May 4, 1937. A. W. FRASER 2,079,553

POWER PRESS

Filed March 14, 1935 3 Sheets-Sheet 1

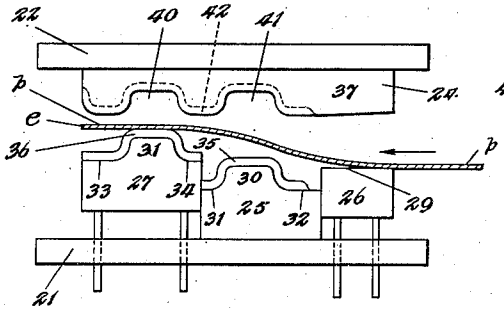


Fig. 1.

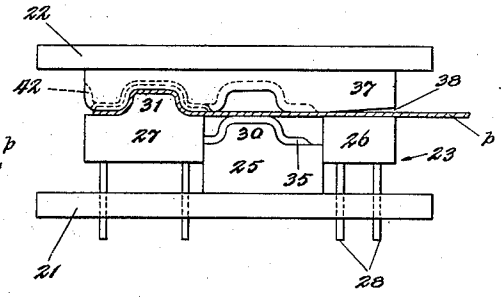


Fig. 2.

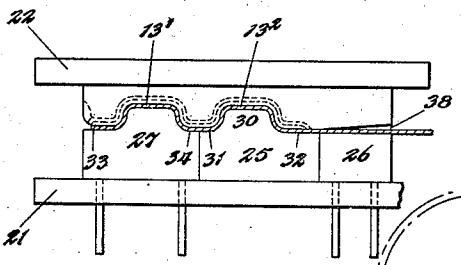


Fig. 3.

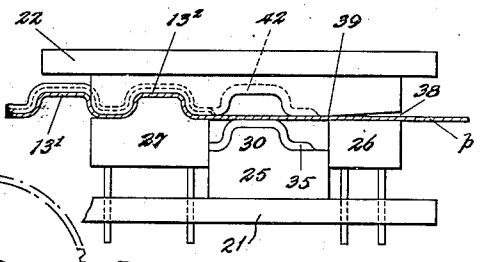


Fig. 4.

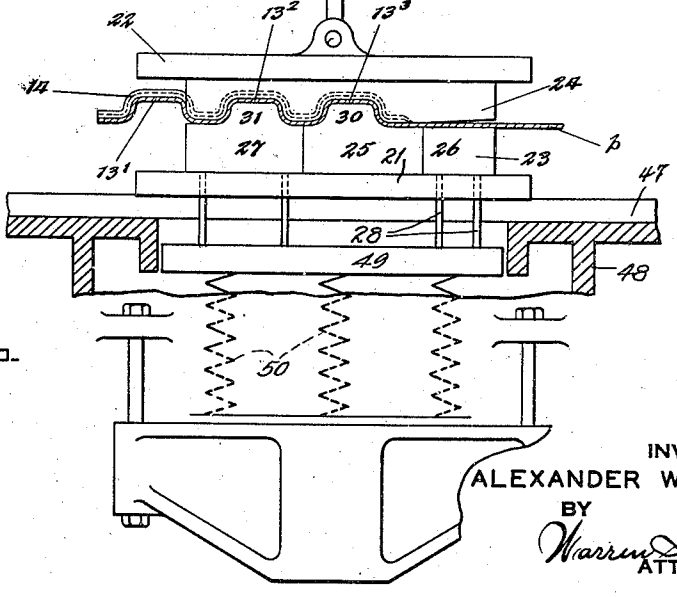


Fig. 5.

