Dec. 20, 1932. O. J. NYBERG 1,891,316

METHOD OF PRODUCING PRESSED STEEL HATCH FRAMES

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Fig. 1.

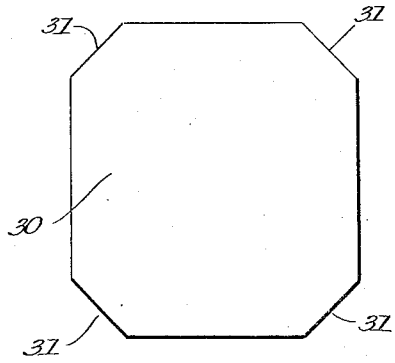


Fig. 2.

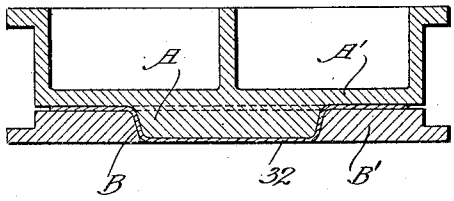


Fig. 5.

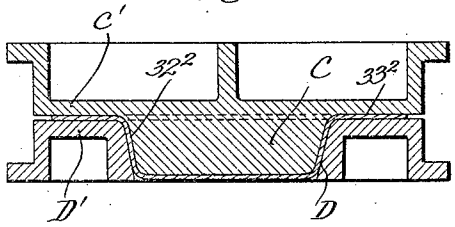


Fig. 3.

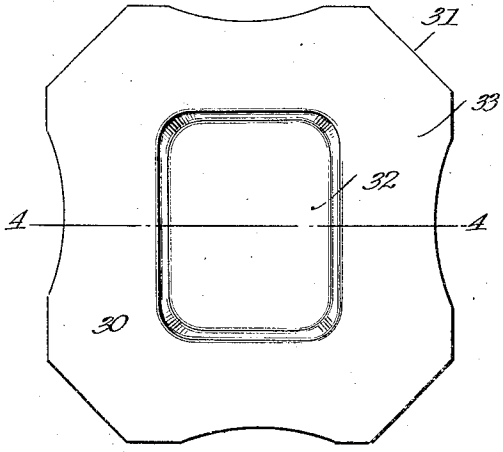


Fig. 6.

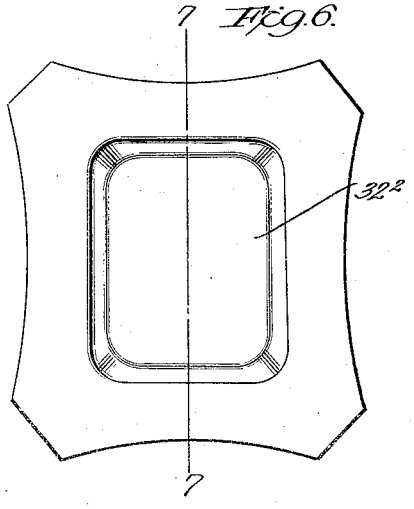


Fig. 4.

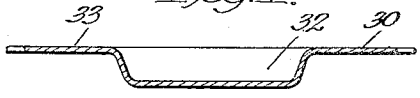
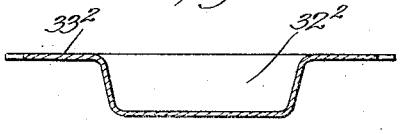


Fig. 7.



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Fig. 8.

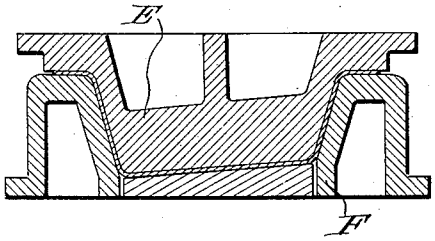


Fig. 11.

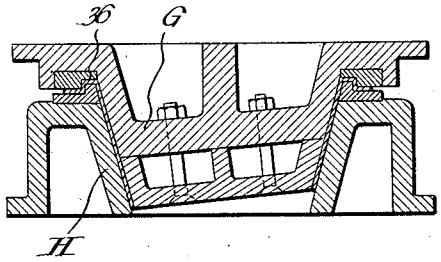


Fig. 9.

