Nov. 21, 1944. U. D. FOSTER 2,363,407

TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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Fig. 2.

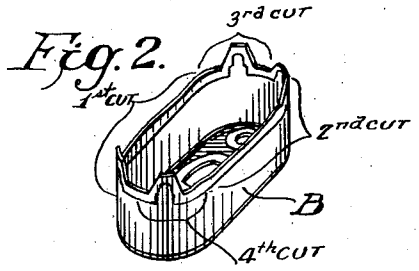


Fig. 3.

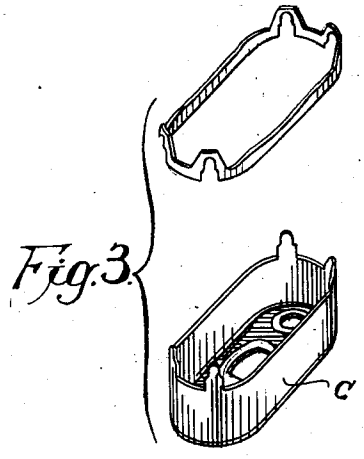


Fig. 1.

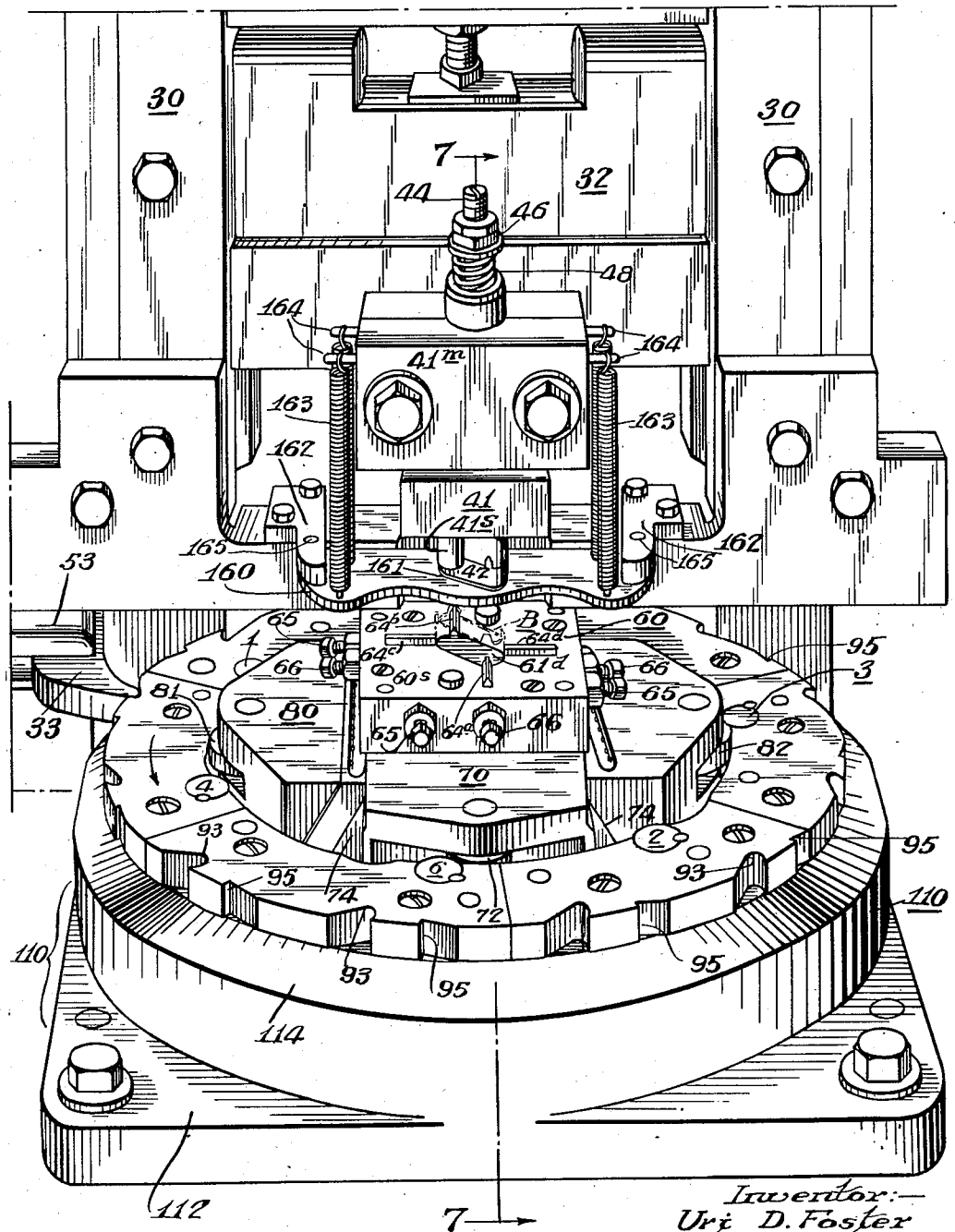
Inventor:-
Uri D. Foster
by his Attorneys
Howson and Howson

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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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Fig. 4.



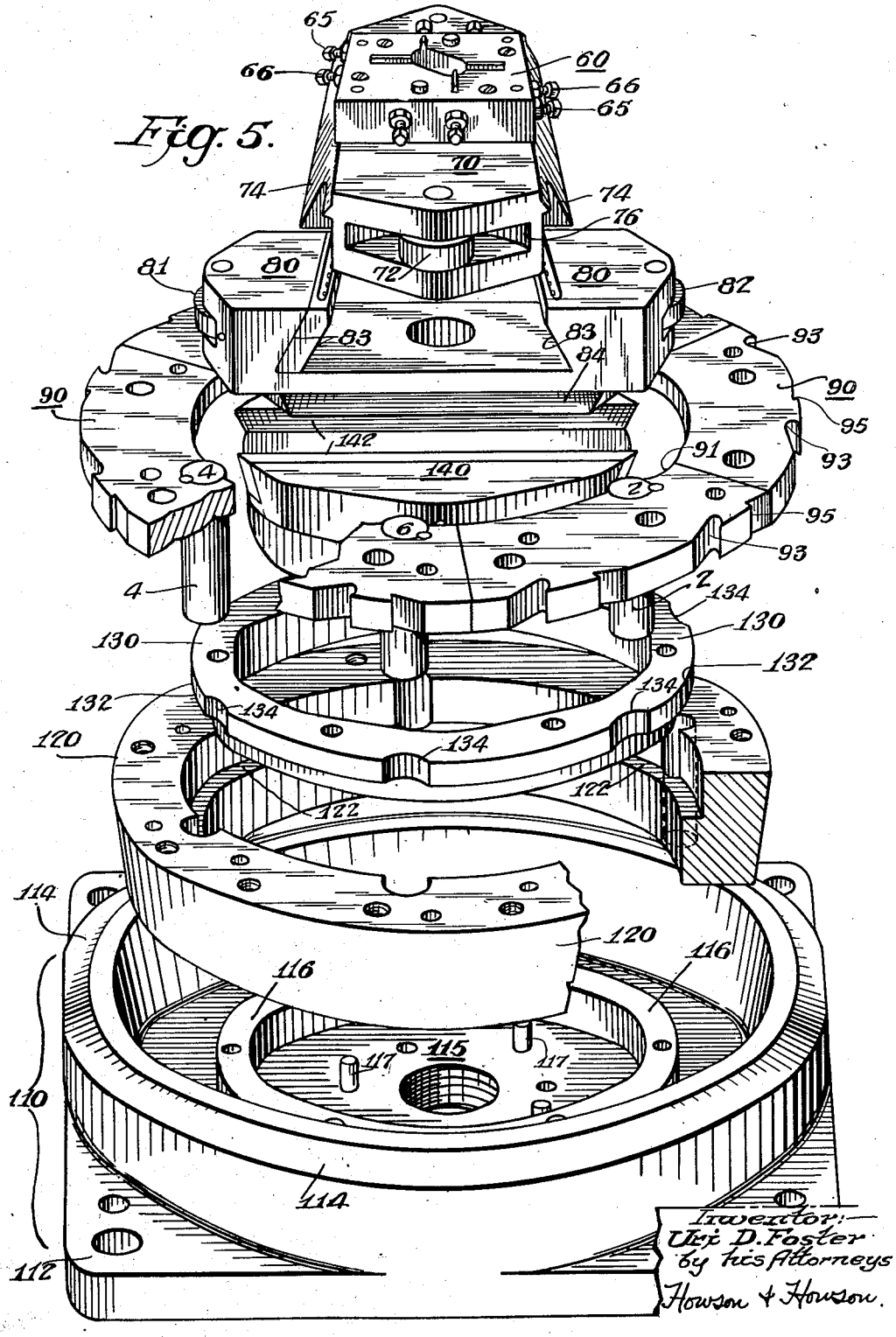
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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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Fig. 5.



