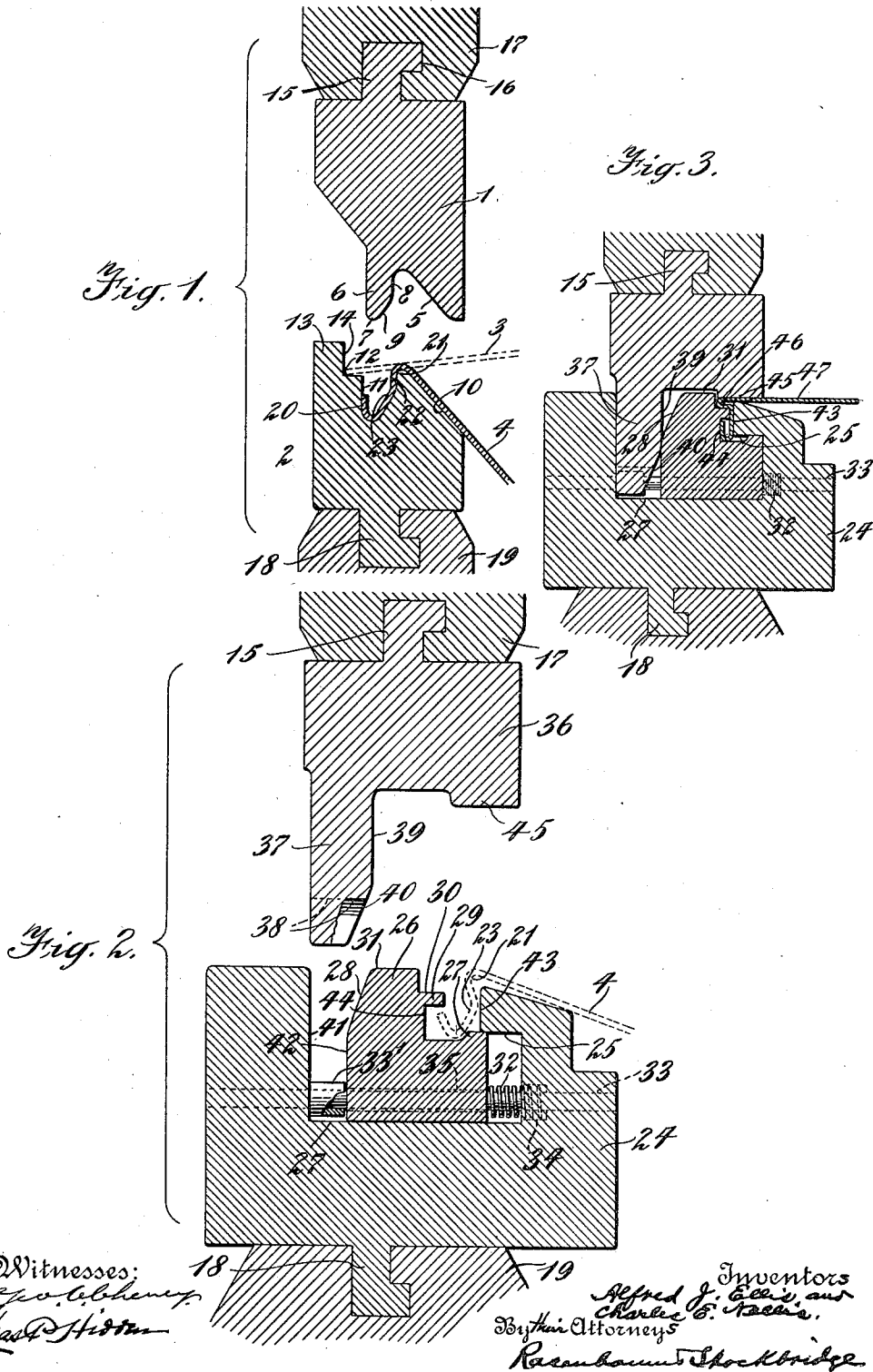


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BENDING DIES.
APPLICATION FILED JAN. 30, 1911.

