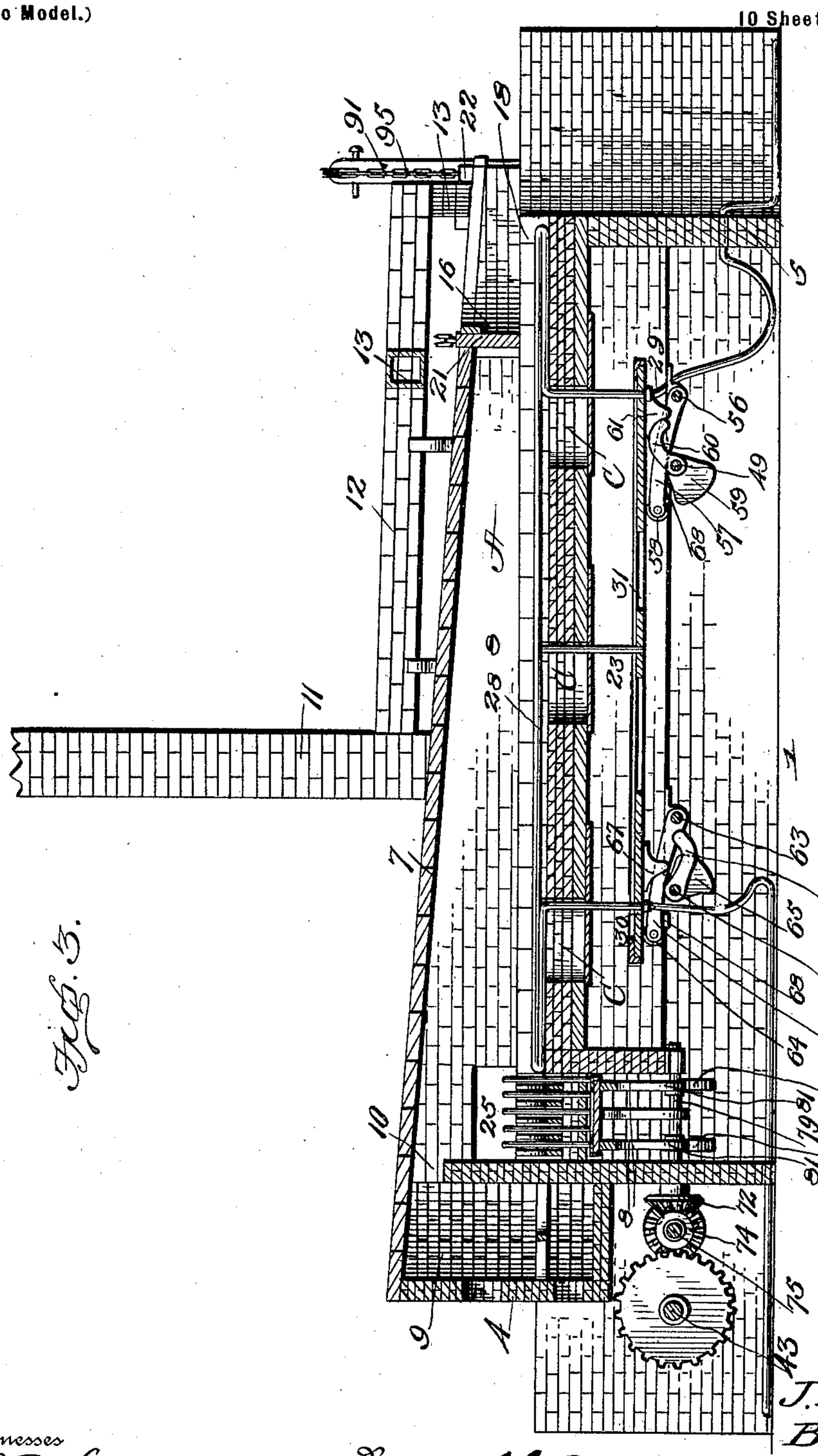

Fig. 3.

Witnesses
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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 4.

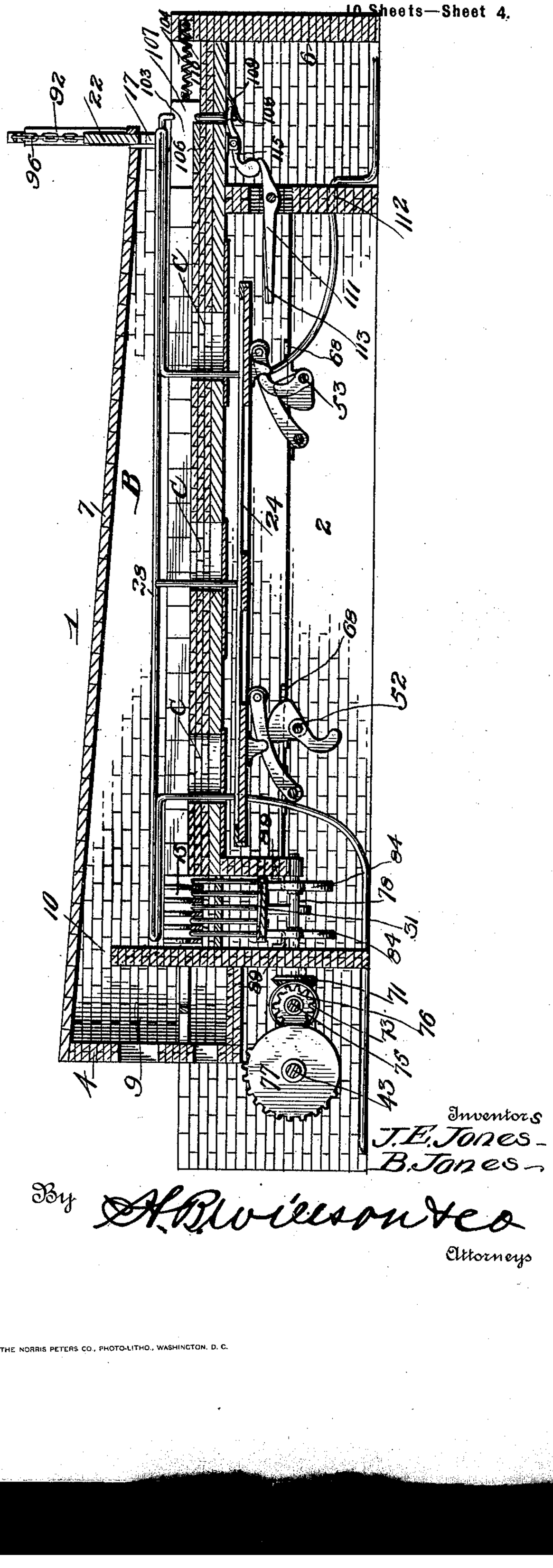

Fig. 4.

Witnesses
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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 5.

