June 5, 1934. P. E. HUNTER ET AL 1,961,221

ANNEALING BOX AND METHOD OF MAKING SAME

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Fig. 1.

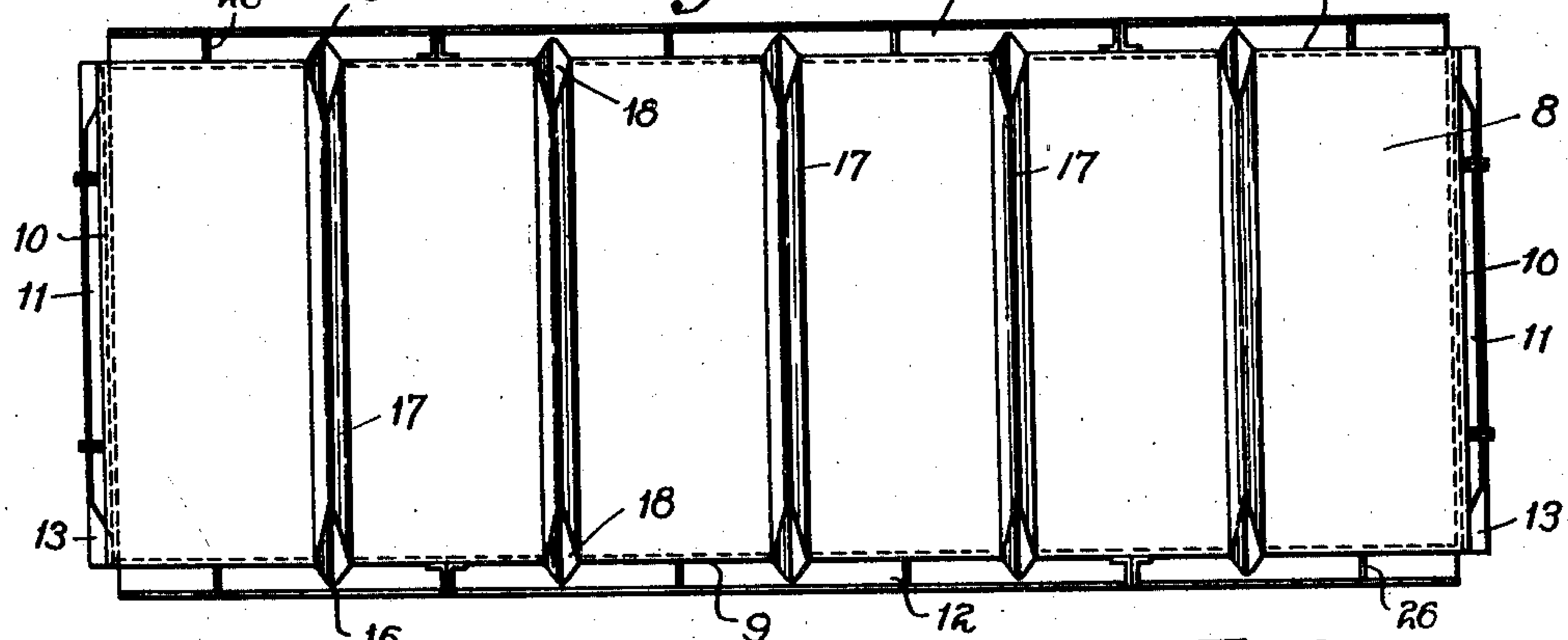

Fig. 2.

