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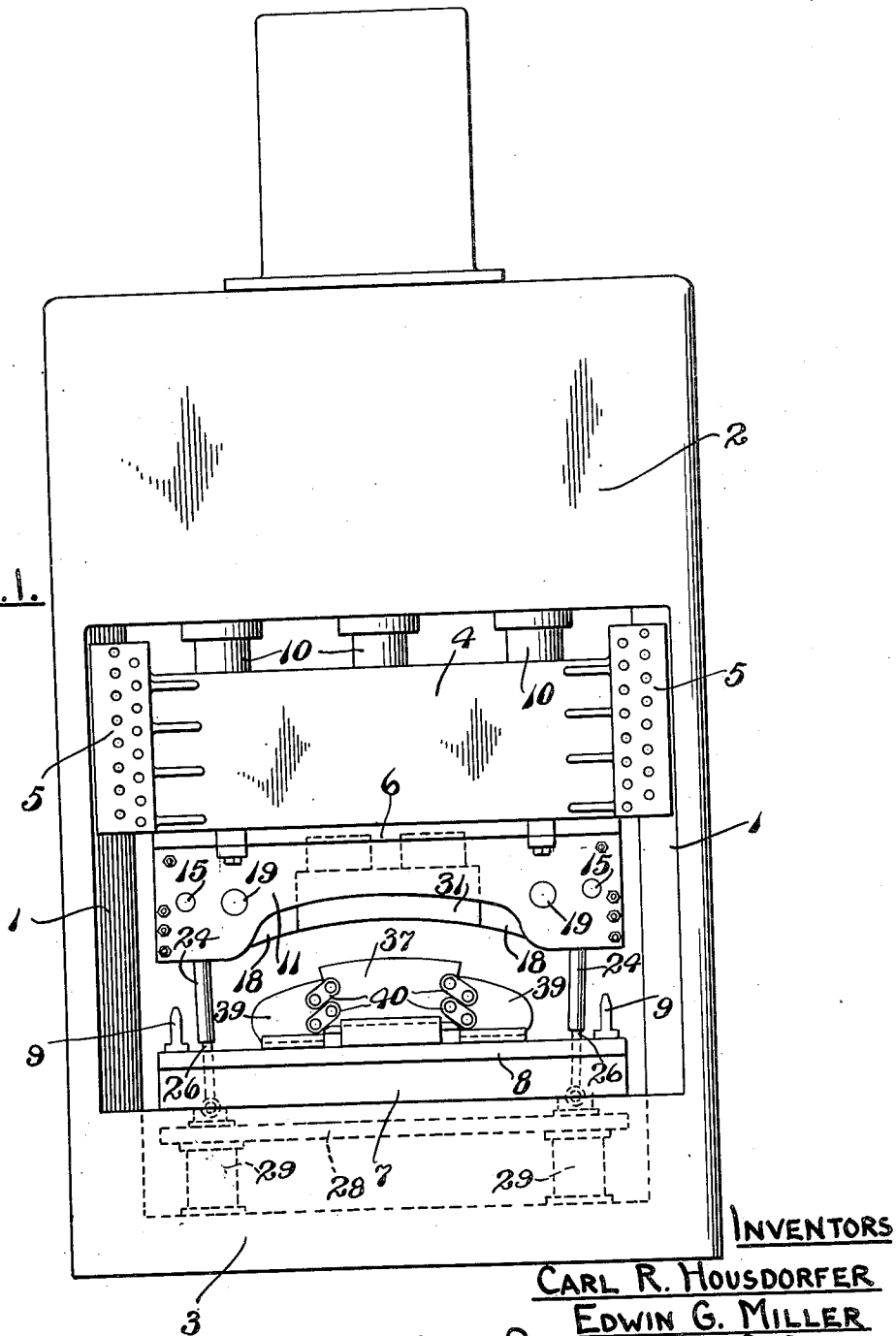
C. R. HOUSDORFER ET AL
RECIPROCATING DIES WITH PIVOTED AND
SLIDABLE END SHAPING DIES

2,536,643

Filed Jan. 15, 1948

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FIG. 1.