INVENTOR
ALEXANDER W. FRASER
BY
Warren S. Orton
ATTORNEY

May 4, 1937. A. W. FRASER 2,079,553

POWER PRESS

Filed March 14, 1935 3 Sheets-Sheet 2

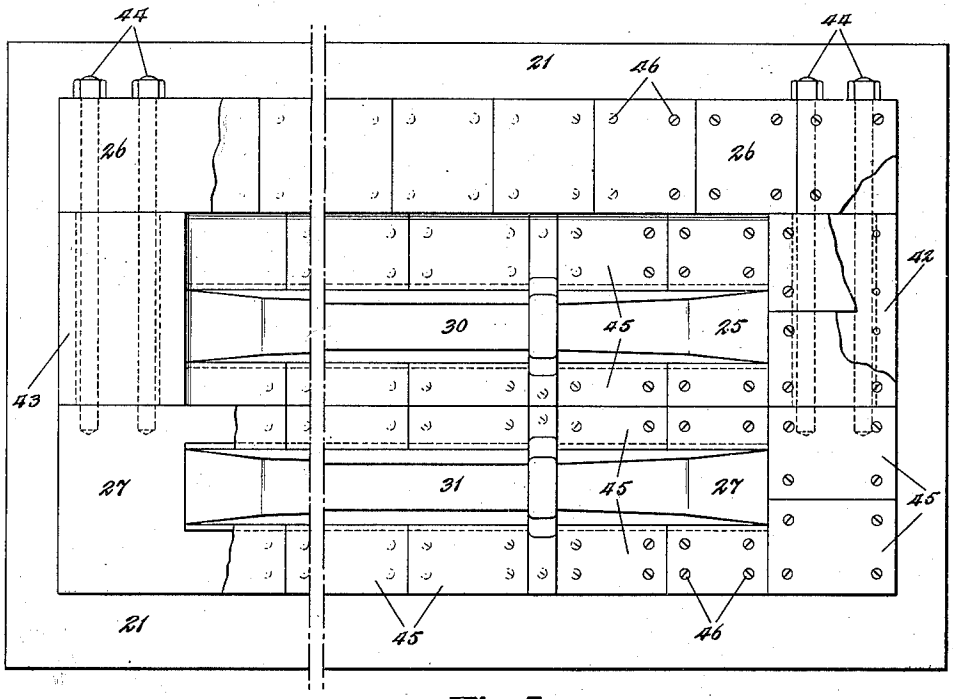


Fig. 6.

Fig. 7.

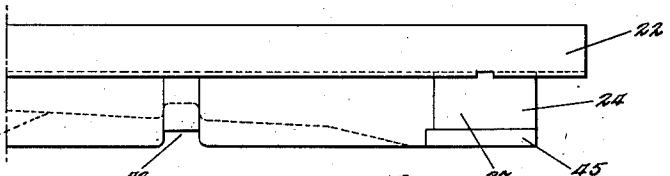
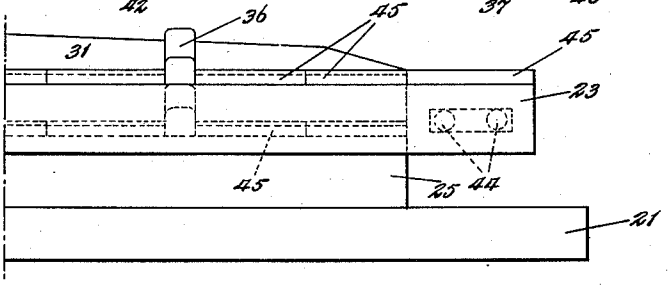


Fig. 8.



INVENTOR
ALEXANDER W. FRASER
BY
Warren S. Orton
ATTORNEY

May 4, 1937. A. W. FRASER 2,079,553

POWER PRESS

Filed March 14, 1935 3 Sheets-Sheet 3

Fig. 9.

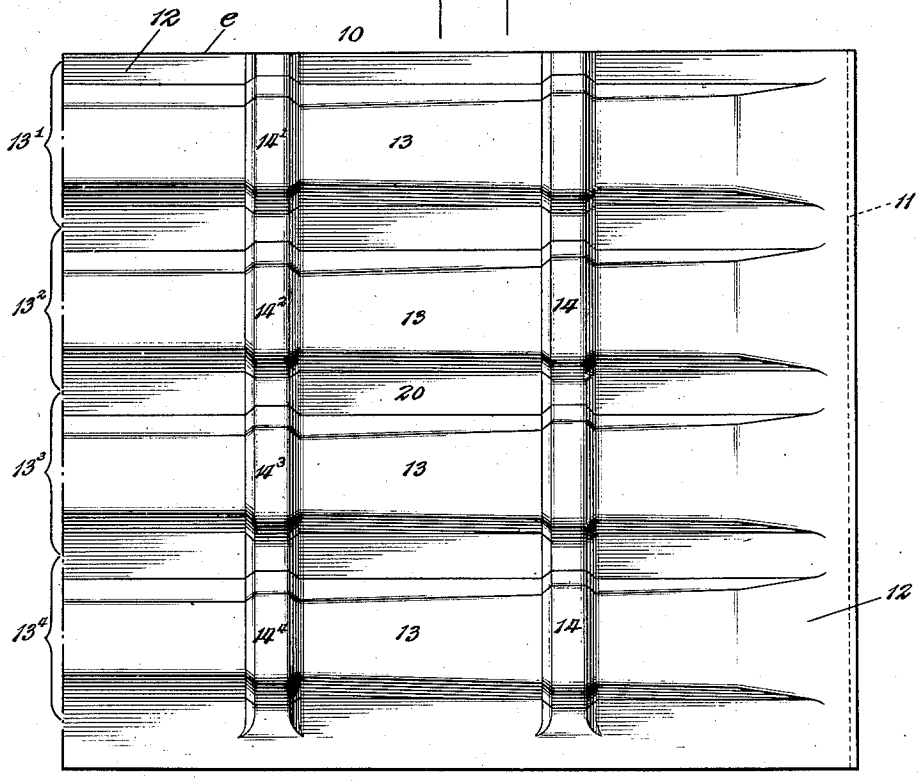
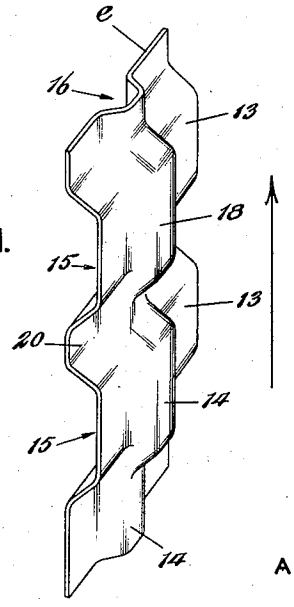


Fig. 10.



