Feb. 3, 1942. C. M. BREHM 2,272,082

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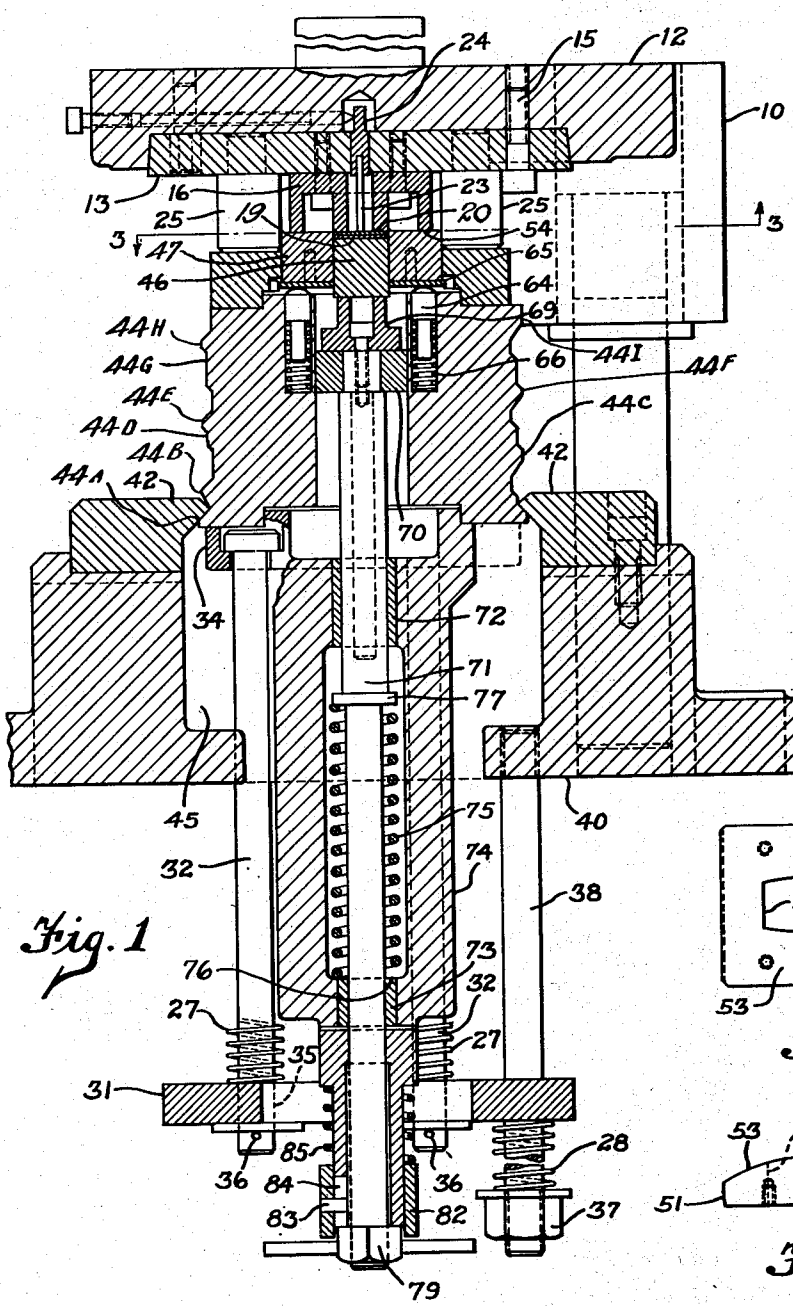


