May 1, 1951 C. A. BAUER ET AL 2,551,411

ICE CUBE TRAY

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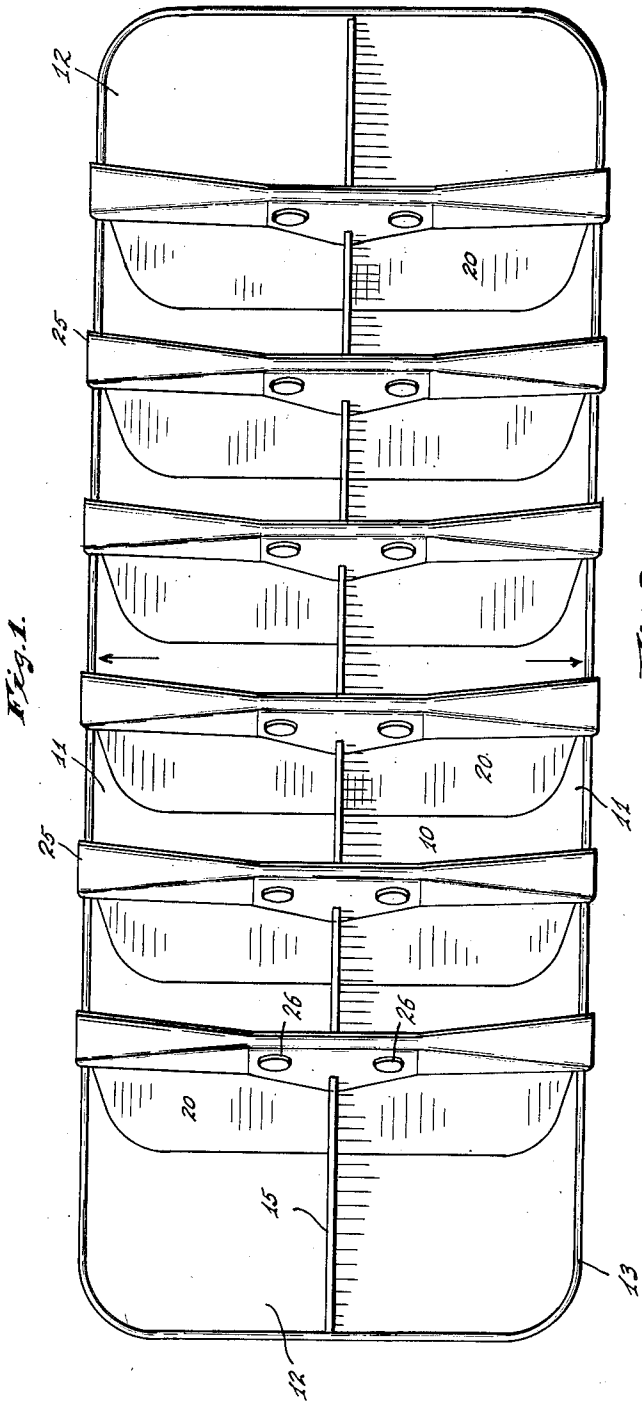



Fig. 1.

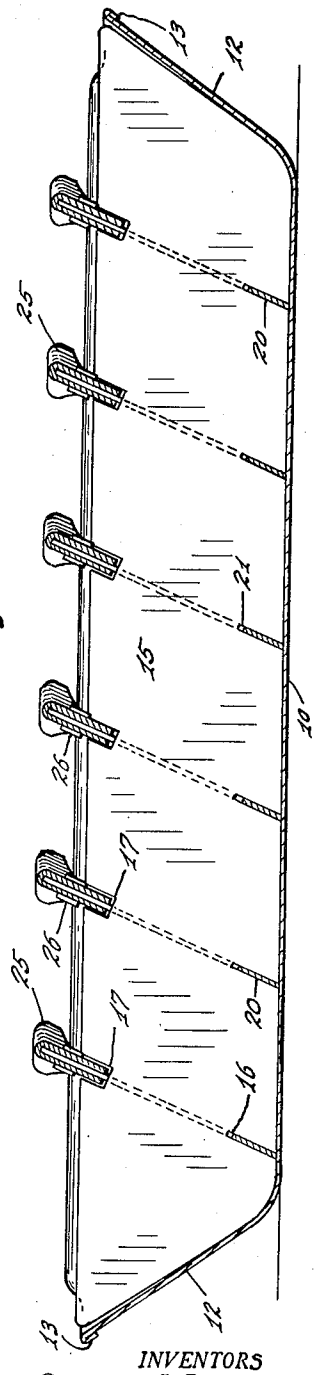



Fig. 2.