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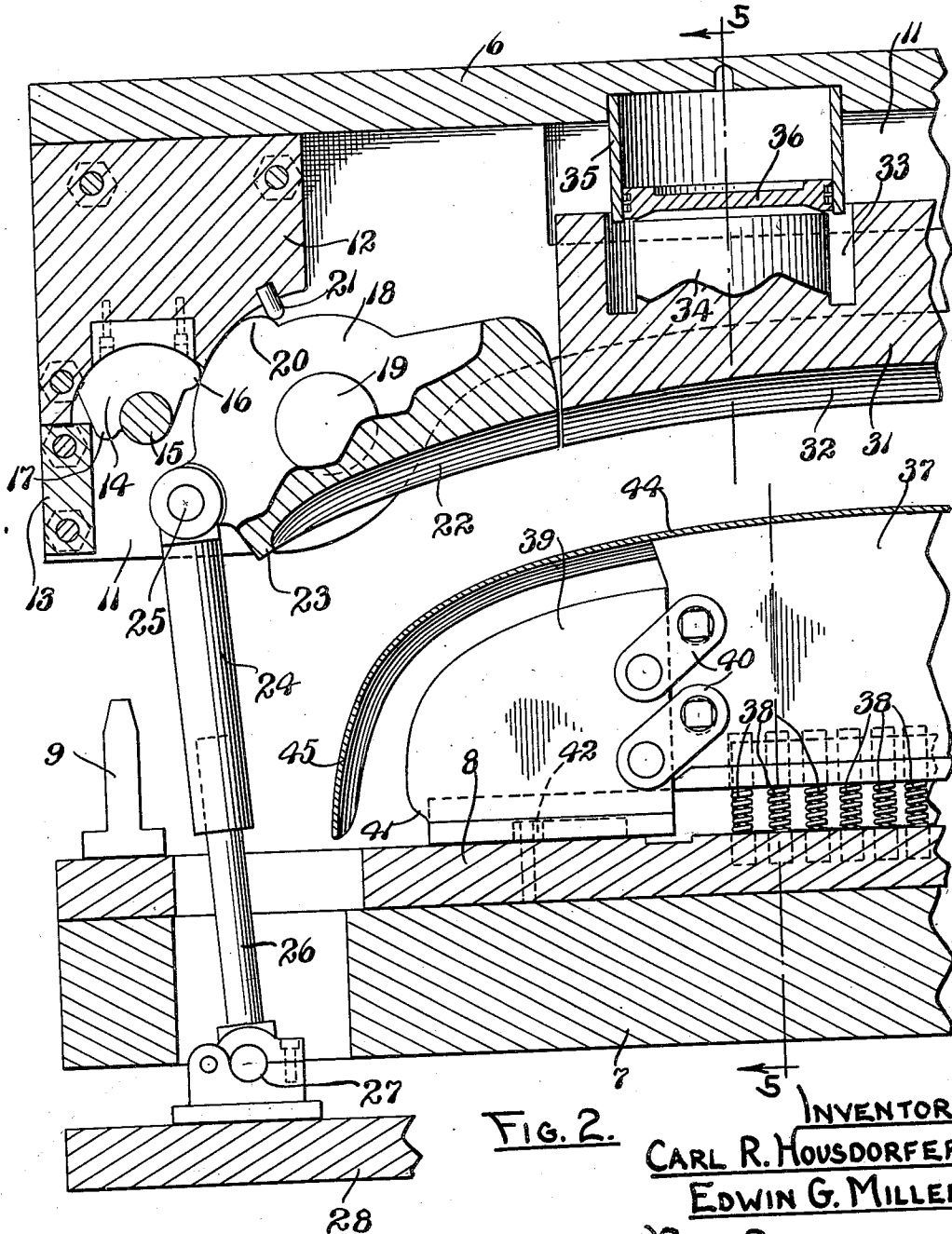


FIG. 2.