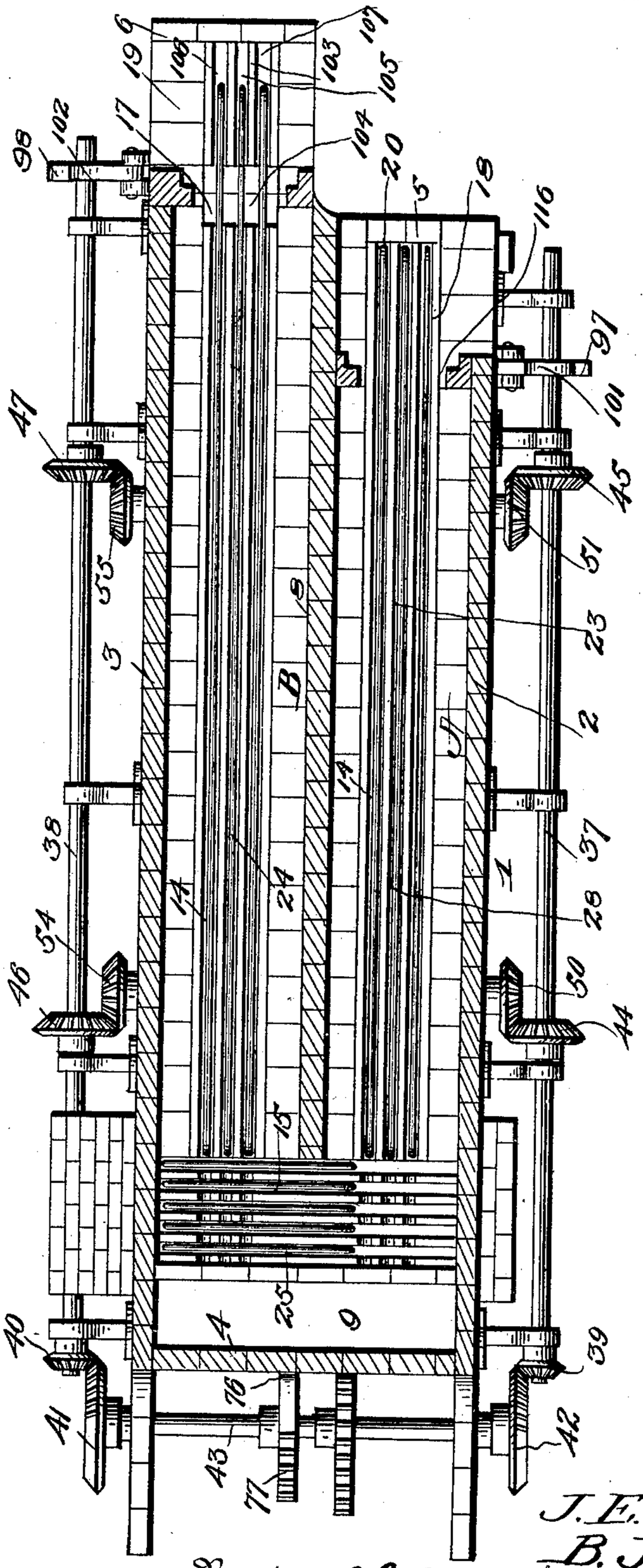

Fig. 5.

Witnesses
C. C. Hunt.
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No. 699,533. Patented May 6, 1902.

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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 6.

Fig. 6.

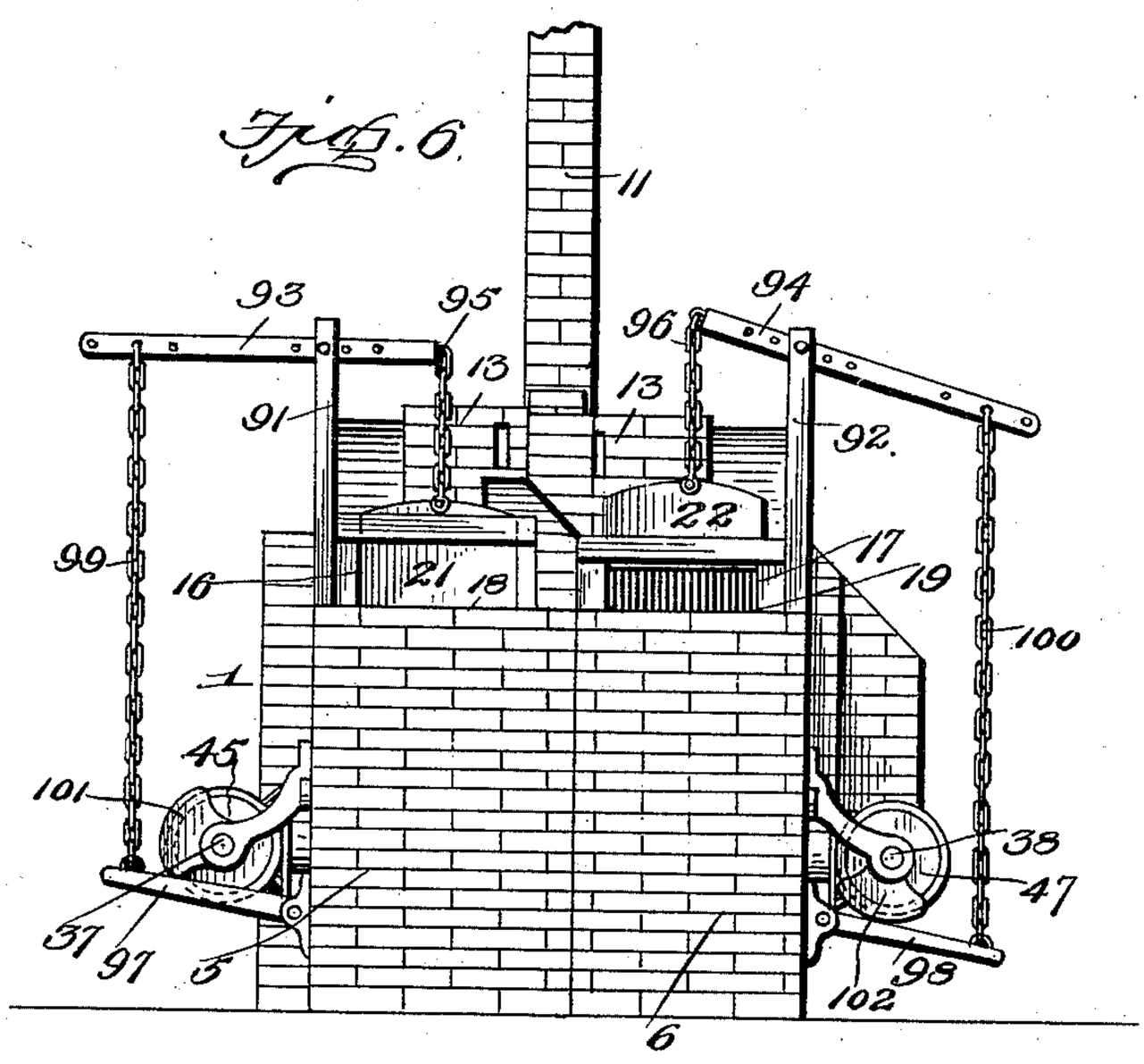
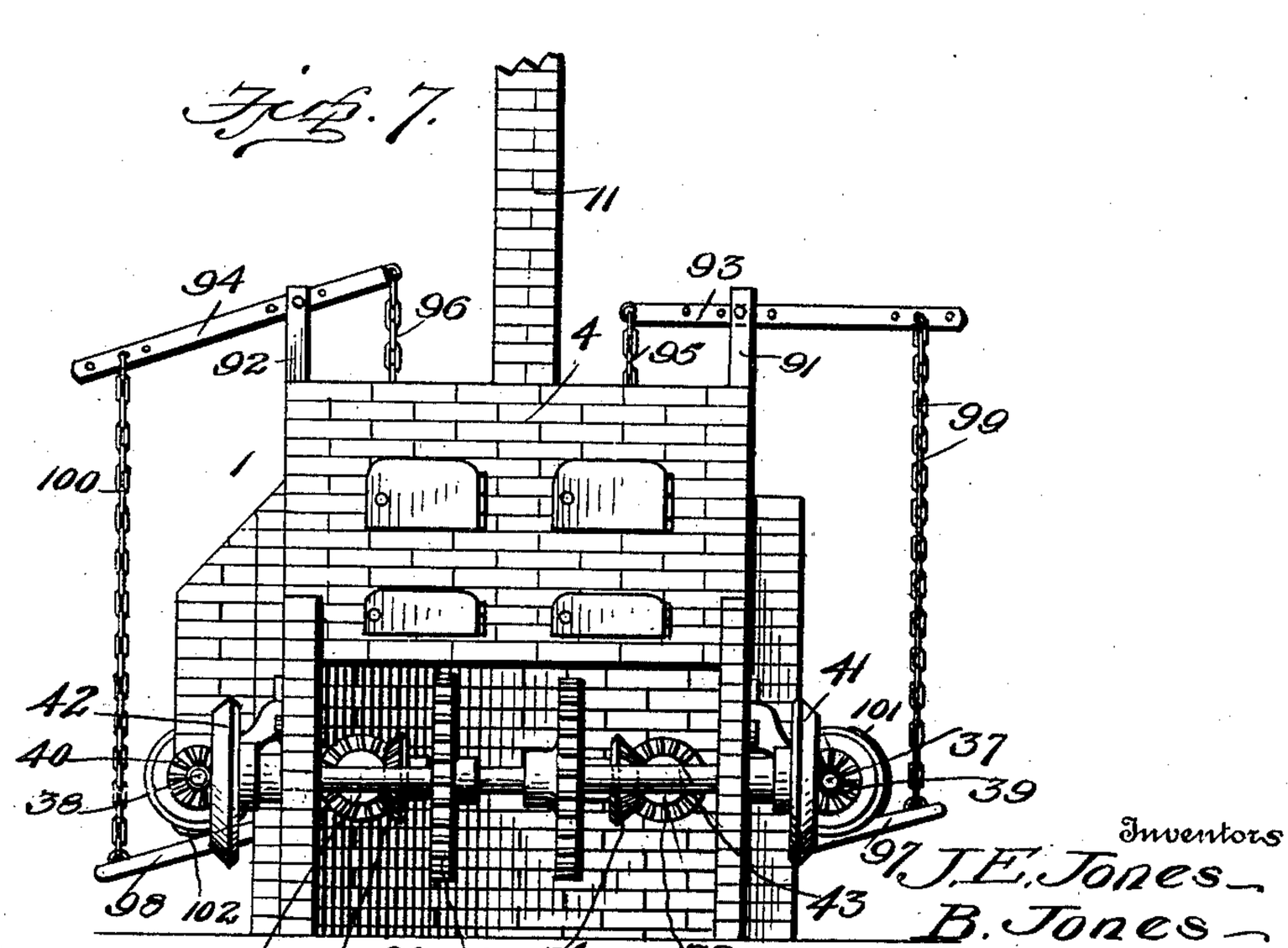


