Jan. 10, 1933. H. O. BREAKER 1,893,930

ANNEALING BOX

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Fig. 1

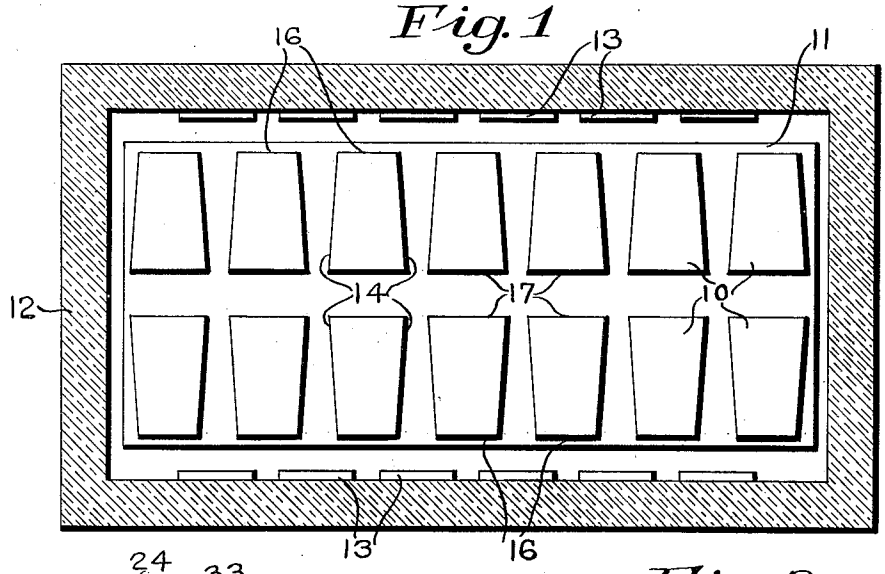


Fig. 2

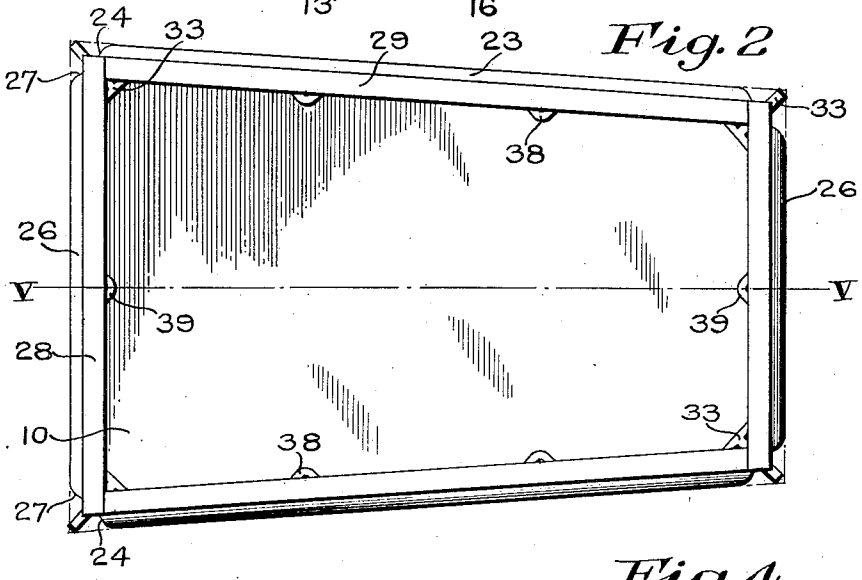


Fig. 3

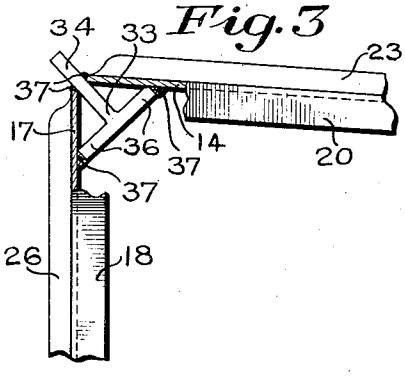
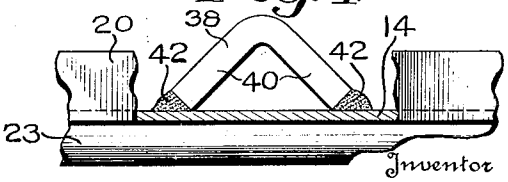