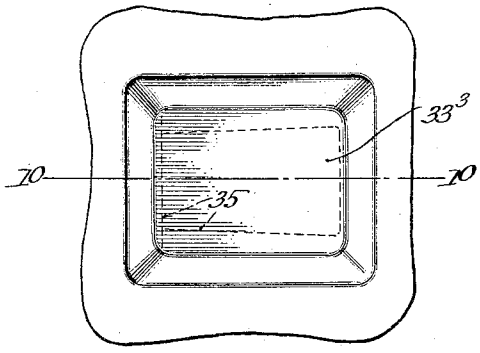


Fig. 12.

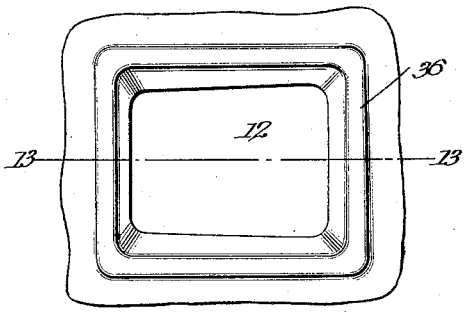


Fig. 10.

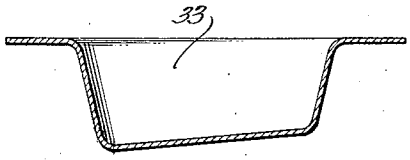
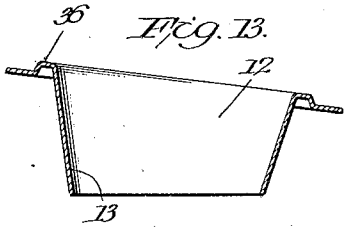


Fig. 13.



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METHOD OF PRODUCING PRESSED STEEL HATCH FRAMES

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Fig. 14.

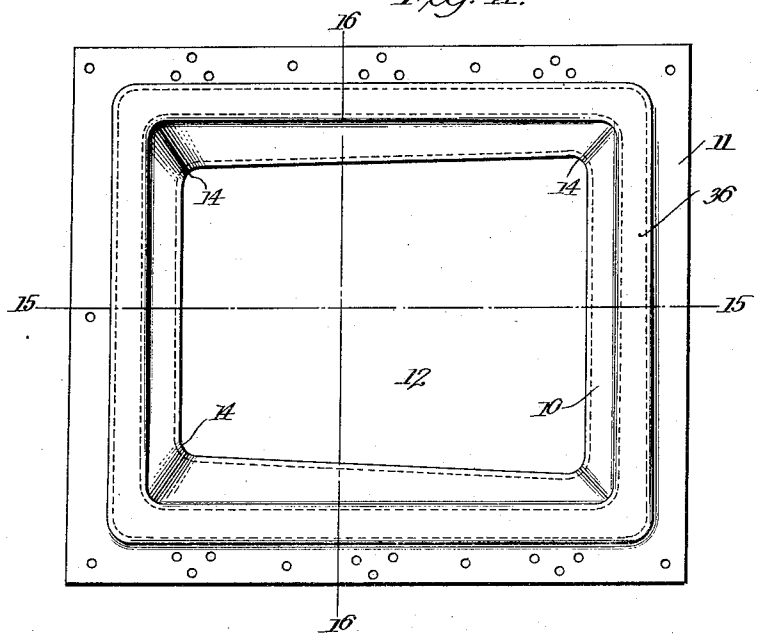


Fig. 15.

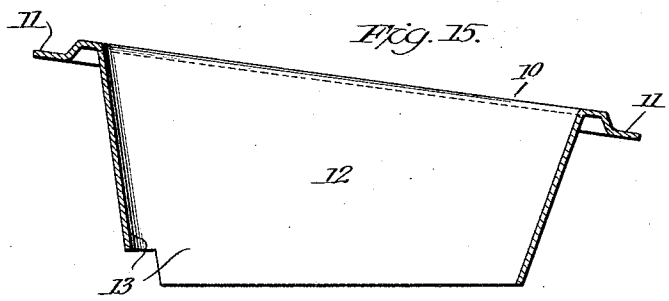
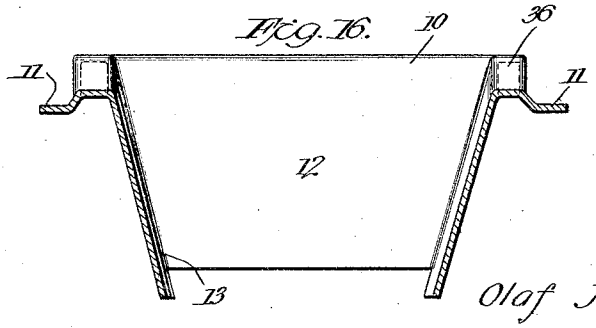


Fig. 16.