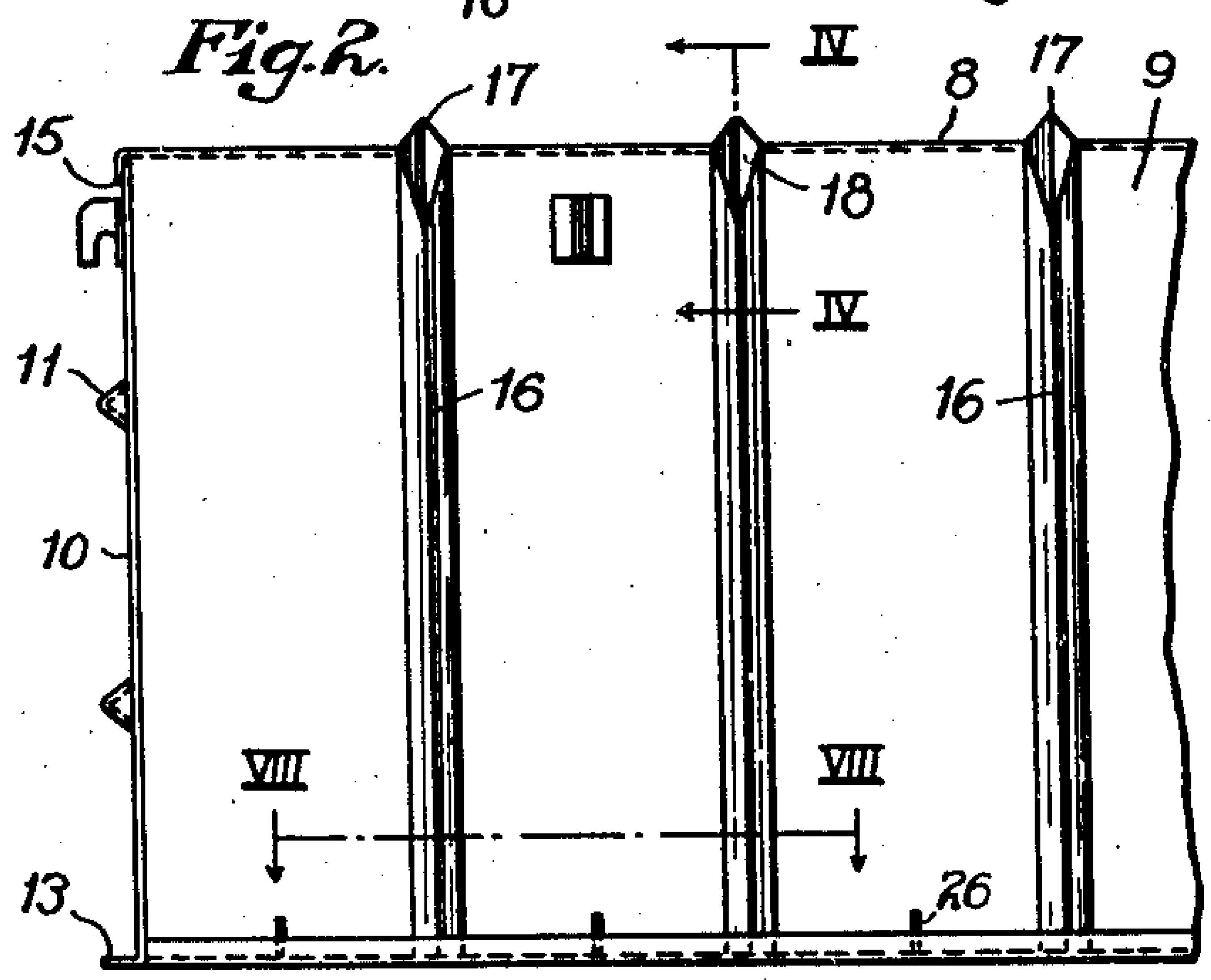

Fig. 3.

