

May 6, 1947.

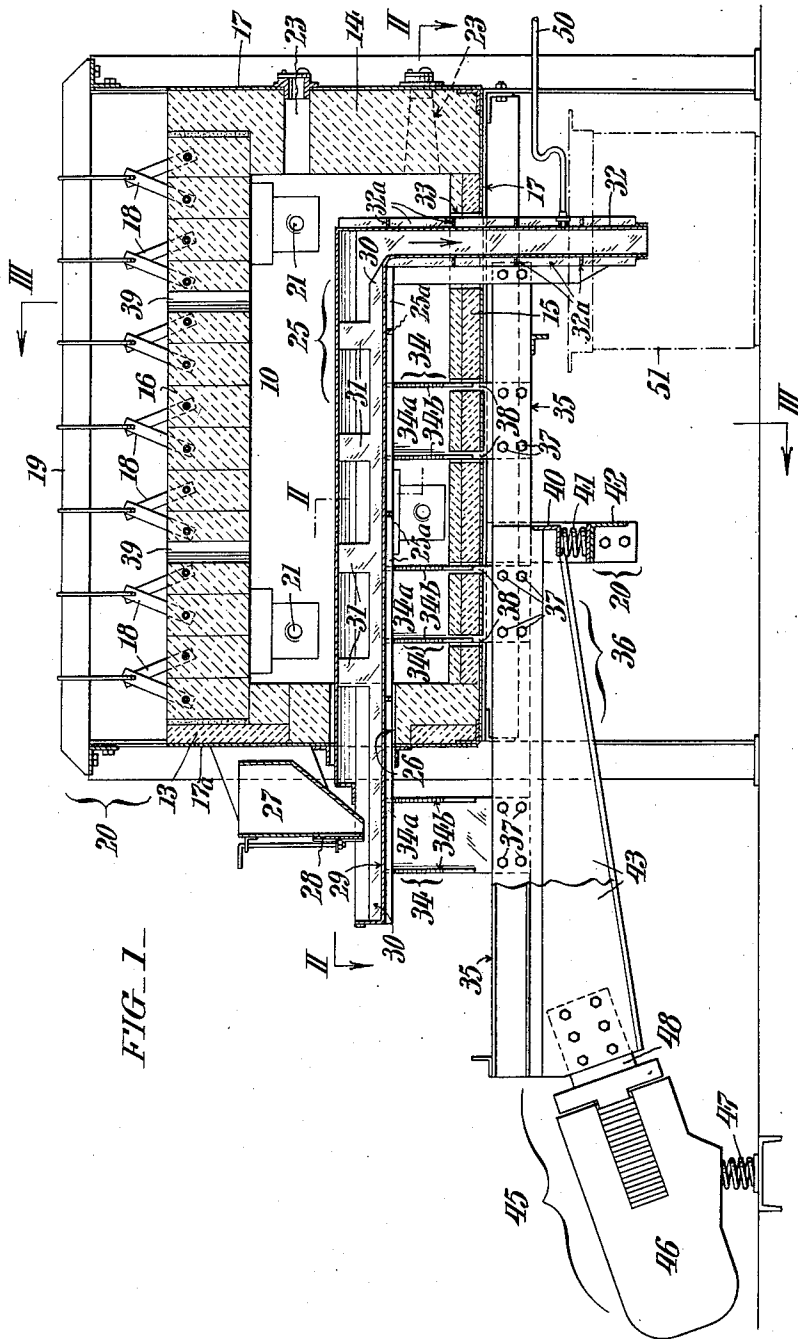
H. E. CURLL ET AL

2,420,126

HEAT TREATING FURNACE

Filed April 17, 1945