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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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Fig. 6.

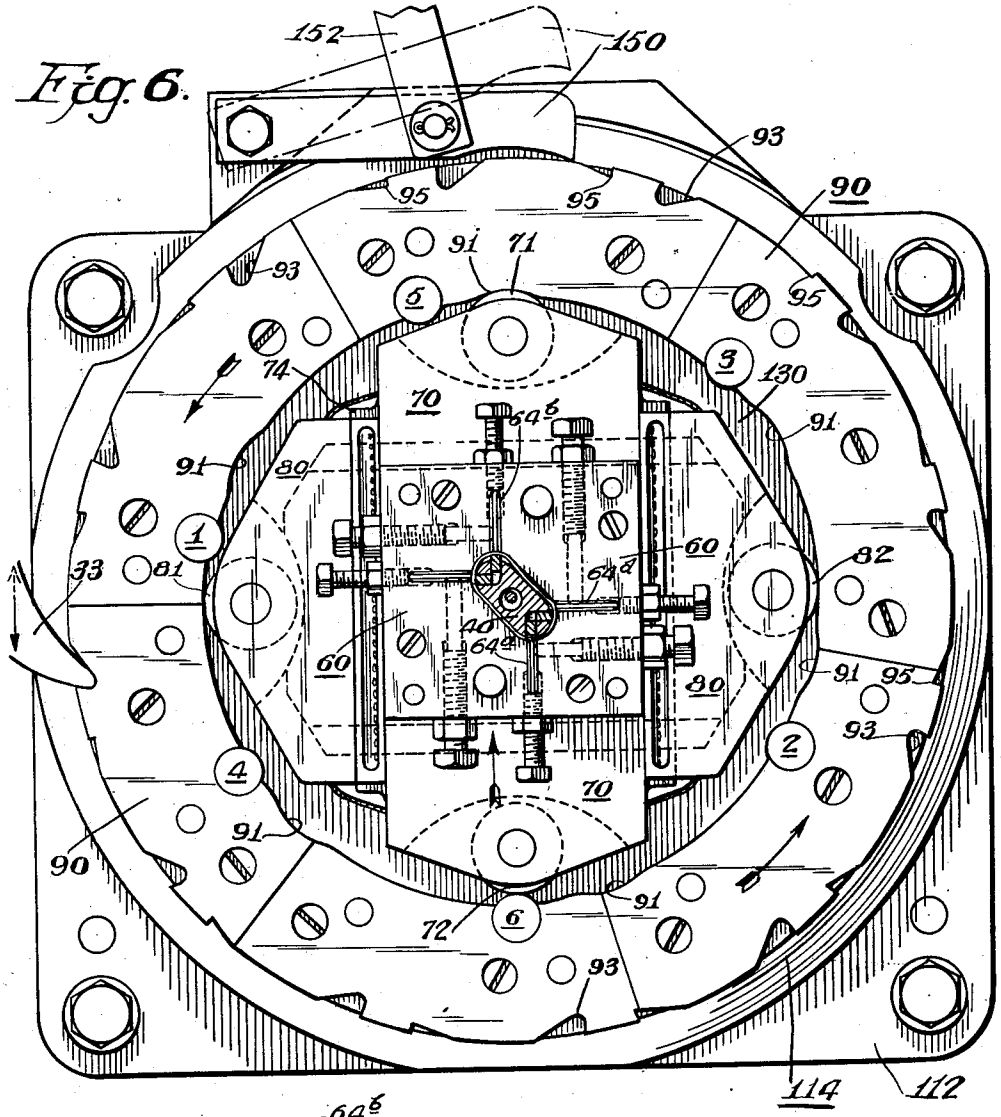
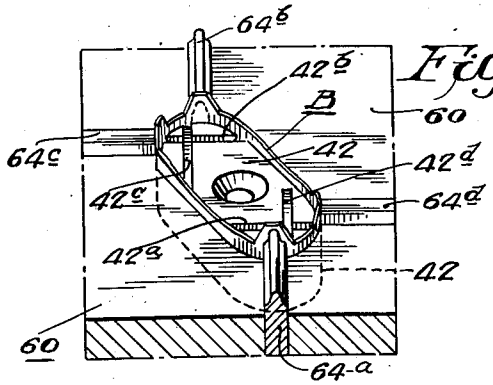


Fig. 21.



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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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Fig. 7.

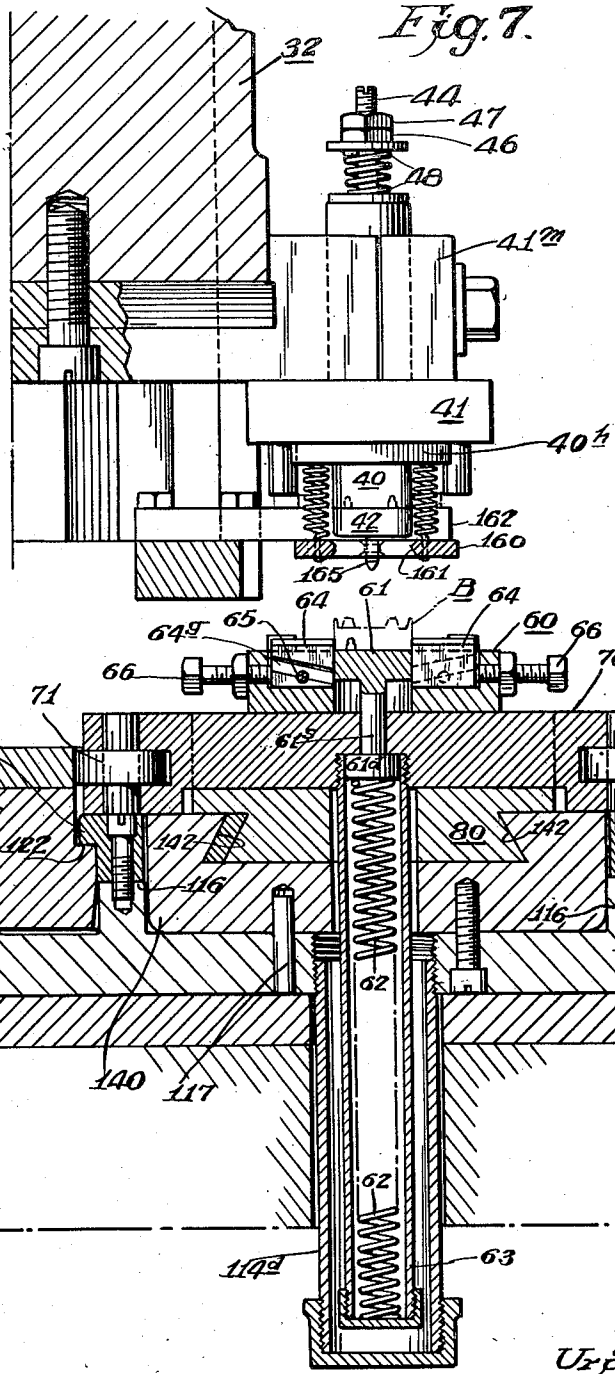
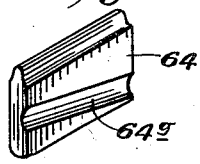


Fig. 8.