INVENTOR
ALEXANDER W. FRASER
BY
Warren S. Orton
ATTORNEY

Patented May 4, 1937

2,079,553

UNITED STATES PATENT OFFICE

2,079,553

POWER PRESS

Alexander W. Fraser, Hamilton, Ontario, Canada, assignor to National Steel Car Corporation, Limited, Hamilton, Ontario, Canada, a corporation of Canada

Application March 14, 1935, Serial No. 10,975

21 Claims. (Cl. 153—76)

The invention relates in general to power presses of general application and particularly relates to a power press for forming corrugations in steel car ends, car sides, car doors and similar heavy metal structural parts of railroad cars and other building constructions, together with improved forms of dies for the same, and the invention is specifically designed to fabricate the car ends disclosed in my Patent No. 1,996,004 granted on March 26, 1935, application Serial No. 700,098, filed November 28, 1933.

The car ends in the said patent are characterized by having a reinforcing corrugated area spaced inwardly from the outlining edges and in which the corrugated area is formed of two sets of corrugations, with the corrugations of each set extending parallel to each other; the corrugations of one set intersecting the corrugations of the other set to form a checker-board design and wherein the corrugations are each of a U-shaped flat web and inclined side wall type, with relatively narrow corrugations forming one set identified as vertical posts extending with uniform cross sectional configuration from end to end, hurdling or overlapping the relatively wide horizontal corrugations of the other set, sometime hereinafter identified as horizontal girders.

The primary object of the invention is to provide a simplified means for forming corrugations such as form the corrugated area of the said patented car end.

Corrugated car ends of the type under discussion are usually formed in one or more sections with dimensions when formed of one piece, substantially eight or nine feet wide, four to five feet high, and with a thickness of three to five sixteenths of an inch, and are usually made by die pressing high grade rolled sheet steel. It is the usual practice to form one of the sections constituting the car end in a single die-stamping operation and this procedure necessitates certain refinements of practice, such for instance, as the maintaining of this large area plate at a relatively high temperature and the employment of large sized presses of the order of two thousand five hundred ton presses.

The present method features the forming of the corrugated area of such plates by die-pressing relatively small portions of the plate in each of a series of succeeding stamping operations, and the forming of corrugations in plates of large area on a relatively small size press. In one method of practicing the invention, the corrugations can be formed on a press of relatively low capacity, such as a one thousand ton type of press, thus permitting of the fabrication of heavy type die-pressing of car ends on presses commonly found in the ordinary car and railroad repair shops.

The invention also features the utilization of the previously formed relatively narrow intersecting or transverse corrugations or parts thereof to prevent accidental shifting of the plate in directions at right angles to each other in the plane of the plate, and also features an intensity of clutching engagement in the part of the plate not yet acted upon to permit a restrained creeping of the metal from the part so held into the part being acted upon by the dies, and thus tend to minimize any action of the dies in thinning out the material in the part forming the corrugations, while holding the material not yet worked, or not intended to be worked upon, from any incidental warping.

Referring particularly to the apparatus aspect of the disclosure another object of the invention is to provide a form of die press, or more particularly, a simple form of coacting dies of such a press for practicing the above outlined method economically on a power press, even on a power press of relatively light power.

Still another object of the invention is to provide in a power press of the type herein featured, an organization of the separate parts which will permit the formation of the desired corrugated area with that nicety of control of the material being worked upon to permit the formation of the required corrugations without unduly thinning out the material forming each corrugation and the providing of that degree of clutching intensity which will permit a relatively cold flow of material to the part forming the corrugation and at the same time minimize, if not eliminate objectionable buckling in the parts immediately adjacent the corrugation being formed.

This phase of the invention is provided by utilizing a work-holding clutch which will hold the flat portions of the plate adjacent and outlining the portion at the time being formed into corrugations, with an intensity of clutching action sufficiently great to prevent buckling but not so high as to prevent the desired edgewise creeping of the material from the uncorrugated into the portion in which the corrugation is being formed for the time being. In this connection it is suggested that the work holding clutch have a slightly greater clearance at the intake end of the material than at the discharge end adjacent the corrugation forming side thereby to facili-

tate feeding of the plate into the portion being corrugated.

Various other objects and advantages of the invention will be in part obvious from a consideration of the method features of the disclosure and from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one method of practicing the invention, and the invention also consists in certain new and novel modifications of the preferred method as well as to the products produced following such method or methods.

