No. 704,286. Patented July 8, 1902.

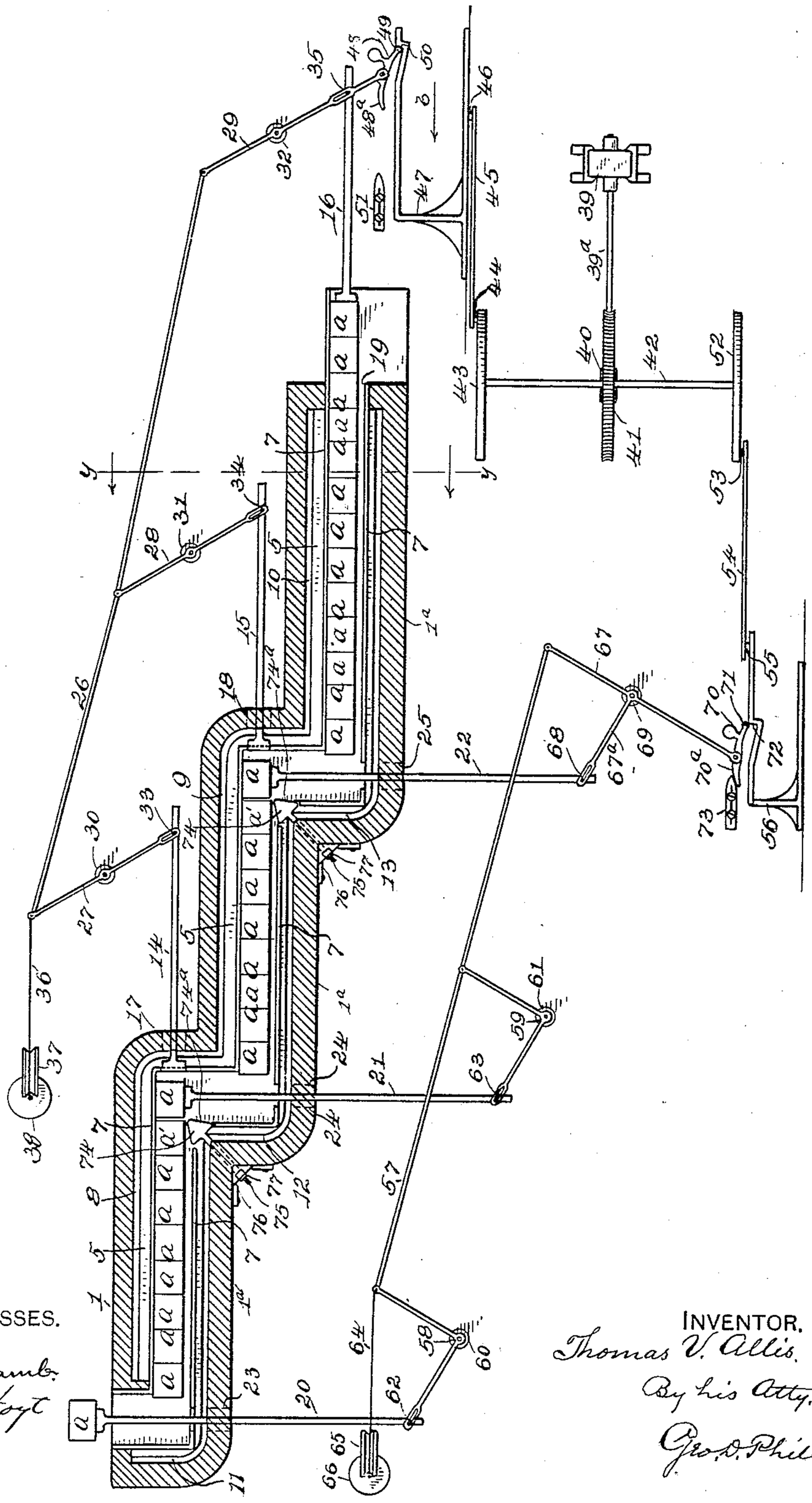
T. V. ALLIS.