3 Sheets-Sheet 1



WITNESSES

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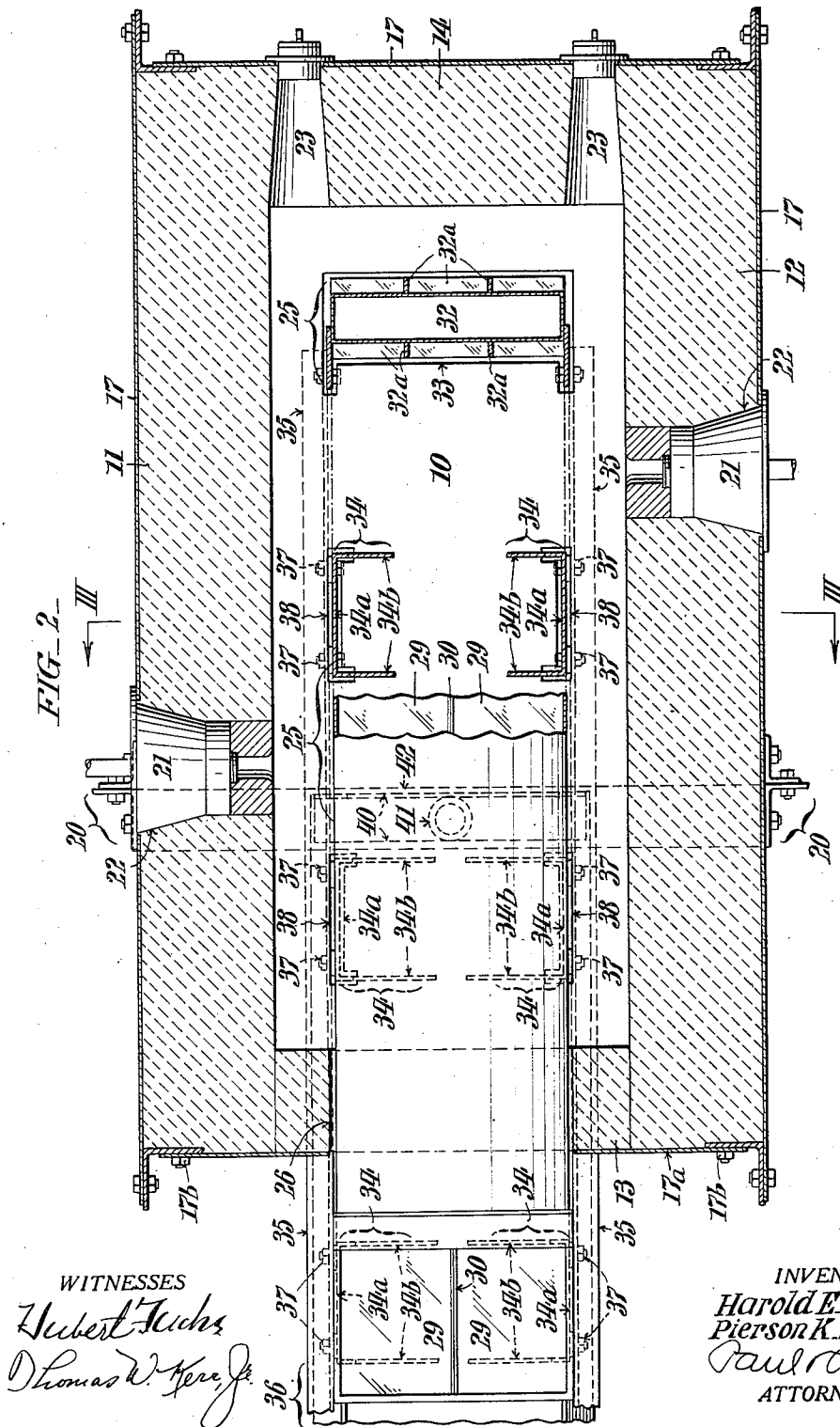