In the accompanying drawings:

Figs. 1 to 4 and the upper portion of Fig. 5 are explanatory views illustrated as if in end elevation of a die press showing successive steps in corrugating sheet metal in practicing the method herein featured, but more properly showing somewhat diagrammatically an end view of the structure shown in Figs. 6, 7 and 8 with the end pieces of the cushioning frame omitted, and illustrating a preferred embodiment of the apparatus features of the disclosure;

Fig. 5 is a view partly in section and partly in an end elevation view of the structure shown in Figs. 6, 7 and 8 and illustrating a power means for operating the upper die and a cushioning means for the lower die;

Fig. 6 is an enlarged plan view of opposite ends of the lower die shown in the preceding figures and with the midportion broken away;

Fig. 7 is a view in elevation of the upper die looking at the same from the right side of the showing in Figs. 1 to 5;

Fig. 8 is a similar view of the companion parts of the lower die;

Fig. 9 is a view in elevation of the lower right hand corner of a car end constructed by following the method herein featured and corresponding to Fig. 1 in the above identified copending application. It can be assumed also that either the lower or upper half of this figure also represents a plan view of either one of the dies shown in end elevation in the preceding figures, it being understood, of course, that both the upper and lower dies are each of twice the length of the showing in Fig. 1; and

Fig. 10 is a perspective view of a portion of the car end shown in Fig. 9, showing one of the vertical corrugations intersecting two of the horizontal corrugations, but likewise it can be assumed that the showing in Fig. 10 is a portion of one of the dies which forms the correspondingly shaped portion of the car end.

Referring to the finished structure, there is eventually formed a substantially flat sheet metal plate or panel 10 having inturned side flanges 11 and an outlining flat uncorrugated edge portion 12. Within the outlining flat edge area 12 the plate is provided with two sets of corrugations to form a central reinforced area to the panel as a whole; one set of corrugations 13 being relatively numerous extends horizontally in parallel relation and the copending disclosure features the forming of these corrugations equidistantly spaced apart to form integral girders in the finished plate. The other set of corrugations 14 being less numerous and in the instant case constituting four, are relatively narrow and extend vertically, and like the horizontal corrugations in the copending disclosure feature the forming of these vertical corrugations substantially equidistantly spaced apart horizontally. These corrugations intersect each other at right angles to form an elongated block-like or checkerboard-design over the entire reinforced area. The trough or channel 15 of the girder forming corrugation 13 is continuous across the entire reinforced area and is straight from end to end. The trough or channel 16 of the post forming corrugation 14 is likewise continuous from end to end across the reinforced area but of course is not straight being of undulatory form. The post forming corrugations 14 are continuous and project outwardly not only from the flat uncorrugated portion of the plate but extend up the sides of, pass over and project beyond the corrugations 13 as shown at 18, Fig. 10. The posts 14 then extend over the girder forming corrugations 13 and along the trough or uncorrugated space 20 formed between the adjacent pairs of the girder forming corrugations 13.

Referring to the showings in Figs. 1 to 8 it will be understood that there is illustrated a conventional form of die pressing machine including a stationary bed 21 and a movable power actuated plunger 22 mounted for vertically reciprocatory movement. A relatively stationary two part male die 23 is carried by the bed 21 on the upper side thereof and the plunger 22 is provided on its underside with a one-piece coacting female die 24.

The die 23 is formed primarily of two relatively movable parts: a middle, long rectangular bar or strip 25 rigidly secured to the bed 21, and an encircling or rather middle bar-enclosing, rectangular, hollow frame. The frame includes two long outside strip bars or plates 26 and 27, extending parallel to and in edgewise vertical sliding engagement with opposite long sides of the middle strip 25 and two connecting end members or blocks 42 and 43. The strips 26 and 27 are secured together at their ends with the end members 42 and 43 forming spacing members therebetween by means of readily replaceable through bolts 44 as shown in Fig. 6. It is also suggested that the wear surfaces of the parts, particularly the flat surfaces of the dies, be formed of replaceable small size plates, such as are shown at 45 in Fig. 6 and that each of these plates be secured to the dies 23—24 by means of machine screws 46. The frame constitutes a cushioned pad controlled in its vertical movement in the bed by means of supporting legs 28 passing through the bed 21, through a bolster 47 carried by a press bed 48 and resting on top of a pressure cushion 49 guided for vertical movement in the press bed. The frame is normally maintained in position elevated above the bed 21, by means of cushioning springs 50 bearing upwardly against the pressure cushion 49 or, in some forms of such presses, by pneumatic cushions, or plungers, such as are commonly found in presses of this character. In the instant case the pads have a resistance to being depressed equal to about one fifth of the force inherent in the plunger 22 acting to depress the pad forming frame. The strip 26 has a smooth top face 29 and constitutes in the right hand side of the showing one of the elements of a flat-face work-holding jaw or clamp for securing the work plate as hereinafter outlined. The top surface of strip 26 is continuous and on the same level with the top surface of the end blocks 42 and 43 and with the flat faces of the strips 25 and 27.