Fig. 1

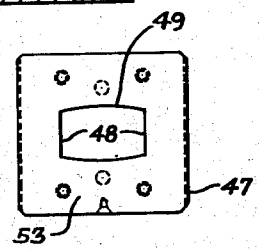


Fig. 7

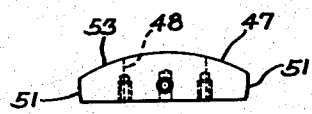


Fig. 8



Fig. 9

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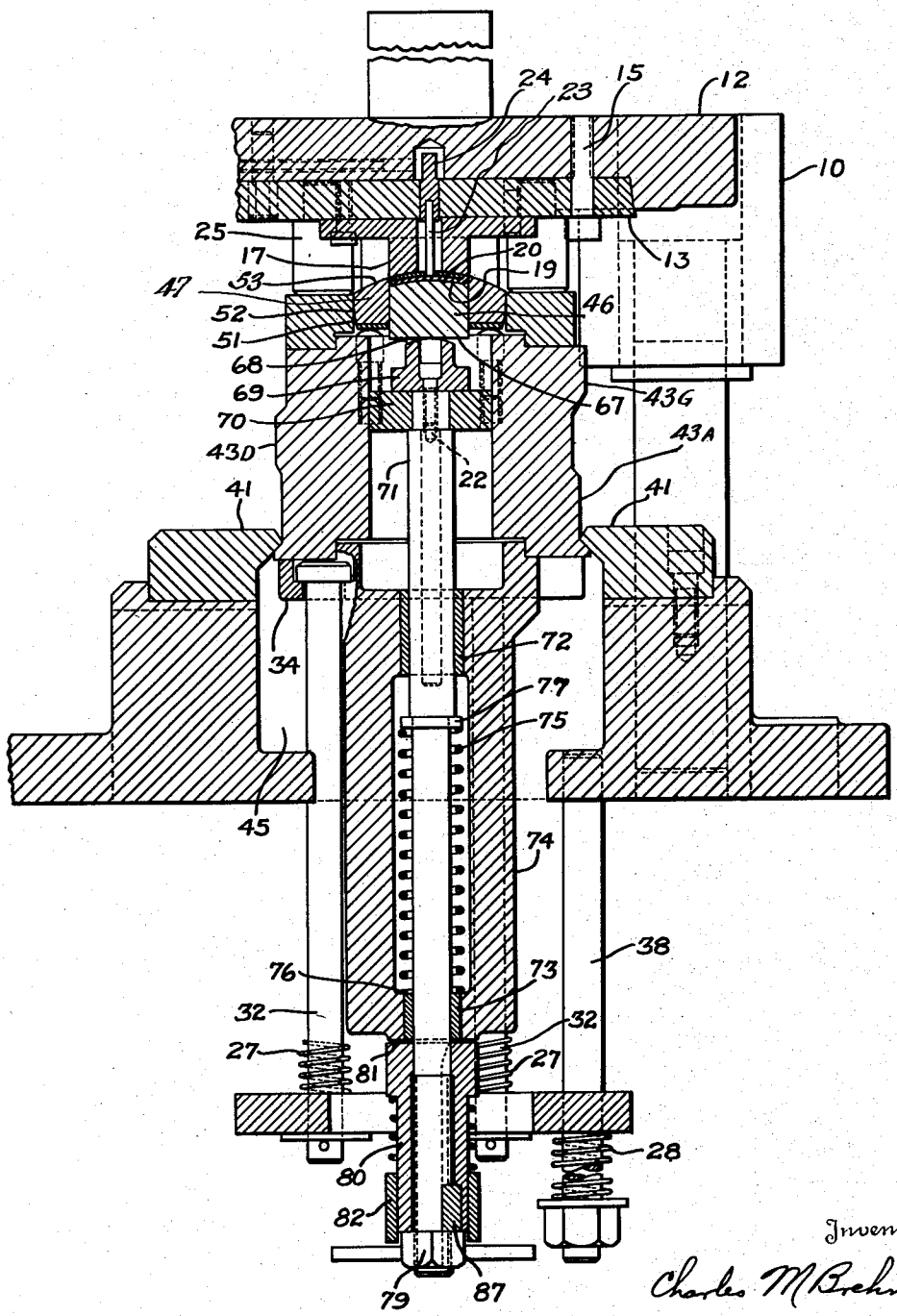


Fig. 2

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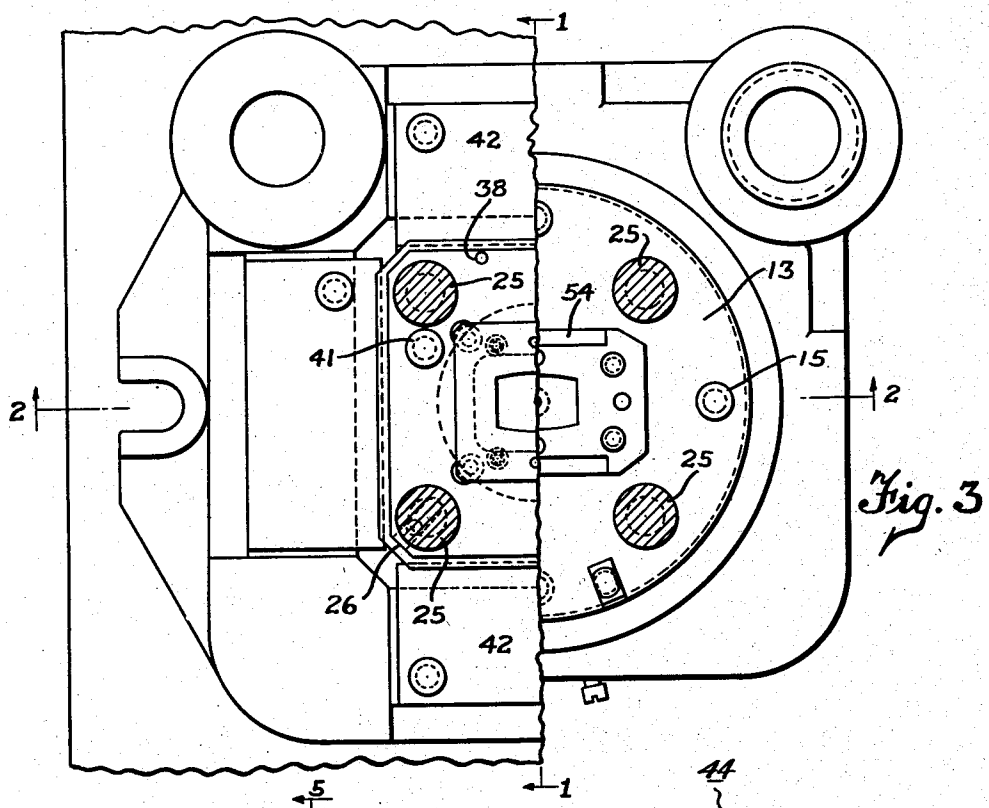