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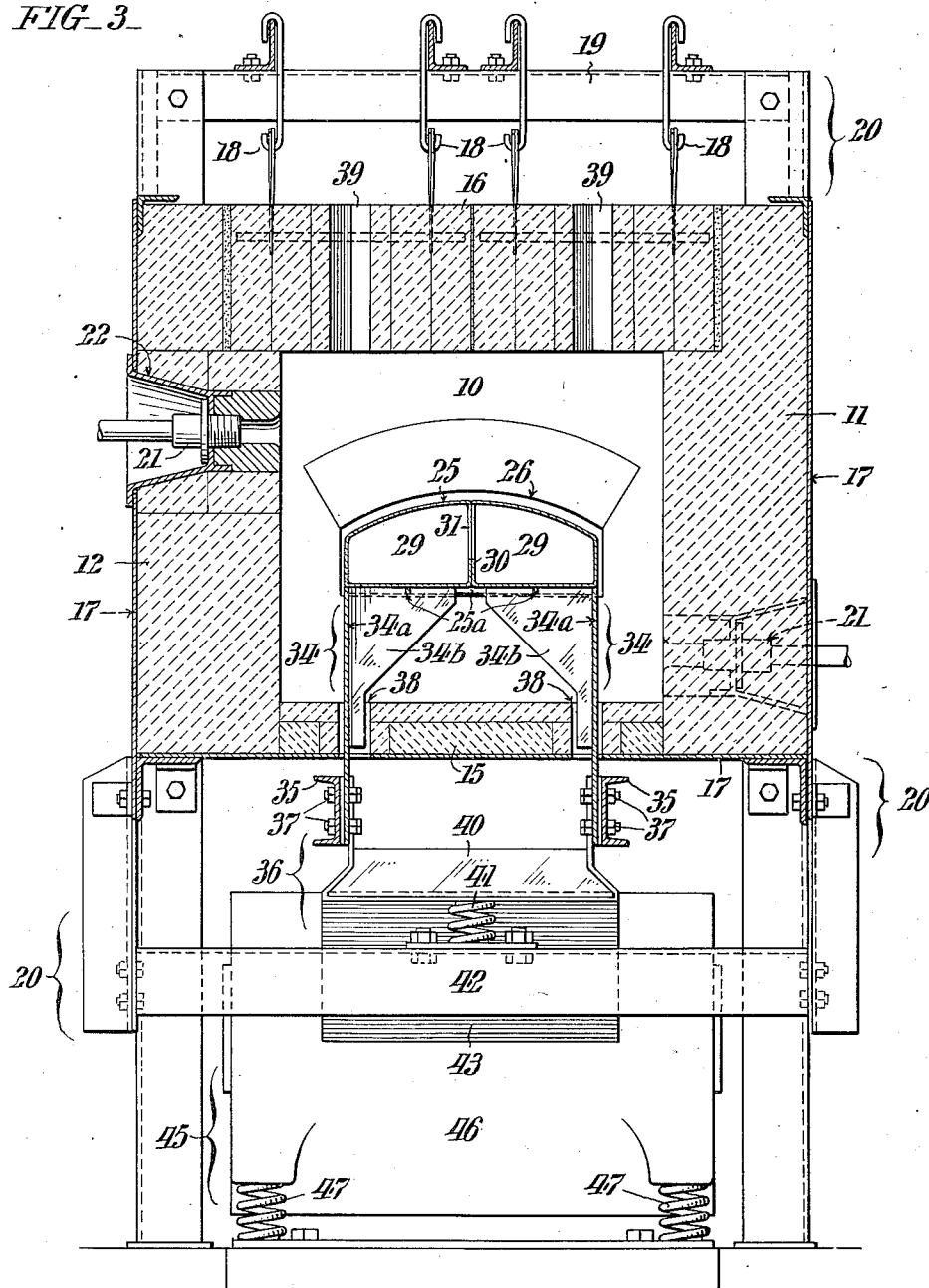
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FIG. 3.