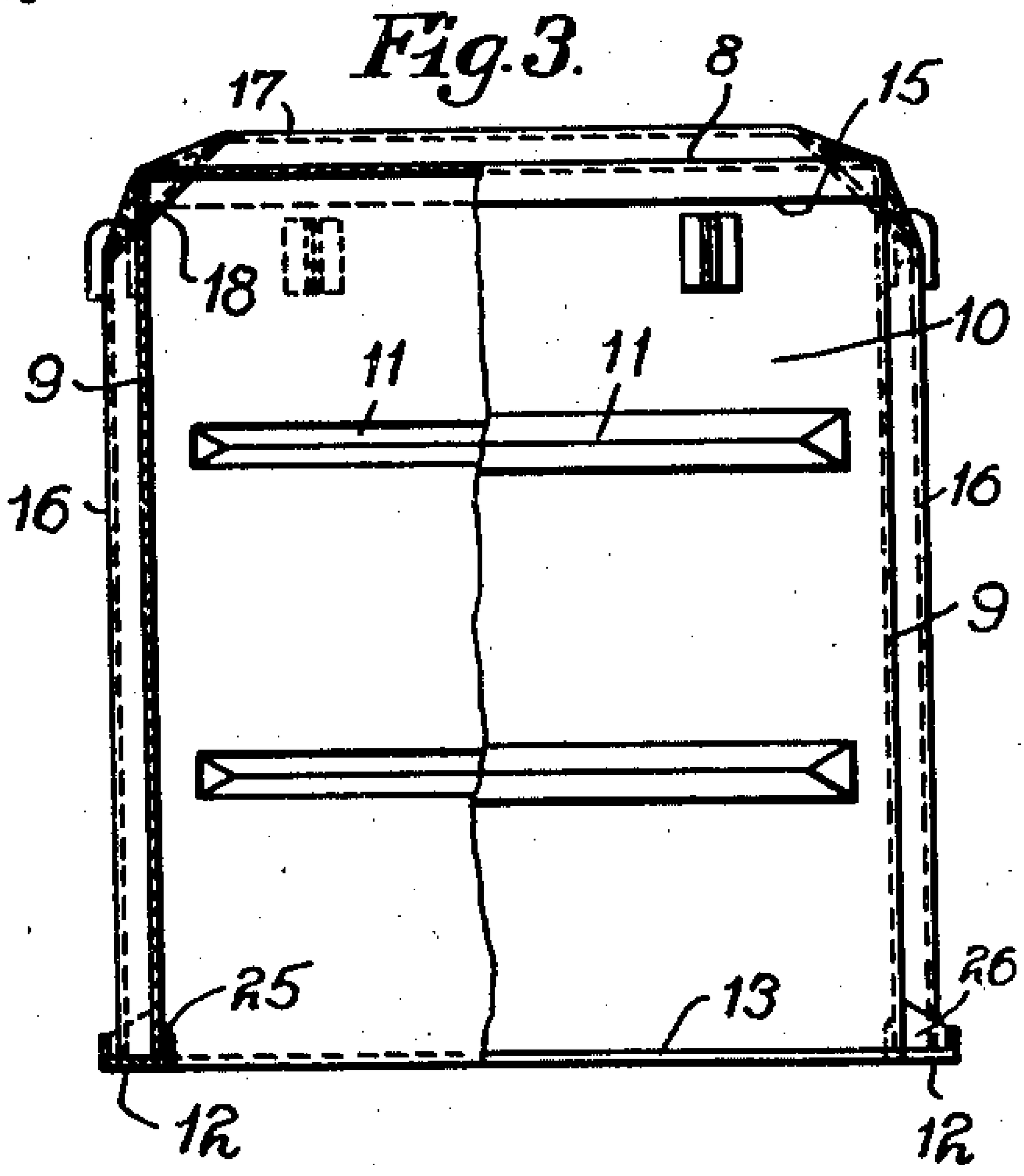

Fig. 4.