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Fig. 3.

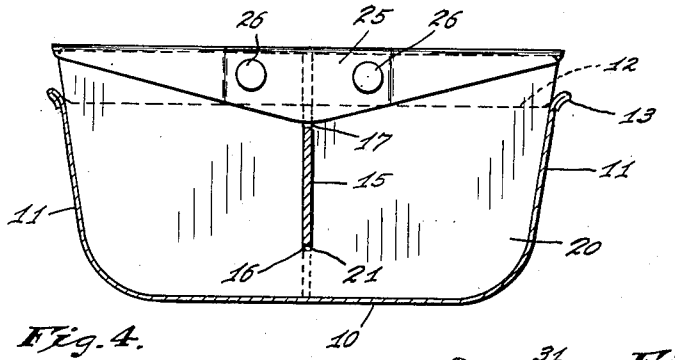



Fig. 4.

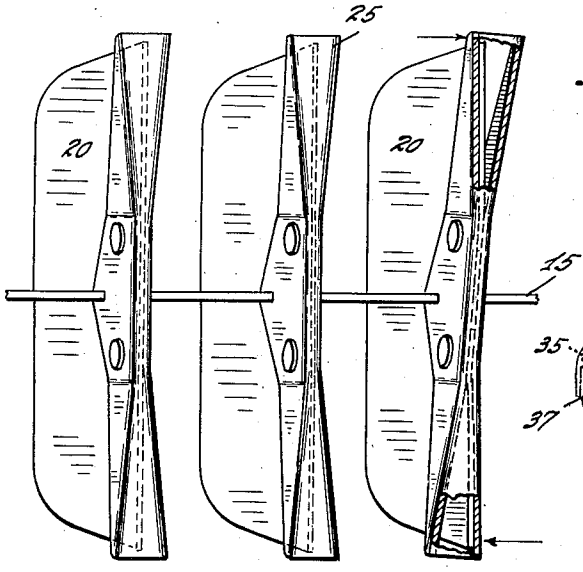



Fig. 5.

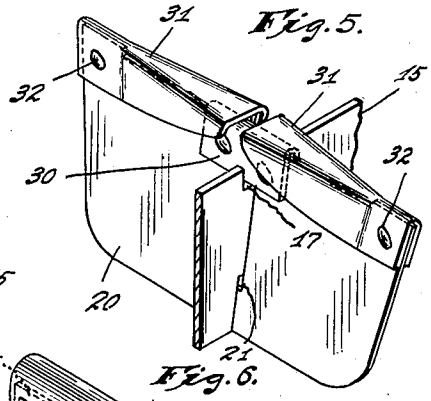



Fig. 6.

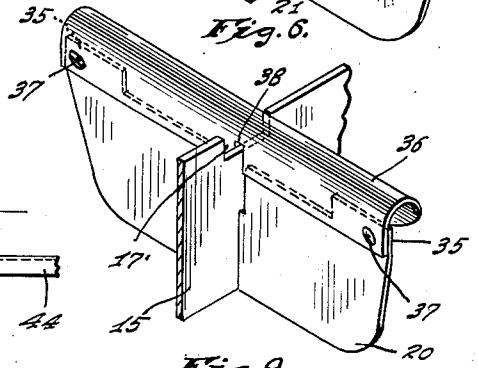



Fig. 7.

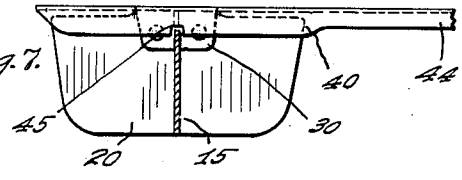



Fig. 8.