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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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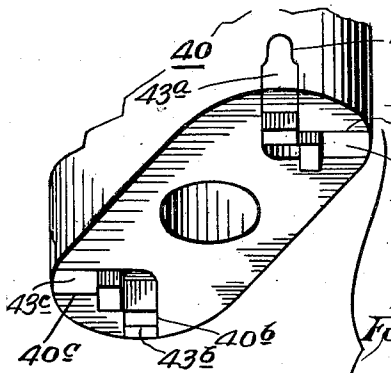


Fig. 10.

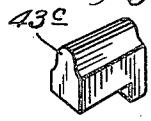
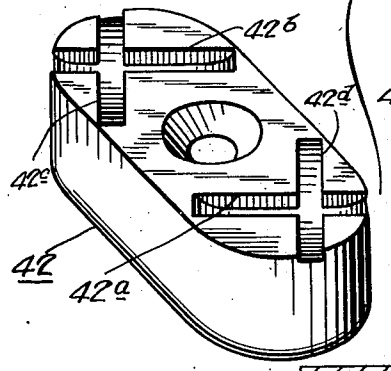


Fig. 13.



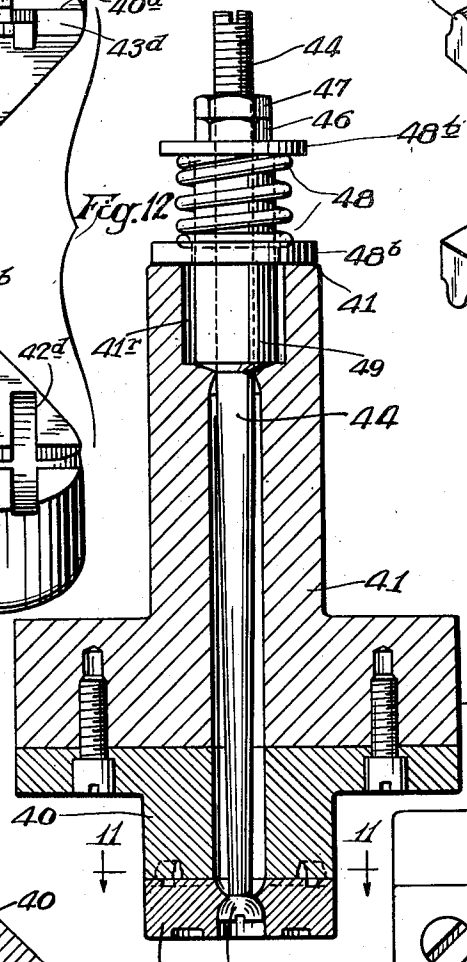


Fig. 12.

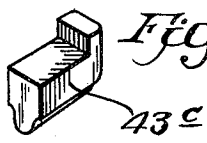


Fig. 14.

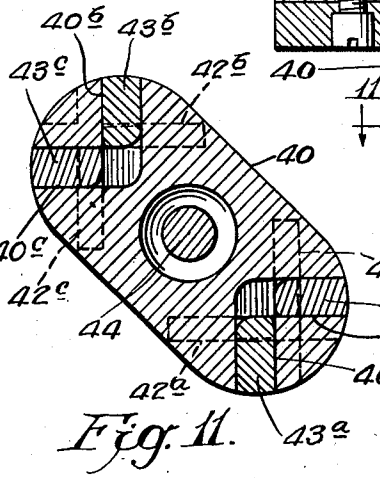


Fig. 11.

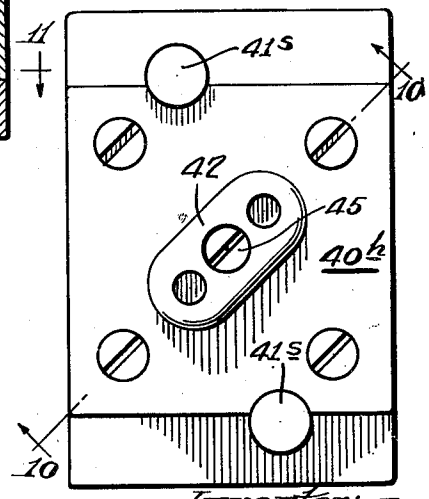


Fig. 9.

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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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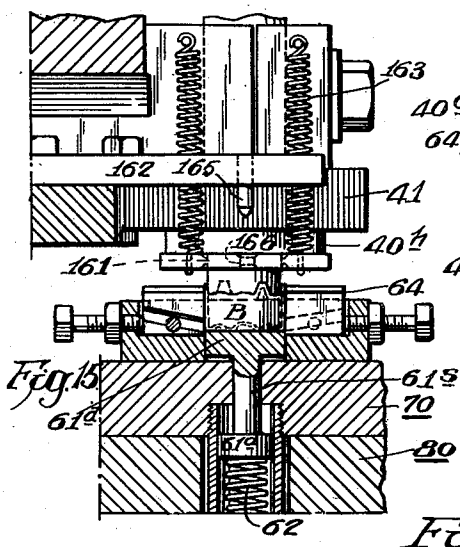


Fig. 15

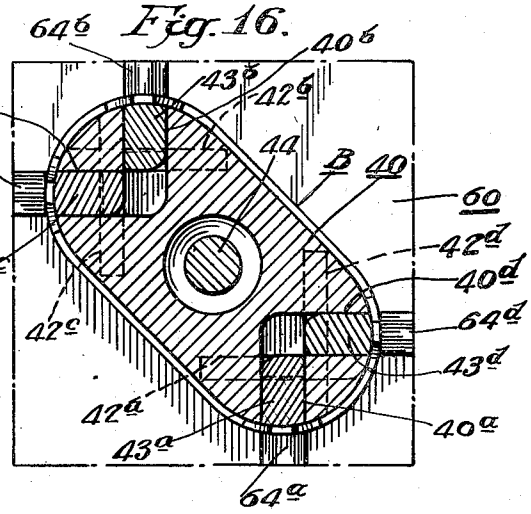


Fig. 16.

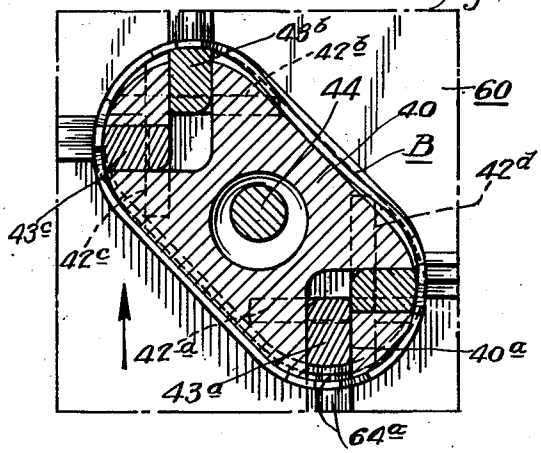


Fig. 17

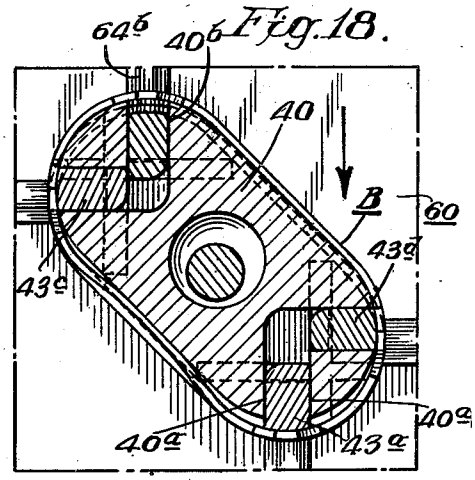


Fig. 18.