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Patented Dec. 20, 1932 1,891,316

UNITED STATES PATENT OFFICE

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METHOD OF PRODUCING PRESSED STEEL HATCH FRAMES

Application filed December 13, 1930. Serial No. 502,172.

The present invention relates to improvements in pressed metal hatch frames and the like and to the method of producing them from single blanks of steel.

One of the primary objects of the invention is to produce a one-piece pressed steel hatch or closure frame which will have smooth faces, free from wrinkles, of uniform thickness of metal, and be more serviceable in use. More specifically my invention aims to improve metal hatch frames of the type disclosed in the Sweeley and Anderson Patent No. 1,776,168, by pressing them from a single piece of metal.

Prior to my invention, so far as I am aware, pressing of such hatch frames has never been considered possible because of the shape thereof, which comprises a rectangular deep pan-shaped opening, the side walls of which are tapered and are connected by fillets of small radius of curvature. Attempts to produce such frames from a single blank by known methods resulted in badly wrinkled faces, and thinning of the metal, during the pressing of the pan, such as to tear it, thus rendering the frame useless.

In order that my invention may be fully understood, reference may be had to the accompanying drawings, illustrating the various steps in the manufacture of a one-piece pressed steel hatch frame for use on refrigerator cars together with supporters that I have found suitable for practising the method.

In the drawings:

Fig. 1 is a plan view of a blank of steel from which the finished hatch frame (see Figs. 14, 15 and 16) is pressed;

Fig. 2 is a sectional view through dies suitable for the first die pressing operation;

Fig. 3 is a plan view of the blank after the first die pressing operation;

Fig. 4 is a sectional view thereof;

Fig. 5 is a sectional view through dies suitable for the second die pressing operation;

Fig. 6 is a plan view of the blank after the second die pressing operation;

Fig. 7 is a sectional view thereof;

Fig. 8 is a sectional view through dies suitable for the third pressing operation;

Fig. 9 is a plan view of the blank after the third die pressing operation;

Fig. 10 is a sectional view thereof;

Fig. 11 is a sectional view through dies suitable for the fourth pressing operation;

Fig. 12 is a plan view of the blank after the fourth pressing operation;

Fig. 13 is a sectional view thereof;

Fig. 14 is a top plan view of the finished hatch frame;

Fig. 15 is a sectional view thereof taken on the line 15—15 of Fig. 14; and

Fig. 16 is a sectional view taken on the line 16—16 of Fig. 14.

The particular type of article illustrated herein is a steel hatch frame 10 (see Figs. 14, 15 and 16) as shown in the Sweeley and Anderson Patent No. 1,776,168 for use on refrigerator cars and through which the ice is poured into the cars for refrigeration purposes. According to my invention these frames are made of heavy steel plates (3/16″ in thickness) as distinguished from lighter gauged sheet steel, and are preferably of rectangular shape, having a flanged portion 11, surrounding a rectangular shaped well 12 surrounded by deep side and end walls 13, which are tapered and connected together by fillets 14 of small radii of curvature. In use the frame is adapted to receive a plug or closure of felt, canvas or other insulating material, and in order that the plug or closure not be damaged as well as tightly fit the frame, it is important that the frame present smooth faces, free from wrinkles. To press such frames from a single piece of metal, so as to produce a seamless, smooth-faced hatch frame is obviously the most satisfactory in use.

Heretofore, such frames have been cast, and were consequently very heavy, and brittle, subjected to frequent breaking when large cakes of ice were dumped into the car, and it has been considered impossible to press such frames from a single blank die to the thickness of the metal required, the deep side and end walls 13 of the hatch well must be pressed in a pan, and the small fillets of the finished frame, due to the impossibility of

pressing such a deep pan of such shape without excessive thinning or tearing of the metal.

According to my method, special shaped hatch or closure frames are pressed from a single blank of metal, producing a one-piece frame, (as shown in Figs. 14, 15 and 16) whose faces are free from wrinkles and the thickness of the metal is maintained uniform throughout.