Fig. 3

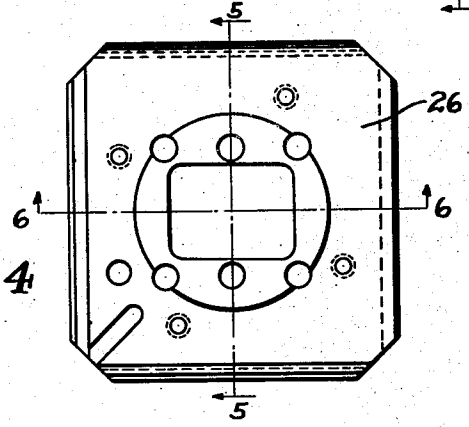


Fig. 4

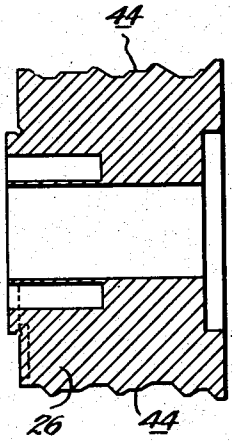


Fig. 5

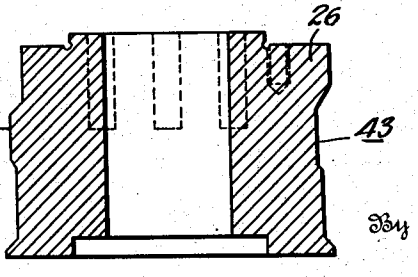


Fig. 6

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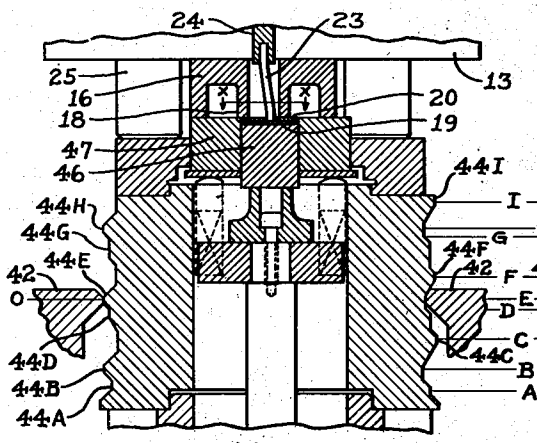


