

July 29, 1952

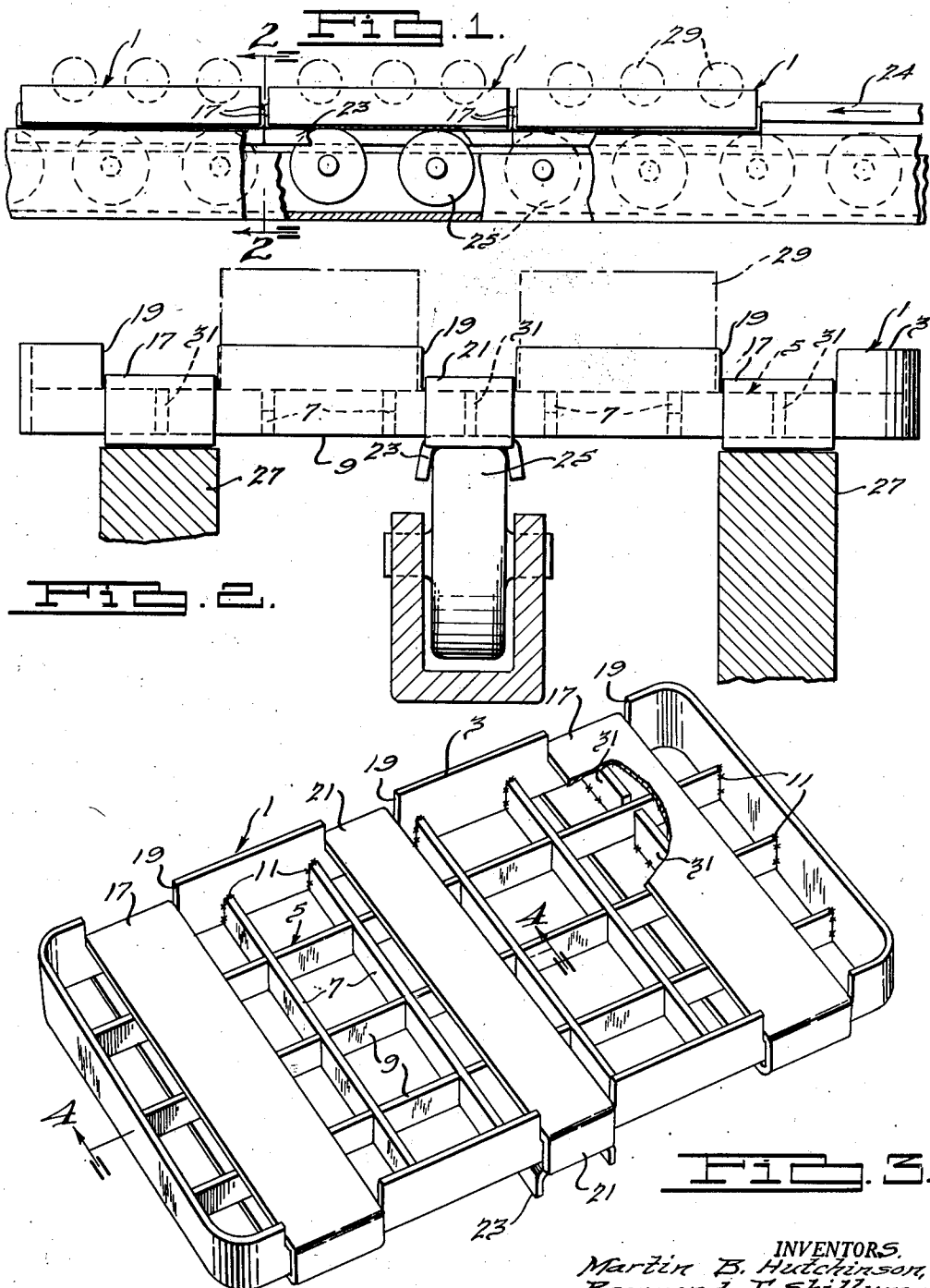
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2,605,092

HEAT TREAT TRAY

Filed Feb. 17, 1949

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

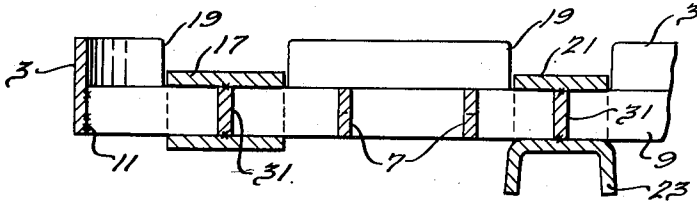


FIG. 4.