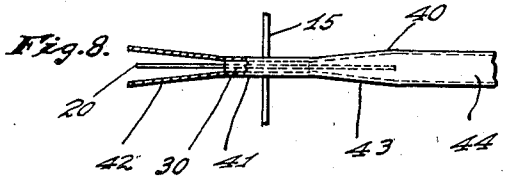
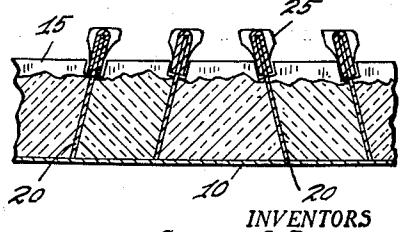



Fig. 9.




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# UNITED STATES PATENT OFFICE

2,551,411

## ICE CUBE TRAY

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6 Claims. (Cl. 62—108.5)

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Our invention relates to ice-cube trays of the type commonly employed in domestic refrigerators. It is the object of our invention to produce a tray which can be simply and economically manufactured and from which the ice cubes can be readily freed.

In carrying out our invention, we employ a tray which is conveniently generally rectangular in shape and has upwardly diverging side and end walls. For reception in such tray, we provide a grid comprising a relatively rigid central rib adapted to extend longitudinally of the tray and a plurality of transversely extending fins which, in co-operation with the central rib, divide the interior of the tray into two rows of individual cube-compartments. Associated with each of the transverse fins there is a means facilitating the application of a manual force or forces tending to distort the fin from its normal plane condition. The fins are made of metal flexible enough to yield slightly under such forces, and the tray itself is also preferably made of metal sufficiently flexible to permit it to be peeled from the outer surface of the ice cube either by the application of a torque to the entire tray or by the application of a spreading effort applied adjacent the mid-point of the tray-sides.

The accompanying drawings illustrate our invention:

Figs. 1 and 2 are respectively a plan view and a longitudinal section through a preferred form of tray; Fig. 3 is a transverse section of the tray shown in Figs. 1 and 2; Fig. 4 is a fragmental view similar to Fig. 1 but showing the grid removed from the tray and a distorting effort applied to one of the fins; Figs. 5 and 6 are fragmental isometric views illustrating modified grid constructions; Figs. 7 and 8 are respectively a transverse section and a fragmental plan view of a further modification; and Fig. 9 is a fragmental longitudinal section similar to Fig. 2 illustrating a somewhat different arrangement of the transverse fins.

The tray illustrated in Figs. 1, 2, and 3 comprises a bottom wall 10, side walls 11, and end walls 12. The tray is desirably formed as a sheet-metal stamping, preferably of aluminum, with the side and end walls 11 and 12 converging downwardly so as to facilitate both forming of the tray and removal of the ice cubes therefrom. To eliminate sharp edges and also to increase strength, the rim of the tray may be turned downwardly as indicated at 13 in Fig. 2.

The grid for reception in the tray comprises a vertical, sheet-metal rib 15 adapted to extend

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longitudinally of the tray along the central line thereof. At intervals along its length the bottom edge of the rib 15 is provided with notches 16, while the upper edge of the rib is provided with a corresponding number of notches 17. Each pair of notches 16 and 17 provide a means for attaching to the rib 15 a transversely extending fin 20, desirably of sheet-metal like the tray and rib 15. Each of the fins 20 is provided with a central notch 21 which extends downwardly from the upper edge of the fin and which is just wide enough to receive the central rib 15. Desirably, the notches 16 and 21 are deep enough to permit the lower edges of the fins 20 to occupy positions slightly above the lower edge of the rib 15. The notches 17 in the upper edge of the rib 15 are wider than the notches 16 in the lower edge to permit the reception of the mid-portion of an operating member 25 which embraces the upper edge of each fin 20 and which is secured thereto, as by rivets 26. As will be obvious, the grid is assembled by inserting the fins 20 into the notches 16 from below and subsequently attaching the operating member 25 to each fin. Such operating member bridges the upper end of the central notch 21 in the fin and, by engagement with the bottom of the notch 17, prevents the fin from being withdrawn from association with the central rib 15. Desirably, the notches 17 are deep enough to permit the fins to drop downwardly to positions in which their lower edges are somewhat below the lower edge of the rib 15.