Fig. 10

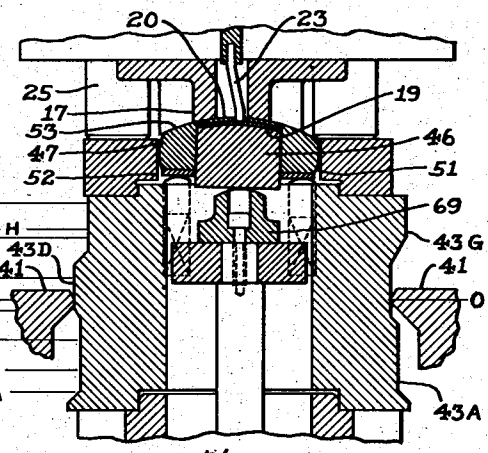


Fig. 11

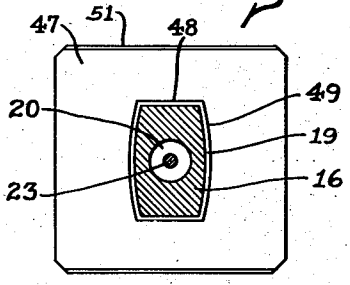


Fig 10A

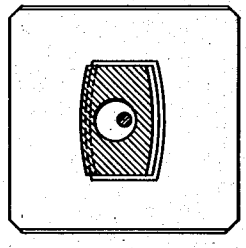


Fig. 10B

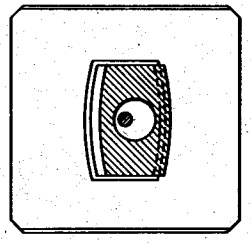


Fig. 10C

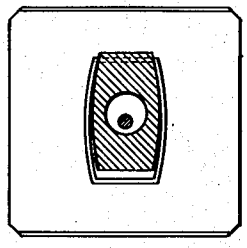


Fig. 10D

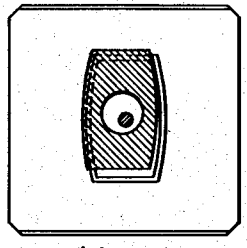


Fig. 10E

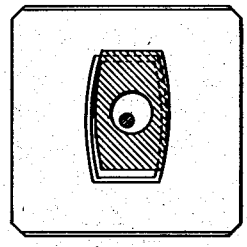


Fig. 10F

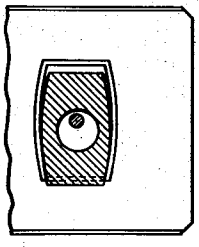


Fig. 10G

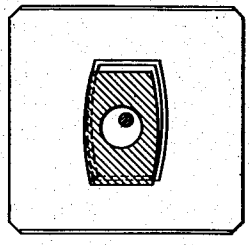


Fig. 10H

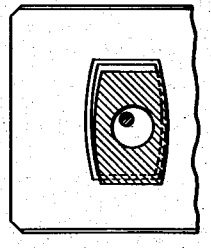


Fig. 10I

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Patented Feb. 3, 1942 2,272,082

UNITED STATES PATENT OFFICE

2,272,082

DIE

Charles M. Brehm, Springfield, Ohio, assignor to The Steel Products Engineering Company, Springfield, Ohio, a corporation of Ohio

Application July 19, 1939, Serial No. 285,383

17 Claims. (Cl. 164—19)

This invention relates to apparatus for trimming formed articles and more particularly to die construction having relatively movable cooperating parts which shift with respect to one another to trim a partially formed blank.

One object of the invention is the provision of a trimming die of the character mentioned embodying a plurality of die members which are adapted to be brought together and moved simultaneously in one direction and to have a relative shifting movement during such simultaneous movement, one of the die members having a blank engaging portion which is arranged to be tilted during the shifting movement, to trim the blank.

Another object of the invention is the provision of a trimming die one portion of which is shifted relatively to another by a cam block, and embodying cooperating parts adapted to trim the blank along a curved line.

Another object of the invention is the provision of a trimming die of the character mentioned and including a blank-engaging part which is arranged to tilt or rock on one die member, in the trimming operation, such part being slidably guided on a cooperating part carried by the other die member to give an arcuately curved trim line.

Another object of the invention is the provision of a cam-operated trimming die having relatively shiftable parts one of which carries a blank-clamping and gaging member which is mounted for tilting movement along a curved path.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawings in which a preferred embodiment of the invention has been illustrated.

In the drawings,

Fig. 1 is a vertical section taken centrally through a trimming die embodying the present invention, showing the upper and lower die members in engaged position;

Fig. 2 is a vertical sectional view through the trimming die on a line at right angles to the section plane of Fig. 1;

Fig. 3 is a horizontal section on the line 3—3 of Fig. 1;

Fig. 4 is a top plan view of the cam block;

Fig. 5 is a section through the cam block on the line 5—5 of Fig. 4;

Fig. 6 is a section through the cam block on the line 6—6 of Fig. 4;

Fig. 7 is a detail view of the lower blank-engaging and trimming member;

Fig. 8 is a side elevation of the blank-engaging and trimming member;

Fig. 9 is a perspective view of the trimmed blank;

Fig. 10 is a broken sectional view through the trimming die in an intermediate stage of operation;

Figs. 10A to 10I are enlarged sectional views each taken on the line X—X of Fig. 10 and showing the relative positionings of the blank and trimming parts throughout a complete series of operative positions; and

Fig. 11 is a sectional view similar to Fig. 10 but taken through the dies at right angles to the section of Fig. 10.

Referring more particularly to the drawings there is illustrated a preferred form of die construction adapted to trim edges of a partly formed blank or shell such as a sheet metal drawing or stamping, the trimming operation being effected by relatively movable portions of a punch 10 which is adapted to be moved up and down by the slide or ram of a power press, and a female die member 11 which is carried on the press bed. Any suitable form of press may be used to operate the die members. As herein shown the blank-engaging portions of the die are so formed as to trim the side walls or edge portions of a section of a sheet metal watch-case.

The punch 10 comprises a suitable carrying member 12 which is adapted to be bolted to the slide of a press and which carries a plate 13 secured to member 12 by means of bolts 15. Removably bolted to the lower side of the plate 13 is a trimming part 16 having trimming edges 17 and 18 adapted to trim the edges of a blank 19 by means of a relative shifting movement that is caused to take place between the blank and trimming member 47 with respect to the trimming part 16 in a cycle of operations. As shown, the two opposed trimming edges 17 are straight and produce straight lines of trim on the opposite ends of the blank, and the trimming edges 18 are arcuately curved to trim the blank along curved lines at the two other sides.

