July 1, 1952 P. S. MENOUGH 2,601,980

ANNEALING TRAY

Original Filed Jan. 9, 1947 4 Sheets-Sheet 1

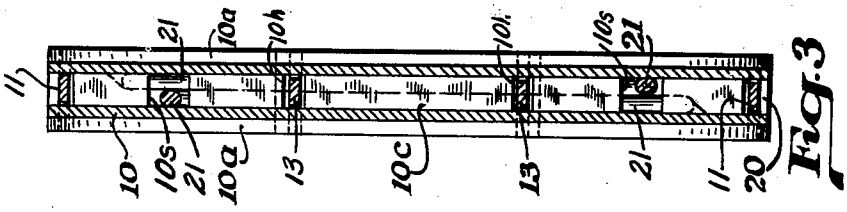


Fig. 3

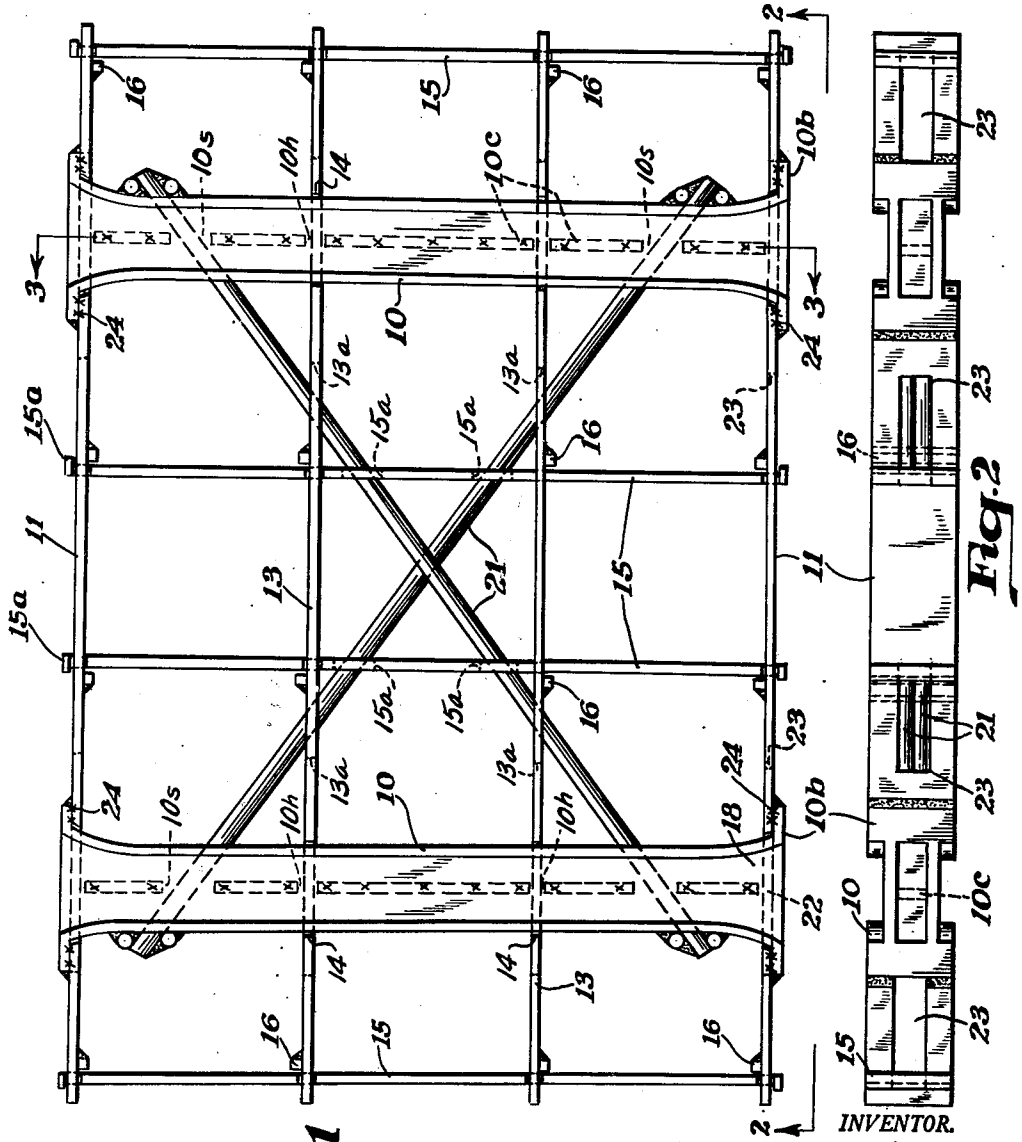


Fig. 1

Fig. 2

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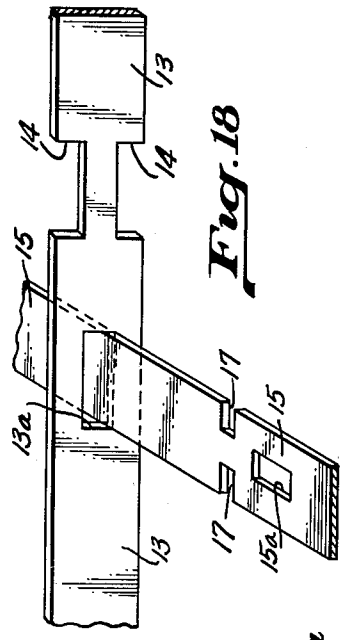


Fig. 1B

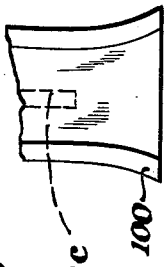