Fig. 7.



Witnesses
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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 7.

Fig. 8.

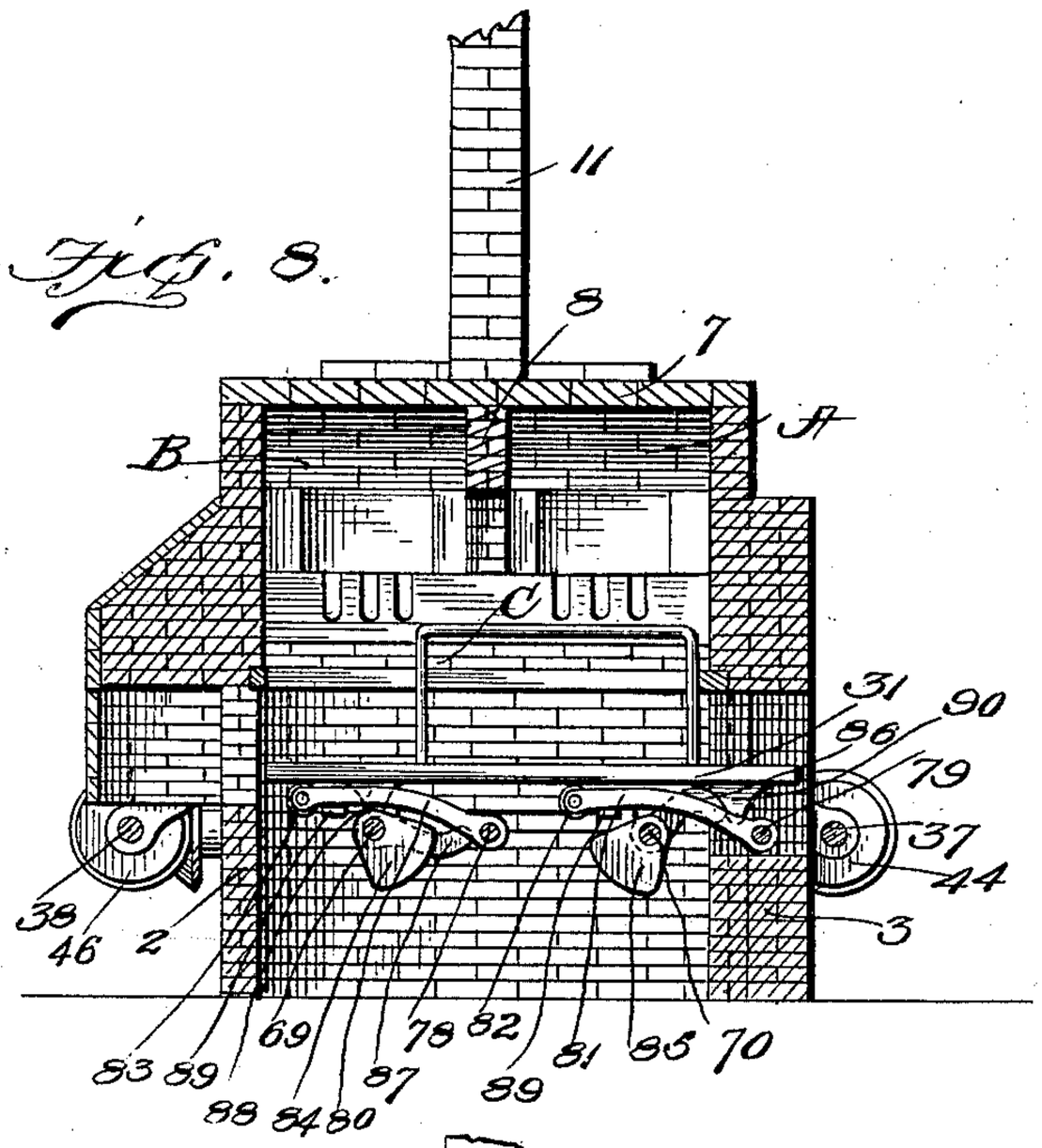
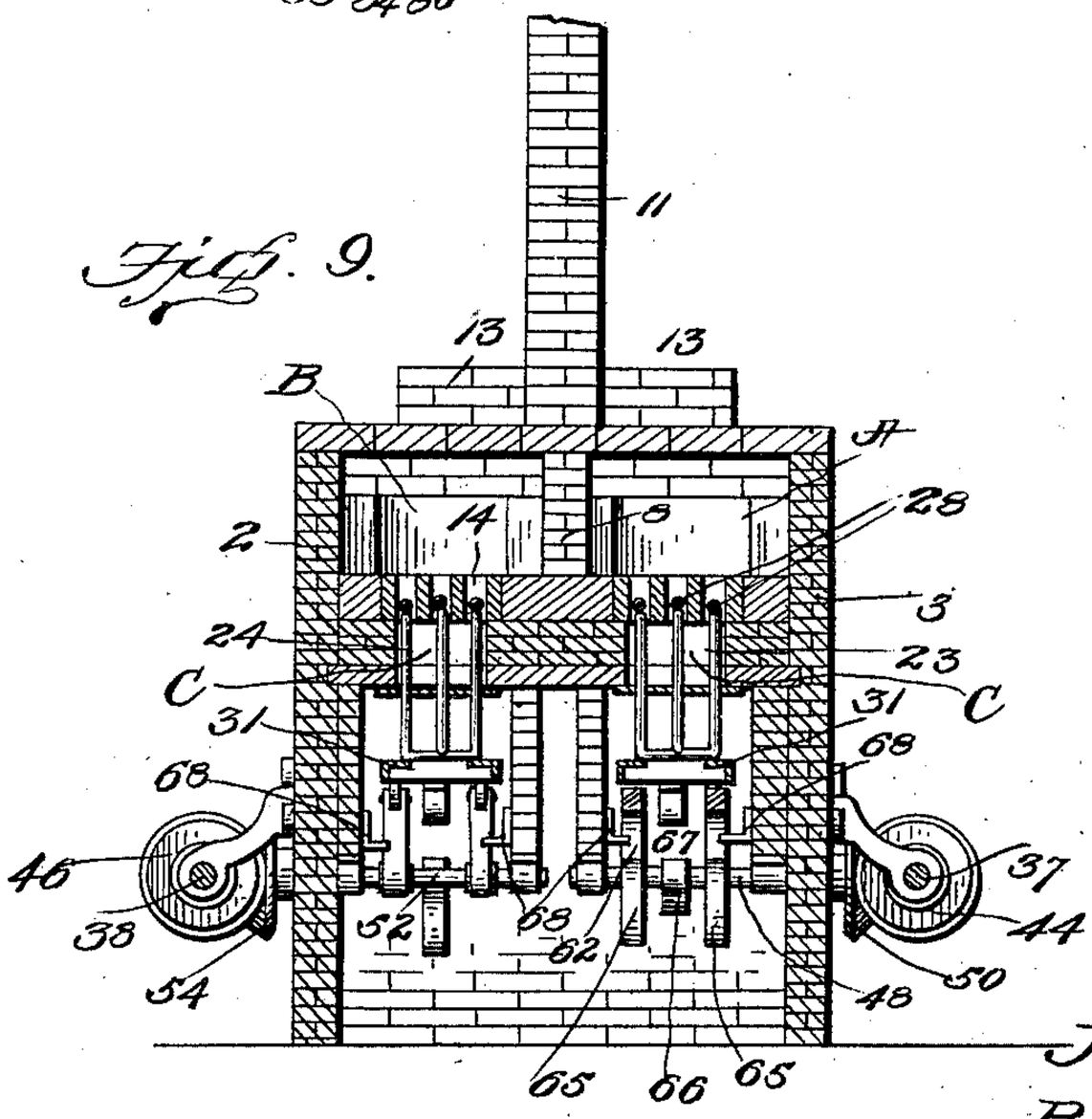