The connection between each fin 20 and the central rib 15 is not a rigid connection, as the fin can move generally vertically in its own plane to the limit provided by the excess depth of the notches 17 and can also rock to a limited extent about its intersection with the central rib. I prefer, however, that the notches 16 and 17 be narrow enough to prevent any substantial bodily movement of the fin in a horizontal direction parallel to the central rib or to prevent any substantial rocking of any fin about a horizontal axis in its own plane. Because the fins 20 are not rigidly attached to the central rib, I prefer to arrange the notches 16 and 17 so that each rib is held in an inclined position, whereby the reaction of the tray-bottom 10 on the lower edges of the fins will tend to maintain them in positions normal to the central rib. The primary purpose of the lost motion permitted by the extra depth of the notches 16 and 17 is to insure that engagement of the central rib 15 with the tray-bottom 10 will not prevent the fins from engaging the

tray-bottom to be rocked thereby into a position substantially normal to the central rib.

Each of the operating members **25** is of channel section throughout its extent transversely of the tray. Over the mid-portion of the operating member, the channel is just wide enough to receive the upper edge of the associated fin **20**, to which it is secured by the rivets **26**; but beyond the rivets **26**, the channel is of gradually increasing width toward the outer ends of the operating members, as will be clear from Figs. 1 and 4. By applying the thumb and forefinger to any operating member at the points indicated by the arrows in Fig. 4, it is readily possible to apply to the associated fin **20** a torque tending to rotate it about its line of junction with the central rib **15**.

In using the device described, the grid is put in place in the tray and the tray is filled with water to the desired level and placed in the freezing compartment of a refrigerator. When ice cubes are desired, the tray is removed from the refrigerator and the bond between the tray and the ice therein is broken. To break such bond, outwardly directed forces may be applied with the thumbs to the upper edges of the side walls **11** as indicated by the arrows in Fig. 1 or, as an alternative the ends of the tray can be gripped in the hands and the tray subjected to a torque about its longitudinal axis. The metal of which the tray is formed is sufficiently flexible to permit it to yield under either of the distorting influences mentioned with the result that the bond between the ray and the ice is broken progressively by a peeling action which can be carried out with relatively little effort. To insure that the tray will not be filled to a depth which will prevent the application of outwardly directed forces indicated by the arrows in Fig. 1, the side walls **11** may extend upwardly somewhat farther than do the end walls **12**.

With the bond between the tray and the ice broken, the cubes are then freed from the grid by applying a torque as indicated by the arrows in Fig. 4 to the operating members **25**. It is usually desirable to free first the cubes at that end of the tray where the end fin **20** slopes opposite to the adjacent end wall **12**, or to the left-hand end of the tray in Figs. 1 and 2. The twisting effort or torque applied to the operating member **25** is transmitted to the associated fin **20** near its mid-point, and the resulting distortion of the fin breaks the bonds between it and the ice cubes on each side of it, as well as breaking the bond between the end ice cubes and the central rib. If more than the two end ice cubes are desired, a torque is applied to the second operating member **25**, thus freeing the next pair of ice cubes in similar fashion. By applying torques successively to all the operating members, all the ice cubes are readily freed from the grid.

Instead of applying a twisting torque to each individual transverse fin **20** by oppositely directed forces applied to opposite ends of the associated operating member as indicated by the arrows in Fig. 4, corresponding ends of adjacent operating members may be gripped between the thumb and forefinger and forced toward each other. This action likewise subjects the fins to warping efords which break the bonds between the grid and and the ice cubes. In this connection, it is to be noted that until the bonds are broken the presence of the ice cubes opposes movement of the fins, and this opposition in cooperation with the manual effort applied above the ice level to the operating member **25** causes the fin to warp.



In the modified form of the invention illustrated in Fig. 5, a fin-warping effort is applied to the ends of the fin rather than to its mid-portion. In this construction, a metal clip **30** of U-shaped cross-section embraces the upper edge of the fin **20** near its mid-point, bridges the upper end of the notch **21** in the fin, and prevents downward withdrawal of the fin from the central rib **15**. Associated with each fin there are a pair of operating members **31**, each of channel section. At their outer ends, the channel-section is just wide enough to receive the upper edge of the fin **20**, to which it is secured by a rivet **32**; but inwardly beyond the rivet **32** the channel-section is of gradually increasing width.