Fig. 8



Fig. 7

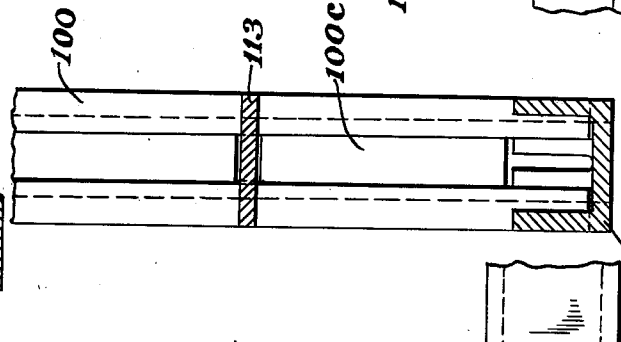


Fig. 6

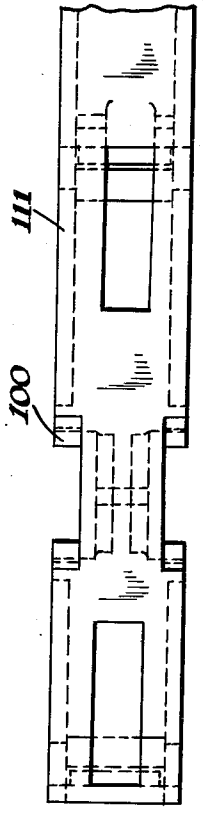


Fig. 5

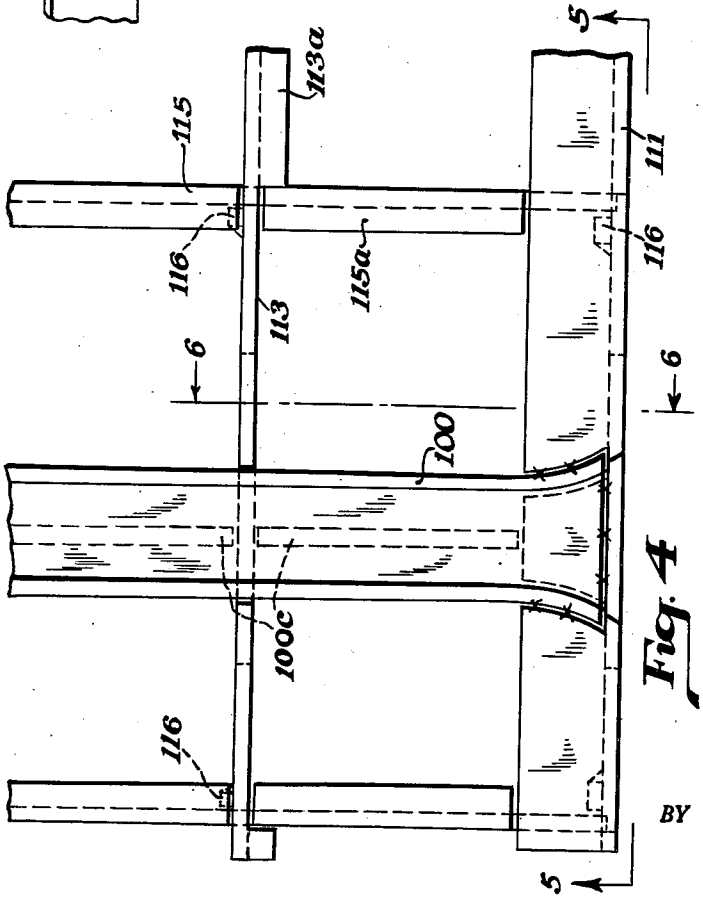


Fig. 4

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ANNEALING TRAY

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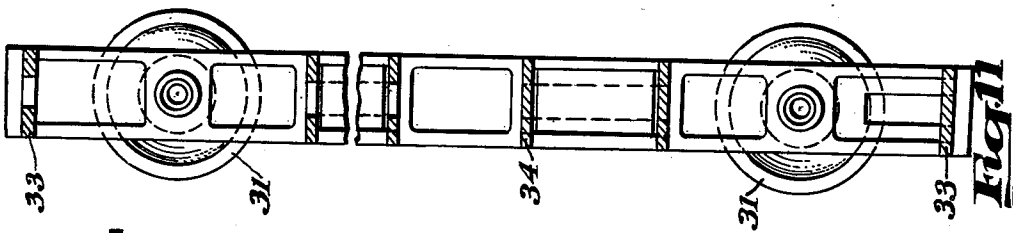