Fig. 4



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Fig. 5

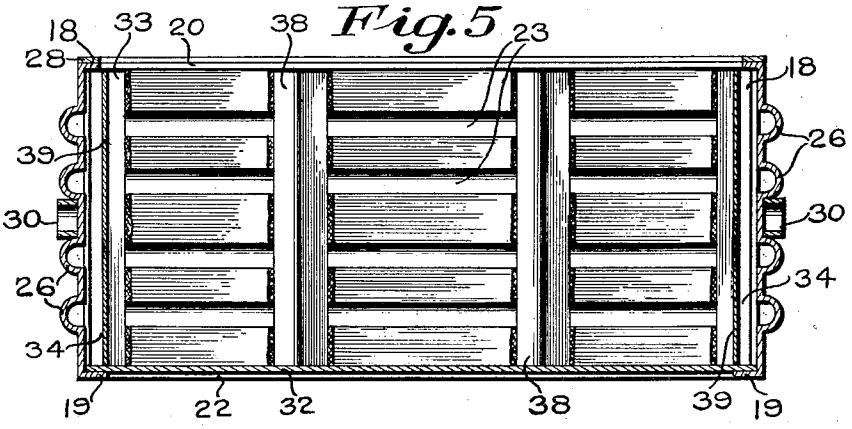


Fig. 6

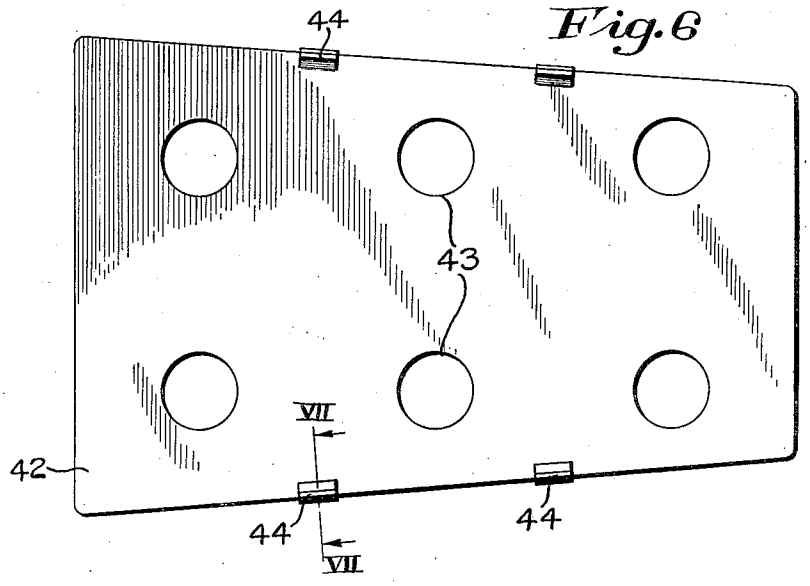
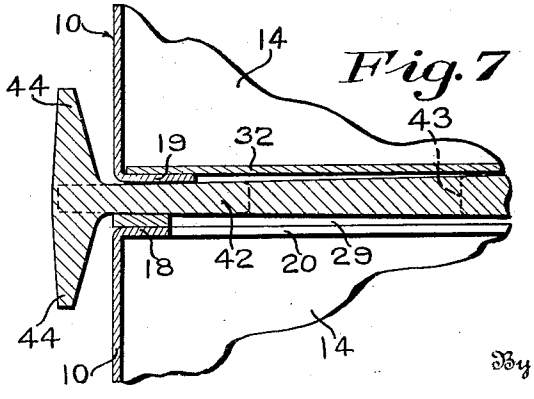


Fig. 7



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UNITED STATES PATENT OFFICE

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ANNEALING BOX

Application filed July 23, 1931. Serial No. 552,718.