Suspended below the trimming part 16 is a blank gaging and clamping member 20 adapted to enter the blank to be trimmed and force the blank down in the lower die member as the upper and lower die members are brought together. This blank clamping and gaging member 20 on its lower side is formed to the shape of the lower surface of the blank,—that is, for an arcuately

curved watch-case section, it is curved about a center 22, and the upper surface of the blank gaging member 20 is concentrically curved and slides against the correspondingly curved lower surface of the trimming part 16. A flexible cable or resilient wire support 23 is suitably fastened at its lower end to member 20 and permits relative sliding movement between the blank gaging member 20 and the lower side of the trimming part 16 while holding the gaging member 20 up against the lower side of the trimming part. The upper end of the flexible cable 23 is carried by a stud 24 adjustably held in the plate 13.

The upper die member 10 is also provided with pressure pins 25 fixed on the lower side of the plate 13 and adapted to press down against the upper surface of a plate forming the upper portion of movable cam block 26 which forms a portion of the lower die member, these pins causing the lower die member to descend with the upper die member as soon as the die is closed.

The cam block 26 of the lower die member is normally maintained in its uppermost position illustrated in Figs. 1 and 2 by means of springs 27 and 28 or other equivalent yielding means. As herein shown there are four springs 27 arranged on the upper side of a pressure plate 31. Rods 32 are loosely carried within the springs 27, the upper ends of the rods being supported in flanged portions 34 of a part 14 secured to the cam block, and the lower ends of the rods operating through holes 35 in the pressure plate and carrying pins 36 which limit the relative downward movement of the plate 31. The springs 28 engage against the lower side of the plate 31 and against nuts 37 carried by the lower ends of four supporting rods 38 which are carried in fixed relation with the lower side of a support 40, which is adapted to be readily installed in a press.

Carried by the support 40 are cams 41 and 42 engaging the cam sides 43 and 44 respectively of the cam block. These cam sides are so formed as to cause the cam block to shift laterally back and forth in a plurality of directions and in a predetermined sequence of shifting movements, as the cam block 26 is moved downwardly in the opening 45 in the supporting member 40 and against the action of the springs 27, 28, such downward movement being produced by the force applied through the pins 25 of the upper die member.

Mounted in the cam block is a blank-clamping member 46, the shape of its upper surface corresponding with the shape of the lower side of the blank. The clamping member 46 is yieldingly urged upwardly as will be presently described, and is slidably carried for endwise movement in a lower blank-engaging and trimming member 47. This blank trimming member is provided with shearing edges 48 which are straight edges adapted to cooperate with the shearing edges 17 of the upper trimming part 16. The member 47 is also provided with curved trimming edges 49, (see Fig. 7), and as will be apparent from Fig. 1 these trimming edges 49 engage the outer side of the blank at the trim line and cooperate with the trimming edges 18 when the member 47 shifts to the right or left as viewed in Fig. 1 with respect to the descending trimming part 16. Such shifting movement is imparted to the trimming block by means of the cam portions 44A to 44I.

The cam portions 43A, 43D, and 43G of the cam block produce the back and forth shifting movement towards the right and left as viewed in Fig. 2. However during this shifting movement of the cam block, the blank trimming member 47, instead of having a mere reciprocating movement with the cam block, is caused to tilt or rock about the center 22 in order that the shearing edges 48 may be moved across the shearing edges 17. The member 47 is provided with opposed curved pressure surfaces 51 fitting with the parallel vertical surfaces 52 on the top plate portion of the cam block, and is provided with an arcuately formed surface 53 having a center of curvature at 22, and slidably engaging against the correspondingly curved surfaces 54 on the lower side of the trimming part 16. As the member 47 is moved to the right or left as viewed in Fig. 2 it therefore slides along the curved guide surfaces 54 and is compelled to rock about the center 22 so as to swing the blank about a fixed center whose radius corresponds to the radius of the curved trim line of the blank. It will thus be apparent that by shifting the cam block back and forth in a plurality of different shifting directions, the straight edges of the blank may be trimmed at opposite sides of the blank, and the curved edges may be trimmed at the other opposing sides by a tilting or rocking movement imparted to the blank and a mere reciprocating movement imparted to the blank, respectively.

Reference to the construction of the cam block and the several cams as shown in Figs. 10 and 11, and to the detailed sequence of movements as represented in Figs. 10A to 10I, will show the way in which the entire peripheral edge of the blank is trimmed upon a downward stroke of movement of the cam block.

In Fig. 10, the two cams 42 at opposite sides of the cam block are shown in relation to the block which has been depressed to an intermediate position. In Fig. 11 which is a section through the cam block at right angles to that of Fig. 10, the two cams 41 are shown in relation to the cam block which is depressed to the same intermediate position. The working plane or axis of all four cams is the same and is indicated by the line O—O'. It will be noted that each of the four faces of the cam block has a surface at a neutral level which provides for the cam block being held in a central location, and that when there is a rise on one of the faces there is a corresponding drop on the opposite face, to effect controlled movements of the cam block, trimming member 47, and the blank from one side to the other of its neutral position in the two directions at right angles to each other. Trimming member 16 has a downward movement only and hence a relative shifting between trimming members 16 and 47 occurs which results in the trimming of the entire peripheral edge of the blank.