Fig. 9.



Witnesses
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No. 699,533. Patented May 6, 1902.

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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 8.

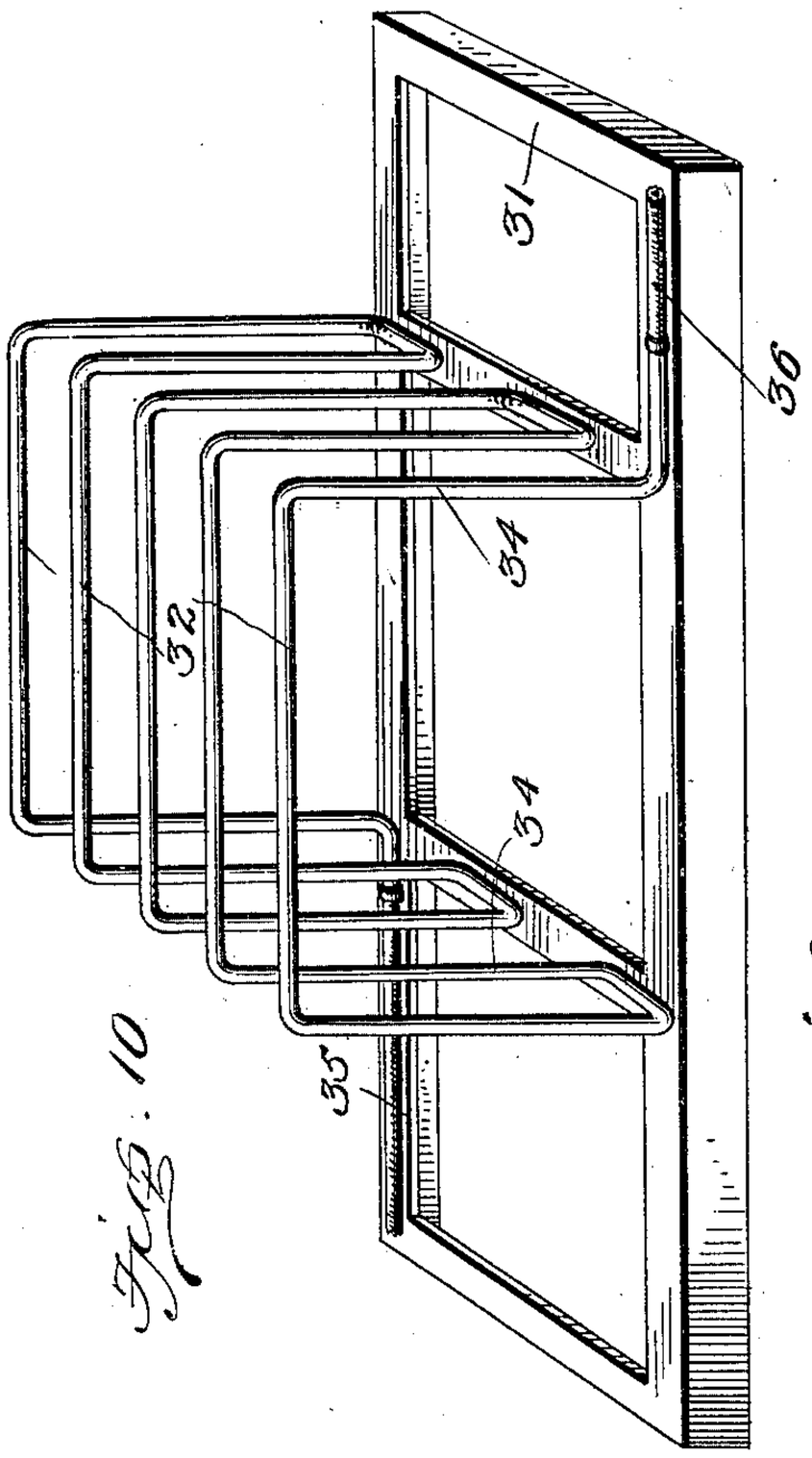

Fig. 10.