In order best to illustrate the method, I will describe the invention as applied to a preferred method of making a hatch frame as shown in Figs. 14, 15 and 16, having a deep central well, which is usually substantially equal to its width, the walls 13 surrounding the well being tapered, the end walls being connected to the side walls by fillets of comparatively small radius. The frames are preferably pressed from rolled metal plates, for instance of 3/16″ in thickness.

In pressing a frame as above referred to, a blank 30 of steel plate of the desired thickness of the finished product (3/16″ of an inch in the illustration is used. There is a considerable excess of metal at the corners of the blank (approximately 33⅓ per cent) which has a tendency to deeply wrinkle during the blanking operation. In order to partially overcome this objection the corners of the blank are cut off as at 31 (see Fig. 1).

The blank is then heated to a white heat and pressed between relatively movable male and female dies A and B (see Fig. 2) to form in the central portion of the blank a shallow pan 32. This initial forging of the pan 32 tends to wrinkle the flange portion 33 of the blank, and the depth of the pan produced in the first forging operation is preferably of less depth than required to produce wrinkles of such size as will fold over. Thus such wrinkling as may be effected in the flange portions 33 is maintained to a minimum, and is immediately flattened out by pressure between the flange portions A′ and B′ of the die members.

The action of the dies A and B is easy on the metal of the blank bending the metal into a shallow pan along gradual curvatures such as will not tear the steel. For example, in making the specific shape of frame shown in Figs. 14, 15 and 16, which may have fillets of 2″ radius connecting the side walls 13 of the well, the fillets connecting the side walls of the pan during the first forging operation are preferably curved in a much greater radius, as for example, a 4″ radius. Likewise the radius of curvature of the fillet connecting the pan 32 and flange portion 33 is such as to make an easy bend, so that any tearing of the steel at this high heat is avoided.

Thus the initial forging operation is made along gradual curves that make easy bends in the steel, and the depth of the pan formed in this operation is stopped at a point prior to reaching a depth where the wrinkles reach the pan shaped portion 32 of the blank, so that all wrinkles will be held to small size to be flattened out by the flange portions A′ and B′ of the dies during their final closing movement. This restoring of the metal of the flanges into its flat condition makes possible the subsequent forging operations, and the production of a smooth faced frame.

After the first forging operation, the blank is again heated to a white heat and pressed in between dies C and D (Fig. 5) which is a repetition of the process of the first forging operation, that is, it produces a similarly shaped pan of slightly greater depth, the depth in this instance being limited to a point less than the depth at which the wrinkles produced in the flanges reach the pan 32^2, and thus the depth of the pan during the second forging operation may be increased to substantially twice the depth of the pan formed during the first operation, without any tearing, thinning of the metal, or damaging wrinkles produced in the pan. Likewise during the final closing movements of the dies C and D, the flanges C′ and D′ thereof flatten out such wrinkles as may have been formed in the flanges 33^2 of the blank, so that a smooth flanged deep pan blank is produced ready for the third operation.

The blank is again reheated preferably to a white heat, and is subjected to the forging action of dies E and F during the third operation. It is during this operation that the radius of curvature of the corner fillets is changed to substantially the size and shape of the well 12 of the finished hatch frame, and the size of the bottom of the pan 33^3 is slightly decreased to the proper size of the well of finished frame. Thus, by decreasing the size of the pan bottom and the radius of curvature of the corner fillets, sufficient metal is provided to make easy the deepening of the pan between dies E and F (Fig. 8), without any tearing or thinning of the metal. Also by providing metal by reduction in size of the bottom of the pan and corner fillets to permit of final deepening of the pan, sufficient metal is provided at the bottom of the pan to prevent tearing of the metal during the final deepening.

Furthermore, the decrease in radius of the corner fillets results in a taking-up of the wrinkles which would otherwise be found in the well faces, since the compressive forces which normally produce the wrinkles will be decreased and the material which would normally form the wrinkles will be allowed to move toward the corners without lapping or folding. That is, the normal decrease in circumference which would attend the descent of a particular horizontal cross-section of the pan into the female dies, due to the latter sloping inwardly, is counterbalanced by the decrease in the radius of the corner fillets and this results in maintaining the cir-

cumference more nearly constant and preventing compressive force which would otherwise wrinkle the pan faces and pile up metal in the corners.