This invention relates to heating apparatus employed in treating metal and it has particular relation to so-called annealing boxes and to methods involved in constructing, arranging the boxes, and applying heat thereto.

Annealing devices heretofore employed in furnaces for treating metal have been placed in such relation as to utilize as little space as possible and heat was applied from the side walls of the furnaces. One type of commonly known annealing box is rectangular in shape and accordingly only one side of each box was exposed directly to the heat rays. It would of course be possible to arrange the box with one of its corners projecting toward the furnace wall or heating element, but even then only half of the box would be properly exposed to the heat rays, and such arrangement is inconvenient because of the undesirable positioning that would be required.

According to this invention the boxes are so shaped as to insure a very practical and efficient application of heat thereto. At least three sides of the boxes are directly affected by the heat radiation from the furnace walls or from the heating elements in the walls. Such advantage in heating greatly enhances the commercial aspects of annealing boxes, and these advantages can be secured without material additional expense over the methods previously employed. The invention also contemplates an improved construction for distortion-resisting annealing boxes, the novel boxes being provided with corner and wall reinforcing elements particularly adapted to withstand the distortion which would otherwise be caused by the great changes in temperature and the severe usage to which the boxes are subjected.

For a better understanding of the invention reference may now be had to the accompanying drawings forming a part of this specification, of which:

Fig. 1 is a horizontal section of a furnace having boxes therein shown in plan and constructed and arranged according to the invention;

Fig. 2 is a plan, on a larger scale, of one of the annealing boxes;

Fig. 3 is a fragmentary plan, on a larger scale, showing in detail a corner construction of one of the annealing boxes;

Fig. 4 is a fragmentary plan, on a larger scale, showing in detail a side reinforcing construction for one of the annealing boxes;

Fig. 5 is a vertical section taken substantially along the lines V—V of Fig. 1;

Fig. 6 is a plan of a cover for an annealing box; and

Fig. 7 is a fragmentary cross-section, on a larger scale, taken substantially along the lines VII—VII and showing the manner in which the boxes are superposed with the cover between them.

Referring in detail to the drawings, Fig. 1 includes a diagrammatical showing of a plurality of annealing boxes 10 resting upon a support 11 in a furnace 12 that is composed of refractory material for resisting the deteriorating effect of extremely high temperatures. Suitable heating elements 13 distributed along the inner side walls of the furnace are energized by means of electricity or other heat producing means. It will be observed that the plan outline of each annealing box is trapezoidal in contour and that a plurality of rows of boxes are so arranged that their sides 14 converge toward the adjacent walls of the furnace along which the heating elements are disposed. By arranging the boxes in this manner the heat from the elements 13 is radiated indirectly but effectively against their entire opposite converging side walls 14, as well as directly against their smaller end walls 16 that face directly opposite the furnace walls. The larger end walls 17 of the several boxes are arranged in opposing spaced relation. Thus the heat radiation against the boxes is much more effective than the radiation would be if the boxes were rectangu-

lar. In fact it has been found that the annealing boxes shaped and arranged in this manner in the furnace are heated approximately 25 per cent more effectively than annealing boxes of previously known types when subjected to an equally heated furnace.

The end walls 16 and 17 of each box are provided with inwardly turned upper and lower flanges 18 and 19 which abut at the box corners, and with similar upper and lower flanges 20 and 22 on the converging side walls of the box.