FURNACE FOR PROGRESSIVE METAL HEATING.

(Application filed Apr. 20, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



WITNESSES.

H. A. Lamb.
L. R. Hoyt

INVENTOR.

Thomas V. Allis.
By his Atty.
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Fig. 2.

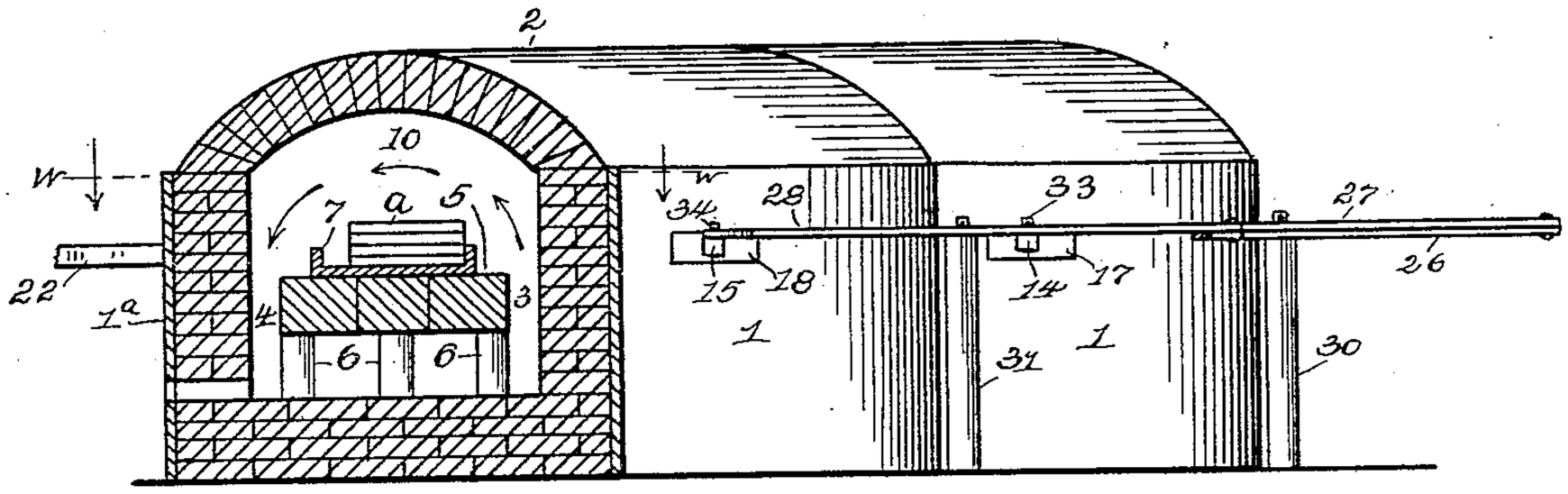
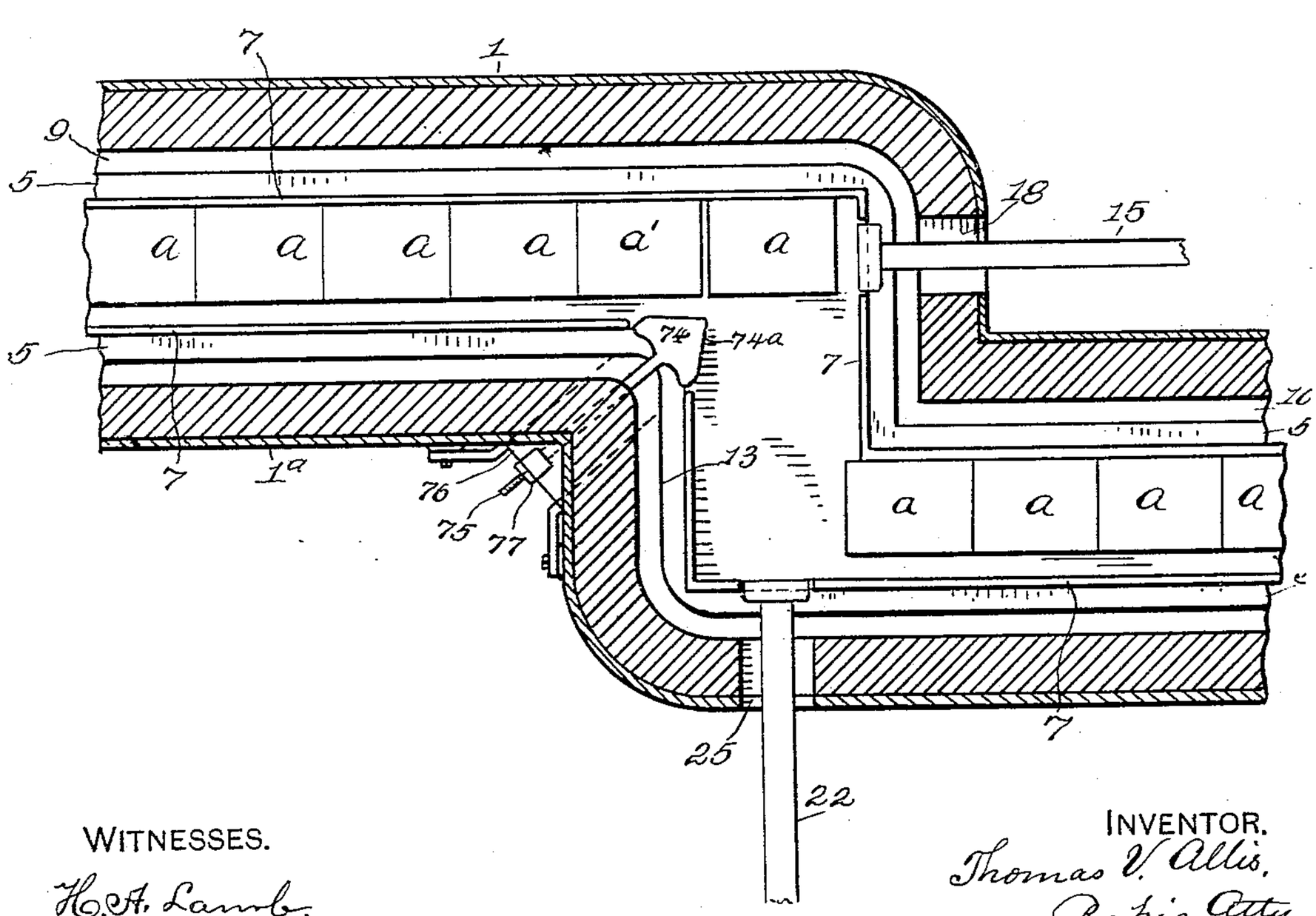


