No. 699,130. Patented May 6, 1902.

T. V. ALLIS.

FURNACE FOR PROGRESSIVELY HEATING METAL PLATES OR PACKS.

(Application filed Feb. 1, 1901.)

(No Model.)

Fig. 3.

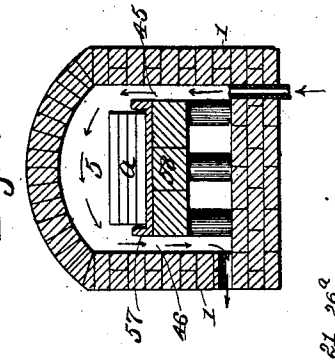




Fig. 1.

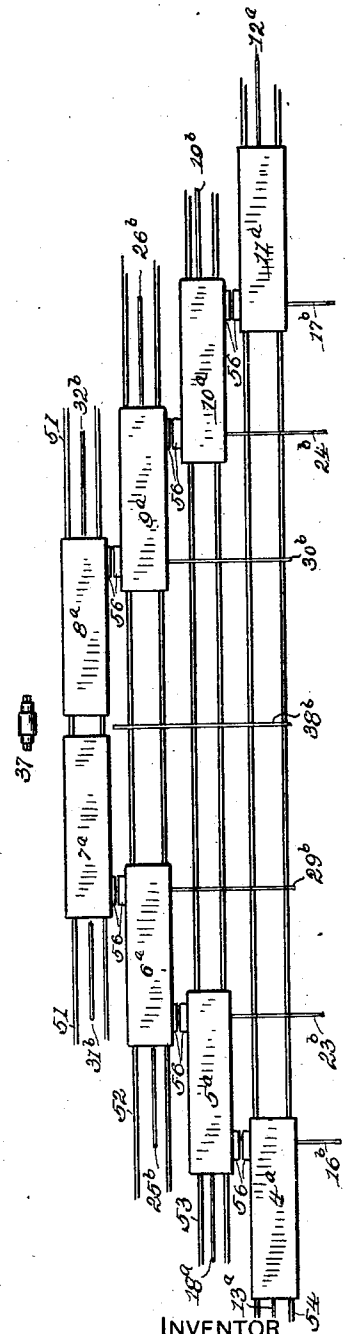


Fig. 2.

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# UNITED STATES PATENT OFFICE.

THOMAS V. ALLIS, OF BRIDGEPORT, CONNECTICUT.

## FURNACE FOR PROGRESSIVELY HEATING METAL PLATES OR PACKS.

SPECIFICATION forming part of Letters Patent No. 699,130, dated May 6, 1902.

Application filed February 1, 1901. Serial No. 45,631. (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 certain new and useful Improvements in Furnaces for Progressively Heating Metal Plates or Packs, of which the following is specification.

My invention consists in an improved furnace for progressive metal-heating, which I will first proceed to describe and subsequently set forth in the claims its novel characteristics.

In order that comparatively thin plates or packs of such plates 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 on different parallel planes one in advance of the other, with passages between each chamber. In the respective chambers 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 the 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 pack. 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, an exposure 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 rolls, where the principal and heaviest reduction is made. In my construction I break up this long heating-chamber into short compartments or chambers, step them off, and direct the heat and flame across the furnace and not lengthwise. I am thus able to practically control the heat of each chamber and its contents.

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

Figure 1 represents a longitudinal interior view of my improved furnace, also sets of reduction-rolls arranged in tandem, also an auxiliary set of reduction-rolls placed to one side. Fig. 2 is a plan view of separable heating-chambers composing the furnace, showing a relative arrangement of the chambers and mounted on ways. Fig. 3 is an enlarged transverse section of one of the furnaces.

The construction and operation are as follows:

The furnace (shown at Fig. 1) is composed of the two end sections 1 and 2 and the movable central section 3. The sections 1 and 2 have their heating-chambers 4, 5, 6, 7, 8, 9, 10, and 11 staggered and arranged one in advance of the other. The metal plates or packs *a* are entered at the respective charging ends $4^a$ and $11^a$ of the first or primary heating-chambers 4 and 11, and they are moved through said chambers by means of the pusher-rods 12 and 13. When the forward packs in these chambers have reached the short transverse passages 14 and 15, the pusher-rods 16 and 17, operating through the