1,013,871.

Patented Jan. 9, 1912.



UNITED STATES PATENT OFFICE.

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BENDING-DIES.

1,013,871.

Specification of Letters Patent.

Patented Jan. 9, 1912.

Application filed January 30, 1911. Serial No. 605,425.

To all whom it may concern:

Be it known that we, ALFRED J. ELLIS and CHARLES E. NELLIS, citizens of the United States, residing at Woodcliff-on-Hudson, township of North Bergen, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Bending-Dies, of which the following is a full, clear, and exact description.

10 This invention relates to sheet-bending appliances and more particularly to dies for bending sheet metal or other suitable sheet material in a novel manner to the end that an "interlocking" flange construction may be provided along one or more edges of the sheet of material.

The formation of a compound flange structure in sheet material presents peculiar difficulties and our herein described invention provides means for efficiently producing a uniform product. Two sets of forming appliances are preferably used, which cooperate to attain the desired result by first bending the edge of the material into a particular shape, and the second set of appliances thereafter completes the several bends started in the first operation, to form the product. The said second set of appliances, which in this exemplification of our invention are the secondary dies hereinafter referred to, present novel features and these and other objects of our invention will be hereinafter referred to and more particularly set forth in the appended claims.

35 In the drawing which forms a part hereof and in which like reference characters designate like parts throughout the several views: Figure 1 is a cross-section of a set of dies adapted to effect the first operation; Fig. 2 is a cross-section of the novel secondary dies, the several parts of the device being shown in open position. Fig. 3 is a cross-section of said secondary dies in closed relationship with the product shown in section in place therebetween.

Referring first to Fig. 1, an upper die, broadly designated 1, cooperates with a lower die 2 to bend the edge of a plane sheet of material, such as that indicated in dotted lines 3, into the form shown by the full lines 4. The upper die 1 has an operative surface 5 thereof angularly disposed to the general alining plane of said dies, and a rib 6 of somewhat peculiar configuration projects

downwardly from one side of this angularly disposed surface at an angle thereto and substantially in alinement with the said general plane. The left hand side of this rib is preferably formed plane and terminates at the lower edge of the rib in a slightly rounded or arcuate surface 7, while the right hand side 8 of the rib is in substantial parallelism with the side 6, but is considerably narrower, this surface being joined to the arcuate or curved surface 7 by a short angularly disposed surface 9 which may be said to be approximately perpendicular to the surface 5. The lower die 2 has one portion 10 of its upper surface arranged substantially in parallelism with the surface 5 of member 1, while another portion is grooved as at 11, for the reception of the rib 6, this recess being contoured to snugly fit the sheet material when the latter is disposed around the rib 6 and bent by the coaction of said rib and recess into conformation therewith.

In order to obtain a uniform product it is desirable that a stop or guide should be provided for the edge of the sheet 3, which has been done in this instance by rectangularly rabbeting the left hand wall of the groove 11 as at 12; the die 2 hence having an upward extension 13, the vertical wall 14 of which serves as this stop. The upper die is provided with an L-shaped rib or extension 15 which is adapted to be received into a correspondingly shaped groove 16 in a bar 17 which is reciprocally mounted in any suitable manner, forming preferably a part of a reciprocating element or jaw of a press. Correspondingly the lower member 2 is provided with an L-shaped extension 18 which is received in a fixed strip or bar 19, which may form, for example, the lower jaw of a press.

When the die 1 is driven downwardly toward die 2, the edge 7 of the rib 6 bends the sheet 3, which is supported on either side thereof in the manner shown in Fig. 1, and forces such bent portion downwardly into the groove 11. The bend in the sheet prevents its lateral displacement and hence the left hand wall of the recess 11 will sharply bend the extreme edge of the sheet around into the position shown at 20, while the surfaces 5 and 10 will abruptly incline the body of the sheet downwardly and form a bend 21 therein, and the wall 8 of the rib and the