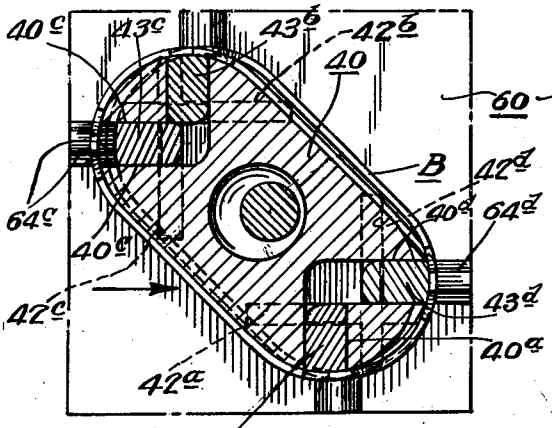


Fig. 19.

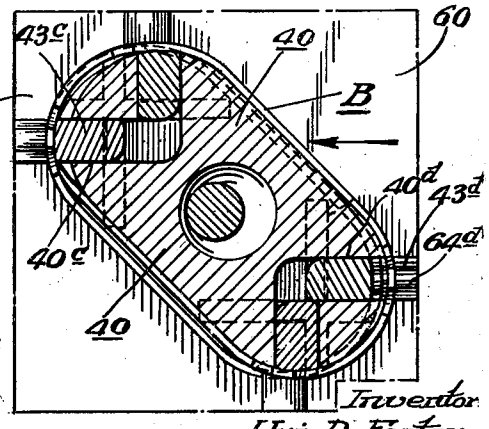


Fig. 20.

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TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

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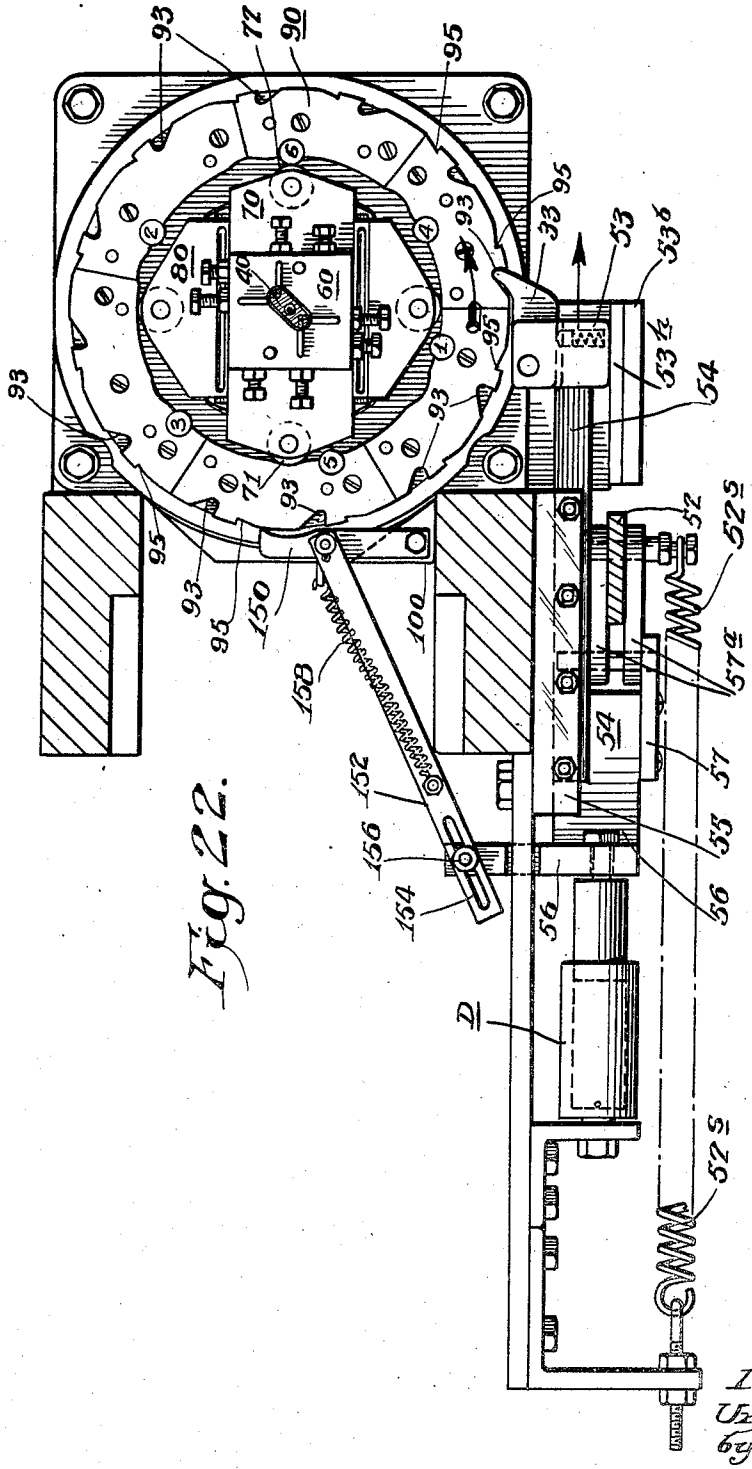


Fig. 22.

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Patented Nov. 21, 1944 2,363,407

UNITED STATES PATENT OFFICE

2,363,407

TRIMMING PRESS AND DIE ARRANGEMENT FOR SAME

Uri D. Foster, Hartford, Conn., assignor to The Arrow-Hart & Hegeman Electric Co., Hartford, Conn., a corporation of Connecticut

Application June 23, 1943, Serial No. 491,998

35 Claims. (Cl. 164—48)

In modern manufacturing of metal articles from sheet metal, by stamping blanks therefrom, it frequently becomes necessary to trim hollow blanks to size or shape or to remove additional metal therefrom. These secondary operations are performed after the blank has been stamped generally into shape in original or primary stamping operations.

My invention relates to presses for carrying out the secondary trimming, shaping or forming operations and the like, and to the arrangement of dies and associated parts in such presses, where metal must be trimmed or shaped on opposite or adjacent, or on opposite and adjacent sides, walls or surfaces of blanks, particularly hollowed blanks or stampings.

It is an object of my invention to provide an improved press mechanism for moving dies to trim or shape blanks, particularly hollow blanks, of metal, plastic or other materials where the shaping, trimming or forming must be done on adjacent or opposite, or adjacent and opposite sides, walls, or surfaces of the blank.

Another object is to provide an improved arrangement of dies, parts and mechanism to move same in a press where the foregoing trimming, shaping or forming operations are to be performed.

Another object is to provide an arrangement, mounting and mechanism for moving die parts in multiple directions, such as back and forth and transversely, so as to shear, cut, trim or form a hollow or cupped blank in multiple directions in one machine and in one placement of the blank so that in many cases when the blank is removed it will be completely formed and trimmed.

Among the many other objects of my invention are the creation, arrangement and improvement in the form, combination and operation of parts in a die press for carrying out the foregoing shaping, forming and trimming operations.

Other objects will become apparent as the invention is described in connection with the accompanying drawings.