Fig11

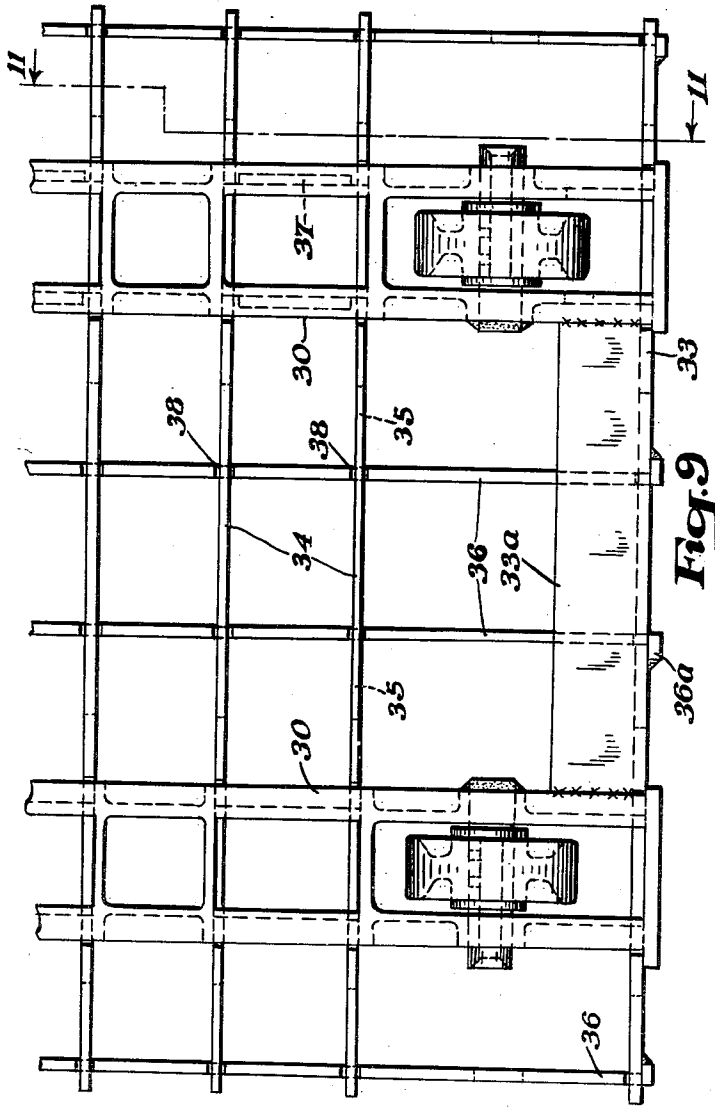


Fig.9

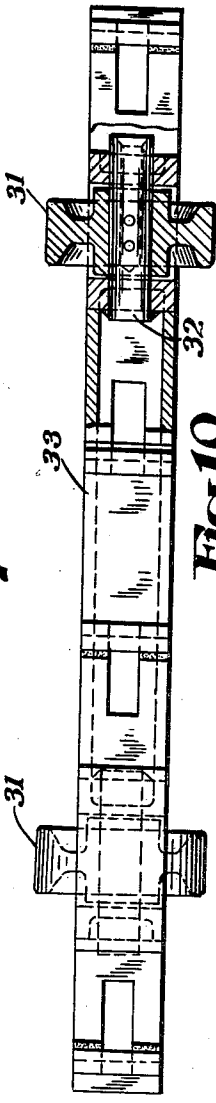


Fig10

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ANNEALING TRAY

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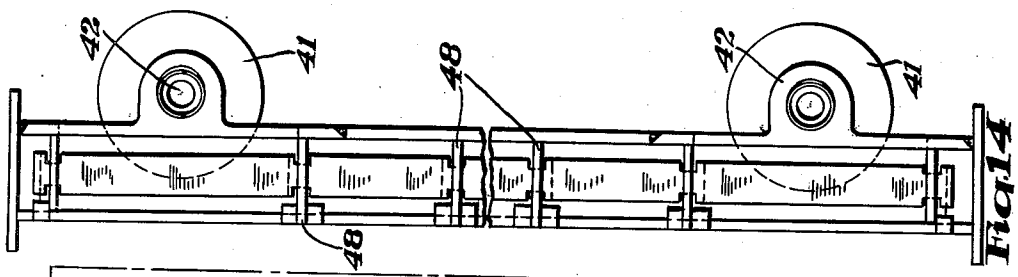