The middle strip 25 and the outside strip 27 are each provided with a longitudinally extending rib one being a duplicate of the other designated respectively 30 and 31, each designed to form any

and all of the girder forming corrugations 13 and each half length of said rib having the shape in plane shown at any of the strips marked 13. The top face of each of these strips 25 and 27 is provided on opposite sides of the base of its rib with a flat top face; the faces on opposite sides of rib 30 marked 31 and 32 and the similar faces on opposite sides of rib 31 marked 33 and 34. The two top faces 31 and 34 when in the position shown in Figs. 3 and 5 maintain the trough or uncorrugated spaces 20 in the finished structure.

The top, die-forming surface of each of the strips 25 and 27 is also provided with a plurality, in the instant case with four, transversely extending beads 35 and 36, one for forming each of the upstanding relatively narrow corrugations 14. It is understood, of course, that each bead extends when the pad 27 is in its lowermost position continuously across and between the two ribs 30 and 31.

The die 24 is formed as the negative or complement of the two part die 23, except that the portion 37 immediately above and forming the coacting element of the clutch jaw 26 is formed flat and preferably polished as is the top face of the floating clutch element 26 but has a greater clearance at its outer edge, as indicated at 38, than at its inner edge 39 when the die elements are in their proper corrugation forming relation. The left two-thirds of the underside of the die 24 is provided with two identical channels 40 and 41 for receiving respectively the ribs 30 and 31 and with transversely extending smaller grooves 42, one for each of the beads 35—36. When viewed in plane, a part of the underside of die 24 corresponds to the showing in Fig. 10 in its inclusion of two grooves 15 and one of the transverse grooves 16.

It will be understood that the press is provided with conventional parts such, for instance, as means for adjusting the cushioning tension on the floating pads, feed tables for feeding the stock to the press and for withdrawing the finished product from the press and with guides and templets for locating the stock in its initial position in the press and means for heating the plate for the time being acted upon.

In operation and referring first to the showing of the parts in Fig. 1 with the plunger and pads in their normal elevated position, the plate p to be corrugated is advanced into the machine in the direction indicated by the arrows in Figs. 1 and 10 until the advanced edge e meets a stop (not shown) but located to bring the channel 16 at the upper edge of the end plate as shown in Fig. 9. Other stops are used to insure the requisite width of edge portion 12 and flange 11 to this particular piece of work. At this time the plate assumes roughly the position indicated in Fig. 1.

Power is then turned on to lower the plunger 22 and during the lowering movement at this initial operation two actions take place. First, the left portion of the coacting dies, that is the pad 27 and the coacting part immediaely above the same, catches the portion of the plate therebetween and the entire frame and with it the pad 27 is lowered against the resistance of the frame holding springs.

These springs are so tensioned relative to the plate being worked upon that the associated die parts begin to form the first corrugation marked 13^1, Fig. 9, and at the end of this step the parts are at least approximately in the position shown in Fig. 2. By this time the upper die has taken up the clearance between the clutch elements 26—37 and their connecting end pieces but the die parts formed by the middle strip 25 and the corresponding parts above the same have not yet contacted or have just about contacted with the uncorrugated portion of the plate therebetween. As the upper diet continues to lower, the first corrugation 13^1 is more or less completely formed. At this time there is formed not only the corrugation 13^1 but the intersecting portions of each of the corrugations 14 embraced within the bracket marked 13^1, Fig. 9. It will thus be seen that the advanced edge of the plate is held between the left hand portion of the dies and is held from movement in the direction of advance of the plate (shown by the arrow) by the rib 31, and is held from lateral movement in the transverse direction by the several sections 14^1 of the transversely extending corrugations engaging over the beads 36. While this advanced corrugated portion of the plate is thus being held with any desired degree of clutching intensity controlled by the springs acting on pad 27, the machine is so designed that the clutch 26—37 with their connecting end pieces 42 and 43 is holding the uncorrugated portion of the plate between its jaw elements with sufficient intensity to prevent this part of the plate from buckling, but with sufficient slipping to permit the held portion of the plate to creep towards the central portion of the die elements in the succeeding steps of forming the second corrugation 13^2 and associated corrugations 14^2.

Tracing the continued lowering movement of the plunger, the parts finally arrive in the position shown in Fig. 3 at which time the frame 26—27—42—43 is being pressed firmly into engagement with the bed 21 and both of the corrugation forming parts of the dies have completed their final pressing action so that at the end of the step indicated in Fig. 3, the first two corrugations 13^1, 13^2, have been completely formed, and the adjacent flat portions surrounding the same have been kept flat.