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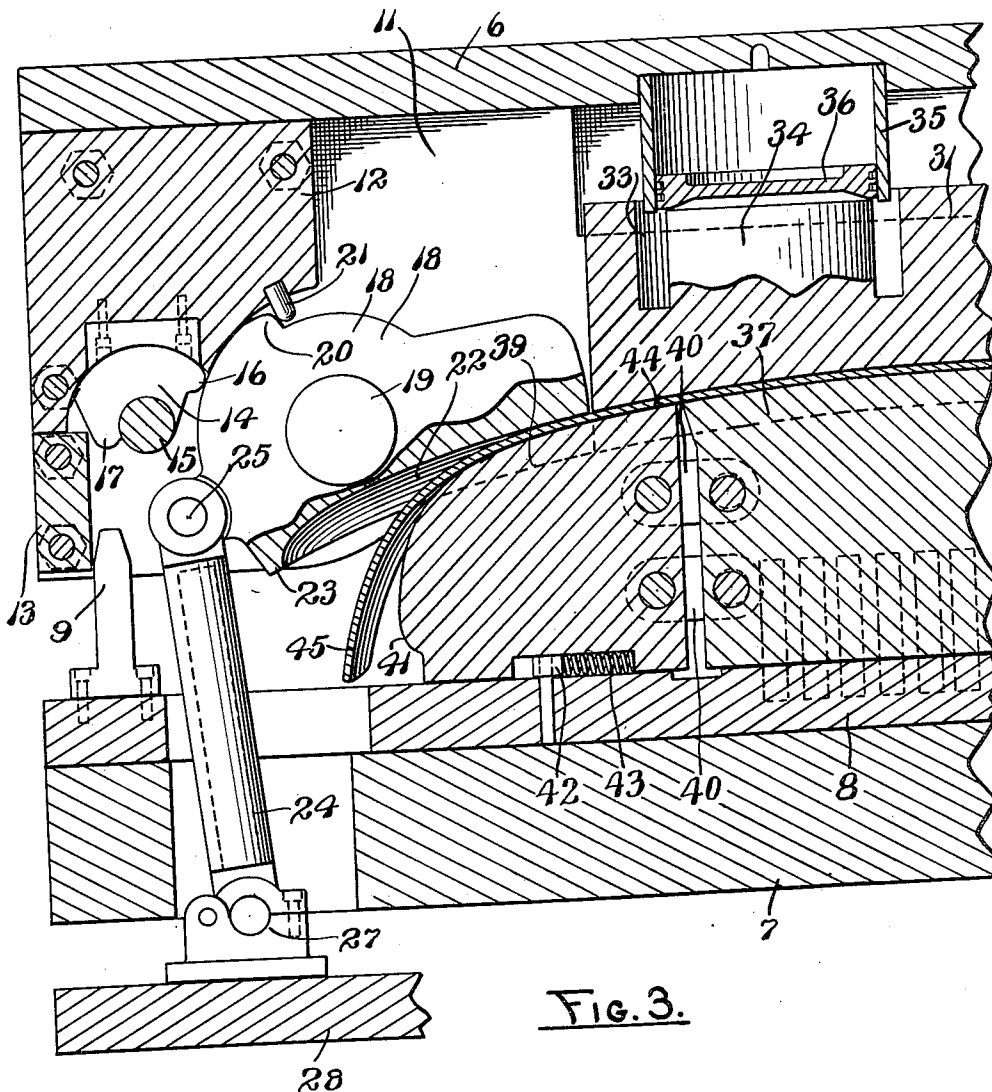


FIG. 3.