Fig. 14

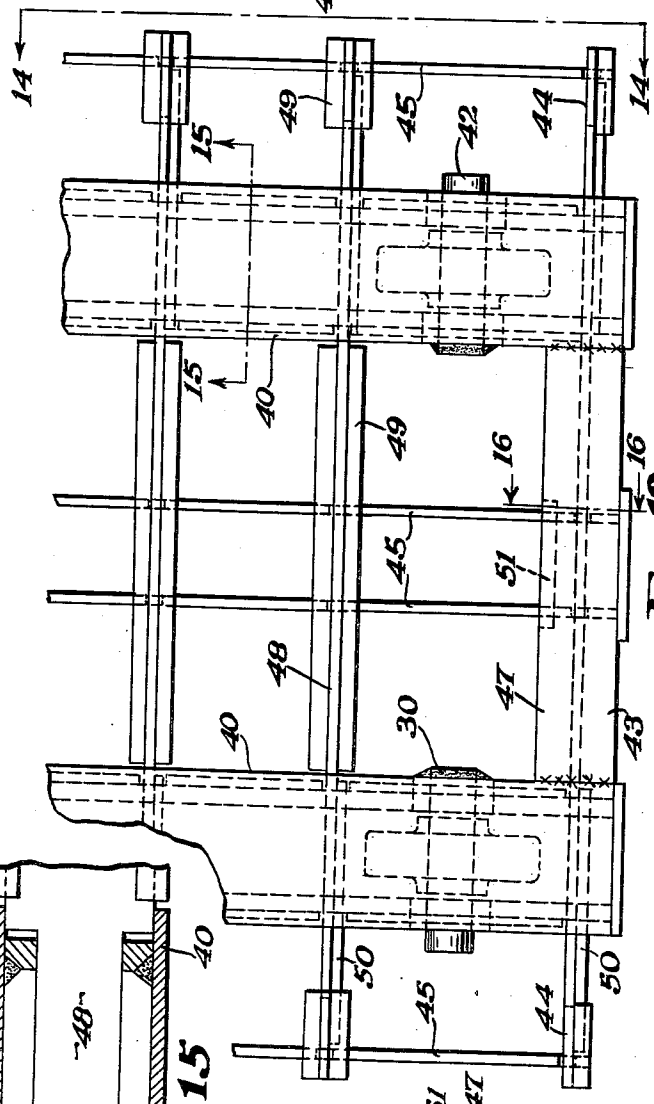


Fig. 12

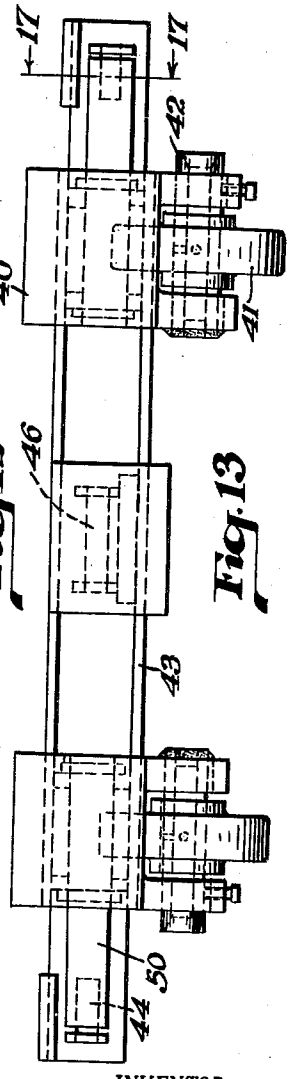


Fig. 13

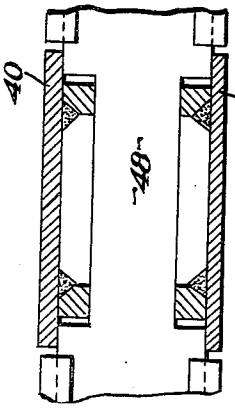


Fig. 15

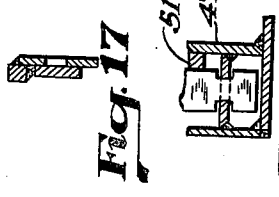


Fig. 16

Fig. 17

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Patented July 1, 1952

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UNITED STATES PATENT OFFICE

2,601,980

ANNEALING TRAY

Paul S. Menough, Rocky River, Ohio

Continuation of application Serial No. 721,106, January 9, 1947. This application January 30, 1951, Serial No. 208,460

12 Claims. (Cl. 263—47)

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This invention relates generally to annealing trays and particularly to trays composed of a plurality of parts several of which may move to a limited extent relative to other parts.