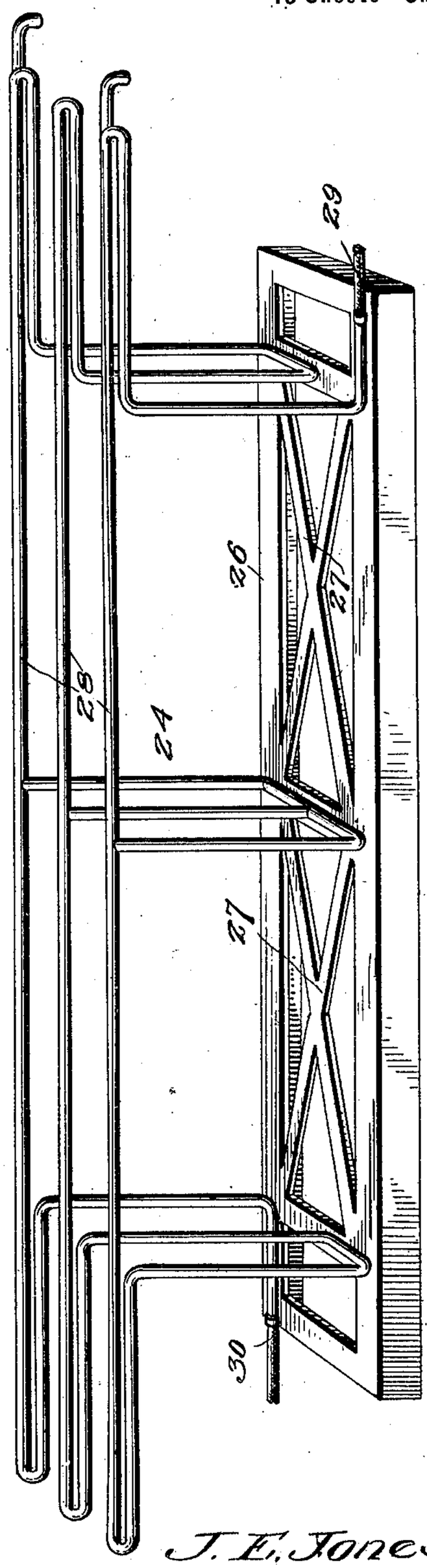

Fig. 11.

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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 9.

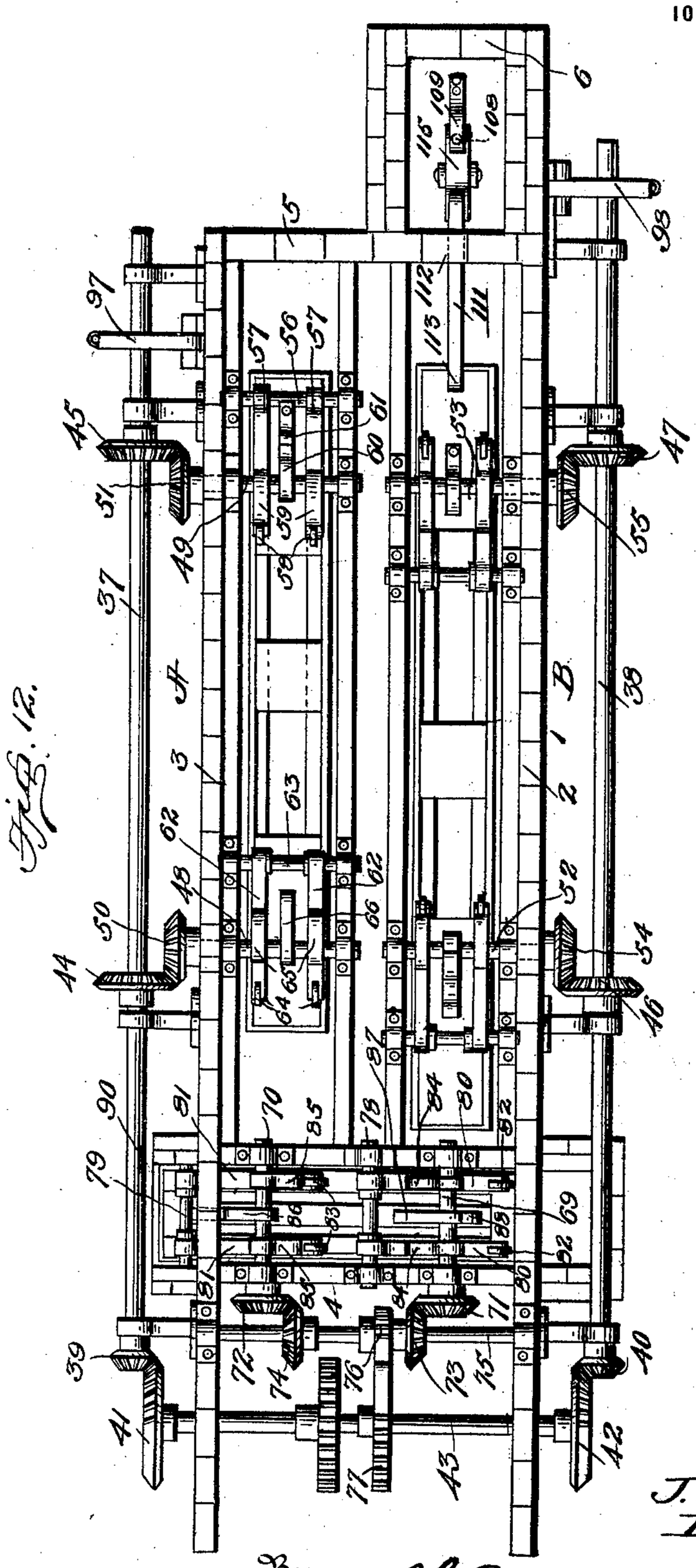

Fig. 12.

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SHEET METAL HEATING FURNACE.

(Application filed June 24, 1901.)

(No Model.) 10 Sheets—Sheet 10.

Fig. 14.

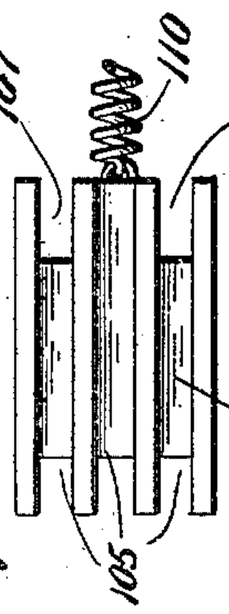


Fig. 15.