Fig 3



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UNITED STATES PATENT OFFICE.

THOMAS V. ALLIS, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE INTERNATIONAL TIN PLATE CORPORATION, A CORPORATION OF NEW JERSEY.

FURNACE FOR PROGRESSIVE METAL-HEATING.

SPECIFICATION forming part of Letters Patent No. 704,286, dated July 8, 1902.

Application filed April 20, 1901. Serial No. 56,788. (No model.)

To all whom it may concern:

Be it known that I, THOMAS V. ALLIS, a citizen of the United States, and a resident of Bridgeport, in the county of Fairfield and State of Connecticut, have invented a certain new and useful Improved Furnace for Progressive Metal-Heating, of which the following is a specification.

This invention consists in the construction of a furnace and in mechanism for automatically moving metal plates or packs of metal plates therethrough, said furnace being composed of a series of comparatively short heating-chambers arranged one in advance of another and in "staggered" relation with communicating passages between, as shown and described in a separate application for a patent filed by me September 23, 1901, Serial No. 76,205. In the separate application referred to the furnace heating apparatus is substantially like the one shown in this application, inclusive of the pusher-rods for advancing and transferring the plates or packs, which in such instance are not connected with operating devices. The present invention, therefore, is confined to the construction of said furnace and to the described means for manipulating the plates or packs in transit through the furnace by the progressive method therein claimed.

In order that comparatively thin plates or packs may be uniformly heated in a progressive manner, it is necessary to construct a furnace of considerable length and that the impetus propelling such line of plates or packs should take place at short intervals; otherwise the force required to move said line through a furnace of sufficient length to heat said plates or packs while traversing such furnace would cause a riding or overlapping of the plates or packs one upon the other; also the leaves comprising a pack would be forced between the leaves of adjoining packs, thereby bending and distorting them. To obviate this difficulty, I have constructed a furnace wherein the hitherto long heating-chamber is divided into comparatively short chambers arranged in staggered relation on different parallel planes one in advance of the other, with passages between each chamber. The different chambers are really distinct, inasmuch as the temperature of each may be regulated as required without materially altering the temperature of the adjoining chambers. This graduation of heat is a very important feature in the manufacture of black plate, the packs of which before rolling require an even mild "soaking" heat, which through the peculiar arrangement of my furnace I am able to effect. The first chamber, where the cold plates or packs are charged, can be very hot, thus quickly heating the incoming metal and overcoming the chilling of the furnace by the constantly-entering cold metal. The next chamber of my furnace may be of somewhat milder temperature, and so onward to the last chamber, where the metal is given that soaking mellowing heat so necessary to uniform ductility. In heating and rolling packs of thin metal it is very essential that they should be exposed as little as possible to chilling influences, which cool the outer leaves and also the sides and edges of the packs. The cooling of the outer leaves makes them less susceptible to the reducing operation of the rolls. Consequently they are thicker and shorter than the inner leaves. Again, a current cooling the sides and edges of heated packs, even to a slight degree, causes cracks and ragged edges and consequent waste. With my improved furnace I am able to obviate all of these objectionable features and deliver the packs at a uniform mellow heat and without exposure to the cooling and oxidizing influence of air and unevenly heated currents direct to the first pair of reducing-rolls, where the principal and heaviest reduction is made. In my construction I offset this long heating-chamber into short compartments or chambers and direct the heat and flame across the furnace and not lengthwise. I am thus able to practically control the degree of heat of each chamber and the metal therein.

To enable others to understand my invention, reference may be had to the accompanying drawings, in which—

Figure 1 is a plan view of my improved furnace on line *w* of Fig. 2, also showing the

pusher-rods connected to automatic mechanism for operating them. The longitudinally-operating pusher-rods are shown as withdrawn, while the transverse pusher-rods are shown in their forward position. Fig. 2 is a section of the furnace and the connecting-rod for the longitudinal pushers and broken view of one of the transverse pusher-rods through line *v* of Fig. 1. Fig. 3 is an enlarged broken sectional view of the furnace, showing one of the corner guides.

The construction of the furnace and the mechanism for manipulating the plates or packs are as follows:

1 and 1ª represent the sides of the furnace; 2, the roof; 3, the flue for the introduction of fuel-gas, and 4 the flue whereby the waste products of combustion escape.

5 is the floor of the furnace, supported upon the stools 6.

7 is a channel-iron resting on the floor, in which the metal packs *a* are placed.

8, 9, and 10 are the longitudinal heating-chambers, and 11 is a short transverse passage at right angles to the heating-chambers, whereby the packs are pushed out of the last chamber to the reduction-rolls. (Not shown.)

12 and 13 are similar transverse passages through which the packs are carried from one chamber to the other.