This invention comprises means for constructing trays or basket bases from simple castings, from rolled sections or from a combination of castings and rolled sections. It is directed primarily to such trays or baskets as are used in connection with commercial heating furnaces.

Heretofore trays for transmission through a heating furnace have usually been made from one piece castings of some analysis that is heat resistant. Generally, small castings or forgings are supported on such trays as they are pushed, end to end, through a tunnel-like furnace. Consequently, the work supporting surface of the tray is an open grid with the openings of such size that none of the individual pieces being carried can possibly fall through the grid. The bars forming this grid extend both from side to side of the tray and from end to end. Wherever there is a juncture of these transverse and longitudinal ribs there must be a heavy section of metal that heats up and cools off out of time with the surrounding structure. Therefore, every heating and cooling cycle sets up thermal strains of appreciable extent throughout the grid. Also, wherever heavy sections are present in any high alloy casting there is a concentration of impurities which weaken and embrittle the structure just where strength and ductility are needed most.

Furthermore, such trays are loaded with as much work as can be placed on the load-bearing surface without danger of individual pieces jolting off as the tray is pushed by successive stages through the furnace. They are heated, generally from a source of heat along the face of the side walls. There is a space for circulation of hot gases at the ends of the work on each tray. Consequently, the four sides of the tray heat up and cool off at a fairly uniform rate. The center of the tray, however, due to the chill of the work and no direct exposure to the heat, lags seriously behind the four sides in arriving at a uniform temperature. These heretofore uncontrollable stresses, in connection with a service developed loss of ductility, are usually the cause of failure and if they could be eliminated or to a large degree decreased the life of these expensive alloy steel structures would be very materially increased.

In built up trays for the service above described, provision should be made for holding the sides

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of the tray square and parallel. If there is any play or lost motion between the ends and the sides of tray, and such has generally been the case with fabricated trays heretofore constructed, one side can push ahead of the other side during progress through the furnace. Such distortion may be cumulative through the train so that the trays at the end may try to ride over the rail and jam the load of trays in the furnace. Even if this does not occur to the disastrous extent outlined above, as the trays get older in service they warp to some extent and any out of square position they assume will set up stresses that cause tray breakage. Furthermore, if the tray comes from the furnace with one side leading the other and is placed in service at the entrance end of the furnace it is then used as a strut to push the entire train a step through the furnace. However, this strut is now out of square and the push is not concentric on the long articulated column of heated trays. Every effort must be made to keep all stresses uniform in these structures as they are exposed to the very severe service to which they are subjected. Otherwise a short tray life will be realized and possibly a wreck in the furnace that will cause the furnace to be shut down for repairs and the scrapping of a number of distorted and broken trays.

In my invention, I have eliminated the above uncertainties of previously designed furnace trays. The tray is held in square by tightly connecting the side and end rails while the center of the tray, on which the load is concentrated, is made from sections which are free to expand and contract independently of their neighbors. On all trays which carry a load through a heating furnace, the center should be divorced from the more rapidly heated side and end members. Furthermore, I have constructed the individual tray members from the simplest possible sections. In the case of castings, this is of prime importance. In addition in these trays the center sections are divorced from the rapidly heated side and end members and all the parts, both center and peripheral, are of the simplest uniform section and embody no relatively large and difficultly heated and cooled metal masses. Also, the castings I have indicated as desirable in the trays of my construction, will be of most economical design from the viewpoint of the foundry in that they are "flat backs" and can be made in shallow dry sand cores and stacked in multiple for pouring—an important consideration in

keeping to a minimum the price of castings and consequently of the assembled tray.

Any welded sections which are used in the fabrication of a sectional tray should be, if possible, relieved of any structural stresses as they progress through a series of heating and cooling cycles. These welds, under the above conditions of repeated stress of reversal of stress while at elevated temperatures have a tendency to lose ductility and eventually develop cracks. Consequently, in my tray design I have anchored the center bars and the longitudinal bars to each other and to the side frame members by mechanical means. In other words, I do not depend on welds to hold the structure in its fabricated position, they are only incidental to the mechanical interlocks, and not subjected to destructive reversals of stress.

Trays embodying the present invention comprise a rectangular, shape retaining frame including parallel support rails and transverse members connected rigidly thereto, and load carrying members secured to the frame for limited relative movement. Tie bars may extend parallel to the support rails and be connected to the load bars for limited relative movement. The support rails may be formed to run on rollers positioned in the furnace bottom or may carry rollers. These rollers may project from only one side of the tray or may be disposed symmetrically so as to project on opposite sides of the tray.