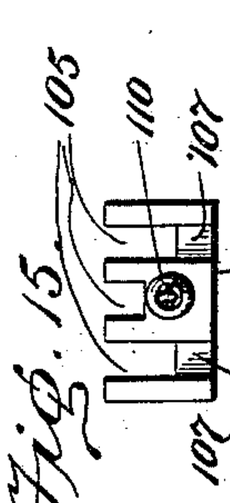
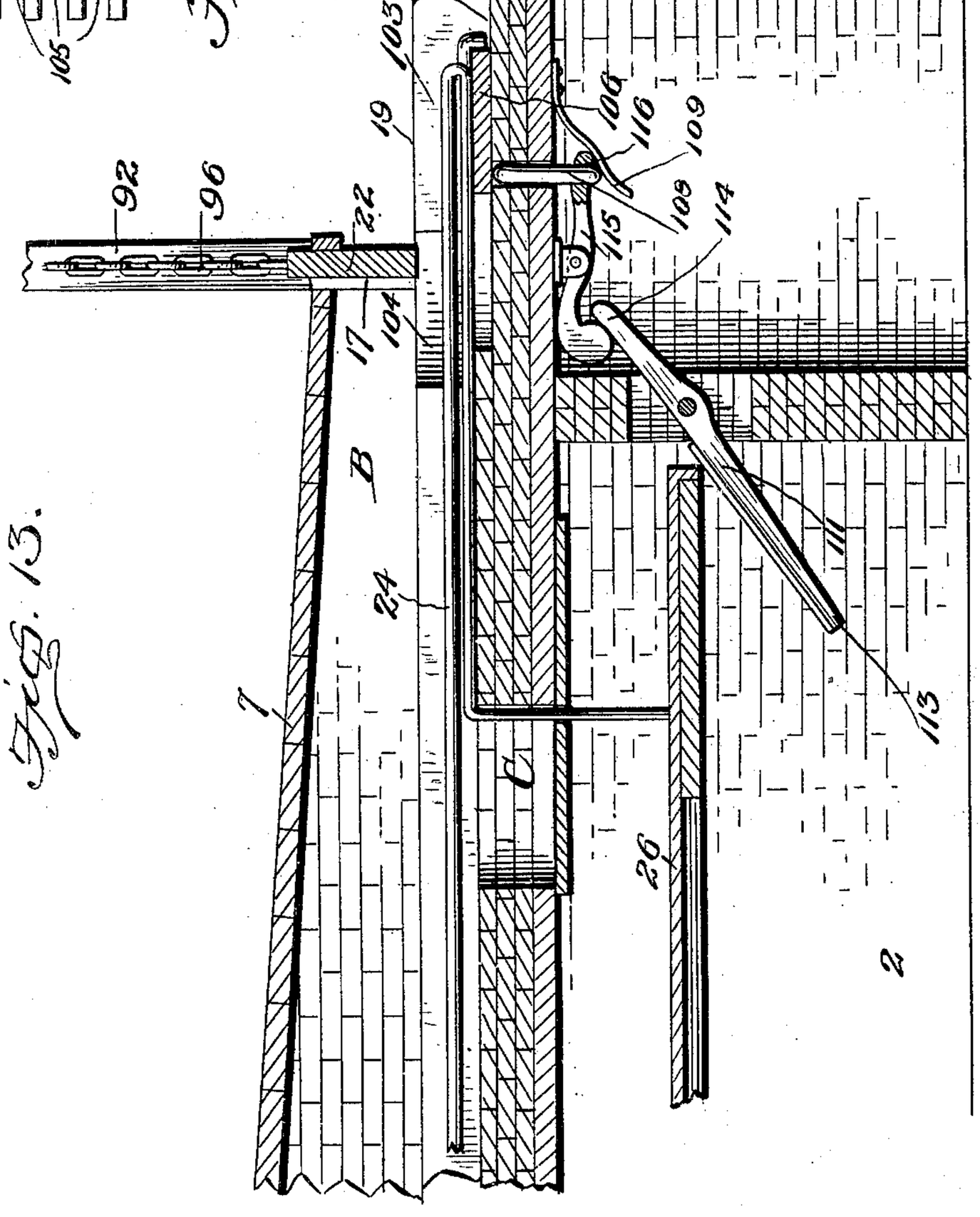


Fig. 13.



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UNITED STATES PATENT OFFICE.

JOHN E. JONES AND BENJAMIN JONES, OF ELWOOD, INDIANA.

SHEET-METAL-HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 699,533, dated May 6, 1902.

Application filed June 24, 1901. Serial No. 65,837. (No model.)

To all whom it may concern:

Be it known that we, JOHN E. JONES and BENJAMIN JONES, citizens of the United States, residing at Elwood, in the county of Madison and State of Indiana, have invented certain new and useful Improvements in Sheet-Metal-Heating Furnaces; and we do 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.

The invention relates to a sheet-metal-heating furnace for rolling-mills designed for preparing sheet metals, such as sheet-iron or tin-plate, for rolling.

The object of the invention is to provide a heater of this character which shall be simple of construction, durable in use, comparatively inexpensive of production, efficient in operation, and one in which the temperature of the sheet metal will be gradually raised to the proper degree and the packs of sheet metal ejected from the heater upon the receiving-table at a point distant from the heater and within convenient reach of the operator of the rolling-mill, or "roller," as he is known in the art.

With these and other objects in view the invention consists of certain novel features of construction, combination, and arrangement of parts, which will be hereinafter more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is an elevation taken from one side of the heater. Fig. 2 is a plan view. Fig. 3 is a longitudinal vertical sectional view on line *x x*, Fig. 2. Fig. 4 is a similar view on line *y y*, Fig. 2. Fig. 5 is a longitudinal horizontal sectional view taken above the bottom of the heating-chamber. Fig. 6 is a front end view of the heater. Fig. 7 is a rear end view of the same. Fig. 8 is a cross-sectional view on line *v v*, Fig. 2. Fig. 9 is a similar view on line *u u*, Fig. 2. Fig. 10 is a detail perspective view of the transverse conveyer. Fig. 11 is a similar view of one of the longitudinal conveyers. Fig. 12 is a bottom plan view of the entire heater. Fig. 13 is an enlarged sectional view through the heater, showing the ejector in a position opposite to that shown in Fig. 4. Fig. 14 is a top plan view of the ejector-slide, and Fig. 15 is an end view of the same.

Referring to the drawings, 1 denotes the heater, consisting of the side walls 2 and 3, end walls 4, 5, and 6, top 7, and longitudinal partition 8. The partition divides the interior of the heater into two longitudinal heating-chambers A and B and terminates short of the rear end of the heater, thus forming a transverse heating-chamber at that end of the heater, and thus establishing communication between the two longitudinal heating-chambers.

9 denotes the fire-chamber, which has an exit 10 communicating with the transverse heating-chamber, so that the products of combustion will pass through the transverse and longitudinal heating-chambers.

11 denotes an uptake or chimney, and 12 denotes a longitudinal pipe communicating with said chimney and having branches 13 communicating with the forward ends of the longitudinal heating-chambers, so that the products of combustion from the fire-chamber are caused to pass the length of the heating-chambers before they can escape from the heater.

The floors of the longitudinal heating-chambers are each formed with longitudinal parallel grooves 14, and the floor of the transverse heating-chamber is provided with grooves 15, arranged at right angles to the grooves 14 and intersected thereby.

16 denotes the entrance to the chamber A, and 17 denotes the exit of the chamber B. The entrance is provided with a feed-table 18 and the exit with a discharge-table 19. The table 18 is provided with longitudinal grooves 20, which communicate with the grooves in the floor of the chamber A. The entrance is provided with a vertically-sliding door 21 and the exit with a similar door 22, the operation of which will be hereinafter fully set forth.