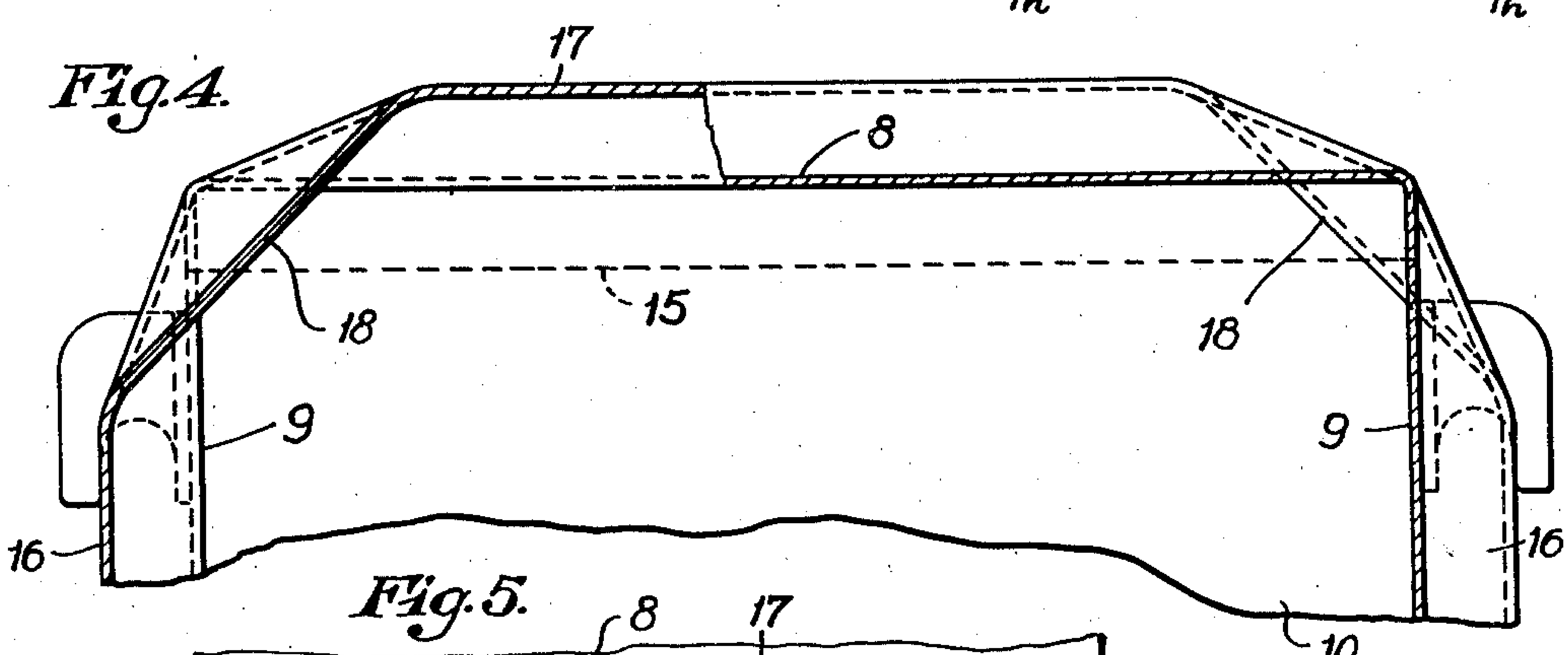

Fig. 5.

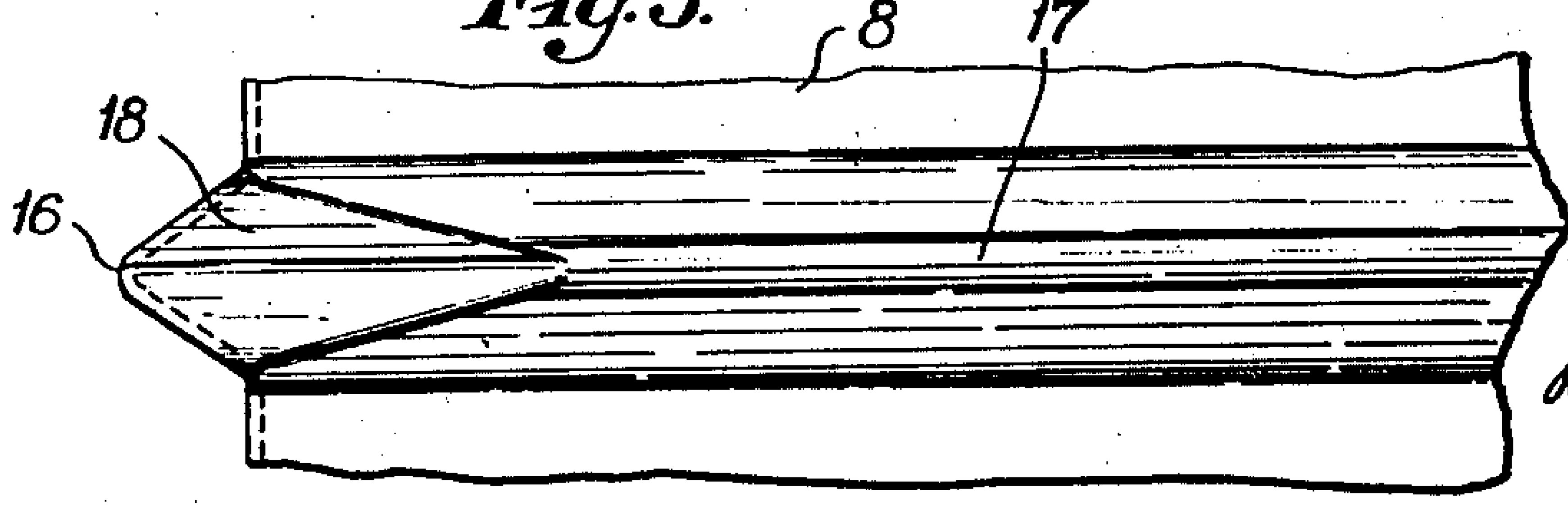

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Fig. 6.