In the drawings—

Fig. 1 is a perspective view of a press embodying the invention;

Fig. 2 is a perspective view of a blank to be trimmed by the press of Fig. 1;

Fig. 3 is a perspective view of the blank, after trimming, of Fig. 2 and also showing the scrap or trimmed portion;

Fig. 4 is a perspective view looking down on the die from the front of the press shown in Fig. 1;

Fig. 5 is an exploded view of the lower die and the mounting of the whole assembly of elements which carries the lower die;

Fig. 6 is a plan view of the parts shown in Fig. 5 when they are assembled;

Fig. 7 is a transverse sectional view taken along lines 7—7 of Fig. 4;

Fig. 8 is a perspective view of one of the lower die inserts;

Fig. 9 is a bottom plan view of the upper die and its mounting bracket;

Fig. 10 is a vertical sectional view, taken transversely through the upper die and its mounting bracket, along line 10—10 of Fig. 9;

Fig. 11 is a horizontal sectional view taken along line 11—11 of Fig. 10;

Fig. 12 is a perspective view showing the bottom portion of the upper die and its foot, the foot being separated from the die;

Fig. 13 is a perspective view of one of the key inserts for the upper die;

Fig. 14 is a perspective view of the key insert of Fig. 13 inverted;

Fig. 15 is a fragmentary sectional view similar to Fig. 7 but with the upper die in depressed position ready for the trimming operations;

Fig. 16 is a horizontal section view through the upper die and blank on a line similar to 11—11 of Fig. 10 when the upper die is depressed into the cutting position of Fig. 15;

Figs. 17, 18, 19 and 20 are views similar to Fig. 16 but showing the dies in their four cutting or trimming positions;

Fig. 21 is a fragmentary perspective view showing the blank to be trimmed when positioned within the lower die, and with the foot of the upper die within the blank but removed from the upper die; and

Fig. 22 is a plan view of the machine of Fig. 1 showing only the lower die and the press parts that are on levels below said lower die.

In the following description like reference numerals refer to like parts in the several figures.

General description

Presses to which this invention relates, for trimming or otherwise working upon formed blanks, have a conventional framework **30** with vertical guide surfaces to guide the vertical rising and falling of a slide **32** which carries the upper die elements **40**.

The slide **32** is operated, in the machine illus-

trated, by a main shaft **34** turned by a single revolution clutch **36**. Since the single revolution clutch is a well-known mechanism, it need not be described in detail. In operation, when the clutch is engaged (as by the machine operator putting her left and right hands on knobs, such as *r*, on the ends of levers *r'* and L') the shaft turns one revolution and the clutch then automatically disengages itself, whereupon the shaft stops.

According to the present invention, there is on the main shaft **34** a large cam **38** whose surface engages an anti-friction roller **39** mounted on the vertical slide **32**. The cam **38** is of such shape that when its low surface **38***b* (Fig. 1) is in engagement with the roller, the slide will be held in its uppermost position by powerful springs **37** provided for that purpose. When the cam **38** rotates, its high surface **38***t* comes into engagement with the roller **39** to move the slide down and hold it there during the die cutting or trimming operation. Thereafter it rises again as the low surface engages the roller. The up movement, being powerfully carried out by springs **37** is dampened by an air dash pot (not shown).

The driving mechanism also includes a two-winged cam **35** on the main shaft **34** which is engaged by a roller **50** mounted on the end of a lever **52** that is pivotally mounted on a bracket **30***b* on the frame **30** of the machine. The purpose of this cam and lever arrangement is to drive a pawl **33** (Fig. 6) which will revolve a ratchet **90** in steps to move the lowermost of two cooperating dies, as will hereinafter be more fully described.

In employing the invention to trim a blank B, such as is shown in Fig. 2, to produce the casing body C, shown in Fig. 3, four cuts are made, by relative movement of the two cooperating dies **40** and **60**. The top die **40** is carried by the vertical slide **32** and upon being moved down by the slide preparatory to the cutting or trimming operation, it remains stationary until the cutting or trimming is completed. The bottom die **60** carries the blank which is to be trimmed and is movable back and forth and also crosswise at right angles to the back and forth motion. For such purpose the bottom die is mounted in a horizontally movable slide **70** which is mounted for sliding movement back and forth within a second horizontal slide **80** whose direction of motion is crosswise (or at right angles to the direction of motion of the first horizontal or die carrying slide).

The cuts are made by moving the bottom die **60** and the blank first to the right, then to the left, then forward, then backward, while the top die remains stationary.

Referring to Fig. 2, in a typical operation the movement of the bottom die **60** and the blank to the right causes the first cut, which trims the opposite or left lug and the adjacent edges of the blank around to the top and bottom lugs. The next movement of the die and blank is to the left and causes the second cut, which trims the opposite or right lug and the adjacent edges around to the top and bottom lugs. The third movement of the die and blank is forward and causes the third cut to trim the top (or back) lug and the adjacent edges. The fourth movement of the die and blank is backward and causes the fourth cut, which trims the bottom (or front) lug and the adjacent edges, completing the trimming of the blank.

For reasons as will hereinafter become clear, the cuts are not always in the same sequence on succeeding blanks, though the crosswise cuts are always made first and the back and forth cuts last.

The reciprocation of the slides **70** and **80** is accomplished by cam action. Each of the top and bottom slides is provided with a roller **71**, **72** and **81**, **82** at each end. The rollers cooperate with cam plugs **1**—**6** in the form of cylindrical pins that are mounted in a rotary assembly that is rotated step by step by a ratchet member **90** in response to reciprocations of the pawl **33** which is driven from the driving mechanism by the two-winged driving cam **35** heretofore mentioned.

Detailed description of the mounting assembly for the die parts and the movement thereof

The mounting of the whole assembly of elements which carries the lower die parts is upon the bed plate of the machine frame **100** (see Figs. 1 and 7). The foundation or bottom member **110** of such assembly has a rectangular bottom portion **112** (see Figs. 5 and 7) from the surface of which a circular flange **114** extends upwardly forming an oil reservoir, to provide for lubrication of the sliding surfaces. The inner surface of the flange is machined and tapered or inclined toward the center of the member, and receives in rotary sliding relation a complementally-tapered surface of a cam-carrying ring or holder **120**, whose top surface lies flush with the top surface of the flange **114**.

To hold the cam holder or ring **120** in location, a circular shoulder **122** is formed on its inner peripheral surface by recessing the inner top portion of the holder. Overlying said shoulder is the circumferential flange **132** of a retaining ring **130** which seats on and is secured to a circular rib **116** raised from the bottom of the reservoir member **110**.

Seated and secured upon the upper surface of the rotary cam holder **120** is a flat ratchet ring **90** made in segmental sections, each of which is bolted firmly to the cam holder. Both the ratchet **90** and cam holder **120** are drilled vertically at spaced points around and intersecting the inner peripheries thereof for the reception of cylindrical cam plugs **1**—**6** inclusive. These plugs are notched (as at **6***n*) in the area opposite the retaining ring so as to permit the rotation of the cam holder **120**, the ratchet **90** and the cam plugs together, while the retaining ring **130** remains still and holds the cam holder **120** within the flange **114** of the reservoir member **110**. To permit insertion of the cam plugs the retaining ring **130** has its periphery recessed adjacent the cam plug borings, as indicated at **134**.

For the purpose of guiding the back and forth movement of the die **60**, it is mounted on an upper slide member **70** which is of elongated hexagonal shape (see Fig. 6) and has wedge-shaped or sloping side walls **74** (see Fig. 5) dovetailing within an undercut channel **83** in a lower sliding member **80**. The ends of the upper slide are horizontally slotted as at **76** to receive anti-friction rollers **72** that rotate on vertical axles transverse of the end slots. The lower slide member **80** is of elongated hexagonal shape and has its ends horizontally slotted for anti-friction rollers, in like manner to the upper slide **70**. The lower slide is guided for crosswise sliding by a broad dovetail rib **84** that fits within a dovetail slot **142** in a slide holding member **140** that seats on the bottom **115** of the reservoir

member 110 within the area encompassed by the circular rib 116. The position of the slide holding member 140 may be determined by dowel pins 117 placed in the floor of the reservoir member 110 and received in holes in the bottom of the slide holder 140.