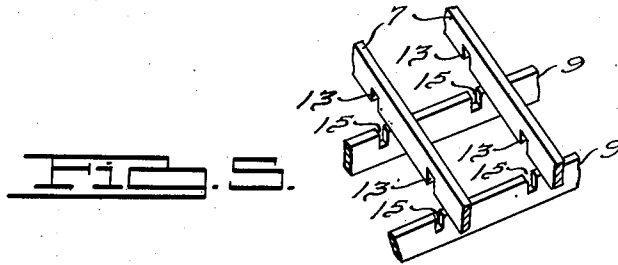


FIG. 5.

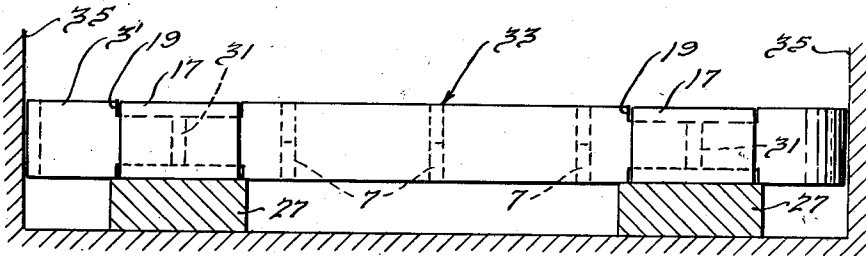


FIG. 6.

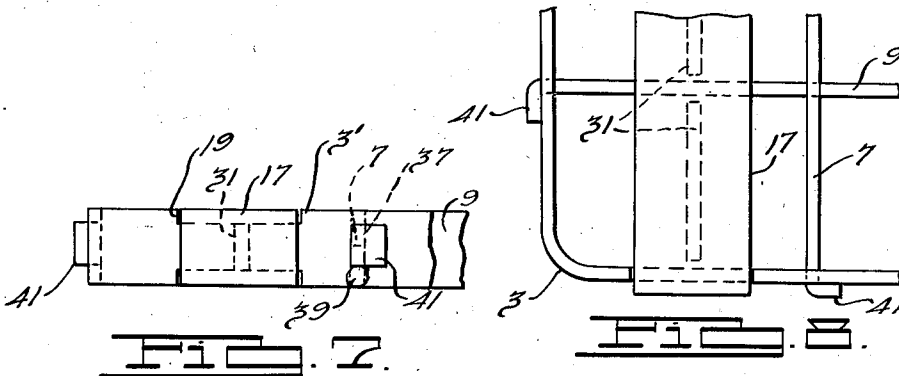


FIG. 7.

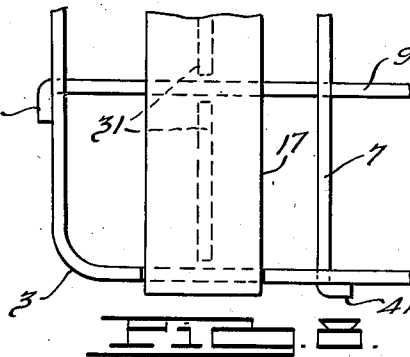


FIG. 8.

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HEAT TREAT TRAY

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8 Claims. (Cl. 263—47)

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This invention relates to the art of heat treating and, in particular, refers to trays for carrying articles to be treated through heat treat furnaces.

In addition to ability to withstand high temperatures without excessive scaling or other forms of chemical deterioration, heat treat trays must also maintain sufficient strength and rigidity while at elevated temperatures to properly support the articles to be heat treated. The first requirement can, of course, be met by proper selection of materials, but the second requirement is a matter of design. With regard to the design requirements, the tray must have as high a ratio of strength to weight as possible. The tray represents a distinct loss in the furnace so far as absorption of heat and time required to bring the parts up to heat-treating temperatures are concerned, and this loss is proportional to the weight of tray which must be heated. Hence, it is desired to keep the weight a minimum consistent with satisfactory high temperature strength. The prior art has felt that the maximum ratio of strength to weight is obtained by tray designs which can be embodied into actual trays only by casting or foundry methods. Hence, the conventional tray, for production furnaces at least, is a casting.