corresponding right hand wall of the groove 11 will bend the intermediate portion of the sheet around to form the straight portion 22 thereof, the oblique face 9 of the rib and the
 5 corresponding oblique wall of the recess further bending such intermediate portion as at 23. This completes the first operation and the bent edge of the so prepared sheet is now adapted for insertion into a suitable recess
 10 formed between cooperating parts of the secondary forming dies. This second set of dies comprises three principal elements; a lower member 24, which is substantially U-shaped in cross-section, although one leg of
 15 the U is undercut as at 25. The U-shaped member is adapted for the reception of a laterally displaceable die 26. This part is also somewhat L-shaped, one leg of the L bearing upon the flat surface 27 which forms the
 20 bottom of the recess in member 24, and the other leg of the L having one corner thereof obliquely cut away as at 28 for reasons hereinafter set forth. The laterally disposed flange of the part 26 is provided with a lip
 25 27 along the upper edge thereof, the upper face of which lip is adapted to engage the horizontally disposed upper wall of recess 25. A thin rib 29 extends laterally along
 30 the length of the upstanding flange of the part 26, the upper surface 30 of such rib being preferably spaced down from the upper surface 31 of member 26 in the manner shown and for reasons hereinafter to be set forth. The part 26 is normally pressed out
 35 into the position which it occupies in Fig. 2 by the springs 32 which are disposed around suitable guiding pins 33; the outer extremities of these springs being received in the recesses 34 disposed at spaced intervals
 40 along the vertical wall of recess 25. Correspondingly member 26 has a series of holes 35 therein adapted for the snug reception of pins 33. Pins 33 may, if desired, be of sufficient length to extend entirely through the
 45 member 24, and may be provided with sleeves 33' to serve as stops for part 26. The upper die in this group of parts has been broadly designated 36 and has a relatively heavy downwardly projecting rib 37
 50 which may extend the entire length of this part. This rib may be recessed, as indicated by the dotted line 38, to clear the sleeve 33'. Rib 37 has somewhat the configuration of the rib 6, referred to above, but is intended
 55 to operate in a distinctively different manner. The vertical left hand flank or side of rib 37 is of relatively considerable width, while the right hand flank 39 is preferably parallel to the former, but is cut away as at
 60 40 at an angle corresponding to the surface 28 of part 26. The left hand flank of rib 37 is substantially in alinement with the left hand wall 41 of the recess in the lower part 24, so that when member 36 is caused to descend, or vice versa should part 24 be caused

to ascend, the oblique surface 40 will engage surface 28 and rib 37 will act as a wedge and will laterally displace member 26, so continuing to displace the same until the
 70 wall 39 is in engagement with the wall 42 at the left hand side of member 26, the springs 32, of course, being compressed during this operation.

Considering now that the sheet of material has been bent as in the foregoing and that its bent portion has been inserted into the recess formed between the wall 43 of
 75 member 24 and the correspondingly opposed and co-acting surfaces of member 26, and that the upper die is then caused to approach the lower, or vice versa, until wall 39 coincides with wall 42 in the manner above described, it will be readily seen that the member
 80 26 will be driven laterally into the position which it occupies in Fig. 3. This procedure will cause the extreme edge or lip of the bent plate 4 to engage the vertical wall 44 of the recess in member 26 below the rib 29 while the body of the sheet will be held against lateral displacement by the wall 43
 85 of member 24, and will thereby fold said edge over into parallelism with the adjacent sheet material, the complete bend so formed by these successive operations being one of approximately 180°. While this operation
 90 has been taking place, a projection 45, which extends downwardly from the right hand side of the member 36, has been caused to approach the rib 29 and when the member 36 has almost completed its downward movement, the lower surface of this projection engages the surface of the sheet 4 adjacent the bend 21 thereof and completes this bend through substantially 180° by pressing the
 95 metal against the upper surface of the rib 29; this, of course, also simultaneously resulting in completing bend 23 through substantially 90°.