The upper die is then elevated to its normal raised position and the corrugated edge of the plate is then raised out of engagement with the lower die elements. The plate is then advanced one step in the direction of the arrows and into its next succeeding position in the die assembly, the second corrugations 13^2 being located on the rib 31 of the floating pad 27, and, of course, with the transverse corrugation portion 14^2 fitted over the beads 36 of this floating pad and the parts are then in position to form the third corrugation 13^3. The plunger is lowered with the second or succeeding stroke of the machine, first into the position shown in Fig. 4 so as to clamp the second corrugation in position between the die elements and in this way to hold the second corrugation firmly in place during the operation of forming the third corrugation. The third corrugation is formed beginning with the position of the dies as shown in Fig. 4 and ending with the position of the dies as shown in Fig. 5, at which time the third corrugation 13^3 and its associated transverse portions 14^3 are formed, while the surrounding flat portion is held in such flat position.

It will be understood that this operation is repeated, each previously formed corrugation being utilized as a holding and spacing means to locate the next succeeding parallel wide corrugation and associated part of the continuous

transverse corrugations until the required area has been formed with its arrangement of intersecting corrugations.

By practicing the method herein disclosed it is possible to form a one-piece corrugated car end or similarly large construction unit without necessity of using the powerful presses heretofore found necessary in pressing car ends into their requisite corrugated forms.

As each corrugation after the first one is formed by the same die part **25** and the coacting part immediately above **25**, it follows that all of the wide corrugations **13** are of identical contour and that at the end of the procedure each transverse corrugation **14** is of identical conformation throughout its length, thus providing a car end of any desired number of corrugations **13** formed from a die assembly composed only of two corrugation forming parts. Even though the high, or most advanced, portions **18** of the corrugations **14** are pressed out of the plane of the flat sheet considerably in advance of the depth of the channels **15**, the refinement practiced in this method of permitting the creeping of the plate into the portion being formed into corrugations results in forming each corrugation separately without appreciably thinning out the metal as it is curved into the U-form in cross section characterizing the corrugations in the finished plate. Finishing the clutching faces of the jaw elements with a machine smooth finish minimizes frictional resistance to the advance of the metal into the trough forms while the portion of the plate next to be corrugated, as well as the outlining edge portions, are held in their initial flat condition and are thus freed from strain and lines of weakness which might otherwise occur when the flat portions are subsequently subject to the action of the corrugation forming dies. It will be understood, of course, that the clearance illustrated in Figs. 1 to 5 between the jaw elements has been purposely exaggerated in order to show it, but in actual practice the increase in clearance is slight and the action might be more properly designed as having less clutching intensity at the incoming edge **38** of the clutch than at the discharge edge **39** adjacent the fixed die element.

While there has been shown, described and pointed out in the annexed claims, certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

I claim:

1. A press for forming corrugations in sheet metal including a supporting bed, means forming a relatively fixed lower die comprising three parallel strips in edge to edge side abutting relation, the middle strip being immovably fixed to the bed and the two outside strips constituting floating pads connected to move in unison and normally supported resiliently in spaced relation above the bed and adapted to be lowered against the resistance of their resilient supports into stopped engagement with the bed, the middle strip and one of the outside pads each having its upper die surface fashioned to provide a die for forming a single corrugation and said fixed die and said floating die coacting when the die forming pad is in its lowered position to form in outline two identical forms of corrugations with an intervening trough therebetween, the top of the other floating pad being flat and polished and constituting a jaw of a work holding clamp, and a movable upper die having a part of its die forming under surface fashioned to provide the negative of the contour of the said two corrugations and intervening trough and another part of its undersurface flat and constituting the coacting jaw of the holding clamp.

2. A press for forming corrugations in sheet metal including a supporting bed, means forming a relatively fixed lower die comprising three parallel strips in edge to edge side abutting relation, the middle strip being immovably fixed to the bed and the two outside strips constituting floating pads being normally supported resiliently in spaced relation above the bed and adapted to be lowered against the resistance of its resilient supports into stopped engagement with the bed, the middle strip and said pad each having its upper die surface fashioned to provide a die for forming a single corrugation and said fixed die and said floating die coacting when the die forming pad is in its lowered position to form in outline two identical forms of corrugations with an intervening trough therebetween, the top of the other floating pad being flat and polished and constituting a jaw of a work holding clamp, and a movable upper die having a part of its die forming undersurface fashioned to provide the negative of the contour of the said two corrugations and intervening trough and another part of its undersurface flat and constituting the coacting jaw of the holding clamp, said pads having a resistance to being depressed into engagement with the bed equal to about one-fifth of the force inherent in the movable die acting to so depress the pads.

3. A press for forming corrugations in sheet metal including a supporting bed, means forming a relatively fixed lower die comprising two parallel strips in side abutting relation, one of the strips being fixed to the bed and the other strip being resiliently supported, and forming a floating pad, the top surface of the fixed strip forming an element of a corrugating die and the top surface of the pad normally spaced above the die a distance equal to the depth of the corrugation formed by the press, said top surface of the pad being flat and forming a jaw of a clamp for holding the sheet while being pressed, and means forming a movable upper die having part of its undersurface fashioned to form the negative of the die forming face of the fixed die and coacting therewith to form a corrugation in a sheet of metal held by the clamp in position between the dies and said movable die having part of its undersurface flat and forming the coacting element of the clamp.