As the cam-holder 120 rotates (see Fig. 6), the cam plugs 1—6 will strike the anti-friction rollers 81, 82, and 71, 72. The cam plugs 1—8 are of such number and position that after one plug acts to move one slide in one direction, the next cam to act will act on the roller at the opposite end of the same slide to move it in the opposite direction. The third cam to act may engage one roller of the other slide to move it to one side, and the fourth cam to act will engage the roller at the opposite end of the said other slide to move it to the other side. No two cam plugs can be spaced apart the exact distance of any slide roller from any other slide roller, since only one cam should act at one time.

To permit movement of the slides as the cam action takes place, it is necessary to recess the inner periphery of the ratchet diametrically opposite every cam plug, as at 91 (see Fig. 6), so as to receive the anti-friction roller opposite whichever cam plug is acting at the moment. Return of the slide to central position after each movement is accomplished by the anti-friction roller, which at the moment is in a recess, engaging the trailing side of the recess as the ratchet rotates.

Thus, any cam plug 1 will move any slide 80 by engaging one roller 81, whereupon the opposite roller 82 is received in a recess 91 diametrically opposite the then active coupling 1. On continuing rotation, the trailing side of ratchet ring recess 91 engages the received roller 82 and reversely moves the slide 80 until it is again in central position. Then the next cam 2 may act and the slide will be moved in corresponding manner, in another direction. (It will be understood that the numerals in this paragraph are solely for illustration and example, the response of any slide to the action of any cam and to the ratchet being the same in every case, except as to direction of movement of the particular slide.)

With the foregoing arrangement, and with the cam plugs placed, for example at 0°, 44°, 104°, 164°, 240°, 300°, approximately, if the transverse or lower slide 80 is first moved to the right by cam 1 engaging roller 81, said slide will next be moved to the left by cam 2 engaging roller 82; then the back and forth or upper slide 70 will move forward by cam 3 engaging roller 71 and will move rearwardly by cam 4 engaging roller 72. The ratchet will have moved through 60° in causing the foregoing slide movements.

During the next 60° ratchet movement, cam 5 will engage roller 81 to move transverse slide 80 to the right; then cam 6 will engage roller 82 to move said slide to the left; then cam 1 will come into action for the second time, engaging roller 72 on the lower slide 70, moving it backward; then cam 2 will come into action for the second time, engaging roller 71 to move slide 70 forward.

The two foregoing 60° movements will have moved the slides for completing the trimming of two blanks.

From the foregoing, the operation of the slides by the cams 1—6 during the whole 360° rotation of the ratchet can be understood, as the press completes operations on six blanks and starts to repeat its sequence.

The step-by-step rotation of the ratchet 90 is accomplished by the reciprocation of a pawl tooth 33 which engages in turn in twelve equally-spaced notches 93, in the periphery of the ratchet. The reciprocation of the pawl tooth is accomplished by pivotally mounting it on a block 53 on the front end of a reciprocated member 54 that is horizontally slidable within a guide 55 affixed to the side of the press frame. The guide 55 has a dovetail slot receiving and guiding the central bar portion of the reciprocated member 54. Additional guidance at the front of the reciprocated member is provided by a hold-in plate 53*h* and bracket 53*b*. The rear end of member 54 is provided with a lateral extension 56 to the side of which a bar 57 is attached. Between the end of bar 57 and the member 54 one end of a pair of parallel links 57*a* is pivoted, their other ends being pivotally connected to a vertical lever 52 which oscillates and thereby serves to reciprocate the member 54. Oscillation of the lever 52 is caused by the winged cam 35 on the main shaft 34 as it rotates, the cam engaging an anti-friction roller 50 on the upper end of the lever 52, which is bifurcated to receive and facilitate the mounting of the anti-friction roller. The lever 52 is pivotally supported at its center on the press frame by a bracket 58 and pivot pin 59. Constant engagement of the roller 50 with the winged cam 35 is maintained by a tension spring 52*s* pulling the lower end of the lever 52 rearward. The sudden retraction of the slide 54 by the springs 57*s* may be dampened by an air dash pot D.

By the foregoing arrangement, the winged cam causes two oscillations of the lever 52 to occur in every reciprocation of the main shaft and hence two steps of the rotation of the ratchet 90 are caused. Because of the location and number of the push notches 93 for the pawl, in the ratchet the two steps amount to one-sixth of the full rotation of the ratchet, during which sixth two cam plugs will have acted on each of the four slide rollers 71, 72, 81, 82.

Exact positioning of the lower die parts and hence of the mounting therefor is important. Since the push imparted by the pawl to rotate the relatively heavy parts moved by and with the ratchet 90 would have a tendency to cause those parts to be carried by inertia past their intended position, I provide a safety stop mechanism comprising a latch 150 pivoted on a stationary part of the press, such as the bottom member 110, and moved by a latch operating bar 152 pivotally connected at one end to the latch 150 and having at its other end a slot 154 and pin 156 connected to the side 54 through the block 56 thereon. A spring 158 connected at one end to the press frame and at the other end to the central part of the latch bar 152 constantly urges the bar and latch against the periphery of the ratchet 90. The periphery is provided with accurately placed notches 95, cut reversely to the direction of ratchet rotation, in which the latch engages to stop the ratchet and associated parts from moving beyond their intended and exact positions.

As the slide 54 moves back or recovers after pushing the ratchet 90 a step, the pin 156 strikes the rear end of the slot 154 in the latch bar 152 to retract the latch 120 from the stop notch 95 in the ratchet. Upon the slide 54 being subsequently moved forwardly at the start of the next

ratchet step, the latch will fall on the periphery of the ratchet and the periphery will ride under the latch until the next stop notch **95** is encountered. Since the push notches **93** face oppositely to the stop notches **95**, the operation of the pawl **33** is not affected by the stop notches **95**, nor is the operation of the latch **150** affected by the push notches **93**.

Detailed description of the die parts

The following description is of the die parts for trimming a hollow cup-shaped casing with lugs extending from the edges at the four quarters thereof. An untrimmed blank B is shown in perspective in Fig. 2, while Fig. 3 shows the trimmed blank C and the parts trimmed off, above. Although the description is of a particular part or blank, it will be understood that the principles of the invention are applicable more broadly and are not limited to the precise form of blank illustrated and described.

The bottom die comprises a rectangular block of metal **60** cut out in its central portion to receive the blank of Fig. 2 when the blank is placed diagonally. The block seats on is bolted to the upper slide **70**. A resiliently supported platform **61** is received in the die aperture **60***a* and normally is flush with the surface of the die. The platform is a mushroom-shaped part whose stem **61***s* extends down through a hole in the upper slide **70** and has a disk **61***d* screwed on its lower end against which may press a compression spring **62** to hold the platform elevated. The spring **62** may be housed in a tubular spring guide or housing **63** threaded at its upper end into the bottom of the slide **70** and its lower end is closed by a screw cap. Both spring and housing extend through openings in the lower slide **80** and slide holder **140**, the openings being large enough to permit the necessary relative motion of the slides **70**, **80** and their motion relative to the slide holder **140**. Screwed into the reservoir member **114** and surrounding the spring housing **63** in an oil retaining pipe **114***d*.