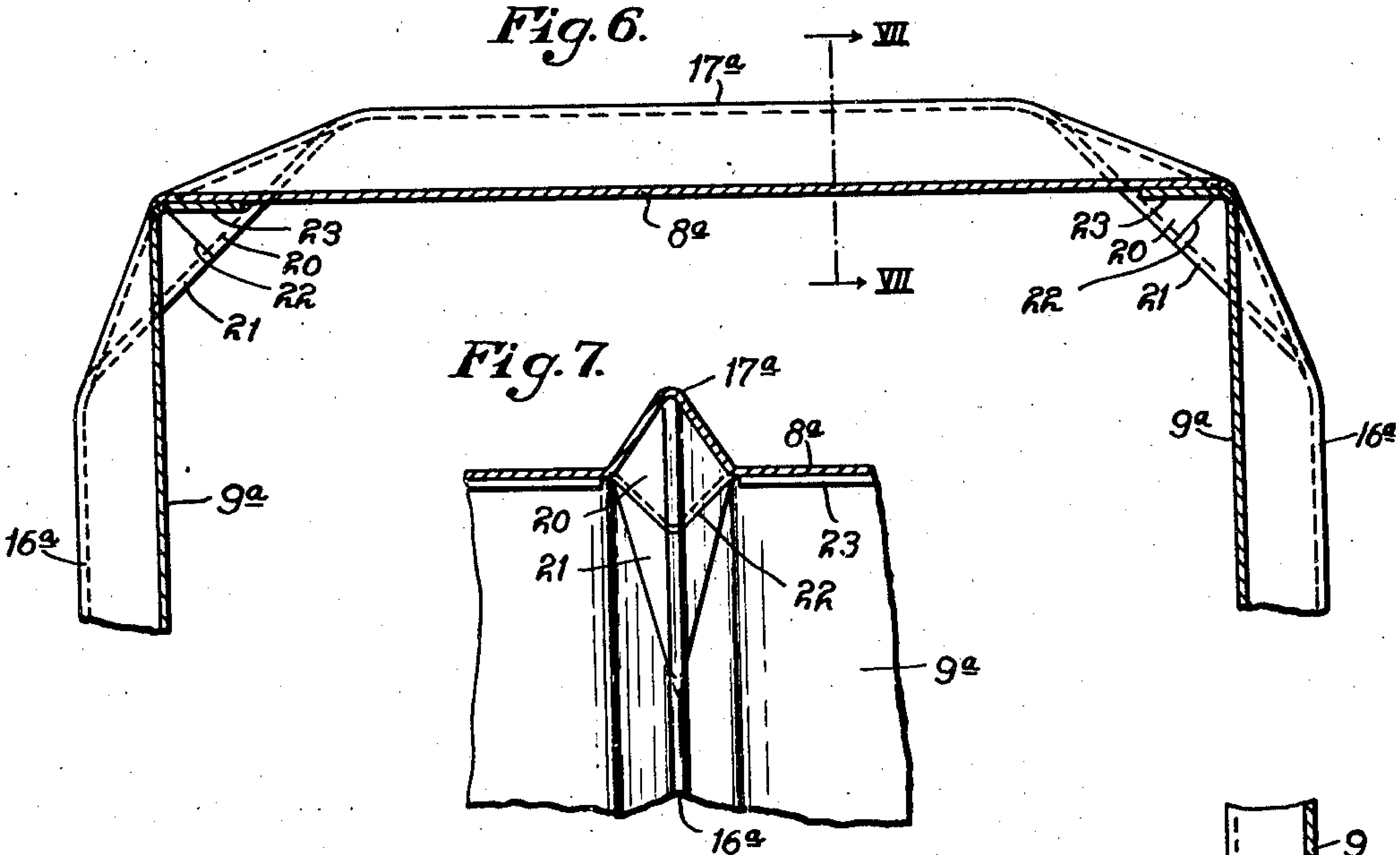
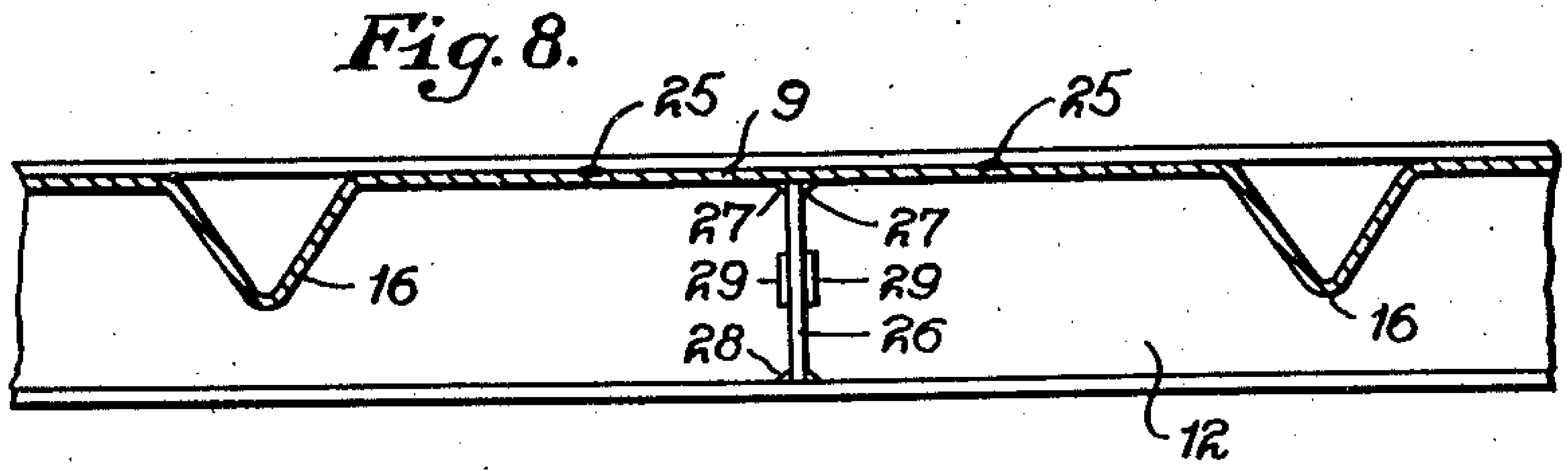