The rib 29 is sufficiently narrow to enter the space formed between the so formed
 100 folded portion 46 of the finished plate 47 and the up turned edge of the said plate, and the resulting product has substantially the configuration indicated in cross-section in Fig. 3. The member 36 is secured to a
 105 bar 17 by means of an L-shaped extension 15 in substantially the same manner as in the foregoing, while member 24 may be correspondingly secured to a bar 19 of a press or the like by means of an L-shaped extension 18.

The several dies may be made of any desired length; so that a long sheet of material may be flanged in the novel manner shown along the entire edge of such sheet.

Having thus described our invention what we claim, is:

1. In sheet bending appliances, three dies adapted for relative movement therebetween, one of said dies being recessed and

having a laterally projecting rib extending along one side of said recess, a wall opposite the edge of said rib, said rib and wall being adapted to receive a portion of the sheet to be bent therebetween, the wall of said recess adjacent said rib being adapted to engage another portion of said sheet and to fold over said portion between said wall of the recess and the wall of the second die above referred to, said third die having a portion thereof adapted to co-act with a lateral surface of said rib to form a second fold in said material when the dies are being closed.

2. In sheet bending appliances, a substantially U-shaped die having a recess in one of the interior faces thereof, a laterally displaceable die disposed in said recess, said last mentioned die having a groove along one side thereof and having a rib projecting laterally therefrom over said groove, and a third die, angularly displaceable with respect to the path of movement of said laterally displaceable die, said third die having a surface adapted to co-act with the upper surface of said rib to form a fold in sheet material therebetween, a wall of said groove disposed below said rib being adapted to co-act with an interior surface of said U-shaped die to form a second fold in said material substantially at right angles to the first fold when said wall and surface are proximated, and means carried by said third die for moving said laterally displaceable die into the recess in the interior face of said U-shaped die, whereby said wall and surface are proximated.

3. In sheet bending appliances, a substantially U-shaped die having a recess in one of the interior faces thereof, a laterally displaceable die disposed in said recess, said last mentioned die having a groove along one side thereof and having a rib projecting laterally therefrom over said groove, and a vertically displaceable die having a surface adapted to co-act with the upper surface of said rib to form a fold in sheet material therebetween, a wall of said groove being adapted to co-act with an interior surface of said U-shaped die to form a second fold in said material substantially at right angles to the first fold when said wall and surface are proximated, said vertically movable die having a depending wedge-shaped rib adapted for insertion between an outer wall of said laterally displaceable die and the interior surface of said U-shaped die which is

opposed to the recessed surface thereof aforesaid.

4. In sheet bending appliances, three dies adapted for relative movement therebetween, one of said dies being recessed and having a laterally projecting rib extending along one side of said recess, a wall opposite the edge of said rib, said rib and wall being adapted to receive a portion of the sheet to be bent therebetween, the wall of said recess adjacent said rib being adapted to engage another portion of said sheet and to fold over said portion between said wall of the recess and the wall of the second die above referred to, the recess aforesaid adjacent the rib being free from die parts when the dies are in closed position, said third die having a portion thereof adapted to co-act with a lateral surface of said rib to form a second fold in said material when the dies are being closed.

5. In sheet bending appliances, three dies adapted for relative movement therebetween, one of said dies being recessed and having a laterally projecting rib extending along one side of said recess and partially inclosing the same, a second of said dies having a wall substantially perpendicular to said rib, the space between said wall and rib varying with the movement of one of the dies aforesaid, the wall of said recess normal to said rib being adapted to co-act with the wall aforesaid to fold over sheet metal therebetween, said wall of said recess being spaced from said wall of said second die by at least double the thickness of the material to be folded when the dies are in closed relationship whereby to accommodate the folded material, said rib having a lateral surface thereof substantially normal to at least one of said walls, the third die having a portion thereof adapted to co-act with said lateral surface of the rib to form a second fold in said material when the dies are being closed, and means for supporting the material along the line of the first mentioned fold when the dies are being proximated, said means preventing displacement of said folding line.

In witness whereof, we subscribe our signatures, in the presence of two witnesses.

ALFRED J. ELLIS.
CHARLES E. NELLIS.

Witnesses:

WALDO M. CHAPIN,
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