In order to strengthen the box against distortion as a result of repeated changes in temperature or of severe handling thereof, the walls 14 are provided with horizontal corrugations 23 which merge, as indicated at 24, into the plane surfaces of the walls adjacent the box corners. Likewise the walls 16 and 17 are provided with similar corrugations 26 which merge, as indicated at 27, into the plane surfaces of the walls adjacent the box corners. Additional metal strengthening strips 28 and 29 complemental with respect to the upper flanges 18 and 20 are welded or otherwise rigidly secured about the upper edges of the box. The trunnion rings 30 are rigidly secured by welding or otherwise to the end walls 16 and 17 between the central corrugations 26 and serve to facilitate the removal of the boxes from the furnace by insertion of elements of a suitable hoisting apparatus (not shown). Each box is provided with a suitable sheet metal bottom 32 which rests upon the lower flanges 19 and 22 and is rigidly secured thereto.

Each corner of the boxes is provided with a vertical reinforcing bar 33 which is T-shaped in cross-section and includes a flange 34 (Fig. 3) disposed diagonally between the vertical corner edges of the box walls; whereas integral continuous flanges 36 of the T-bar are disposed diagonally across the inside corner portions of the box. The T-bar is welded, as indicated at 37, at the corner portions of the boxes in the positions described and thus provides an extremely rigid and strong corner construction. It will be observed that each flange 34 divides the inner and outer opposite angles defined by the intersecting planes of the adjacent walls 14 and 17, and that the extreme outer edge of the flange 34 is substantially confined within the outline of the outer wall contour as defined by the projected broken lines shown in Fig. 2.

Further reinforcing elements 38 and 39 in the form of vertical angle bars having their flanges 40 secured by welding, as indicated, at 42 to the inner surface of the opposite converging side walls 14 and to the end walls 16 and 17 respectively of the box. It will be observed that the flanges 40 are equal in width and that the corners of the angle bars project inwardly of the box.

A plate cover 42 corresponding to the contour of each box, but having slightly greater area than the top of the box, is provided with ventilating openings 43 and a plurality of integral flanges 44 extending in opposite directions transversely of the plane of the cover. These flanges are designed to facilitate stacking of a plurality of boxes 10 in superimposed relation and to prevent accidental displacement of the boxes from their stacked relation. Since the converging relation is included in the flanges 44, the boxes can be guided therebetween and thus held in superimposed relation.

In the commercial use of the annealing boxes they are repeatedly heated to high temperatures and then allowed to cool. As a result of these conditions there is a strong tendency for the box to become rounded at the corners and even to assume spherical form. By constructing a box according to the foregoing description, this tendency is satisfactorily resisted and the boxes can be utilized over long periods without material distortion either from this cause or from being subjected to severe mechanical or manual usage. Moreover, by reason of their peculiar shape and arrangement in the furnace the boxes provide for a most efficient absorption of heat required in the process of annealing.

Since these annealing boxes in horizontal section are in substantially the form of trapezoids, and the smaller ends are directed toward the heating elements in the walls of the furnace, a maximum heating of the boxes and castings that are disposed therein is insured.

It may be stated that, in order to prevent distortion of the castings when packed without the customary packing material, it is necessary to limit the weight that any individual casting may sustain as a result of arranging the castings in superimposed relation. It has been found that, at temperatures as high as approximately 1700 degrees F., the average casting cannot be packed more than approximately 16 inches deep without causing excessive distortion and warping. It is to be understood, of course, that the lighter castings cannot be packed to this depth and that the heavier castings can be packed deeper. However, castings which may be nested can be packed three to five feet deep, but these are not ordinarily placed in containers. Therefore, it is necessary, in building up a five foot load, that the weight of the upper castings be sustained independently, over a space of sixteen inches, from the lower castings. Theoretically, it would be possible to accomplish this method of stacking by utilizing annealing boxes having heavy bottoms. However, any material which could be practical and justified from a commercial standpoint would gradually sag under repeated heating and cooling, if it were permanently fixed in such position as

to have the loads carried repeatedly in the same manner. Therefore, the separate cover or plate 42, which is disposed between the boxes and which can be reversed under each consecutive load, affords great advantages over the arrangements previously employed. Although the openings 43 in the plate may serve to ventilate the boxes, they are primarily provided for the purpose of minimizing the weight of the plates. These plates are distorted only slightly during each heating operation, and the convexed side is directed upwardly at the beginning of each consecutive heating operation.