The trimming of the lugs on the blank is provided for by placing four identical die inserts (designated generally by the numeral **64** and specifically by the letters *a*, *b*, *c*, *d*) in channels in the die **60** extending from the die aperture in the four directions that the die is movable. The form of the inserts **64** is clearly shown in Fig. 8. Each insert is held in its channel by a horizontal securing bolt **65** threaded through the side wall of the die block. The end of the bolt **65** engages the lower edge or surface of a diagonal groove **64***g* in the die insert sloping toward the center of the die block, in order to exert a force downward on the insert and hold it in the bottom of its channel. Adjustment of the inserts **64** lengthwise of the channel is provided for by other horizontal bolts **66** threading through the side walls of the die block in alignment with the inserts. As the inserts **64** and the die block **60** wear, it may become necessary to grind their working surfaces. When the top surface of the die block is ground, the bottom surface of the die insert, as well as the working end surface of the insert, will be ground so that the dimension of the die insert above the die block will be the same as before; also the die insert will still be held down firmly on the bottom of its channel since the inclination of the groove **64***g* will cause the securing bolt **65** always to press on the bottom edge or surface of the groove **64***g* as the insert is moved inward, thus always providing a downward component of force.

The upper die is bolted on a bracket **41** that is, in turn, bolted to the vertical slide **32** of the press and hence moves up and down with that vertical slide. The lower or shearing portion of the die has the elongated shape of the blank B and had passageways **40***a*, *b*, *c*, *d*, cut in it in position to receive the die inserts **64***a* to *d* and the cut lugs of the blank as the die block **60** is moved in the four directions hereinbefore mentioned to make the four trimming cuts on the blank.

For the purpose of pressing down the platform **61** within the die aperture of the lower die **60** and at the same time carrying the blank B down into that aperture in position it will occupy during the trimming operations and holding it there during those operations (see Fig. 15), a foot member **42** (see Figs. 9–12) is resiliently held against the bottom surface of the die **40**. The foot **42** has a shape conforming to the blank B in which it is received and is movably held against the upper die **40** so as to be able to follow the movements of the lower die **60** and blank B during their movements in the trimming operations. For such purpose the foot **42** is held by a rod **44** passing vertically through borings in the center of the upper die **40** and through the mounting bracket **41**. A hemispherical end **45** of rod **44** holds the foot **42** in place, the hemispherical shape of the end **45** allowing sliding movement of the foot **42** relative to the die **40**, as hereinafter described. The upper end of the rod **44** is threaded to receive an adjustment nut **46** and a lock nut **47** which compresses a spring **48** between upper and lower washers **48***t* and *b*, the lower **48***b* being cupped to receive oil and resting on the top surface of the die supporting bracket **41**. A sleeve **49** around the top end of the rod **44** has its lower end rounded and received within a recess **41***r* in the upper surface, so that when the adjustment screw **46** is tightened to give about .001 clearance between the sleeve **44** and the top washer **48***t*, the rod **44** and associated parts will swivel about the point of engagement of the rounded end of sleeve **49** and bracket **41** as a fulcrum.

To allow sliding movement of the foot **42** relative to the die **40** as the rod **44** pivots, the end of the rod is tapered sufficiently to permit the necessary movement in the desired directions.

To enable and also to guide sliding movement of the foot **42** relative to the upper die **40**, only in the predetermined paths of movement caused by movement of the lower die **60**, intersecting grooves **42***a* and *b* and **42***c* and *d* are cut in the top surface of the foot **42** at opposite ends, as indicated best in Fig. 12, to receive the downward extensions of key inserts **43***a*, *b*, *c* and *d* that are located within and slide within the same passageways **40***a* to *d* that were provided for reception of the die inserts **64** of the lower die **60** as those die inserts move relative to the upper die **40**. The key inserts **43***a*, *b*, *c* and *d* can slide back and forth in the passageways **40***a*, *b*, *c* and *d* when compelled to do so by movement of the foot **42** induced by the lower die **40**. Specifically, the back and forth motion is caused by the extensions of the key inserts **43***a*, *b*, *c* and *d* with the walls of the grooves **42***a*, *b*, *c* and *d* in which they lie. In Figs. 11 and 16 the upper die foot **42** is shown in mid-position. Fig. 16 also shows a blank B in position to be trimmed.

On movement of the lower die **60** backward toward the rear of the press (into the position of Fig. 17) the die insert **64***a* of said lower die will move into the passageway **40***a* in the upper die. With the upper die the foot **42** thereof will move

simultaneously rearward, moving the key inserts 43*a*, 43*b* with it by reason of the engagement of the walls of the grooves 42*a*, 42*b* with the downward extension of these key inserts 43*a*, 43*b*. During this motion of the foot 42, the key inserts 43*c*, 43*d* remain stationary because their extensions lie in the grooves 42*c*, 42*d* which run in the direction of motion of the foot 42 and hence the foot can move while those key inserts 43*c*, 43*d* do not.

Movement of the lower die 60 forward (into the position of Fig. 18) causes no motion of the key inserts 43*c*, 43*d* for the same reason as in the preceding paragraph; but the lower die insert 64*b* will move into the passageway 40*b* and key insert 43*a* will move out of the passageway 40*a* for the same reasons the opposite motion was brought about during backward movement of the lower die.

Movement of the lower die to the right (into the position of Fig. 19 from center or Fig. 16 position) will move the die insert 64*c* of the lower die into the passageway 40*c* at the same time the key insert 43*c* in the upper die 40 will move inwardly of its passageway 40*c* and key insert 43*d* will move outwardly of its passageway 40*d* because of the extensions on those inserts 43*c*, 43*d* being engaged by the walls of the grooves 42*c*, 42*d* in which they lie. The movement of the lower die 60 transversely (either to the right or left) will not move the key inserts 43*a*, 43*b* because their extensions lie in transverse grooves 42*a*, 42*b* of the foot 42.

On movement of the lower die 60 to the left (into the position of Fig. 20) the key insert 43*d* will move inwardly of its passage 40*d* and the die insert 64*d* will enter passage 40*d* and the key insert 43*c* will move outwardly of passage 40*c*.

Each one of the four above-described movements shears off part of the blank wall or makes one cut of the trimming operation. On completion of all four, the blank will be completely trimmed, having the shape illustrated in the bottom part of Fig. 3. The trimmed-off portion is scrapped. It may or may not be in one piece, as shown, since it is stretched by whichever key insert is opposite the die insert that at the moment is performing a shearing or cutting operation. The stretching is due to the moving of the key insert outward of its passageway against the uncut wall of the blank. (For example, see key insert 43*b* in Fig. 17 stretching the top wall of the blank B.)

After the last cut is made, the upper die 40 will rise with the vertical slide 32 by reason of the low part 38*b* of the cam 38 coming into engagement with the slide roller 39 permitting the springs 37 to raise the slide 32 and die 40 carried thereby. Thereupon the platform 61 carrying a trimmed blank (like C in Fig. 3) will rise from the position of Fig. 15 to the position of Fig. 7.

For accuracy in assembling and lining up the upper and lower dies, studs 60*s* may be provided at the lower die to be lined up coaxially with identical studs 41*s* on the mounting bracket of the upper die (see Fig. 4). These studs also serve to locate the dies vertically. The stud ends abut when the horizontal cutting surfaces of the dies are even, so that they may move laterally to trim a blank without striking one another.

The stripper mechanism

In order to strip the blank including the trimmed scrap from the upper die, a stripper plate 160 is provided. This plate has an aperture 161 through which the upper die passes. When the machine is inactive, the plate is held against arms 162 extending from the press frame by a pair of springs 163 on either side of the mounting 41*m* for the upper die carrying bracket 41, the upper ends of the springs being attached to said bracket by pins 164, while the lower ends are connected to the stripper. In such position the die 40 and die foot 42 lie above the stripper plate 160. As the vertical slide 32 descends in the operation of the press, the die and its foot pass through the stripper plate opening and the head 40*h* of the die 40 engages the stripper plate carrying it down with the die. (See Fig. 15.) After the trimming operation, the upper die and stripper will rise until the stripper engages the arms 162, whereupon the die 40 and die foot 42 will continue upward through the stripper aperture 161 which, being of area only sufficient to permit passage of the die and foot, will strip off any scrap or the blank that may have been retained on the die 40 or die foot 42.