Heat treat trays, however, are not merely subjected to the dead load of the parts which they carry through furnaces. They may also be subject to intense internal forces due to expansion and contraction upon heating and cooling. Unless the design is just right and all parts of the tray change dimension uniformly in response to the temperature changes, these forces will be present in the tray. They are usually great enough to distort the tray and very often sufficient to rupture it. As those in the art now appreciate, it is virtually impossible to produce a cast tray which is not subjected to harmful internal forces of this nature, and, to at least this extent, the cast trays of the prior art are unsatisfactory.

The tray of the present invention may be fabricated from wrought metals of suitable heat-resisting character. The design is such that it provides a higher strength-weight ratio than heretofore obtainable with trays produced by casting or any other method. Furthermore, the present tray is flexible, so far as relative movement of its component parts is concerned, and internal forces due to dimensional changes are either eliminated or, at the very least, reduced to such an extent that they are not harmful.

It will now be realized that an object of the invention is to increase the strength and life of heat treat trays.

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Another object is to provide a heat treat tray of high strength which may be fabricated from wrought materials.

An additional object is to provide an extremely durable general purpose heat treat tray which may be economically manufactured.

The features of the invention whereby these and other objects are accomplished are illustrated in the accompanying drawings wherein:

Figure 1 shows a typical manner in which the trays are used;

Fig. 2 is a cross section taken on line 2—2 of Fig. 1 to show an end elevation of the improved tray;

Fig. 3 is a perspective view of the tray;

Fig. 4 is a section taken on line 4—4 of Fig. 3;

Fig. 5 is a perspective view showing the interlock connection between frame members;

Fig. 6 shows a modified form of the invention in end elevation; and,

Figs. 7 and 8 are end and plan views showing a modified means for connecting the frame work to the rim of the tray.

As best shown in Figs. 3-5, the improved heat treat tray 1 comprises basically a rim or marginal member 3 to which is secured a framework 5 consisting of a first series of spaced parallel strips 7 and a second series, normal to the first, of spaced parallel strips 9. The ends of the strips 7 and 9 may be affixed to the rim 3 by welding, as shown at 11. The rim and strips as well as the remainder of the tray to be presently described are desirably formed of about the same gauge of heat resistant alloy. Weld material is selected which has substantially the same expansion characteristics and analysis as the alloy. If desired, however, the ends of the strips may be bent and then riveted to the rim.

The strips 7 and 9 are joined together by a connection of the type illustrated in Fig. 5. The lower half of the strips 7 have vertical slots 13 and the upper half of the strips 9 have vertical slots 15. These slots are at the lines of intersection of the strips and enable the two sets of strips to fit together or interlock without being rigidly interconnected. This connection will be recognized as the type often used between transverse spacer strips in cardboard boxes. Retail egg boxes in particular are of this construction so that hereinafter the present framework 5 will be referred to as an "egg crate" framework.

In addition to its well-known advantages relative to ease of manufacture and assembly, the "egg crate" construction has particular virtues when used in a heat treat tray. These are in part associated with the expansion and contraction of the strips 7 and 9. Such expansion or contraction is appreciable inasmuch as the trays

are raised from room temperature to temperatures which are not uncommonly as high as 2000° F., and in some cases even higher, and then lowered back to room temperature. Expansion (and the same is true of contraction) is harmful when resisted. Resistance occurs when there is no room to accommodate expansion and also when all parts are not at the same temperature, i. e., when a temperature gradient exists in the interconnected parts. In the present construction the slots 13 and 15 provide room to accommodate expansion of the strips 7 and 9. Furthermore, they permit a certain amount of relative movement or shifting of the strips 7 and 9 as these members react in accordance with the forces of expansion and contraction. The present construction also expands and contracts uniformly. The sections of the strips 7 and 9, including those at the junctions thereof, are uniform hence no harmful temperature gradient is present in the framework 5 as it is heated to or cooled from the high temperatures to which it is subjected. Thus, it is evident that the "egg crate" construction minimizes resistance to changes in length of the strips 7 and 9 and therefore minimizes forces tending to distort or rupture the framework 5 and the tray 1.