23 and 24 denote the longitudinal conveyers for the heating-chambers A and B, and 25 denotes the transverse conveyer for the transverse chamber. Each longitudinal conveyer consists of a rectangular frame 26, preferably made of angle-iron and braced by diagonal bars 27 and the parallel members 28, which engage the grooves in the floors of the longi-

tudinal heating-chambers and have a vertical movement above said floors in a manner hereinafter described, and preferably consist of a system of communicating pipes, 29 denoting the inlet thereto, and 30 denoting the outlet thereof. Through these pipes is adapted to flow cold water to cool the pipes, especially those portions located within the heating-chambers, and prevent them from burning out.

The transverse conveyer consists of an angle-iron frame 31, rectangular in shape, and the transverse parallel members 32, suitably secured in said frame and preferably consisting of a series of communicating pipes 34, the inlet of which is indicated by the numeral 35 and the outlet of which is indicated by the numeral 36. Through these pipes is adapted to flow cold water for the same purpose as it is used in the longitudinal conveyers above described. The parallel members of the transverse conveyer are adapted to lie in the grooves of the floor of the transverse chamber and work vertically above the bottom of the floor for a purpose hereinafter described. The vertical members of the three sets of conveyers project through slots C in the floors of their respective chambers.

Suitable mechanism, to be hereinafter described, is employed for moving the longitudinal conveyer 23 from its position below the surface of the floor vertically to lift the pack of sheet metal deposited upon the floor of the chamber, thence rearwardly to move the pack of sheet metal rearwardly, thence downwardly to a position below the surface of the floor to leave the pack of metal sheets upon the floor, and thence rearwardly in its grooves to its normal position.

Suitable mechanism, to be hereinafter described, is employed for moving the conveyer 24 simultaneously with the movement of the conveyer 23, one moving longitudinally in its elevated position while the other is moving longitudinally in its depressed position. It will thus be seen that while the conveyer 23 is carrying a pack of sheet metal to the rear of the machine the conveyer 24 is carrying a pack of sheet metal to the forward end of the machine.

Suitable mechanism, hereinafter to be described, is employed for operating, in alternation with the longitudinal conveyers, the transverse conveyer 25 to move the packs of sheet metal from the rear end of one longitudinal heating-chamber to that of the other. These various sets of mechanism are so constructed, arranged, and timed that when the transverse conveyer is in its depressed position below the surface of the floor of the transverse heating-chamber the rear ends of the longitudinal conveyers are moved over the ends of the transverse conveyer into the intersecting grooves in the floor of the transverse heating-chamber, the conveyer 23 depositing a pack of sheet metal onto the floor of the transverse heating-chamber immediately above one end of the tranverse conveyer, while the conveyer 24 moves under a previously-deposited pack of sheet metal on the opposite end of the floor of the transverse chamber. Now in the forward movement of the longitudinal conveyers one pack of sheet metal is elevated, moved, and deposited on the floor of the transverse chamber by the conveyer 23, while the pack of metal sheets at the opposite end of the floor is engaged by the rear end of the conveyer 24, elevated, and moved forwardly and laid upon the floor in the chamber B, to be again engaged by the conveyer, elevated, and moved forwardly in the next forward movement of the conveyer. At the instant the rear ends of the longitudinal conveyers are withdrawn from the intersecting grooves in the floor of the transverse chamber the transverse conveyer is elevated above the grooves in the bottom of the transverse chamber, engages and lifts the pack of metal sheets just deposited upon that end of the floor by the conveyer 23, then moves the sheets transversely and deposits them upon the opposite end of the floor of the transverse chamber in a position to be again engaged by the conveyer 24.

We will now proceed to describe the mechanism for operating the conveyers 23 and 24.

37 and 38 denote longitudinal shafts journaled in bearings secured to the sides of the heater. At the rear ends these shafts are provided with beveled gears 39 and 40, which mesh with intermittent beveled gears 41 and 42, respectively, said intermittent gears being fixed to a suitably-driven shaft 43, which we will term a "drive-shaft."

The shaft 37 is provided with oppositely-beveled gear-wheels 44 and 45, while the shaft 38 is provided with oppositely-beveled gear-wheels 46 and 47.

48 and 49 denote two transverse shafts which extend through the side of the heating-chamber A and are provided on their outer ends with beveled gears 50 and 51, which mesh, respectively, with beveled gears 44 and 45.

52 and 53 denote transverse shafts which extend through the opposite side of the heater under the floor of the heating-chamber B and have fixed to their outer ends beveled gear-wheels 54 and 55, which mesh, respectively, with the beveled gears 46 and 47.

Journaled to a shaft 56 under the floor of the chamber A are two rearwardly-projecting lifting-arms 57, the free ends of which are preferably provided with antifriction-rollers 58, which are adapted to engage the outer side of the rectangular angle-iron frame of the conveyer 23.

Fixed to the inner end of the shaft 49 are two wiper-cams 59, which are adapted to engage the under sides of the lifting-arms 57 and elevate the same in the rotation of the shaft 49, and fixed to the shaft 49 is a retractor 60 in the form of a hooked arm, which is adapted to engage a lug 61, projecting downwardly

from the frame of the conveyer 23, and move said conveyer rearwardly in its depressed position, as hereinafter described.

62 denotes lifting-arms pivoted on a shaft 63, secured under the chamber A in advance of the shaft 56, and provided at their rear ends with rollers 64, which are adapted to engage the rear end of the rectangular frame of the conveyer 23 and elevate it when engaged by the wiper-cams 65, fixed to the shaft 48. This shaft 48 has secured to it a hooked arm 66, which we will term, in contradistinction to the retractor and for convenience of reference, the "advancer," for as the arm 60 serves to retract the conveyer the arm 66 advances the conveyer toward the rear end to carry the packs of metal sheets from one end of the heating-chamber to the other. This advancer engages a stud 67, projecting downwardly from the under side of the forward end of the main frame of the conveyer 23, and after said conveyer has been elevated by the two sets of wiper-cams and the lifting-arms with which they coact said advancer engages the stud 67, and while the conveyer is in its elevated position moves it rearwardly. At the instant the advancer disengages the stud 67 the two sets of cams move from engagement with the lifting-arms, which lower and engage with their free ends stop-brackets 68. At this point the retractor 60 engages the stud 61 and moves the conveyer forwardly.

The mechanism for operating the conveyer 24 is precisely the same as that shown and described for operating the conveyer 23, the wiper-cams, advancers, and retractors, however, being so set with relation to the corresponding parts for the conveyer 23 that the conveyer 24 in moving forwardly is in its elevated position, while the conveyer 23 in moving in unison with the conveyer 24 is in its depressed position, as previously described, and for this reason it is not believed that a detailed explanation of the parts will be required.

The mechanism for actuating the transverse conveyer comprises the longitudinal short shafts 69 and 70, which are suitably journaled under the floor of the transverse heating-chamber and have fixed to their rear ends beveled pinions 71 and 72, which mesh oppositely-facing beveled pinions 73 and 74, respectively, fixed to the ends of the shaft 75, journaled in suitable bearings at the rear end of the heater. This shaft 75 is provided with a gear-wheel 76, which meshes with an intermittent gear 77, fixed to the shaft 43, the arrangement being such that the blank or toothless portion of said gear 77 is opposite the gear 76, while the toothed portions of the gears 41 and 42 are in engagement with the gears 39 and 40. In other words, while the shafts 37 and 38 are in motion the shaft 75 will be at a state of rest.