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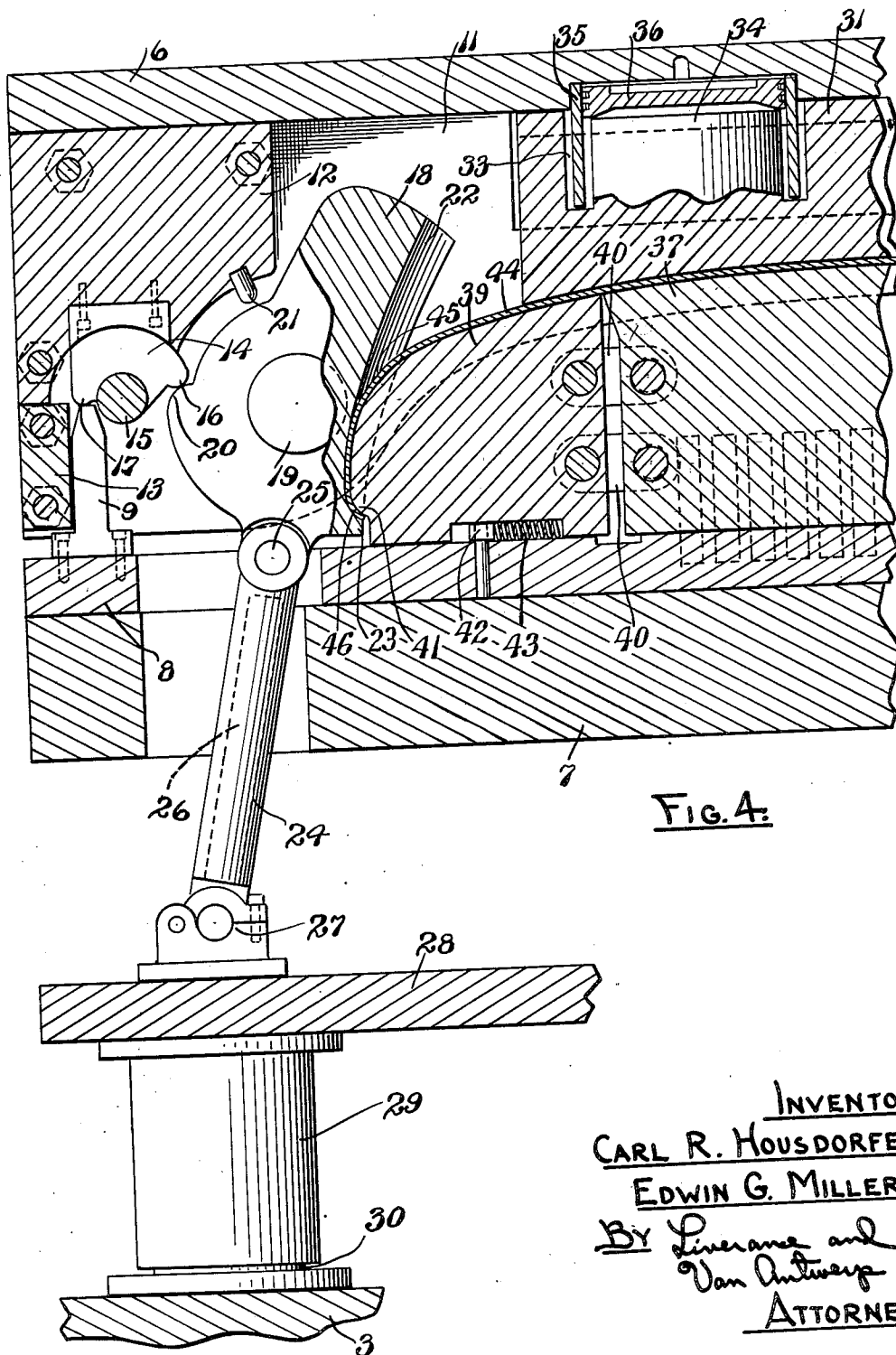
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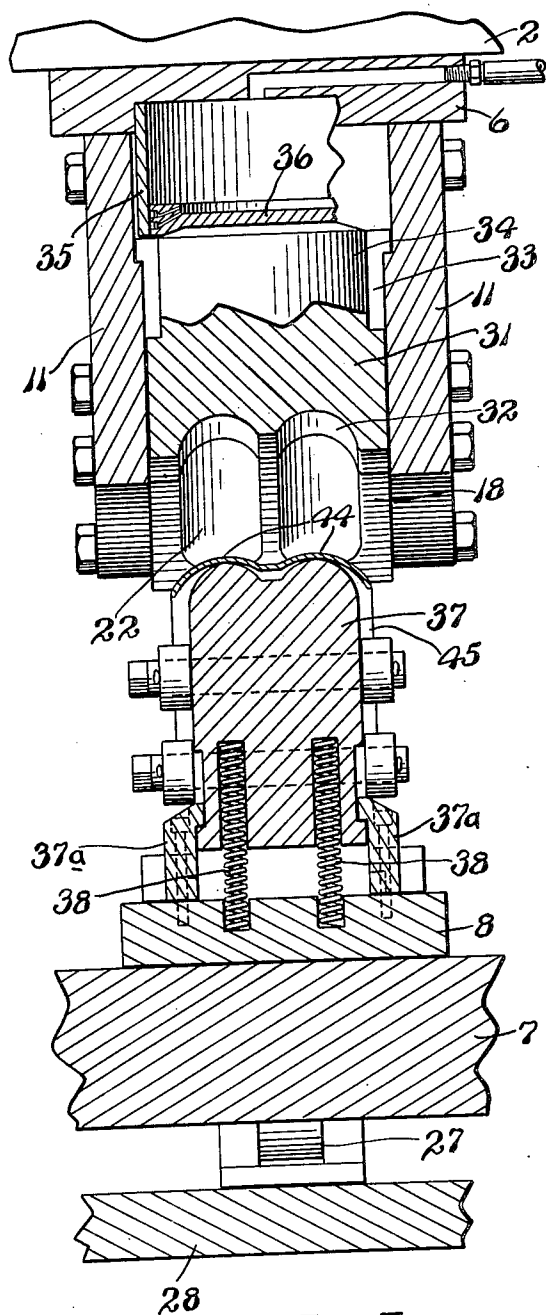


FIG. 5.