4. A press for forming corrugations in sheet metal including a supporting bed, means forming a relatively fixed lower die comprising two parallel strips in side abutting relation, one of the strips being fixed to the bed and the other strip being resiliently supported, and forming a floating pad, the top surface of the fixed strip forming an element of a corrugating die and the top surface of the pad normally spaced above the die a distance equal to the depth of the corrugation formed by the press, said top surface of the pad being flat and forming a jaw of a clamp for holding the sheet while being pressed, and means forming a movable upper die having part of its undersurface fashioned to form the negative of the die forming face of the fixed die and coacting therewith to form a corrugation in a sheet

of metal held by the clamp in position between the dies and said movable die having part of its undersurface flat and forming the coacting element of the clamp, said clamp when in closed position having slightly less clearance between the jaws at the edge nearest the fixed die than at the outer edge of the floating pad.

5. A die assembly including a male die having its work face fashioned to provide a longitudinally extending rib with flat faces extending outwardly from the base of the rib and said work faces provided with a transversely extending rib of uniform cross sectional form projecting continuously above the flat faces and the top and sides of the first-named rib and a coacting female die having a longitudinally extending groove forming the negative of the first-named rib and having a transversely extending groove forming the negative of the transverse rib.

6. A die assembly including a male die having its work face fashioned to provide a longitudinally extending rib with flat faces extending outwardly from the base of the rib and said work faces provided with a transversely extending rib of uniform cross sectional form projecting continuously above the flat faces and the top and sides of the first-named rib and coacting female die having a longitudinally extending groove forming the negative of the first-named rib and having a transversely extending groove forming the negative of the transverse rib, and a second resiliently supported pad located on the side of the fixed die element opposite the first-named pad and coacting with a portion of the movable die opposite the same to resiliently clamp the portion of the plate in rear of the portion being acted upon by the fixed die element whereby the plate is clamped simultaneously on both sides of the portion being die formed into a corrugation.

7. A press for forming a corrugation in sheet metal parallel to and spaced from a previously formed similar corrugation, means forming a relatively fixed die comprising two elements, one fixed in position and the other resiliently supported, the top die forming surfaces of both elements being of identical contour and each including a rib-like member having substantially flat surfaces on opposite lateral sides thereof and a coacting movable member having its underside provided with two spaced apart parallel grooves corresponding to and located opposite to the rib-like members.

8. A press for forming a corrugation in sheet metal parallel to and spaced from a previously formed similar corrugation, means forming a relatively fixed die comprising two elements, one fixed in position and the other resiliently supported, the top die forming surfaces of both elements being of identical contour and each including a rib-like member having substantially flat surfaces on opposite lateral sides thereof and a coacting movable member having its underside provided with two spaced apart parallel grooves corresponding to and located opposite to the rib-like members, the die surfaces also provided with laterally extending coacting transverse die forming ribs and grooves formed with transverse ribs projecting from both of the elements provided with the rib-like member and the transverse grooves being formed on the underside of the movable die and each groove being continuous across both of the first-named parallel grooves and across the intervening surface.

9. In a press for forming spaced apart parallel corrugations in a plate, the combination of a support, means forming a relatively fixed lower die carried by the support and including two die forming elements extending parallel to each other, one fixed to the support and the other resiliently supported and forming a floating pad adapted to be moved into a stopped position engaging the support and disposed with its top surface normally positioned above the top surface of the fixed element, each of said top surfaces provided with a longitudinally extending rib-like member for forming or securing in place one of the corrugations in the finished plate and said top surfaces each provided on opposite sides of its respective rib with a flat surface, the flat surface adapted to be moved into alignment when the pad is lowered into engagement with the support, and a coacting one-piece movable upper die having its undersurface provided with two spaced apart parallel grooves corresponding in contour to the rib-like member and the portion of the movable die opposite the pad coacting therewith to hold a previously formed corrugation therebetween while the fixed element and the portion of the movable die opposite the same is acting on the plate to form the next adjacent corrugation spaced from the held corrugation a distance determined by the width of the flat portions between the two rib-like die members.

10. A die for use in forming corrugated plates provided in its die face with two parallel and transversely spaced apart relatively wide grooves with a substantially flat face therebetween and said die face also provided with a plurality of laterally extending parallel, spaced apart relatively narrow grooves, each of said narrow grooves extending continuously and without change in cross sectional configuration across both of the portions of the die face provided with two wide grooves and across the flat space between the two wide grooves, and a coacting die including two relatively wide rib-like members, one for each of the wide grooves and located opposite the same and a plurality of transverse relatively narrow beads, one for each narrow groove, projecting beyond the rib-like members.