14, 15, and 16 are the pusher-rods for moving the packs through the longitudinal chambers, and 17, 18, and 19 are small openings in each end of said chambers, through which these rods operate.

20, 21, and 22 are the transversely-operating pusher-rods inserted through the openings 23, 24, and 25.

26 is a connecting-rod to which the outer ends of the levers 27, 28, and 29 are pivoted. These levers are also pivotally supported on the standards 30, 31, and 32. The inner ends of said levers are slotted, and such slotted ends engage with pins 33, 34, and 35 of the said pusher-rods.

36 is a cable attached to one end of the connecting-rod 26, said cable passing over the pulley 37. 38 is a weight attached to this cable, whereby at the proper time, presently to be explained, the said pusher-rods are simultaneously drawn back.

39 is a motor whose shaft 39ª carries the worm 40, operating in the worm-gear 41, mounted on the shaft 42. 43 is a disk on one end of this shaft, connected by pin 44 to the rod 45. The opposite side of this rod has the pin 46, connecting with the slide 47. The lower end of the lever 29 carries the pawl 48, and 49 is a roller in one end of this pawl, which is adapted to be engaged by the notch 50 of the slide 47.

51 is an adjustable trip adapted to be engaged by the forward end 48ª of the pawl, which engagement will raise the roller end of said pawl out of the notch in the slide 47. The slide 47 is about to start on its forward movement, as indicated by the arrow *b*, and by reason of the engagement of the pawl 48 therewith will also carry all of the pusher-rods 14, 15, and 16 forward. In the meantime the pusher-rods 20, 21, and 22, instead of being pushed forward, as shown, will have retreated to their outward position. When, therefore, the rods 14, 15, and 16 have moved forward sufficiently to place the forward pack in all of the chambers in front of the transverse pusher-rods 20, 21, and 22, the pawl 48 will be tripped and the weight 38 will instantly return all of said rods 14, 15, and 16 to their normal position. As soon as the packs are relieved from the forward pressure of said pusher-rods the transverse pusher-rods will be brought into action by means of similar mechanism, presently to be described, and will carry such forward packs through the several transverse passages into the next chambers, the last pusher-rod carrying the forward pack of the last chamber into the rolls. (Not shown.) 52 is another disk on the opposite end of the shaft 42. This disk carries the pin 53 to engage with the rod 54, whose pin 55 engages with the slide 56.

57 is a connecting-rod to which is pivoted one arm of the bell-crank levers 58 and 59, which levers are pivotally supported on the standards 60 and 61. The other arm of these levers is slotted to engage with pins 62 and 63 of the pusher-rods 20 and 21.

64 is a cable attached to the forward end of the connecting-rod 57, which cable passes over the pulley 65 and carries the weight 66. The opposite end of connecting-rod 57 is pivoted to the lever 67, whose right-angle arm 67ª is also slotted at its outer end to engage with the pin 68 of the pusher-rod 22. The lever 67 is pivotally supported on the standard 69 and carries at its lower end the pawl 70, whose roll 71 is adapted to engage with the notch 72 of the slide 56.

73 is an adjustable trip adapted to be engaged by the forward end 70ª for the same purpose as described for the pawl 48.

It is essential that as soon as the pusher-rods 14, 15, and 16 have moved forward a distance sufficient to place a pack in the transverse passages or the pusher-rods 20, 21, and 22 have moved forward a distance sufficient to deposit a pack into the next chamber and to the reduction-rolls they should instantly return. For this reason they are not permanently attached to the slides 47 and 56; otherwise they would have to hold onto said slides until the disks 43 and 52 had made a complete revolution. The trips 51 and 73 are made adjustable, so that the travel of the pusher-rods may vary to accommodate different-sized packs.

At Fig. 1 the pusher-rods 14, 15, and 16, as before mentioned, have been returned and the pawl 48 has just engaged with the slide 47, while the pawl 70 is just leaving the notch 72 of the slide 56, when the weight 66 will instantly return the pusher-rods 20, 21, and 22

before the pusher-rods 14, 15, and 16 have advanced.