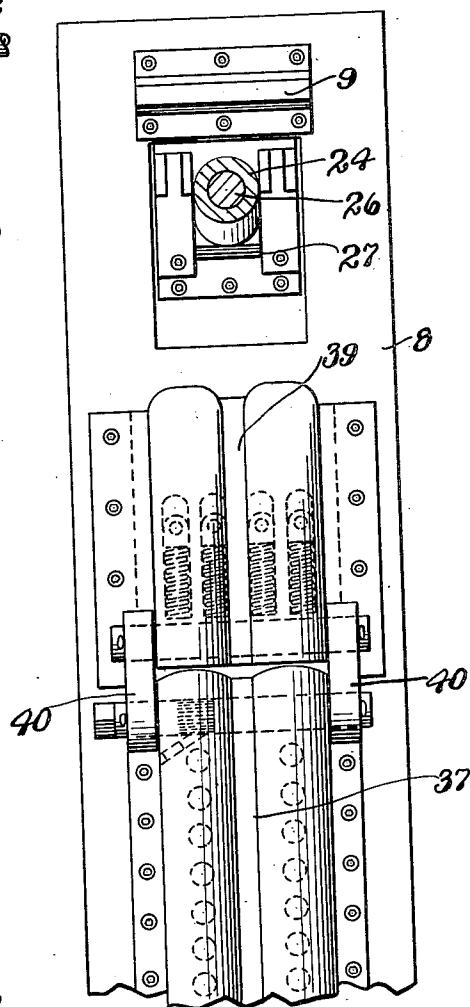


FIG. 6

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RECIPROCATING DIES WITH PIVOTED AND
SLIDABLE END SHAPING DIES

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This invention relates to a die, which is particularly useful in the final or finishing formation of motor vehicle bumpers. Such bumpers are made of a relatively heavy gauge of flat metal, designed to present an attractive appearance and are of a crown shape transversely both for appearance and for strength. At their end portions they are curved, and terminate in inwardly turned edge portions to cover and disguise the otherwise unattractive end appearance which would be presented.

With our invention, a die which may be used in a press and operated by suitable pressure, usually hydraulic, is provided which is of novel structure and in which a bumper, or a number of them simultaneously, may be pressed and finished to form and completed ready for the application thereto of plating or other desired outside finish for the bumpers.

It is an object and purpose of the present invention to provide a novel die structure, by means of which the bumpers, either singly or a number of them simultaneously, may be thus pressed and shaped to their finished form and in which the movable parts of the die are controlled in their movements, certain parts being pushed out and around which the ends of a bumper are shaped and formed with the inwardly turned lip portions at the extreme ends of the bumper, and which parts are automatically retracted after such formation so that disengagement of the finished bumper may be had. A further object and purpose of the invention is to provide novel, automatically operated rolling die members for the outer end portions of the bumper, which shape and finish the bumpers at the ends thereof in a particularly satisfactory manner. Many other objects and purposes than those stated will appear, upon understanding of the structure described in the following description, taken in connection with the accompanying drawings, in which,

Fig. 1 is an elevation of a press in which the die of our invention is used for bumper production,

Fig. 2 is a fragmentary enlarged longitudinal section through the die at one end portion thereof, with the ram and male bottom die separated as at the beginning of the operation,

Fig. 3 is a view similar to Fig. 2, showing the initial steps of operation of the die, or what first occurs when the ram is moved in a downward direction,

Fig. 4 is a like view showing succeeding and completing operations of the die,

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Fig. 5 is a transverse vertical section, substantially on the plane of line 5—5 of Fig. 2, looking in the direction of the arrows, and

Fig. 6 is a fragmentary plan view, partly in section, of the lower or male bottom die.

Like reference characters refer to like parts in the different figures of the drawings.

As shown in Fig. 1, a vertical press frame has spaced vertical side guides 1, an upper head 2 and a horizontal bottom 3. The ram 4 extends horizontally between the side guides 1 and is slidably movable thereon, said ram at each end having vertical cooperating guide members 5 in slidable association with the sides 1 of the press frame.

To the lower side of the ram 4 a top die plate 6 is securely connected. A horizontal bottom bolster plate 7 is secured at the upper side of the lower horizontal portion 3 of the frame, and above it, a bottom die plate 8 is connected which, adjacent each end, has an upwardly extending finger 9 as shown in Figs. 1 and 6. The punch of the die is secured to and extends downwardly from the upper or top die plate 6, and the male or bottom die is at the upper side of the bottom die plate 8. The ram 4 is forced downwardly, preferably by hydraulic pressure, the detail of which forms no part of the present invention, pistons 10 (Fig. 1) extending into suitable cylinders into which the liquid under pressure is forced to move the ram and the punch downwardly.

In the structure of the punch, front and rear vertically positioned plates 11, of a length somewhat shorter than the distance between the side guides 1 of the press frame and longer than the bumper which is to be processed, have, between their ends and at their upper portions, spacing blocks 12 (Figs. 2, 3 and 4) with which they are permanently connected, and at their ends and lower portions other smaller blocks 13. An arc-shaped member 14 is mounted to turn about the horizontal axis of a heavy journal pin 15, the ends of which are mounted in bearings in the plates 11 and is located one at the under side of each of the blocks 12, which are suitably recessed and shaped to provide bearing seats for the curved outer surfaces of the members 14. Said members 14 have projecting knobs 16 and 17 at opposite sides of the pin 15, the latter of which, when the ram is moved in a downward direction, come to the upper ends of the fingers 9, so that on further downward movement of the ram and the punch connected thereto, said members 14 are turned inwardly about the horizontal axes of their mounting journals 15.