At the beginning of the downward travel of the trimming member 16 but before any downward movement of the cam block has taken place, all four of the cams occupy neutral positions and the cam block is thus held centrally. In this position clamping member 20 may be readily engaged within the blank under the guiding action of supporting member 23.

As the cam block moves on a stroke of movement it traverses a series of zones or positions indicated by the letters A to H in Figs. 10 and 11, these several positions occurring in sequence as the cam block moves progressively with relation to the working axis of the cams. Figs. 10A to 10I show the corresponding positions of the trimming members and the blank in each of these positions and indicate the sequence of operations which results in the trimming of the entire blank. In the first or A position, the line desig-

nated A coincides with the working axis O—O' of the several cams. Cam face 44A is at a neutral level and so is cam face 43A. Consequently the cam block and member 47 will occupy a neutral position with respect to the trimming part 16, which as shown in Fig. 10A, stands centrally of the blank 19.

In the next or B position, with the cam block moved downwardly to a level where line B coincides with axis O—O', the rise 44B of the cam block causes a shift thereof to the right as shown in Fig. 10 resulting in a displacement of the trimming member 47 with respect to trimming part 16 to cause the trimming of the left-hand curved edge of the blank, as shown in 10B.

In the next or C position, the block has moved to such point that line C coincides with axis O—O', and cam surface 44C on the opposite side of the block causes movement of the cam block and member 47 in the opposite direction or to the left as shown in Fig. 10. This results in the trimming of the right-hand arcuate side edge of the blank as shown in Fig. 10C.

In the D position, cam surface 44D is at the neutral level and hence the block is returned to a central position in the plane of Fig. 10. However in the plane at right angles thereto as shown in Fig. 11, elongated cam face 43D has caused movement of the cam block and member 47 in such manner as to cause trimming part 16 to trim one of the straight edges of the blank. In the course of such movement member 47 is given the arcuate or rocking motion as previously described. As shown in Fig. 10D, member 47 has been moved downwardly and hence the upper straight edge of the blank has been trimmed.

This leaves at the upper edge of the blank only the two small corner portions, and in order to trim those portions, elongated cam face 43D retains the cam block in the downwardly offset position while a movement thereof from one side to the other takes place. Thus in position E, cam face 44E causes movement of the cam block and member 47 to the right and the consequent trimming of the upper left-hand corner of the blank. This is indicated in Fig. 10E, and is the actual position which the cam block is shown as occupying in Figs. 10 and 11.

In the F position, cam face 44F causes movement of the member 47 to the left while it is still held in a position of downward displacement by cam face 43D. This results in the trimming of the upper right-hand corner of the blank as indicated in Fig. 10F.

A similar sequence of operations then takes place with respect to the lower edge of the blank. In the G position elongated cam face 43G causes upward movement of member 47 while it is held centrally by cam face 44G at the neutral level and as shown in Fig. 10G this results in the trimming of the lower straight edge of the blank, leaving only the two lower corner portions to be trimmed.

In the H position, while the block and member 47 are held with this upward displacement by cam face 43G, cam face 44H effects shifting thereof to the right, to thereby trim the lower left-hand corner of the blank as shown in Fig. 10H.

In the final position, cam face 44I effects movement of the cam block and member 47 to the left and causes the trimming of the lower right-hand corner of the blank as indicated in Fig. 10I. The reverse sequence occurs upon the return or upward stroke of movement of the cam block.

It will be understood that the reference to right and left, and upper and lower portions of the blank are used for purposes of description only, and in reference to the arrangement of the parts as shown in Figs. 10 and 11, the actual movements occurring in the two directions at right angles to each other.

The lower trimming member 47 is yieldingly carried by several pins 64 having curved upper sides engaging the lower hardened plate portion 65 of member 47. These pins 64 are slidably received in cylindrical vertical sockets provided in the cam block, and springs 66 arranged in these sockets normally press the pins 64 upwardly and thus maintain the member 47 with a predetermined force against the lower side of the trimming part 16 during operation. An extension at the end of plate 65 limits the upward travel of the member 47 with respect to the cam block.