WITNESSES

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2,420,126

HEAT-TREATING FURNACE

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Application April 17, 1945, Serial No. 588,786

7 Claims. (Cl. 263—21)

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This invention relates to furnaces useful in heat treating metallic and other products, and is concerned more particularly with vibratory hearth furnaces.

Amongst the aims of our invention are to secure a more perfect balance of the vibratory hearth in a furnace of the kind referred to so as to preclude detrimental weakening strains and make possible operation at higher speeds; to insure even progression of the materials through the furnace, and determine absolute uniformity in the finished product; to provide for effective cooling of the parts by which the hearth is supported in the furnace and thereby add to their longevity; and to generally simplify the construction of such a furnace with a view toward rendering it more compact and less expensive to build.

Other objects and attendant advantages will appear from the following detailed description of the attached drawings, wherein:

Fig. 1 is a view in longitudinal section of a vibrating furnace conveniently embodying our invention.

Fig. 2 is a staggered horizontal section of the furnace taken as indicated by the angled arrows II—II in Fig. 1; and

Fig. 3 is a cross section taken as indicated by the angled arrows III—III in Figs. 1 and 2.

As herein illustrated, the treating chamber 10 of our improved furnace has relatively thick side and end walls 11, 12 and 13, 14, a floor 15 and a top or roof 16. The side and end walls 11—14 may be molded or otherwise formed from any suitable heat resistant material, while the floor 15 and roof 16 are preferably constructed from fire bricks or tiles. At its sides, ends and bottom the furnace is sheathed with metal plates 17, the plate 17a being detachably secured by screw bolts 17b to permit removal of the front wall 13 for a purpose later on explained. To allow for expansion and contraction, the roof bricks or tiles are supported in pairs by hangers 18 suspended from laterally-spaced longitudinals 19 at the top of a structural iron framework 20 by which the furnace is supported at an elevation from the floor level. For the purpose of firing the furnace, we have indicated oil burners 21 as disposed in staggered relation in openings 22 in the opposite side walls 11, 12. It is to be understood however that, if desired or found more convenient, heating may be effected by gas or electricity. The behavior of the burners 21 during the operation of the furnace is observable through the sight openings 23 in the end wall 14 of the chamber 10.

Disposed lengthwise of the chamber 10 is a vibratory hearth 25 whereof the receiving end extends to the exterior through an opening 26 in the front end wall of the furnace beneath a hopper 27, see Fig. 1, from which the articles or

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pieces to be heat treated are discharged by gravity, said hopper being suitably supported by brackets on the end wall 13 and the delivery therefrom being controlled by a manually adjustable gate 28.

As illustrated, the hearth 25 is of the closed or muffle type and in practice is fashioned from fabricated or cast metal in such manner that in this instance two juxtapositioned conduits 29 are provided for traverse by the articles or pieces during heat treatment in the furnace the separating partition 30 between the conduits being relatively low but having at intervals lengthwise thereof upward projections 31 which reach to and support the hearth top, said partition also serving as a stiffening means. The hearth may of course be made either with a single conduit or more than two which may be arranged as desired or found convenient. At its inner end, the hearth 25 has a depending delivery spout 32 which extends downward through a clearance opening 33 in the chamber bottom 15, and of which the hollow is common to the two conduits 29. As a further means for reinforcing the hearth against warping under intense heat, we have provided it with longitudinal and transverse ribs 25a and its chute with similar longitudinal ribs 32a. By means of a series of transversely-aligned longitudinally-spaced pairs of upright supports 34, the hearth 25 is rigidly connected to the channel side rails 35 of a carriage frame 36 which extends horizontally beneath the furnace. Like the hearth itself, the supports 34 are built up from sheet metal, each one of them including a main web 34a and bracing webs 34b attached along opposite side edges of said main web. The main web 34a of each support 34 is welded or otherwise permanently secured at the top to the corresponding side of the hearth 25 and at the bottom fastened to the corresponding side rail of the carriage 36 by screw bolts 37, while the bracing webs 34b underreach the hearth and are permanently secured to the hearth bottom. All except one of the supports 34 extend through the floor 15 of the furnace which is provided with suitably shaped openings 38 for clearance of the webs 34a and 34b by a slight margin to allow vibratory movement of the hearth in a manner presently explained. The metal actually employed in the construction of the hearth 25 and its supporting struts may be of any kind or alloy capable of withstanding not only the high temperatures maintained within the chamber 10, but also the rapid and sudden impacts imparted thereto incident to communication of the vibratory movements. However, in order to keep the delivery spout 32 and the supports 34 as cool as possible we provide the roof 16 of the furnace with suitably disposed vent holes 39 for creation of drafts of air from beneath the furnace upwardly through the clearance openings 33 and 38

and around said parts, and also to carry off products resulting from combustion of the fuel used in heating.

Extending crosswise of the carriage frame channels 35 at an intermediate point is a crosswise angle bar 40 which rests on a resilient element in the form of a centrally located helical spring 41 seated on a transverse underslung angle bar 42 of the framework 20. Forwardly of the angle bar 40, the frame channels 35 are further rigidly connected by a troughed web 43 of sheet metal and which is tapered as viewed from the side. The weight of the web 43 and the direction of its taper are such that the delivery spout 32 of the hearth 25 is counterbalanced at the spring 41.