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Between the plates 11 at each end portion thereof, and below the blocks 12 and inwardly of the blocks 13, end-forming dies 18 are mounted to turn on heavy journals 19 which are mounted at their ends in bearings in the plates 11. As shown in Figs. 2 and 3, said die members 18 have a greater radius of curvature at their outer ends which upon reduction substantially midway between the ends of the die member provide on each a shoulder 20 which, in the position of said member shown in Figs. 2 and 3, comes against a pin or pins 21 extending from the blocks 12. The under sides of the end die members 18 of the punch are properly grooved and shaped, as indicated at 22, in accordance with the cross sectional shape of the bumper which is to be made. Such grooves extend from the inner ends of the die members 18 outwardly toward but terminate a short distance from the outer ends thereof, running out at their under surfaces so as to leave a projecting section 23.

Each of the swingable end die members 18 at its outer end has a generally vertical tubular member or sleeve 24 pivotally connected thereto by a pivot pin 25. The sleeves 24 extend downwardly and telescopically receive the upper end portions of rods 26, which pass through openings therefor in the bolster plate 7 and the bottom die plate 8, and have a pivotal connection at their lower ends at 27 to a horizontal cushion plate 28. As shown in Fig. 4, the cushion plate 28 at its under side and at each end has a downwardly extending cylinder 29, open at its lower end, permanently connected thereto, which telescopes over a piston 30 which is carried by the lower fixed bottom 3 of the press frame. Pneumatic pressure within the cylinder 29 serves to tend to maintain the cushion plate in an upper position, in which position it remains until overcome by a heavier pressure from above. Pneumatic pressure such as that of compressed air will yield upon encountering the heavier pressure from above and permit the cushion plate 28 to move downwardly. The piston cylinder structure at 29 and 30 provides in effect a strong, pneumatically-actuated dashpot, and such structure will yield sufficiently in the final downward movement of the hydraulically operated ram to insure against breakage or other damage of the parts with a sufficient resistance that the metal from which the bumper is made will be formed and shaped to the desired pattern.

A punch die member 31 between the rotatable end die members 18 is movably mounted on and between the plates 11, at its lower side having longitudinal concave grooves 32 shaped to form the outer surfaces of bumpers. Adjacent each end of the member 31 a cylindrical vertical recess 33 is made surrounding a cylindrical projection 34. A short cylinder 35 over each of the projections 34 is fixed at its upper end on and depends from the top die plate 6, in which a flat piston 36 with packing around it as shown is located. Compressed air or other pneumatic fluid pressure is supplied to the cylinders 35 through connections and passages best shown in Fig. 5, to thereby hold the die member 31 in its lower position as shown in Fig. 5.

In the structure of the male bottom die, a central die member 37 is located over the bottom die plate 8 between front and back retaining plates 37a (Fig. 7), with respect to which it has a limited vertical movement. When free from pressure the die member 37 is held in an upper

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position by a plurality of coiled compression springs 38.

At each end of the middle member of the male bottom die, a retracting die 39 is slidably mounted on the bottom die plate 8 and each is connected by pairs of parallel links 40 to the die member 37. When the member 37 is held in upper position by the springs 38, the retracting dies 39 are moved toward it so that the die members 37 and 39 have end abutting engagement as in Fig. 2. When the middle die member is forced down so that its lower side bottoms against the plate 8, the parallel links 40 being straightened to horizontal position (Figs. 3 and 4), the retracting dies are moved outwardly a short distance. In such outward movement springs 43 (Figs. 3 and 4) at one end bearing against stops 42 therefor are compressed. Such springs tend to move the retracting dies 39 back to their initial positions when the die member 37 is lifted by the springs 38.

In the operation, the bumper having an elongated central portion 44 and ends 45 curved therefrom (Fig. 2) is laid upon the middle member 37 of the bottom die. Previously such bumper has been shaped by a simple die pressure into a generally concave cross sectional form throughout its length as shown. It is of course to be understood that the upper sides of the male bottom die 37 and the sides and ends of the retracting dies 39 have convex upwardly extending ribs lengthwise thereof over which the bumper is to be shaped. At the outer end of each retracting die 39 it is formed with an inwardly extending shoulder 41, underneath and against which the extreme end portions of the bumper are to be pressed. As shown in Fig. 5 the cooperating male dies have a pair of such ribs and the cooperating punch die members 18 and 31 two complementary elongated grooves or recesses 22 and 32. Therefore, two of the bumpers may be simultaneously pressed and shaped to form being integrally connected lengthwise thereof. After the process is finished they may be separated by severing from each other. Of course the die may be made to form a single bumper, or to simultaneously form and shape more than two without affecting the invention.