Those skilled in the art will gain a further understanding of my invention upon referring to the drawings accompanying and forming a part of this specification, in which:

Fig. 1 is a plan view of one form of tray of this invention;

Fig. 2 is a view taken on line 2—2 of Fig. 1;

Fig. 3 is a view taken on line 3—3 of Fig. 1;

Fig. 4 is a fragmentary view of another tray embodying this invention;

Fig. 5 is a view taken on line 5—5 of Fig. 4;

Fig. 6 is a view taken on line 6—6 of Fig. 4;

Fig. 7 is a view similar to that of Fig. 4 showing the portion of the side member of the tray which is engaged with the end of the rail of the tray;

Fig. 8 is a fragmentary view showing the flared end of the rail of Fig. 4;

Fig. 9 is a fragmentary plan view of another tray embodying this invention and provided with rails;

Fig. 10 is a side elevational view partly in section of the tray of Fig. 9;

Fig. 11 is a view taken on line 11—11 of Fig. 9;

Fig. 12 is a fragmentary plan view of still another tray of this invention;

Fig. 13 is a side elevational view of the tray of Fig. 12;

Fig. 14 is a view taken on line 14—14 of Fig. 12;

Fig. 15 is a view taken on line 15—15 of Fig. 12;

Fig. 16 is a view taken on line 16—16 of Fig. 12;

Fig. 17 is a view taken on line 17—17 of Fig. 13; and,

Fig. 18 is a fragmentary, perspective view of a load carrying member and a tie bar of Fig. 1 tray at an intermediate stage in their assembly.

In the modification of the present invention shown in Figs. 1, 2 and 3, the illustrated tray comprises parallel rails 10, transverse members 11 secured to the rails at their ends, load carrying members 13 extending through the rails parallel to members 11, tie bars 15 extending parallel to the rails and operatively associated with members 11 and 13, keepers 16 for maintaining members 11, 13 and 15 in assembled position while permitting relative movements thereof, and braces 21 welded at their ends to opposite ends of the rails.

The rails 10 of Figs. 1 to 3 are each composed of two channel-shaped members 10*a* integrally connected at their ends by plates 10*b* and connected between their ends by a plurality of plates 10*c* which are welded in place and serve as webs for the rails, as well as keepers for load bars 13. The several elements of plate 10*c* of each rail are spaced apart to define holes 10*h* to receive load bars 13 and elongated openings 10*s* extending longitudinally along the neutral axes of the rail near the ends of the rail through which braces 21 may extend. The flat surfaces of parts 10*a* of the rails are suited to run on rollers and the marginal flanges projecting beyond those surfaces serve to prevent the rails from running off the rollers.

Transverse members 11 are flat plates and are provided with notches 22 and openings 23. These members extend through the rails and the latter are disposed in notches 22. The end plates 10*b* of the rails are welded to members 11, as indicated at 24. Rails 10 and members 11, when so assembled, constitute a rectangular frame which is substantially rigid and which can be pushed through a furnace without being whacked out of square.

Load bars 13 are flat plates with notches 14 in their opposite edges to receive rails 10 through which they extend, and openings or holes through which tie bars extend. Load bars 13 are maintained in assembled position with rails 10 by the plates 10*c* which are welded in place in the rails after assembly of the load bars therewith.

Tie bars 15 are flat backs, have lugs 15*a* at their ends and notches 17 in their opposite edges to cooperate with load bars 13 through which they extend. These tie bars 15 are maintained in assembled position with members 11 and 13 by bar-like keepers 16 which are welded to members 11 and 13 adjacent to each intersection thereof with tie bars 15.

As shown in Fig. 18, tie bars and load bars of this tray are formed for interlocking engagement with each other and with rails 10. Openings 13*a* in bars 13 are elongated and aligned along the neutral axes of said bars, and notches 14 are spaced apart longitudinally of bars 13 to receive rails 10, being slightly wider than the thickness of the rails. Openings 13*a* are also slightly wider than the thickness of the tie bars, which are of substantially the same width as the load bars. Notches 17 in the edges of bars 15 are arranged in opposed pairs and are longitudinally spaced and slightly wider than the thickness of the load bars. As these parts are assembled together, as illustrated in Figs. 1–3, inclusive, the tie bars extend through openings 13*a* in the load bars and each pair of notches 17 receives one of said load bars. Tie bars 15 are also provided with elongated openings 15*a* extending along the neutral axes of these bars to receive braces 21, being in register diagonally of the tray with adjacent openings 13*a* of the load bars.

Braces 21 are preferably rods extending diagonally of the tray and through the rails and load bars and tie members therebetween. These braces supplement the bracing action afforded by welds 24.