openings $16^a$ and $17^a$, will carry them over in line with the chambers 5 and 10. The pusher-rods 18 and 19, operating through the openings $18^a$ and $19^a$, will then move the packs in said chambers into the transverse passages 20 and 21. Then the pusher-rods 23 and 24, operating through the openings $23^a$ and $24^a$, will carry said packs over into the chambers 6 and 9. Then the pusher-rods 25 and 26, operating through the openings $25^a$ and $26^a$, will carry said packs into the transverse passages 27 and 28, whereupon the pusher-rods 29 and 30, operating through the openings $29^a$ and $30^a$, will carry said packs over into the last chambers 7 and 8. Then the pusher-rods 31 and 32, operating through the openings $31^a$ and $32^a$, will carry said packs through said chambers and also through the chambers 33 and 34 of the middle section 3 to the central opening 35 of such section. It will be understood that all of the pusher-rods in sections 1 and 2 operate alternately. From either of these chambers 33 or 34 the packs are alternately pushed into the guideway 36, and from thence a pack is pushed forward to the first set of rolls 37 by means of the pusher-rod 38 operating through the opening $38^a$ of said central section. Other rolls, such as 39 and 40, are used when a further reduction is required, and 41 and 42 are guideways to the rolls.

When the metal is rolled in packs, the thickness of the component leaves cannot be measured, and the only way to determine whether they have been rolled to the proper gage is by the amount of elongation produced in the rolling. To determine this, the elongated packs are measured after they leave the last set of rolls in line, and if not found of sufficient length they are transferred over to the auxiliary pair of rolls 43, where the proper reduction is made. This set of rolls is placed to one side, so as not to interfere with the continuous output of the tandem train by attempting to reroll packs in the last set of rolls in the train. The number of pairs of rolls will of course be determined by the nature of the work and the amount of reduction required. This feature of my invention forms the subject-matter of a separate application for a patent filed by me August 31, 1901, Serial No. 74,024, and is not, therefore, claimed herein.

44 and 45 are flues in one side of the sections for the introduction of fuel-gas, and the apertures 46 and 47 on the opposite side of said sections are for the escape of the waste products of combustion. The central section has the flue 48, which matches with the flues 44 and 45 of the end sections, as well as the aperture 49 to match with the apertures 46 and 47 of said end sections.

The central section 3 is adapted to be moved out of alinement with the end sections 1 and 2. For this purpose I prefer to mount said section on wheels (not shown) running on the track 50. The advantage of this movable feature is for convenience and accessibility to the rolls 37 whenever the same need repairs or changing, or at the end of a week's work said section can be run back and away from the other sections, and thus enable the packs remaining in the end sections of the last chambers to be removed.

A modification of the above-described construction is shown at Fig. 2, wherein separable and movable furnaces $4^a$, $5^a$, $6^a$, $7^a$, $8^a$, $9^a$, $10^a$, and $11^a$, having heating-chambers, are relatively arranged with respect to each other, as in the three sections shown at Fig. 1. Each of these furnaces is mounted upon the tracks 31, 32, 33, and 34, and adapted thereby to be removed when repairs are needed and replaced by other furnaces. Each furnace is provided with the delivery extension 56, through which the metal is transferred from one furnace to the other. 57 is a channel-iron lying on the furnace-floor 58, in which the packs *a* are placed. The pusher-rods $12^a$, $13^a$, $16^b$, $17^b$, $18^b$, $19^b$, $23^b$, $24^b$, $25^b$, $26^b$, $29^b$, $30^b$, $31^b$, $32^b$, and $38^b$ perform the same functions as the pusher-rods in the construction shown at Fig. 1. The fuel-gas may be supplied to said furnaces by coupling to pipes in any convenient location.

I may find it desirable to use either section 1 or 2 separate, in which case the chambers 7 or 8 might extend up the rolling-field, or I could use sections 1 and 2, leaving out the movable central section and extend the chambers 7 and 8 up to the rolling-field. This modification of the construction shown in Fig. 1 is embodied in a separate application for a patent filed by me September 23, 1901, Serial No. 76,205.

It will readily be seen from the foregoing description that progressive heating and rolling are effected. While there is an intermittent movement of the metal in each section, caused by the slight delay in feeding forward and transferring the metal from one chamber to another, the movements will be so arranged that while the metal is being transferred from one chamber to another in one section the metal is fed forward in chambers of the opposite section. This will result in a delivery of packs into the rolling-field as fast as they can be rolled and handled. These intermittent or alternate movements enter into the calculation of the time required for heating the metal and determines the length and number of the heating-chambers.

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

1. A furnace for progressive metal-heating consisting of a double series of heating-chambers and a central heating and delivery chamber intermediate of said series, the several heating-chambers composing the respective series being arranged in a staggered relative position and communicating one with another

through transverse end passages and each series with said central chamber substantially as set forth.

2. A furnace for progressive metal-heating composed of a double series of separable and movable heating-chambers relatively arranged in a staggered position and a central heating and delivery chamber intermediate of said series, the several heating-chambers composing the respective series communicating one with another, and each series with the central chamber, and said chambers mounted on ways for purposes of removal, substitution or repair, as set forth.

Signed at Bridgeport, in the county of Fairfield and State of Connecticut, this 30th day of January, A. D. 1901.

THOMAS V. ALLIS.

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