In the first stages of the downward movement of the ram 4 under hydraulic pressure, the middle upper punch member 31 comes against the portion 44 of the bumper. Upon continuation of downward movement the male die 37 is forced downwardly until stopped by the plate 8, with a simultaneous outward movement of the retracting dies 39. The pneumatic fluid pressure within the cylinders 35 is strong enough to hold the pistons 36 in their lower position during such operation. At the same time the sleeves 24 telescope over the rods 26 until they strike at their lower ends against the shoulders shown at the lower ends of rods 26, as in Fig. 3.

Upon continued downward movement of the ram, the male die member 37 remains stationary as does also the intermediate die member 31 of the punch. But as the other parts of the punch are forced downwardly the cylinders 35 move downwardly into the annular recesses 33. The flat pistons 36 are thus moved up by the cylindrical projections 34, the ram force being strong enough to overcome pressure within said cylinders 35. Thereupon the bumper at its intermediate portion is drawn and pressed to final shape.

Simultaneously, the end die members 18 of the

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punch are turned about the axes of their journals 19 outwardly as shown in Fig. 4. This occurs because sleeves 24 being held substantially against movement farther in a downward direction with respect to the rods 26, the cushion plate 28, pneumatically supported, is forced downwardly below the bolster plate 7 or from the position in Fig. 3 to that in Fig. 4. When the projecting knobs at 17 strike against the fingers 9 the end punch die members 18 will have come to a position such that the knobs 17 engage against the shoulders at 20; and in the final downward movement of the ram the members 14 are turned about the journals 15 to thereby engage the knobs 16 against the shoulders 20 and roll the end punch die member 18 to force the extreme portion 46 of the curved member 45 of the bumper under the shoulders 41 of the retracting dies 39.

This completes the formation of the bumper. On elevating the ram, the parts return, by reverse movements, to their position as shown in Fig. 2 and are ready for a succeeding bumper finishing operation.

The structure described is very practical and useful and a large quantity production is obtained at low cost. The die is sturdy and dependable and is not liable to get out of order. When the retracting dies 39 return to their initial position, as in Fig. 2, they disengage from the inwardly turned end lips 46 of the bumper so that the finished bumper is free to be removed and have another, partially shaped as in Fig. 2, take its place for the finishing die process thereon.

It is to be understood that the central male and retracting dies and the punch may be reversed without affecting the invention. The ram of the press may move upwardly instead of downwardly in such reversal, which may be desirable in connection with scale at the surfaces of the bumper bars which are formed and shaped when said bars are processed after they have first been heated.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

We claim:

1. In a structure as described, a fixed horizontal bottom plate, a male die located at a side of the bottom plate, yielding means between the bottom plate and die for moving said die away from said plate, a retracting die at an end of the male die slidably mounted on the plate for movement toward and away from said male die, and connections between said male die and retracting die for moving said retracting die outwardly on movement of the male die toward the plate and for drawing it inwardly on movement away therefrom.

2. A structure as defined in claim 1, said connecting means between the male die and the retracting die comprising, a link pivotally connected to the male and retracting dies and extending between them, said link being disposed substantially horizontal when the retracting die is at its outermost position and having an inclination to the horizontal when the retractor die is at its inner position.

3. In a structure as described, a horizontal plate adapted to be fixedly secured to the vertically movable ram of a press, spaced apart front and rear vertical plates fixedly secured to said horizontal plate, and a centrally located punch die movably mounted between said vertical plates for reciprocal movement, said punch die having cylindrical grooves one at each end thereof in its

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side nearest the plate extending thereinto, a cylinder secured to the plate opposite each groove extending from the plate and adapted to enter said groove, and a piston in each cylinder bearing against said central punch die at the portions thereof within said cylindrical grooves.

4. A structure as defined in claim 3, spacing blocks at the ends of and between said front and rear plates permanently connected therewith, and a die member mounted between its ends to turn on a horizontal axis between said plates, one die member located at and extending outwardly from each end of the central die member, the outer ends of said pivotally mounted die members being located adjacent said spacing blocks.