Fig. 7.

Fig. 8.



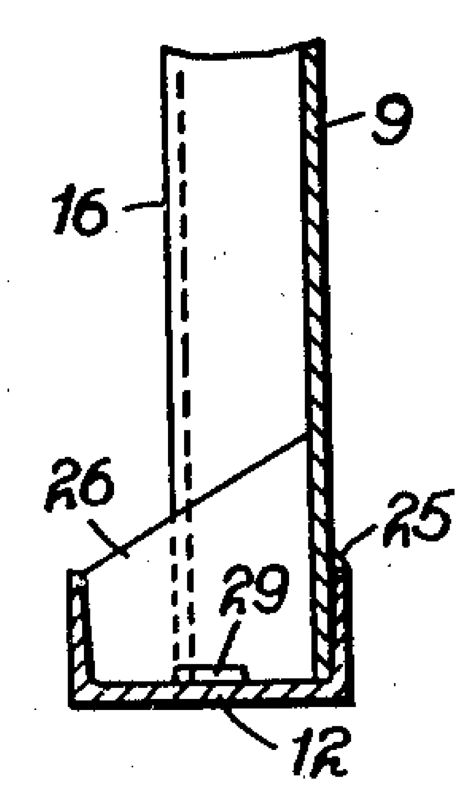


Fig. 9.

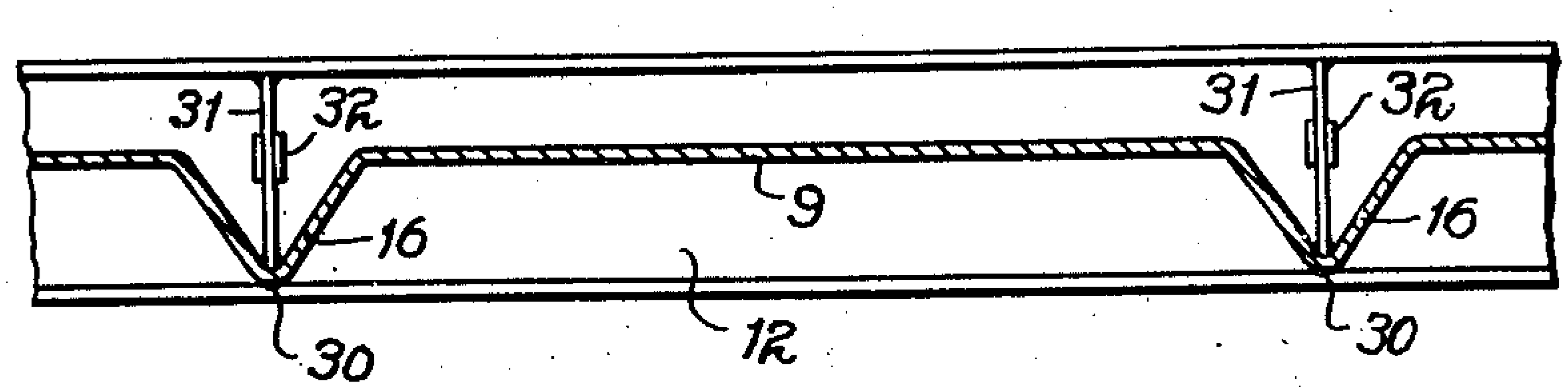


Fig. 10.

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ANNEALING BOX AND METHOD OF MAKING SAME

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Application February 24, 1931, Serial No. 517,849

7 Claims. (Cl. 220—72)

Our invention relates to annealing boxes, and more particularly to those made of sheet steel, or various alloys.