Any suitable means may be employed to vibrate the hearth 25 either constantly or intermittently to progress the material during treatment within the furnace. For this purpose we have illustrated by way of example at 45 in Figs. 1 and 3, a well known commercial type of vibrator whereof the body 46 is sustained by a transversely-arranged pair of resilient elements likewise in the form of helical springs 47, and whereof the reciprocating element or plunger 48 is bolted to the troughed web connecting the forward ends of the channels 35.

Connected, in accordance with our invention, adjacent the lower end of the delivery spout 32 in such a manner as not to interfere with vibration of the hearth 25, is a flexible tube 50 through which different gases necessary or desirable for the maintenance of different atmospheres within the furnace for the proper finishing of the material may be conducted.

In the operation of the furnace, the material constantly discharged from the hopper 27 is continually advanced on the hearth 25 through oscillatory movements communicated by the vibrator 45, said hearth being free to move up and down as well as back and forth by reason of the three point resilient mounting constituted by the springs 41 and 47, so that its action is substantially noiseless. Due to the perfect balancing of the hearth 25, the materials will be evenly progressed in the furnace with assurance of delivery of a uniformly treated product. The balancing is moreover advantageous in connection with the cooling of the supports 34 in that it obviates strains such as would be likely to weaken the hearth, wherefore the latter can be safely operated at high speeds with corresponding increase in the output of the furnace. When required, modifying atmospheres can be maintained in the furnace during the treatment by introducing suitable gases into the delivery spout 32 of the hearth by way of the flexible conduit 50. The treated material discharged from the furnace may be collected in a receptacle such as shown in dot-and-dash lines at 51 in Fig. 1 into which the delivery spout 32 of the hearth 25 extends; and when quick chilling is necessary, said receptacle may be charged with a suitable quenching liquid. The hearth may be either constantly or intermittently vibrated depending upon the length of the time required for the treatment. In the latter case we resort to the use of suitable timing means (not shown) to control energization of the pulsating element 46 of the vibrator 45. Such timing means may be of any of the approved types available on the market.

Since our novel furnace is simple and compact in construction and involves but a single moving part, it can be built at relatively small cost, its

efficiency being enhanced by reason of having solid, thick walls which prevent excessive heat losses by radiation. It is to be understood that we are not confined to the use of a muffle hearth since advantages equal in all respects to those hereinbefore pointed out can be realized if an open vibratory hearth is substituted.

Having thus described our invention, we claim:

1. A furnace of the character described including a treating chamber with means for heating it; a hearth for the material to be treated within the chamber; carriage means outside the chamber with supports extending therefrom through clearance openings in a wall of the chamber floor; means for vibrating the carriage with the supported hearth to effect progression of the material within the chamber; and vent means in a wall of the chamber instrumental in creating upward drafts of air from beneath the furnace through said clearance openings to cool the hearth supports.

2. A furnace according to claim 1, in which the carriage means is located beneath the furnace, and in which the supports extend up through the furnace floor.

3. A furnace according to claim 1, in which the hearth has multiple longitudinal conduits.

4. The invention according to claim 1, wherein the hearth, for the purposes of loading, extends outward through an opening in a wall of the chamber; and wherein the hearth has a spout at its delivery end extending downward through a clearance opening in the chamber floor.

5. A furnace according to claim 1, in which the hearth, for the purposes of loading, extends through an opening in a wall of the chamber; wherein the hearth has a spout at its delivery end extending downward through a clearance opening in the chamber floor; and wherein the chamber wall aforesaid is secured with capacity for removal to permit withdrawal of the hearth for replacement or repair.

6. A furnace according to claim 1, including a resilient means for yieldingly sustaining the carriage means.

7. A furnace according to claim 1, in which the hearth is fashioned from fabricated or cast metal with a pair of juxtaposed conduits separated by a relatively low longitudinal partition with upward projections at intervals reaching to the top of the hearth; in which the carriage means comprises a frame with laterally spaced longitudinal; and in which the individual supports are disposed in transversely aligned pairs and each is formed from sheet metal with a main web extending from the corresponding carriage longitudinal to the hearth, and a bracing web along opposite edges of the main web which underreaches said hearth.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,251,586	Flint	Aug. 5, 1941
2,394,914	Johnson	Feb. 12, 1946
1,924,452	Millan et al.	Aug. 29, 1933
1,695,950	Carpenter	Dec. 18, 1928
2,021,072	Machlet	Nov. 12, 1935