5. A structure as defined in claim 4, an elongated sleeve pivotally connected at one end to the outer end of each of said pivotally mounted die members, a horizontal cushion plate, rods pivotally connected at one of their ends to said cushion plate extended into said sleeves, and yielding means acting on said cushion plate for normally moving said plate toward said horizontal plate but yielding for the plate to move away therefrom upon a predetermined pressure applied thereto.

6. In a structure as described, a supporting frame, a horizontal cushion plate located adjacent one end of the frame, yielding means mounting said plate on the frame for movement toward and away from said end thereof, said means resisting the movement of said cushion plate toward said end of the frame, a die plate fixed on said frame parallel to and spaced from the cushion plate, a male die located on said die plate at a side thereof away from the cushion plate, yielding means tending to move the male die away from said die plate, means limiting said movement of the male die, retractor dies one at each end of the male die slidably mounted at the same side of and on said die plate, connections between the male die and retractor dies for moving said retractor dies outwardly on movement of the male die towards said die plate, a movable ram mounted on said support toward the opposite end of the support, mounted for movement toward and away from the male die, a central punch die mounted on said ram for movement toward or away therefrom, yielding means resisting movement of the central die toward the ram, punch die members, one at each end of said central punch die and pivotally mounted between their ends, a telescoping rod and sleeve connection between the cushion plate and each of said pivotally mounted die members, and means for turning said pivotally mounted die members at their outer ends toward and into operative engagement with the outer ends of the retractor dies on movement of the ram to carry said punch dies to said male die and retractor dies connected therewith.

7. A structure as defined in claim 6, said means for turning said pivotally mounted punch dies comprising, a finger secured near each end of said die plate, said fingers extending toward the punch, and pivotally mounted actuating members mounted adjacent to said pivoted end dies and movable with the ram to engage against said fingers on a predetermined movement of said ram, said pivotally mounted punch die members each having a shoulder engaged by one of said actuating members to thereby turn said pivotally mounted punch die members, substantially as described.

8. A structure as defined in claim 7, said male

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die and retracting dies, and said central punch die member and pivoted punch die members having cooperating ribs and grooves therein for shaping sheet metal disposed between them, said pivoted punch die members at their outer ends having projecting lips at the ends of the grooves therein and said retracting dies having shoulders around which said lips are turned, as and for the purposes described.

9. In a structure as described, a first die plate, a centrally positioned male die located adjacent one side of the die plate, coiled springs between the die and plate to normally move the die away from the plate, retractor dies one at each end of the central male die slidably mounted on said die plate, parallel link connections between the central male die and said retractor dies for moving said retractor dies outwardly on movement of the central male die toward the die plate by pressure to overcome said springs, a second die plate adapted to be secured in horizontal position to the ram of a vertically movable press, a central punch die mounted for reciprocal vertical movements in relation to said second die plate, yielding means for resisting movement of said central punch die toward said second die plate located between said punch die and said second die plate, an end die member at each end of the central punch die, end die supporting means mounted on said second die plate, means for pivotally mounting each of said die members to turn about a horizontal axis on said end die supporting means, and cooperating means on the first die plate and on the end die supporting means for turning said end die members about their pivotal axes to roll said end die members around the outer ends of the retracting dies on movement of said second die plate and punch die toward said male die.

10. A structure as defined in claim 9, said cooperating means comprising, fingers secured to the first die plate one adjacent each end thereof, a turning member pivotally mounted on said end die supporting means adjacent each end die to turn on a horizontal axis, said members being movable with said second die plate and punch die to engage said fingers to turn said members, and each of said pivoted end die members having a shoulder engaged by said turning members to thereby turn the end die members about their pivotal mountings after engagement of said pivoted members by said fingers in the movement of said second die plate and punch die towards said male die at a predetermined position.

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11. In a structure as defined, a male die, a punch die connected to the ram of a punch press and movable toward said male die, a complementary end die adjacent the punch die, means for rotatably mounting the end die, and means for rotating said end die at completion of movement of the punch die toward the male die so that the end die will roll over an end of the male die, said male die comprising a main die and a retractable die and means for extending said retractable die upon movement of the punch die toward the male die.

12. The combination with a punch press having a frame and a movable ram of a male die fixed to the frame of the press, a punch die yieldably connected to said ram for movement in a direction away from the male die, said punch die being carried by said ram toward said male die, an end die complementary to said punch die and rotatably mounted on the ram adjacent the punch die, means for resisting rotation of the end die, and means for rotating the end die upon completion of movement of the punch die toward the male die so that it will roll over an end of the male die, said male die comprising a main die and a retractable die, and means for extending said retractable die upon completion of movement of the punch die toward the male die and before rotation of the end die.

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