The boxes themselves have only very thin plate bottoms 32 adapted to sustain the load of the castings when the boxes are cold but are entirely inadequate for sustaining such loads when subjected to the annealing heat. Accordingly, it is apparent that the reversibility of the covers or plates 42 affords important advantages.

In addition to the advantages of the tapering or converging side walls of the boxes, they also greatly facilitate the use of the plate covers 42 as locking devices because, irrespective of the possible lack of uniformity in the sizes of the boxes and the sizes of the plates, within reasonable limits, it is convenient and practical to manipulate these boxes and plates in slidable relation until the side edges of the boxes are firmly wedged between the flanges or lugs 44 of the plates. Thus the boxes are positively maintained in their stacked relation. This method of stacking further serves to resist warping of the boxes into cylindrical or spherical shape under the influence of repeated heating and cooling thereof. It is apparent that boxes of rectangular shape could not be wedged positively in this manner.

While the construction shown by Fig. 7 is such as to indicate a space between the flanges or lugs 44 and the sides of the boxes 10, it is to be understood that this Figure illustrates preliminary relative positions of these elements and that in the finally stacked relation the lugs contact directly in wedged relation with the sides of the boxes.

Although only one of the forms of the method and apparatus of the invention has been shown and described in detail, it will be apparent to those skilled in the art that the invention is not so limited but that various changes may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What I claim is:

1. An annealing box for disposition in a furnace comprising corrugated walls, and flanged reinforcing members secured to the corrugated walls in transverse relation to the corrugations thereof.

2. An annealing box for disposition in a furnace comprising converging walls having corrugations on one side of each wall, and reinforcing flanged members secured transversely of the corrugations on the side of the wall opposite the corrugations.

3. An annealing box comprising a plurality of walls, having corrugations therein, and members secured in spacing relation between adjacent wall edges, and dividing the inner and outer opposite angles defined by adjacent intersecting wall planes, said members extending outwardly from the corner portions of the box and confined substantially within the projected outline of the outer wall contour.

4. An annealing box comprising a plurality of walls, flanged members for reinforcing the corners of the box, a portion of each flanged member constituting an abutment between the adjacent wall edges.

5. An annealing box comprising a plurality of walls, reinforcing members including flanged portions arranged to provide junctions between adjacent walls, one of the flanged portions rigidly spacing the edges of adjacent walls, the last mentioned flanged portion extending substantially diagonally through the corner portions of the box.

6. An annealing box comprising a plurality of walls, reinforcing members including flanged portions arranged to provide junctions between adjacent walls, one of the flanged portions rigidly spacing the edges of adjacent walls, the last mentioned flanged portions extending substantially diagonally through the corner portions of the box, other flanged portions extending diagonally across the corner portions of the box transversely of said last mentioned flanged portions.

7. A method of heating annealing boxes having opposite laterally converging walls which comprises arranging the boxes in a furnace having heating elements along its walls, said boxes being so positioned as to have an additional lateral wall facing a heating element and the other converging walls converging toward the heating element.

8. A method of annealing metal in a furnace having heating elements along its walls, said method comprising arranging rows of metal-containing annealing boxes having opposite converging walls in the furnace in such manner that the boxes of one row have their walls converging toward the adjacent wall of the furnace and walls of the boxes of another row converging toward the opposite wall of the furnace.

9. A method of annealing metal in a furnace having heating elements arranged along its walls, said method comprising arranging stacks of metal-containing annealing boxes in rows, the boxes of one row having walls facing the heating elements of one wall of the furnace, the boxes of said one row having opposite walls converging toward the heating element, and the boxes of another row

having similar walls arranged in like manner to converge in the opposite direction toward another wall of the furnace.

10. A method of annealing metal in a box having opposite walls converging to the edges of a third wall, said method comprising applying heat by radiation in a furnace directly against the face of said third wall and indirectly against the converging walls by arranging the boxes in such manner that the walls last mentioned converge toward the source of heat.

HARRY O. BREAKER.