Following the third forging operation the blank may be permitted to cool and the bottom of the pan is cut out along lines 35 (see Fig. 9). Thereafter, the blank is subjected to the final shaping dies (G and H) (Fig. 11), which forms a bead 36 on the flange 11 of the frame. The male die G is preferably deeper than the depth of the pan after the previous forging operation, which engages the marginal edges around said cut out portion 35, forcing them downwardly in continuation of the side walls to increase the depth of the well 12. Thus, part of the metal of the bottom of the pan is used to increase the depth of the side walls surrounding the well 12 as may be desired.

After the fourth operation, the blank is ready for a suitable blanking and trimming press where it is trimmed and pierced for suitable fastening means, as for example, rivets, bolts and the like. Such presses are of well known design and may be incorporated in a press having male and female members similar in shape to the dies G and H so as to accurately position the frame in the press during trimming.

I have found that when using a good grade of rolled plate, my process produces hatch frames of the type illustrated of very good quality and without wrinkles, thin spots or tears in the metal. Furthermore, such frames are more durable than similar frames made of cast metal and withstand hard usage, and shock much more effectively.

The method described above, although preferable in pressing hatch frames of the type described, is not without variation. For example, the pressing operations may be cold pressing, in which case it would be necessary to anneal the blank between the several pressing operations and permit it to cool. Such method, however, requires a higher and more expensive grade of steel, higher grade dies and a more powerful press than the preferred method, and hence from the commercial point of view is not as advantageous.

I claim:

1. The method of making a one-piece pressed metal hatch frame or the like having an inwardly tapering rectangular central well of a depth at least approximately equal to the width of the bottom of the well, which comprises the steps of first pressing a shallow rectangular pan from a metal blank, the radii of curvature of the corners of said rectangular pan being relatively larger than of the finished well, deepening the rectangular pan so formed while maintaining the original radii of curvature of said corners, again deepening the pan and simultaneously reducing the radii of curvature of said corners, cutting out the bottom of the pan after the third pressing operation along lines spaced from the side and end walls thereof, and then straightening the marginal edges of the bottom into alignment with said side and end walls thereby to increase the depth of the central well.

2. In the method as defined by claim 1, the utilization of a series of dies for the successive pressing and deepening operations, all of said dies being of substantially the same size bottom and taper.

3. The method of making a one-piece pressed metal hatch frame or the like having an inwardly tapering rectangular central well of a depth at least approximately equal to the width of the bottom of the well, which comprises the steps of first pressing a shallow rectangular pan from a metal blank, the radii of curvature of the corners of said rectangular pan being relatively larger than of the finished well, deepening the rectangular pan so formed while maintaining the original radii of curvature of said corners, again deepening the pan and simultaneously reducing the radii of curvature of said corners, cutting out a portion of the pan bottom, and finishing the frame between relatively movable die members serving to deepen the depth of the well by the utilization of metal from the bottom of the previously formed pan.

4. In the method as defined by claim 3, the utilization of a series of dies of the same sized bottom and taper for successively deepening the pan to finished dimensions at and adjacent the upper portion of the well, and in bending the marginal flanges of the cut-out pan bottom between relatively movable dies of like taper, acting also to give final smoothing to the inner walls of said well.

5. The method of producing a one-piece pressed metal hatch frame or the like having a rectangular central well of a depth approximating its bottom width with inwardly tapering smooth side and end walls free from wrinkles, which comprises the steps of first pressing by the action of die members a shallow rectangular pan from a metal blank, the radii of curvature of the corners of said rectangular pan being relatively larger than of the finished well, secondly, deepening the rectangular pan by the action of die members while maintaining the original radii of curvature of said corners, thirdly, again deepening the rectangular pan by the action of die members and simultaneously reducing the radii of curvature of said corners, all of said die members being of substantially the same sized bottom and taper, to maintain pan bottoms of substantially like area throughout the successive pressing operations and the die members for said third pressing operation being of decreased corner radius from said second operation die member to counterbalance the normal decrease in circumference

attending the descent of the pan section by the dies to prevent fatal forming wrinkles in said well wall, removing the central portion of the pan bottom, and finally finishing the frame between relatively movable dies of like bottom and taper serving to extend marginal portions of the pan bottom into alignment with the walls of said well to deepen said well.

6. In the method as defined by claim 5 wherein the blank is heated to substantially a white heat preliminary to the first, second and third die forming operations.

In testimony whereof, I have signed my name to this specification.

OLAF J. NYBERG.