Cubes are most conveniently freed from the grid of Fig. 5 by placing the thumb against one side of one operating member near the inner end thereof and the forefinger against the opposite side of the other operating member near its inner end; whereupon, by forcing the thumb and forefinger toward each other, warping efforts are applied to the outer ends of the fin **20**. The resultant distortion of the fin **20** breaks the bonds between the grid and the ice cubes.

To prevent injury or permanent distortion of each fin **20** from warping, each operating member is desirably arranged so that its movement relative to the fin as a whole is limited. In the grid illustrated in Figs. 1 to 4, this limiting results from engagement of the sides of the flaring outer ends of the operating member with the upper edges of the associated fin **20**, as indicated in Fig. 4. In the case of the grid shown in Fig. 5, the extent to which each fin can be warped is limited by engagement of the inner ends of the operating members **31** with the clip **30**. It will be noted that in both constructions so far described, three thicknesses of metal occupy each notch **17**. When the grid is removed from the tray, or even when it is in the tray with the ice bonds broken, swinging movement of each fin about its junction with the central rib **15** will be limited by engagement of the sides of the operating member **25** or the sides of the clip **30** with the edges of the notch **17**. The central rib **15**, which need possess no appreciable flexibility, may be made thick enough to withstand injury from any effort likely to be applied to the sides of the notches **17**.

In the modified arrangement illustrated in Fig. 6, each fin **20** is connected to the central rib **15** as in the constructions previously described; but the notches **17'** in the upper edge of the central rib **15** are made wider than in such other constructions. The central portion of the upper edge of each fin **20** is relieved to a point below the bottom of the associated notch **17'** to leave at the ends of the fin two upwardly projecting ears **35**. The operating means by which the fin is distorted comprises a single operating member **36** which extends transversely of the grid and has its ends secured as by rivets **37** to the ears **35**. Desirably, the lower edge of the operating member **36** is located above the relieved central portion of the fin, so that the operating member can pass through the plane of the fin when the operating member is moved longitudinally of the central rib **15**.

The operating member **36** must be sufficiently rigid that a horizontal force applied at or near the center of the operating member will result in the imposition of an appreciable fin-warping effort on the ears **35**. If desired, such rigidity may be imparted to the operating member by forming it of generally semi-circular cross-sec-

tion, as indicated in Fig. 6. The sides of the operating member extend below the bottoms of the notches 17' and are provided with notches 38 receiving the central rib. The notches 38 limit the extent to which the fin may be rotated about a vertical axis relative to the central rib 15, while the sides of the notches 17', by engaging the sides of the operating member 36, limit the extent to which the operating member can be moved longitudinally of the central rib and hence limit the amount of fin-warping.

In operating a grid of the type illustrated in Fig. 6, the bond between the ice and the tray is broken in any desired manner, and one of the end operating members 36 is then moved longitudinally of the central rib 15 toward the adjacent end of such rib by a force applied in or near the plane of the rib. As previously brought out, longitudinal displacement of the operating member 36 under such a force will impose a warping effort on the fin 20 with the result that the ice bonds between the end cubes and the grid will be broken. By moving successively operating members 36 longitudinally of the central rib in the same manner, additional cubes may be freed from the grid.

The further modification of our invention illustrated in Figs. 7 and 8, is much the same as that shown in Figs. 1 to 4 except that instead of providing an operating member permanently associated with each individual fin we employ an operating member which can be brought into association with any fin. As indicated in Figs. 7 and 8, the construction of the central rib 15 and the fins 20 is substantially the same as that shown in Fig. 5, the clip 30 secured to the upper edge of each fin bridging the open upper end of the notch in the fin and preventing the fin from becoming dissociated from the central rib. The operating member 40 shown in Figs. 7 and 8 is of channel cross-section. Spaced inwardly from one end of the operating member, the section is narrowed, as indicated at 41, so as to receive the clip 30. In opposite directions from the narrowed portion 41 the channel is of gradually increasing width, as indicated at 42 and 43. Beyond the tapering portion 43, the operating member is of uniform width to provide a handle 44. Notches 45 may be provided in the side walls of the operating member 40 at the center of the narrowed portion 41 to receive the central rib 15 and thus locate the operating member transversely of the grid and limit the extent to which it may swing relatively to the central rib.