Sheet-metal annealing boxes are desirable, particularly in the larger sizes, because of their relatively light weight and cheaper cost, but as heretofore constructed, they have been the subject of various criticisms, such as short life, tendency to permanent distortion through expansion when subjected to high temperatures, etc. Annealing boxes formed of light sheet steel are also short-lived, because of deterioration through corrosion. Various alloy steels are more resistant to corrosion and hence longer lived, but suitable alloys have considerably greater expansion than ordinary steel, and hence are more likely to become permanently distorted, as a result of expansion under heat variation and fail to contract or shrink to their original form when cooled to ordinary atmospheric temperatures, due to overstraining while not of uniform temperature in their various portions. Furthermore, both in the case of steel annealing boxes and in the case of alloy material, there is uneven expansion as between various portions of the box, thus when a box is positioned for the commencement of an annealing operation, the top portion thereof will, in the initial stages at least, be heated to a much higher temperature than the lower portion of the box, so that the top of the box will expand greatly relative to the lower portion thereof; or one side may be heated faster than another side, thus tending to so distort the metal that it will not return to its original form.

While the walls of annealing boxes have been formed with corrugations, to facilitate expansive and contractive movements thereof without permanent distortion, no commercially practical method has been suggested for providing continuous corrugations in the corners of the box, and particularly in the upper longitudinal corners thereof, so that the metal in the vicinity of such corners could expand and contract as readily as the side walls.

For example, if one side and top longitudinal corner of the box became hotter than the other side and top corner, and the bottom of the hot side was cold as is often the case, the hot corner if it had no corrugations would either buckle or permanently be deformed. By providing continuous corrugations over the sides and across the corners, the hot corner would be relieved, and thus the box would not be over-strained to the extent that it would if the corrugations were not continuous across the sides and corners.

One object of our invention is to provide an annealing box of such form that it may have greater freedom of contraction and expansion throughout all portions thereof.

Another object of our invention is to provide an annealing box of such form that the corners thereof may expand and contract with substantially the same freedom as portions intermediate such corners.

Still another object of our invention is to provide an annealing box of generally simplified and improved form.

Some of the forms which our invention may take are shown in the accompanying drawings wherein Figure 1 is a plan view of an annealing box; Fig. 2 is a side elevational view of a portion of the structure of Fig. 1; Fig. 3 is a sectional elevational end view thereof; Fig. 4 is a view, on an enlarged scale, taken on the line IV—IV of Fig. 2; Fig. 5 is a plan view of the structure of Fig. 4; Fig. 6 is a view similar to Fig. 4, but showing a modification thereof; Fig. 7 is a view taken on the line VII—VII of Fig. 6; Fig. 8 shows a view taken on the line VIII—VIII of Fig. 2, on an enlarged scale; Fig. 9 is a vertical sectional view of the structure of Fig. 8; and Fig. 10 is a view similar to Fig. 8, but showing a modification thereof.

Referring now to Figs. 1 to 5, the box is shown as composed of a top wall 8, side walls 9, and end sheets 10. The top and side walls may be stamped or pressed from a single sheet of metal. The end sheets are provided with stiffening ribs or corrugations 11 and are welded or otherwise secured at the end corners of the box, to the walls 8 and 9. Stiffening channels 12 are secured to the lower edges of the side walls 9, and the end sheets 10 are provided with base flanges 13. The ends of the sheet 8 are turned downwardly as indicated at 15 and welded to the end plates 10. The side walls 9 are pressed outwardly at intervals to form vertically-extending corrugations 16 for the purpose of stiffening the same, and to facilitate expansion and contraction thereof, while the top wall 8 is provided with outwardly-protruding corrugations 17.

As shown in Figs. 8 and 9, the inner flanges of the channels 12 are welded at points 25 to the inner face of the side walls 9, such welds being at various points throughout the length of the channel. The corrugations 16 are not directly welded to the channel 12. For a greater stiffness, cross bars 26 are welded at 27 to the outer side of the plate 9, and are welded at 28 and 29 to the outer flange of the channel 12 and to the web thereof.

This arrangement, while providing for the desired strength and rigidity at the bottom edge of the box, nevertheless permits the side walls to expand and contract through temperature changes, since the corrugations 16 are not directly secured to the channels 12.

In Fig. 10, we show an arrangement similar to that of Fig. 8, but wherein the outer flange of the channel 12 is welded at 30 to the corrugations

16, those portions of the wall 9 lying between the points of weld being free to expand and contract. For greater stiffness, we weld the ends of bars 31 to the corrugations 16 and the inner flange of the channel 12 respectively, and also weld such bars to the web of the channel at 32.