From the foregoing description, it will be understood that the tray of Figs. 1–3 includes a rec-

tangular, substantially rigid, frame in which there are rails to run on supporting rollers and in which the load is carried by load bars and tie members which are assembled for limited movement relative to each other. Furthermore, the tray is reversible.

Figs. 4–8, inclusive, show modifications of certain of the parts of the tray of Figs. 1–3. The transverse members 111 are like members 11 as regards notches and apertures but are channel-shaped in cross-section, as is shown in Fig. 6. Rails 100 are separate flat back castings which fit into correspondingly shaped notches in the flanges of members 111 and are welded there in place. Keepers 100c are welded in place between rail members 100 and correspond to keepers 10c of Figs. 1–3. Load carrying members 113 are provided with flanges 113a which serve as keepers for tie bars 115. These bars have flanges 115a which serve as keepers for load bars 113. Keepers 116 may be welded to members 111 and 113 for maintaining members 115 in assembled position, if desired.

In the modification shown in Figs. 9–11, inclusive, the rails 30 are preferably reversible castings provided with rollers 31 mounted on shafts 32 secured to the rails and having hollow centers through which lubricant may be forced into the hub of the rollers 31 which rotate about the shafts. Transverse members 33, corresponding to members 11 of Fig. 1, are flat backs which extend through rails 30, have notches to receive the rails, and have flanges 33a projecting inwardly along the sides of the rails to which they are welded. The rails 30 and transverse members 33 form a rectangular, suitably rigid, shape-maintaining frame.

Load carrying members 34, corresponding generally to members 13 of Fig. 1, extend through elongated holes in rails 30, have notches to receive the rails and have apertures or elongated holes 35 through which extend and by which tie bars 36 welded to the rails adjacent to load bars 34 serve to maintain them in assembled position with the rails.

Tie bars 36 are flat backs with end flanges 36a welded to transverse members 33. These tie bars extend through apertures 35 in load bars 34 and have notches 38 in their edges to engage opposite sides of bars 34.

It will be understood that the modification of Figs. 9–11 includes the shape-maintaining frame. the load bars and tie bars which are movable relative to each other and to the rails, and that the tray is reversible since rollers 31 project from opposite sides thereof.

In the modification shown in Figs. 12–17, inclusive, the rails 40 are preferably castings, although like rails 30 of Fig. 9 they may be fabricated. These rails 40 have rollers 41 rotatably mounted on shafts 42 which are fixedly attached to the rails and have hollow centers through which lubricant may be supplied through the inner bearing surfaces of the rollers 41. Transverse members 43, generally similar to members 33 of Fig. 9, extend through elongated holes in the rails, have apertures or holes 44 to receive end tie bars 45, an aperture 46 to receive tie bars 45 between the rails and notches to receive rails 40. Flanges 47 extending inwardly along the sides of rails 40 are welded thereto. Transverse members 43 and rails 40 thus form a rigid shape-maintaining frame which, however, is not reversible. Load bars 48 extend through elongated holes in rails 40 and have apertures or holes through which tie bars 45 extend. These load bars have flanges 49 at their top edges to afford supports for articles on the tray. Tie bars 45 extend through holes in load bars 48 and have notches in their opposite edges to engage opposite sides of load bars 48, as is clearly shown in Fig. 14. Keepers 50 serve to position tie bars 45 relative to transverse members 43.

The tray shown in Figs. 12–16, inclusive, like those shown in earlier figures, has a rigid, rectangular frame and load bars and tie bars movable to a limited extent relative to each other. However, unlike those trays, it is not reversible.

In assembling the tray of Figs. 1–3, for instance, two transverse members 11 are placed in a horizontal plane and threaded through holes in rails 10 near their ends, and then turned into vertical planes with notches 22 receiving rails 10. Load bars 13 are similarly threaded through holes in the rails and turned into vertical planes to engage said rails. The two intermediate tie rods 15 are likewise threaded through holes in members 11 and bars 13 and then turned through 90° to engage those elements. Braces 21 are threaded through rails 10, bars 11 and rods 15 and secured to rails 10 by welds, as shown. The two end tie rods 15 are threaded through the end portions of members 11 and bars 13 and then locked in engagement therewith as described. The assembly is then completed by welding rails 10 and members 11 together, welding plates 10c to the rails and welding keepers 16 to members 11 and bars 13, as illustrated.

The present application is a continuation of my copending application, Serial No. 721,106, filed January 9, 1947, later abandoned.

Having thus described the present invention so that others skilled in the art may be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. A reversible annealing tray comprising parallel support rails having their opposite sides in parallel planes, means connecting the ends of said rails and forming therewith a rigid frame, load bars extending through said rails and having limited movement relative thereto and tie bars extending through said load bars and having limited movement relative thereto, said rails having channels open to opposite sides of said tray to engage and run on supporting rollers.