The lower side of the lower blank-clamping member 46 is adapted to slide along a line of contact 67 while reciprocating to the right or left as viewed in Fig. 1, and to rock along a curved surface 68 while rocking to the right or left as viewed in Fig. 2. This slide line and rocking surface are provided on a supporting block 69 which is secured by means of a bolt to the upper end of a rod 71 which extends down through bushings 72 and 73 in a guide housing 74, the latter being secured to and movable with the cam block. A guide piston 70 carried by the upper end of the rod 71 fits loosely in the passage of the cam block and holds the rod from turning. A spring 75 engaging the lower wall 76 of this housing presses against a flange 77 on the rod 71 and normally acts to maintain a yielding upward pressure on the rod 71 in order that a predetermined yielding pressure force may be exerted by the clamping member 46 against the blank. The spring 75, when the die is open, holds the clamping member 46 somewhat elevated with respect to the member 47, and under such conditions the member 47 is also held up by springs 65 somewhat above its position shown in Fig. 2, with respect to the cam block. When the upper die member descends the upper clamping and gaging member 20 enters the blank and forces the lower clamping member 46 downwardly and at the same time the lower side of the upper trimming part 16 engages and pushes downwardly against the lower trimming part 47. The pins 25 then engage against the upper side of the cam block and these parts all then descend further during the shifting movement imparted by the cams. When the upper die member is raised and released from the lower die member, the spring 75 acting against the lower clamping member 46 causes the trimmed blank to be raised or partially ejected from the lower trimming member 47. The extent to which the member 46 is elevated in the member 47 is determined by adjusting a stop nut 79 which is threaded on the lower end of the rod 71 and which engages against the lower side of a sleeve 80 bearing against the lower surface 81 of the guide housing 74. The lower end of the sleeve 80 is surrounded by a collar 82 having a pin 83 which operates along the slot 84 to prevent its rotation. A spring 85 acts against the top of this collar and causes it to lock over nut 79 to hold it against movement. Relative rotational movements between the rod 71 and the sleeve 80 are prevented by a key 87.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus,

and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In combination, a plurality of cooperating die members adapted to be brought together and move simultaneously in one direction in translation, means for shifting said die members relatively during such simultaneous movement, and a blank-engaging member supported for tilting movement in one of said die members as the die members shift.

2. In combination, a plurality of cooperating die members adapted to be brought together and move simultaneously in one direction, means for shifting said die members relatively during such simultaneous movement, a blank-engaging member supported for tilting movement in one of said die members as the die members shift, and means on the other die member controlling the tilting movement of said blank-engaging member.

3. In combination, first and second cooperating die members adapted to be brought together and move simultaneously in one direction and to shift relatively during such simultaneous movement, said first die member comprising a support, a movable block adapted to be moved in one direction by said second die member, cam means for shifting the block on the support relatively to said second die member, and a blank-engaging member operatively mounted in one of said die members for tilting movement by shifting of the block and having shearing edges for trimming the blank during such tilting movement.

4. In combination, first and second cooperating die members adapted to be brought together and move simultaneously in one direction and to shift relatively during such simultaneous movement, said first die member comprising a support, a movable block adapted to be moved in one direction by said second die member, cam means for shifting the block on the support relatively to said second die member, a blank-engaging member operably mounted in one of said die members for tilting movement by shifting of the block and having shearing edges for trimming the blank during such tilting movement, and a blank clamping and gaging member mounted in the other die member for tilting movement with said blank-engaging member.

5. In combination, first and second cooperating die members adapted to be brought together and move simultaneously in one direction and to shift relatively during such simultaneous movement, said first die member comprising a support, a movable block adapted to be moved in one direction by said second die member, cooperating cams on said support and movable block for shifting the block back and forth on the support as the block moves in said one direction, additional cam means on said support and block for shifting the block on the support in a second shifting direction as the block moves in said one direction, and a blank-engaging member operably mounted in one of said die members for sliding and rocking movement on the other die member by shifting movement of the block and having shearing edges for trimming the blank.

6. In combination, a plurality of die members adapted to be brought together and move simultaneously in one direction and to shift relatively during such simultaneous movement, comprising a support, a movable block, a movable die member for moving the block in one direction, cam means for shifting the block on the support relatively to the movable die member, and a blank-engaging member operably mounted in said block for tilting movement by shifting of the block and having shearing means cooperating with the movable die member.

7. In combination, a plurality of cooperating die members adapted to be brought together and moved simultaneously in one direction and to shift relatively during such simultaneous movement, comprising a support, a movable block, a movable die member for moving the block in one direction, cam means for shifting the block on the support relatively to the movable die member, a blank-engaging member mounted in said block for tilting movement about an axis by shifting of the block and having shearing edges for trimming the blank, said movable die member having a curved guide surface concentric with said axis and controlling the rocking movement of said blank-engaging member.

8. In combination, a plurality of die members adapted to be brought together and moved simultaneously in one direction and to shift relatively during such simultaneous movement, comprising a support, a movable block, a movable die member for moving the block in one direction, cam means for shifting the block in one direction on the support relatively to the movable die member, additional cam means for shifting the block in a second direction, and a blank engaging member operably mounted in said block for tilting movement by shifting of the block in said one direction and for rectilinear movement by shifting of the block in the second direction and having shearing means cooperating with the movable die member for shearing the blank in such tilting and rectilinear movement.