The egg crate construction also has an advantageous influence upon the load-carrying capacity of the framework 5. When parts to be heat treated are placed on the framework 5, the strips 7 and 9 tend to bend so that their top edges are shortened and concave in appearance and their bottom edges are lengthened and convex in appearance, i. e., their upper halves are in compression and their lower halves in tension. This bending will tend to close the slots 15 in the strips 9 and cause the edges thereof to pinch the strips 7 and effectuate a somewhat rigid load-transmitting connection so that the weight of the parts being treated may be distributed to some extent throughout the framework. In the event that the slots do not provide enough room for expansion, though the pinching does not prevent expansion of the strips, it may in some cases provide enough resistance to make it desirable to control the temperature at which it occurs by regulation of the width of slots 15, it is apparent that lateral buckling can take place freely thus providing minimum opportunity for permanent distortion. It will be recognized that after due consideration of the loads to be carried, size of the strips 7 and 9, and of the temperatures involved, that the slots 15 can be made of sufficient width so that this pinching occurs at or near a desired temperature. It will be apparent that the strips 9 act as the major load-carrying members and the strips 7 to some extent as spacers due to the relative arrangement of the slots 13 and 15. The strips 9 by virtue of the pinch connection with strips 7 will tend to support the latter strips, which have less resistance to bending, but will also transmit thereto some of the applied load.

While the tray construction so far described provides many of the advantages of the invention and is capable of satisfactory usage, it is desirable practice to provide heat trays with pusher pads. In the present construction, such pads are provided and the members 17 which form them serve the additional purposes of increasing the strength of the tray, carrying certain type loads, supporting the tray in its travel through a furnace. As best recognized from Figures 3 and 4, these members are, in the preferred form, end-

less straps (which may, of course, be produced by welding two strips together at the ends) loosely disposed around the two side portions of the framework 5. Slots 19 may be provided in the rim 3 to accommodate the straps 17; and it may be noted incidentally that the rim 3 need not extend, as shown, above the plane of the framework 5 but such extension provides the obvious advantage of inhibiting the inadvertent sliding or rolling of parts from the tray. The straps 17 are not tightly interconnected with the rim 3 or framework and thus may expand and contract independently thereof. Production furnaces often have a series of rolls or the like down the center thereof to locate and facilitate movement of the trays through the furnace. When used in such furnaces, the trays may be provided with a central guide member 21 in which the rolls fit. The guide 21 comprises a downwardly opening channel 23 which forms one side of an endless strap which, like straps 17, is loosely disposed around the framework 5 and rim 3 through slots 19 in the rim and may be formed by bending a suitable strip around the top and sides of the tray and welding the ends to the channel 23.

As indicated in Figs. 1 and 2, the trays 1 are lined up in series arrangement with the pusher pads 17 abutting and are forced by suitable pusher rods 24 through the furnace. The trays are supported by the members 17 and 21, the guide member 21 resting on rolls 25, as just indicated. The lower faces of the members 17 are adapted to slide on the side rails 27 usually provided in furnaces of this type. When the trays are forced through the furnace in this manner, the pusher bar load passes from one to the next through the straps 17. There is no pusher load on the frameworks 5 or the rims 3 of the trays due to the fact that the straps are of greater length than the trays and loosely connected thereto. In order to increase the strength of the straps without transmitting any pusher loads to the framework 5, they are provided with a series of longitudinally spaced transverse stiffening webs 31. The webs comprise a series of simple plates that are welded to the opposed longitudinal faces of the straps 17 and 21. The webs 31 are shorter than the spaces between the strips 9 and are disposed therebetween so that neither interferes with the dimensional changes of the other. The webs 31 make the members 17 and 21 I-beam members so far as structural characteristics are concerned and thus increase their load-carrying capacity.

As already suggested, the center strap 21 may not be used on trays when the furnaces have no center line of rolls. Thus, in the tray 33 of Fig. 6 there are only the side straps 17 and these ride upon the rails 27 in the furnace. Side guide rails or walls 35 in the furnace coact with the sides of the rim 3' to properly position the tray 33 on the rails 27. In this tray the edges of the rim 3' and the straps are shown flush. The egg crate members 7 and 9 are also of the same width as the rim and strap and are therefore provided with cutouts as shown through which the horizontal strap portions pass. This tray may be inverted and used if desired. In this case the strips 7, rather than the strips 9 as described above, would be the major load-carrying members of such load as may be applied to the framework 5.