In operating the grid shown in Figs. 7 and 8, the operating member 40 is applied successively to the fins 20, each fin being distorted by the application to the handle 44 of a horizontal force generally parallel to the rib 15. As a result of the application of such a force, the associated fin 20 is warped in the same manner as are the fins in the construction shown in Figs. 1 to 4. The extent to which each fin can be warped by the operating member 40 is limited by engagement of the flared sides of the operating member with the upper edge of the fin.

In Fig. 9 we have shown a tray and grid which is identical with that shown in Figs. 1 to 4 except that the fins 20, instead of sloping in the same direction, slope oppositely outwardly and downwardly from the middle of the tray.

All the grids described have in common the fact that an operating member is connected (or connectible) to the upper portion of each fin in a manner which permits the operating member to transmit to the fin a torque about a generally vertical axis in the plane of the fin. To facilitate the creation and application of such torque, each operating member extends preferably transversely of the grid, from its point of connection with the fin to a point of force-application adapted to receive the thumb or a finger of the operator. The application of a force normal to the operating member and at a point thereon spaced from the connection between the operating member and fin results in the application to the fin of a torque which warps the fin—i. e., distorts it from its normal substantially plane condition. The fins are made of material rigid enough to possess a definite shape under all stresses to which they are subjected in normal use except the stresses resulting from the fin-warping torque imposed by the operator when the cubes are to be released; but, at the same time, the fins are flexible enough to yield appreciably when the fin-warping torque is applied and elastic enough to resume their normal shape upon release of the torque. One suitable material for the fins is the aluminum alloy known as 61 ST (yield strength 39,000 pounds per square inch) 0.025 inch in thickness. The tray, which like the fins is called upon to sustain a warping action without permanent injury is desirably made of a softer material in order to facilitate its manufacture. We have found a suitable material for the tray to be the aluminum alloy 52 S½H (yield strength 29,000 pounds per square inch) 0.030 inch in thickness.

We claim as our invention:

1. A grid for dividing an ice-cube tray into a plurality of compartments, said grid comprising a central, longitudinal rib, a plurality of transverse, longitudinally spaced fins mounted on said central rib, and means for independently warping each of said fins, said means comprising an operating member non-rotatably attached to the fin and extending transversely of the grid from its point of attachment to a point of force application, said operating member at such latter point being free to move longitudinally of the grid relative to its associated fin.

2. A grid for dividing an ice-cube tray into a plurality of compartments, said grid comprising a central, longitudinal rib, a plurality of transverse, longitudinally spaced fins mounted on said central rib, and means for independently warping each of said fins, said means comprising an operating member non-rotatably attached to the fin and extending transversely of the grid from its point of attachment to a point of force application, said operating member at such latter point having a limited freedom of movement longitudinally of the grid relative to its associated fin.

3. A grid for dividing an ice-cube tray into a plurality of compartments, said grid comprising a central longitudinal rib, a plurality of transverse, longitudinally spaced fins mounted on said central rib, and means for independently warping each of said fins, said means comprising an operating member of channel cross-section having spaced side walls, said walls having parallel portions adapted to receive the upper edge of a fin and diverging portions adapted to engage the fin and limit rotative movement of the operating member about an axis in the plane of the fin and normal to the upper edge thereof.

4. A grid as set forth in claim 3 with the addition that said parallel wall portions are located intermediate the length of the operating member and secured to the upper edge of the associated fin adjacent the central rib, the side walls

of said operating member diverging from each other in both directions from their parallel portions.

5. A grid as set forth in claim 3 with the addition that said parallel wall portions are located intermediate the length of the operating member, the side walls of said operating member diverging from each other in both directions from their parallel portions.

6. A grid as set forth in claim 1 with the addition of means for limiting movement of said operating member relative to said central rib.

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## REFERENCES CITED

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

UNITED STATES PATENTS


| Number | Name | Date |
|---|---|---|
| 1,913,536 | Culmore | June 13, 1933 |
| 2,240,004 | Morton, Jr., et al. | Apr. 29, 1941 |
| 2,291,437 | Andersson | July 28, 1942 |
| 2,372,483 | Geyer | Mar. 27, 1945 |