While the channel-iron 7 will of course be made wide enough to accommodate the widest pack that will be required for the furnace, the packs are liable to vary in length due to improper shearing, which would interfere with their being carried over in proper alinement with the packs in other chambers. To guard against this, adjustable guides are placed at the angles of the furnace. (See Fig. 3.) These guides have the angular heads 74 and stem 75. The outer ends of these stems are supported in the brackets 76, and such outer ends are also threaded and carry the nuts 77, whereby the position of the head portion 74 is adjusted in the furnace. The apex of the head 74 is so located with respect to the rear end of the rear pack a' in the chamber 9 that in case the next pack to be transferred from chamber 10 be pushed too far forward into the transverse passage 13 its forward end will strike the inclined face 74^a of said head and be thereby pushed back sufficient to prevent its forward end colliding with the pack a'. These guides being adjustable and interchangeable can be arranged to locate any length of pack within the capacity of the transfer-passages.

While I show three chambers and two transfer-passages connecting said chambers, it will be understood that any number of these chambers over two with corresponding transfer-passages can be employed, and of course the number of pusher rods and guides will be increased or decreased accordingly, and, further, while I show pusher-rods for moving the packs through the several chambers and transfer-passages and claim mechanism for automatically operating such rods I wish it to be distinctly understood that I do not limit myself to any particular means for moving the packs through the furnace nor to the exact form of guides shown.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A multisection heating-furnace having offset chambers located one in advance of another in a substantially horizontal plane, the forward end of each chamber overlapping the rear end of the preceding chamber, passages connecting said overlapping chambers, and means intermediate the ends of the heating-chambers for heating each chamber, as set forth.

2. A multisection heating-furnace having offset chambers located one in advance of another in a substantially horizontal plane, the forward end of each chamber overlapping the rear end of the preceding chamber, passages connecting said overlapping chambers, said furnace being constructed at its opposite ends with charging and delivery openings, and means intermediate the ends of the heating-chambers for heating each chamber, and means for mechanically progressing the metal therethrough, as set forth.

3. A furnace having a plurality of chambers arranged in succession, a cross passage or passages connecting said chambers, a pusher entering one end of each chamber, and means for simultaneously advancing the several pushers, as set forth.

4. A furnace having three or more chambers arranged in succession, cross-passages connecting the chambers, pushers in said cross-passages and means for simultaneously advancing said pushers, as set forth.

5. The combination, with a furnace of the character described, having a plurality of chambers set one in advance of another, and transfer-passages connecting said chambers, of pusher-rods for said chambers and transfer-passages, linked together in two separate gangs or sets, and means whereby both gangs or sets are operated and each gang or set tripped and returned to its normal position, as set forth.

6. The combination, with a furnace of the character described, of gangs of feeding pusher-rods and gangs of transfer pusher-rods, means for effecting a forward stroke of each of said gangs, and adjustable means for tripping each gang on its forward stroke and returning the same to a normal position, as set forth.

7. The combination, with a furnace of the character described, having a plurality of chambers set one in advance of another, and transfer-passages connecting said chambers, of interposed guides at the junction of said chambers and passages to prevent colliding of the metal transferred from one chamber, with the metal of an adjoining chamber, as set forth.

8. The combination, with a furnace of the character described, having a plurality of chambers set one in advance of another, and transfer-passages connecting said chambers, of adjustable and interchangeable interposed guides at the junction of said chambers and passages to prevent colliding of the metal transferred from one chamber with the metal of an adjoining chamber, as set forth.

Signed at Bridgeport, in the county of Fairfield and State of Connecticut, this 12th day of April, A. D. 1901.

THOMAS V. ALLIS.

Witnesses:
JOHN B. CLAPP,
GEO. E. HEBBARD.