11. In a machine for forming corrugations, two coacting dies, power means acting on one of the dies to move the same into cooperative relation to the other, one of said dies including a single element and the other die comprising two elements, one fixed in place and the other forming a frame encircling the single element and being resiliently mounted and capable of being moved against the resistance of its resilient mounting when engaged by the other die, said dies having their work engaging faces each fashioned to define a corrugation and said frame having its work engaging face flat and constituting an element of a clutch, the die comprising the single element having its work engaging face fashioned in one part to form the complement of and opposing the corrugation defining faces of the said two elements and another part being flat and constituting the coacting element of the clutch.

12. In a die press for forming corrugated car ends having a corrugated area outlined at opposite edges with flat uncorrugated marginal portions, said press including two relatively movable coacting dies, one of said dies including a central portion rigid with its support, and a frame encircling the central portion and resiliently mounted for movement to and from said support, said central portion and the coacting part of its companion die provided with means for forming

a corrugation in a metal plate held between the dies.

13. In a die press for forming corrugated car ends having a corrugated area outlined at opposite edges with flat uncorrugated marginal portions, said press including two relatively movable coacting dies, one of said dies including a central portion rigid with its support, and a frame encircling the central portion and resiliently mounted for movement to and from said support, said central portion and the coacting part of its companion die provided with means for forming a corrugation in a metal plate held between the dies, and the part of the frame on one side of the central portion and the coacting part of its companion die also provided with means for forming a corrugation in the metal plate, said means being of identical configuration, whereby the corrugation formed by one of said means will fit the other means.

14. In a die press, the combination of a support, a rectangular hollow frame resiliently supported from said support, a bar fitted in said frame and rigidly secured to the support, the bar and a side of the frame on one side of the bar each provided with a corrugation-forming die element, said elements extending parallel to each other, being transversely spaced apart, and of identical contour.

15. In a die press, the combination of a support, a rectangular hollow frame resiliently supported from said support, a bar fitted in said frame and rigidly secured to the support, the bar and a side of the frame on one side of the bar each provided with a corrugation-forming die element, said elements extending parallel to each other, being transversely spaced apart, and of identical contour, and each element including a part extending transversely of the length of said parallel elements and one of said parts adapted to form a continuation of the other.

16. A die press including a die comprising a bed, a long, middle strip secured to the bed, a pair of side strips disposed on opposite sides of said middle strip, end pieces connecting opposite ends of the side strips and coating therewith to form a rectangular frame surrounding the middle strip, means for supporting the frame resiliently from the bed, said middle strip and one of said side strips provided with an element of a corrugation-forming member, said elements extending parallel to each other and transversely spaced apart, the work face of said middle strip and said side strip on opposite sides of said element being flat and the work face of the other side strip being flat, and a coacting die having work-engaging faces forming the complement of the work face of the first-named die and acting on the frame to move the same into a stopped engagement with the bed and against the resistance of its resilient support.

17. In a power press, the combination of coacting dies, including corrugation-forming means, and work-clamping means entirely surrounding said forming means for securing the part of the work adjacent the part being acted upon by the corrugation-forming means and said clamping means including a corrugation constituting a duplication of said forming means.

18. In a power press, the combination of coacting dies with a part of one of said dies forming a cushioned pad surrounding the balance of said die, and said balance of said die as well as the part surrounded thereby being each provided on its work-engaging face with an element of a corrugation-forming means surrounded by a flat uncorrugated face.

19. A press for successively forming identical parallel corrugations in a sheet, comprising two coacting dies, one of said dies being of one piece and the other being of three relatively movable pieces, considered transversely of the lengths of the corrugations, two of said three pieces and the coacting portion of the other die having their die forming surfaces the complement of each other, each of said two pieces and its coacting part of the other die providing means for forming a complete corrugation and the third piece coacting with its companion portion on the other die to provide a flat-faced clamp and means for cushioning said flat faced clamp.

20. A press for successively forming identical parallel corrugations in a sheet comprising two coacting dies, one of said dies including two parts, said two parts having their die forming surfaces the complement of the coacting portion of the other die, each of said two parts and its coacting part of the other die being of identical contour and providing means for forming a complete corrugation whereby a corrugation formed by one of said parts and its associated portion will fit the other part and its associated portion and said coacting dies including coacting clamping members for clamping a flat portion of the sheet while another portion is acted upon by the corrugating dies, said clamping members provided with non-parallel clamping faces.

21. A press for successively forming identical flat corrugations in sheet metal as the metal is fed therethrough, said press comprising two coacting dies, having a portion of the die surface of one constituting the complement of its coacting portion on the other die, said portion of one of the die surfaces including two identically shaped wide flat grooves extending in parallel relation and spaced apart to form a wide flat rib therebetween and the companion portion of the other die similarly provided with two identically shaped wide flat ribs opposing and coacting with the two grooves and forming a groove therebetween opposing and coacting with the rib and one of said dies being divided along a plane intersecting the first named rib and its coacting last named groove to form two relatively movable parts to said die.

ALEXANDER W. FRASER.