2. An annealing tray having top and bottom portions and comprising a rigid, shape-maintaining, rectangular frame, four parallel support rails, parallel load bars and parallel tie bars disposed at right angles to said load bars, said load bars and tie bars extending through said frame and being connected thereto and to each other for limited relative movement, said rails having channels with flaring ends to receive guide means for directing movement of the tray and being secured together in spaced apart pairs with one channel of each pair facing the top of the tray and the other channel facing the bottom of said tray.

3. An open grid annealing tray comprising parallel spaced apart support rails, rollers journalled in said rails, means connecting the ends of said rails and forming therewith a rigid frame, spaced apart load bars extending through elongated holes in said rails and having limited movement relative thereto, and tie bars extending through elongated holes in said load bars and having limited movement relative thereto.

4. An annealing tray having parallel rails, rollers journalled in said rails and projecting beyond opposite sides thereof, means connecting the ends of said rails and forming therewith a rigid frame, load bars extending through elongated holes in said rails and having limited movement relative thereto, and tie bars extending through elongated holes in said load bars and having limited movement relative thereto, said rails having transverse openings, and said rollers being disposed in said openings and projecting above the top and below the bottom of the tray.

5. A load bearing tray of the class described comprising a plurality of parallel, spaced apart beam-like members having webs and elongated holes through said webs on their neutral axes, spaced apart cross members of substantially the same width as said beam-like members spanning the space between the beams and extending through said holes and having notches in the edges of the cross members of such a width as to engage the sides of the beams.

6. A tray of the class described consisting of a plurality of spaced apart equi-length beams with their webs arranged in vertical planes, a series of spaced apart vertical webbed cross bars extending through holes in the beam webs, notches in the edges of the cross bars to engage the sides of the beams and hold them in spaced apart parallel relationship, means to hold the cross bars in predetermined positions, and tie bars independent of said beams and spaced therebetween and extending through holes in said cross bars.

7. A load bearing tray of the class described comprising a plurality of load carrying bars having aligned tie bar-receiving elongated holes extending therethrough longitudinally along their neutral axes, a plurality of tie bars of substantially the same width as said load bars and having opposed pairs of longitudinally spaced notches in their edges, said holes in the load bars being slightly wider than the thickness of the tie bars and said notches being slightly wider than the thickness of the load bars, said tie bars extending through said holes in the load bars with each pair of notches receiving a load bar.

8. An annealing load bearing tray of the class described comprising a rigid, shape-maintaining rectangular open grid frame including a plurality of parallel rails, a plurality of parallel load bars extending through said rails and a plurality of tie bars extending through said load bars, said rails, said load bars and tie bars being of substantially the same width, the rails having elongated load bar-receiving holes extending longitudinally along their neutral axes, said load bars having pairs of notches in their edges spaced apart longitudinally thereof to receive the said rails, said notches being slightly wider than the thickness of the rails, said load bars also having tie bar-receiving elongated holes extending longitudinally therethrough along their neutral axes to receive said tie bars and being slightly wider than the thickness of said bars, said tie bars having pairs of notches in their edges slightly wider than the thickness of said load bars to receive the latter.

9. An annealing tray comprising a rigid, shape-maintaining, generally rectangular frame including parallel members having elongated holes therethrough, transverse members disposed at right angles to said parallel members, projecting through said elongated holes and having notches in their edges to receive said parallel members, and load bars extending through elongated holes in said parallel members and having notches in their edges to receive the latter members.

10. An annealing tray comprising a rigid, shape-maintaining, generally rectangular frame including parallel members having elongated holes therethrough, transverse members disposed at right angles to said parallel members, projecting through said elongated holes and having elongated holes and notches in their edges to receive said parallel members, load bars extending through elongated holes in said parallel members and having notches in their edges to receive the latter members, and tie bars extending through said holes in the transverse members and load bars and having notches in their edges to receive the transverse members and load bars.

11. An annealing tray comprising a rigd, shape-maintaining, generally rectangular frame including parallel rails having elongated holes therethrough, transverse members disposed at right angles to said rails, projecting through said elongated holes and having notches in their edges to receive said rails, load bars extending through elongated holes in said rails and having notches in their edges to receive the rails.

12. A reversible annealing tray comprising a rigid, shape-maintaining, generally rectangular frame including parallel rails having elongated holes therethrough, transverse members disposed at right angles to said rails, projecting through said elongated holes and having notches in their edges to receive said rails, and load bars extending through elongated holes in said rails and having notches in their edges to receive the rails, said rails having surfaces exposed at each side of the tray to engage with, and support the tray on, tracks.

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