78 and 79 denote short shafts secured on the ends of the transverse heating-chamber, and 80 and 81 denote lifting-arms journaled upon said shafts and provided with rollers 82 and 83, which engage the rectangular frame of the transverse conveyer and elevate the same when the arms are engaged by their respective wiper-cams 84 and 85. After the conveyer has been lifted by the wiper-cams the advancer 87, fixed to the shaft 69, engages the lug 88, projecting downwardly from one end of the conveyer, and while in its elevated position the conveyer is moved in a direction from the chamber A to the chamber B to carry the packs of metal sheets from the former to the latter chamber. The advancer 87 now disengages the conveyer, as do also the wiper-cams, allowing the conveyer to lower and engage the stops 89. At this instant the retractor 86 engages the lug 90, projecting downwardly from the end of the conveyer, and while the conveyer is below the bottom of the transverse chamber retracts it and moves it to a position to receive a fresh pack of metal sheets from the conveyer 23, moving in the chamber A.

The doors 21 and 22 are operated automatically in the following manner: To posts 91 and 92, projecting upwardly from the sides of the heater near its forward end, are pivoted levers 93 and 94, the inner ends of which are connected by chains 95 and 96 to the doors. 97 and 98 denote levers pivoted to the sides of the furnace and connected with the upper levers by chains 99 and 100. These levers 97 and 98 are depressed by cams 101 and 102, fixed to the shafts 37 and 38, and at the proper time cause the doors to open. The doors being weighted will by gravity close when the lowermost set of levers is actuated by their coacting cams, so as to prevent an unnecessary amount of heat from escaping from the heater.

The ejector consists of the reciprocatory slide 103, which works in an opening 104, formed in the discharge-table and of proper size to accommodate the ejector. The slide has a parallel row of longitudinal grooves 105, which correspond in number and register with the grooves in the floor of the heating-chamber B. The base or bottom 106 of the slide is provided with two slots 107, which are adapted to be engaged by the downwardly-extending hooked forward ends of the conveyer 24 in its rearward movement to move the rear end of the ejector into engagement with the forward end of the floor of the chamber B to a point within said chamber. To hold the ejector when it has been moved rearwardly with its rear end projecting within the chamber B, we provide a pin 108, which projects through the bottom of the table and has its upper end extending within the path of movement of the forward end of the table and is held in this position by a spring 109. A spring 110, fixed to the forward end of the table and to the forward end of the ejector, serves to withdraw the ejector when released by the pin. A trip 111 is pivoted to a suitably-located post 112 and has its end 113 projecting within

the path of movement of the base-frame of the conveyer 24. The end 114 of said trip is adapted to engage a weighted lever 115, pivoted to the under side of the floor of the chamber B, and this lever 115 has its pivoted end provided with an aperture 116, through which projects the lower end of the pin 108 into engagement with the spring 109.

In operation as the conveyer 24 moves rearwardly in its depressed position its hooked forward end engages the rear walls of the slots of the ejector and moves said ejector rearwardly under the door 22, which is in its lowermost or closed position. When the ejector has been moved rearwardly the limit of its movement, the spring-actuated pin 108 is forced upwardly within the path of movement of the forward end of the ejector, and this locks said ejector against movement. The conveyer 24 after having reached its rearmost point of movement elevates and begins to move forward, and at this instant the door 22 is lifted to permit the forward end of the conveyer depositing a pack of metal sheets upon the ejector. At the instant the pack of metal sheets is deposited upon the ejector the forward end of the base-frame of the conveyer 24 strikes the rear end 113 of the trip 111, lifts the end 114 of said trip, which, contacting with the weighted end of the lever 115, lowers its end 116 and permits the pin 108 to drop, and thus frees the ejector, which is suddenly thrown forwardly by the action of the spring 110, and thus projects the pack forwardly within convenient reach of the roller.

From the foregoing description, taken in connection with the accompanying drawings, the construction, mode of operation, and advantages of the invention will be readily understood without requiring a more extended explanation.

Various changes in the form, proportion, and details of construction may be made within the scope of the invention as claimed without departing from the spirit or sacrificing any of the advantages thereof.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a heater of the character described, the combination of the heating-chambers arranged side by side, a transverse heating-chamber establishing communication between said first-named heating-chambers, conveyers for conveying the material to be heated through the several heating-chambers, and actuating means common to all the conveyers for operating them, substantially as set forth.

2. In a heater of the character described, the combination of the heating-chambers arranged side by side, one having an entrance and the other an exit at their forward ends, a transverse heating-chamber establishing communication between the rear ends of the first-named heating-chambers, conveyers for conveying the material to be heated through the several heating-chambers, and actuating means common to all the conveyers for operating them, substantially as set forth.

3. In a heater of the character described, the combination of the heating-chambers arranged side by side, the transverse heating-chamber establishing communication between said first-named heating-chambers, conveyers for the respective heating-chambers, means for actuating the conveyers in the first-named chambers in unison to project their rear ends into and withdraw them from the transverse chamber, and means for operating the transverse conveyer to reciprocate the same in alternation with the longitudinal conveyers, substantially as set forth.

4. In a heater of the character described, the combination with the longitudinal chambers, of a transverse chamber establishing communication between the rear ends of the longitudinal chambers, said chambers being provided with grooved floors and the grooves of the transverse chamber being intersected by those of the longitudinal chambers, conveyers for said chambers, means for raising the conveyers in the longitudinal chambers across the grooves of the transverse chamber, and means for moving the transverse conveyer in alternation with the longitudinal conveyers, substantially as set forth.

5. In a heater of the character described, the combination with a heating-chamber having an exit, and a door for closing the exit, of a reciprocatory ejector, a conveyer for moving the heated material upon said ejector, means for opening the door, and simultaneously operating the ejector to thrust it forwardly, substantially as set forth.

6. In a heater of the character described, the combination of the heating-chamber provided with an exit, a door for closing the exit, a conveyer having a movement through the exit, an ejector adapted to be engaged by the conveyer and moved rearwardly under the edge of the door, means for elevating said door, and means for returning said ejector to its normal position, substantially as set forth.

7. In a heater of the character described, the combination with the longitudinal heating-chambers and the transverse heating-chamber establishing communication between the longitudinal chambers at the rear ends thereof, of conveyers located within said chambers, the forward ends of said longitudinal chambers being provided one with an entrance and the other an exit and doors for closing the entrance and exit, and means for opening and closing the entrance and exit doors for the entrance into one of the longitudinal heating-chambers, of material to be heated, and the removal from the other longitudinal heating-chamber, of the properly-heated material, substantially as set forth.

8. In a heater of the character described, the combination with the longitudinal heating-chambers and the transverse heating-chamber establishing communication be-

tween the rear ends of the longitudinal chambers, said chambers having slots in their floors of conveyers projecting upwardly through the slots in the floors of the several chambers, cams for elevating the conveyers of the longitudinal chambers in alternation, advancers and retractors for reciprocating the longitudinal conveyers in unison, one in its depressed position and the other in its elevated position, cams for elevating the transverse conveyer, and advancers and retractors for reciprocating the transverse conveyer in alternation with the reciprocatory movement of the longitudinal conveyers, substantially as set forth.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

JOHN E. JONES.
BENJAMIN JONES.

Witnesses:
JAMES J. DAVIS,
HYTON JONES.