The walls 8 and 9 at the upper longitudinal corners of the box are pressed inwardly at the ends of the corrugations 16 and 17 to form inwardly-projecting corrugations 18 that form continuations of the corrugations 16 and 17.

We thus provide an annealing box wherein provision is made for expansion and contraction at the corners of the box in substantially equal degree to the expansive and contractive characteristics of the metal at points removed from such corners.

This arrangement is useful not only in the case of boxes formed from ordinary steel, but is particularly advantageous in the case of alloy metals that are not so subject to corrosion as ordinary steel. The box has such strength that light gage sheets may be employed, which makes for reduced weight, and lower cost, thereby rendering it economically possible to employ the more expensive alloy metal.

Many alloy metals suitable for our purposes have much greater expansion and contraction under temperature changes than does ordinary steel—in some cases approximately four times as much as steel. For example, in a box 8 to 10 feet long, the temperature variations may cause as much as two or three inches change in length of the box, while at the beginning of an annealing operation, the top of the box may be of such high temperature relative to the lower portion thereof that it will expand several inches more than the lower portion. The provision of the corrugations 18 at the corners of the box, in addition to the corrugations 16 and 17 is therefore highly desirable, to prevent such uneven stresses in the metal as to cause permanent distortion thereof.

Referring now to Figs. 6 and 7, we show a structure wherein the top wall *8a* and the side walls *9a* are formed from separate sheets of material, as by pressing flat sheets between dies, to form the vertical corrugations *16a* and horizontal corrugations *17a*, connected by reversely-disposed corrugated portions 20 and 21 that correspond to the corrugations 18 of Fig. 4.

The ends of the corrugations 20 and 21 abut and are welded together along the line 22, so that these portions 20 and 21 together with the portions *16a* and *17a* form substantially continuous corrugations across the sides and corners of the box. The upper edges of the side sheets *9a* are inturned at 23 to form flanges which are welded to the inside of the top sheet *8a*, although these flanges 23 could be omitted if desired, and the upper edges of the side sheets *9a* be welded directly to the horizontal edges of the top sheet *8a*. The other portions of the box of Figs. 6 and 7 may be formed substantially as shown in Figs. 1 to 3.

Not only do the corrugations 18 and 20—21 at the corners of the box serve to prevent permanent distortion of the box, but they function as braces to prevent sagging of the top wall of the box, particularly at the central portion of long boxes. Such sagging of the top wall of the box may occur not only in handling the same, but when the box is heated to such high temperatures that the strength of the metal is reduced.

The arrangement of the corrugations in the corners of the box and in the top and side walls thereof is such that sufficient strength is given to the box, although made of light material, without the necessity of securing bracing members thereto of such dimension that they greatly increase the over-all dimensions of the box as in various prior art structures. We therefore economize in space in that a box of maximum size, and hence of great capacity can be inserted through furnace openings as compared to boxes where relatively large exteriorly-positioned bracing members are required.

We claim as our invention:—

1. A sheet-metal annealing box having a corrugation formed in its top wall and corrugations formed in its opposite side walls, all of said corrugations being disposed in a common vertical plane and the metal at the adjacent ends of said corrugations being reversely bent to form corrugations in the opposite direction.

2. A sheet-metal annealing box having a corrugation formed in its top wall and corrugations formed in its opposite side walls, the metal at the adjacent ends of said corrugations being reversely bent to form corrugations in the opposite direction, the last-named corrugations forming continuations of the first-named corrugations.

3. A box of generally rectangular form in cross section and having outwardly-positioned corrugations formed in two adjacent sides, the adjacent ends of said corrugations merging with an inwardly bent corrugation that extends across the corner of the box.

4. A box having two of its sides connected in angular relation, an outwardly-positioned corrugation in one of said sides merging with an inwardly positioned corrugation that extends across the corner of the box.

5. A sheet-metal box open at one side and having a wall provided with corrugations which terminate at said side, a stiffening bar having an angle therein which receives and closes the ends of the corrugations, the said bar being welded to said wall at spaced points, but being free of direct attachment thereto for the major portion of its length.

6. A sheet-metal box open at one side and having a wall provided with corrugations which terminate at said side, a stiffening bar of channel form which receives the ends of the corrugations, one of the flanges of said bar being secured to said wall at spaced points, but being free of direct attachment thereto for the major portion of its length.

7. A sheet-metal box open at one side and having a corrugated wall terminating at said side, and a channel partially embracing the edge of said wall and its corrugations at the open side, one flange of said channel being welded to the wall at spaced points, but leaving the major portions of the extremities of the corrugations free to expand and contract independently of the channel.

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