It will be recognized that in some cases the weld connections 11 may possibly set up resistance to changes in length of the strips 7 and 9

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to an extent that is not compensated by the egg crate interconnection of the strips. To avoid this possibility, the strips may be slidably mounted in suitable slots 37 in the rim. These slots may, for example, be cut from the top or the bottom edge of the rim 3 and the strips inserted and then the slots closed by weld beads 39. Though not essential, the ends of the strips may be bent into engagement with the outside of the rim, as shown at 41. With this mode of attachment of the framework 5 to the rim 3, relative movement of the strips 7 and 9 and rim can occur freely and no distortive forces will be created by resistance to expansion and contraction.

From the foregoing description, it is evident that the present heat treat tray provides many improved features, particularly when compared with the conventional cast trays. One of these is a maximum strength-weight ratio. Prior trays have been rigid and thus unable to withstand internal stresses due to expansion and contraction. The present tray, on the other hand, is not rigid; the component parts are independently movable. Nevertheless, the present construction maintains the structural integrity of the tray and there is no chance of disassembly. Preferably, of course, the component parts of the present tray are made of uniform section, i. e., the same gauge metal. However, the non-rigid interconnection of the parts makes this unnecessary since variations in length changes due to temperature gradients resulting from sectional non-uniformities may occur without resistance.

Other advantages, such as the ease of fabrication and assembly, will be apparent to those in the art as will be certain modifications that can be made without departing from the spirit of the invention.

What is claimed is:

1. A fabricated wrought iron heat treat tray comprising an egg crate framework defining a load-supporting surface, said frame work including a first set of spaced parallel strips and a second set of spaced parallel strips extending at substantially right angles to said first set of strips, the strips of each set being slotted at the lines of intersection with the strips of the other set so that the two sets of strips are interlocked without being rigidly connected and a rim member connected to the framework and defining the periphery of said surface, said rim member being of a material having substantially the same expansion and contraction characteristics as said frame work.

2. A heat treat tray comprising an egg crate framework defining a load-supporting surface, said frame work including a first set of spaced parallel strips and a second set of spaced parallel strips extending at substantially right angles to said first set of strips, the strips of each set being slotted at the lines of intersection with the strips of the other set so that the two sets of strips are interlocked without being rigidly connected a rim member connected to the framework and defining the periphery of said surface, and an endless strap loosely disposed around said framework and rim.

3. A heat treat tray comprising an egg crate framework defining a load-supporting surface, said frame work including a first set of spaced parallel strips and a second set of spaced parallel strips extending at substantially right angles to said first set of strips, the strips of each set being slotted at the lines of intersection with the strips of the other set so that the two sets of strips are

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interlocked without being rigidly connected a rim member connected to the framework and defining the periphery of said surface, and an endless strap loosely disposed around said framework and rim and having transverse upright stiffening webs disposed in openings of the framework.

4. In a heat treat tray, the combination of a rim, an egg crate framework within the rim, said frame work including a first set of spaced parallel strips and a second set of spaced parallel strips extending at substantially right angles to said first set of strips, the strips of each set being slotted at the lines of intersection with the strips of the other set, so that the two sets are interlocked without being rigidly connected, and means providing slots in the rim for receiving the ends of the frame members whereby said framework is supported by the rim but the ends of the members are movable relative thereto.

5. In a heat treat tray, the combination of an endless upright strap-like member comprising a rim, an egg crate framework secured within and to the rim and defining a load-supporting surface, said rim extending above the surface to provide a marginal border therefor, laterally spaced longitudinally aligned pairs of slots in the marginal border, straps loosely disposed around the rim and framework in said slots having webs in openings of the framework but capable of force transmitting engagement with only the rim.

6. In a heat treat tray, the combination of rim means and a grid defining a load-carrying surface supported by the means, said grid including certain intersecting members with slots at the lines of intersection to provide mouths for receiving the other members.

7. The invention as claimed in claim 6 wherein each of the intersecting members has slots at the lines of intersection to provide mouths in which each of the members receives another.

8. In a heat treat tray, an egg crate framework defining a load-supporting surface, said frame work including a first set of spaced parallel strips and a second set of spaced parallel strips extending at substantially right angles to said first set of strips, the strips of each set being slotted at the lines of intersection with the strips of the other set so that the two sets of strips are interlocked without being rigidly connected and pusher pad means comprising a longitudinal beam member having web sections disposed in certain of the openings of the framework and spaced from the framework members.

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