9. In combination, a plurality of die members adapted to be brought together and move simultaneously in one direction and to shift in a plurality of directions with respect to one another during such simultaneous movement, comprising a support having an aperture, a movable block operable along said aperture, a movable die member for moving the block along said aperture and having shearing means for trimming the blank, yielding means operable on said block against the action of said movable die member, cooperating cam means on said block and support for shifting the block relatively to the movable die member, a blank-engaging member operably mounted in said block for tilting movement by shifting of the block in one direction and for bodily movement only by shifting of the block in the second direction, said blank-engaging member having shearing means cooperating with the movable die member and having a cylindrically curved surface slidably engaging a complementary surface on said movable die member.

10. In combination, a plurality of die members adapted to be brought together and move simultaneously in one direction and to shift relatively during such simultaneous movement, comprising a support, a movable block, a movable die member for moving the block in one direction, cam means for shifting the block on the support relatively to the movable die member, a blank-engaging member axially movable in said block, spring means urging said blank-engaging member outwardly, said member having opposed surfaces adapted to rock on the block when the block is shifted and having shearing edges cooperating with the movable die member for shearing the blank, a blank clamping and gaging member movably supported by said movable die

member to shift with the block, and a cooperating blank clamping member axially slidable in said blank-engaging member and supported for rocking movement therewith.

11. In combination, a pair of cooperating die members adapted to be moved simultaneously in a working stroke of movement, trimming members carried respectively by said dies and shiftable relative to each other to trim a blank, means operative during said movement of said dies for effecting shifting and relative displacement of one of said trimming members from a central position back and forth in the plane normal to the direction of said stroke of movement, and additional means operative during said stroke of movement for shifting said trimming member in a curved path of movement in a direction at right angles to the shifting movement caused by said first shifting means.

12. In combination, a pair of cooperating die members adapted to be moved simultaneously in a working stroke of movement, trimming members carried respectively by said dies and shiftable relative to each other to trim a blank, means operative during said movement of said dies for effecting shifting and relative displacement of one of said trimming members from a central position back and forth in the plane normal to the direction of said stroke of movement, and means operative during displacement of said trimming member in either direction away from said central position for shifting said member in a direction at right angles to said first shifting movement.

13. In combination, a pair of cooperating die members adapted to be moved simultaneously in a working stroke of movement, trimming members carried respectively by said dies and shiftable relative to each other to trim a blank, means operative during said movement of said dies for effecting shifting and relative displacement of one of said trimming members from a central position back and forth in the plane normal to the direction of said stroke of movement, and means operative during displacement of said trimming member away from said central position for shifting said trimming member in a curved path of movement in a direction at right angles to said first shifting movement.

14. In combination, a pair of cooperating die members adapted to be moved simultaneously in a working stroke of movement, trimming members carried respectively by said dies and shiftable relative to each other to trim a blank, means operative during said movement of said dies for effecting shifting and relative displacement of one of said trimming members from a central position back and forth in the plane normal to the direction of said stroke of movement, means operative for shifting said trimming member back and forth in a direction at right angles to said first shifting movement, and additional means for effecting displacement of said trimming member away from said central position concurrently in both said directions at right angles to each other.

15. In combination, a pair of cooperating die members adapted to be moved simultaneously in a working stroke of movement, trimming members carried respectively by said dies and shiftable relative to each other to trim a blank, means operative during said movement of said dies for effecting shifting and relative displacement of one of said trimming members from a central position back and forth in the plane normal to the direction of said stroke of movement, means operative for shifting said trimming member back and forth in a direction at right angles to said first shifting movement, additional means for effecting displacement of said trimming member away from said central position concurrently in both said directions at right angles to each other, and means carried respectively by said pair of die members and supported thereby for shifting movement along with said trimming members for clamping and holding said blank during the trimming operation.

16. Trimming dies of the character described adapted for trimming a blank one edge of which is curved comprising a pair of trimming members, means for supporting said trimming members providing for bringing said trimming members together and for simultaneous movement thereof, means for causing relative shifting of said trimming members during such simultaneous movement, the surfaces of said trimming members being cooperatively curved in one direction to correspond with the curvature desired in the curved edge of said blank, a blank engaging member movable with one of said trimming members, and means for effecting rocking movement of said blank engaging member and its said trimming member during relative shifting of said trimming members.

17. Trimming dies of the character described adapted for trimming a blank one edge of which is curved comprising a pair of trimming members, means for supporting said trimming members providing for bringing said trimming members together and for simultaneous movement thereof, means for causing relative shifting of said trimming members during such simultaneous movement, the surfaces of said trimming members being cooperatively curved in one direction to correspond with the curvature desired in the curved edge of said blank, a member engaging one face of the blank and participating in the movement of one of the trimming members, a second blank engaging member for engaging the opposite side of the blank, and means for yieldably supporting said second blank engaging member to provide for rocking movement thereof concurrently with the movement of said first mentioned blank engaging member during relative shifting of said trimming members.

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