To locate and guide the return of the stripper plate 160 to its uppermost or "at rest" position, downwardly-extending parallel pins 165 are driven into the arms 162. (See Figs. 7 and 15.) As the stripper plate 160 rises, these pins enter holes 166 therein, maintaining the stripper plate in position as the upper die 40 and die foot 42 withdraw from the stripper aperture 161.

From the foregoing it may be understood that an operator placing a blank on the depressible platform 61 in the center of the lower die may then place her hands on the handles of levers L and *r*, causing the clutch mechanism to operate and starting the press. Thereupon, the slide 32 will be moved down by cam 38, causing foot 42 of upper die 40 to enter the blank and press it and the platform 61 down into the position of Fig. 15.

Then the winged cam 35 will operate the lever 52 and pawl carrying slide 53 to rotate the ratchet member 90 and to move the slide 80 and lower die 60 from central or neutral position to the right and to the left and to move the slides 70 and 80 and the lower die forward and to the rear. In so moving, the die 60 will return to central position after movement in any direction before moving in another direction, i. e., returning to center from right before moving to left, forward or toward the rear.

The foregoing movements will make four cuts on the blank, as previously described and as typically illustrated in Fig. 2.

On completion of the cuts, the rotation of the cam 38 will permit the slide 32 to be raised by springs 37, whereupon the blank carrying platform will raise the trimmed blank from the lower die opening; and the stripper 160 will strip off the blank or any scrap retained on the upper die as it passes through the stripper opening. The press will then be ready for trimming another blank.

In the following claims, "forming" is used in a general sense to embrace trimming and similar operations.

Many modifications within the scope of my invention will occur to those skilled in the art. Therefore I do not limit it to the specific embodiment illustrated and described.

I claim:

1. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming opera-

tions on a hollow blank while the first die remains stationary, a plurality of sliding means one of which is movable independently of another, rotary means cooperating with said sliding means to move said rotary means step by step.

2. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, cooperating rotary means and sliding means movable step by step for moving said second die in said directions, and means on said rotary and sliding means to complete all the forming movements of said second die for one blank in a fraction of each rotation of said rotary means.

3. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a resilient support for the blank cooperating with said second die, said support descending into said second die as said first die carries the blank to operative position and automatically rising with the first die on completion of the forming operations to expel the formed blank from within the second die, a plurality of sliding means one of which is movable independently of another, rotary means cooperating with said sliding means for moving said second die in said directions.

4. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a resilient support for the blank cooperating with said second die, said support descending into said second die as said first die carries the blank to operative position and automatically rising with the first die on completion of the forming operations to expel the formed blank from within the second die, stripping means cooperating with the first die to remove the formed blank therefrom as the first die rises, and cooperating rotary means and sliding means for moving said second die in said directions.

5. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a foot associated with said first die and receivable within the blank to carry the blank into position to be operated upon, means holding said foot in sliding engagement with said first die and permitting it to move with said second die and blank during the forming operations, and interengaging means between said first die and its foot to guide the movement of said foot in the paths of movement of said second die, said interengaging means serving to return the blank to central position after each forming operation.

6. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a foot associated with said first die and receivable within the blank to carry the blank into position to be operated upon, means holding said foot in sliding engagement with said first die and permitting it to move with said second die and blank during the forming operations, interengaging means between said first die and its foot guiding the movement of said foot in the paths of movement of said second die, and cooperating rotary means and sliding means for moving said second die in said directions.

7. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a foot associated with said first die and receivable within the blank to carry the blank into position to be operated upon, a resilient support for the blank cooperating with said second die, said support descending into said second die as said first die carries the blank to operative position and automatically rising with the first die on completion of the forming operations to expel the formed blank from within the second die, means holding said foot in sliding engagement with said first die and permitting it to move with said second die and blank during the forming operations, and interengaging means between said first die and its foot to guide the movement of said foot in the paths of movement of said second die.

8. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a foot associated with said first die and receivable within the blank to carry the blank into position to be operated upon, a resilient support for the blank cooperating with said second die, said support descending into said second die as said first die carries the blank to operative position and automatically rising with the first die on completion of the forming operations to expel the formed blank from within the second die, means holding said foot in sliding engagement with said first die and permitting it to move with said second die and blank during the forming operations, interengaging means between said first die and its foot to guide the movement of said foot in the paths of movement of said second die, and cooperating rotary means and sliding means for moving said second die in said directions.

9. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, a foot associated with said first die and receivable within the blank to carry the blank into position to be operated upon, a resilient support for the blank cooperating with said second die, said support descending into said second die as said first die carries the blank to operative position and automatically rising with the first die on completion of the forming operations to expel the formed blank from within the second die, means holding said foot in slid-

ing engagement with said first die and permitting it to move with said second die and blank during the forming operations, interengaging means between said first die and its foot to guide the movement of said foot in the paths of movement of said second die, cooperating rotary means and sliding means movable step by step for moving said second die in said directions, and means to advance said rotary means in a step by step movement.

10. In a press having upper and lower dies, means to lower the upper die from idle position to cooperative position with the lower die, means operating when said dies are in cooperative position to move the lower die relative to the upper die, means on the lower die cooperating with the upper die to perform a forming operation on a blank during said relative movement, means to position the forming means on said lower die, said positioning means being constructed and arranged to locate and secure said forming means on said lower die, with its working surfaces in the same relation to the die surface after redressing as before.

11. In a press of the character described, a lower die having an insert mounted thereon, an adjustment member engaging the lower edge of a groove on the insert, said groove being so constructed and arranged that when the working surfaces and the base of said die and insert are ground to redress them after wear said adjustment member will always engage the lower edge of said groove to hold the insert firmly seated.

12. In a press of the character described, a lower die having an insert located in a slot in the top face of the die, a securing member in said die engaging the lower edge of a groove in the side of said insert, said groove being so constructed and arranged that on grinding the working surfaces and base of said insert and die the securing member will always engage the lower edge of the groove to hold the insert seated firmly.

13. In a press of the character described, a lower die having an insert located in a slot in the top face of the die, a securing member in said die engaging the lower edge of a groove in the side of said insert, said groove being so constructed and arranged that on grinding the working surfaces and base of said insert and die the securing member will always engage the lower edge of the groove to hold the insert seated firmly, and an adjustment member in said die to adjust the insert longitudinally.

14. In a press, a lower die movable horizontally and having an aperture, an upper die vertically movable into cooperative relation to the lower die, a foot on the upper die receivable in a blank and with the blank being receivable in said aperture, and a slidable connection between said foot and upper die permitting movement of said foot as said lower die moves horizontally, and a platform in said aperture normally urged upwardly but depressible as said foot and blank descend, said platform rising as said foot rises, to eject the blank from the aperture.

15. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, and means to advance said rotary means in a step by step movement.

16. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, means to advance said rotary means in a step by step movement, and means to prevent overtravel of said rotary means beyond a predetermined point in each advance.

17. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, means to advance said rotary means in a step by step movement, and means to prevent overtravel of said rotary means beyond a predetermined point in each advance, comprising a catch engageable with notches in said rotary means.

18. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, means to advance said rotary means in a step by step movement, means to prevent overtravel of said rotary means beyond a predetermined point in each advance, and means rendering said overtravel-preventing means operative when said advancing means is active.

19. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, means to advance said rotary means in a step by step movement, means to prevent overtravel of said rotary means beyond a predetermined point in each advance, and means rendering said overtravel-preventing means inoperative when said advancing means becomes inactive.

20. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, means to advance said rotary means in a step by step movement, means to prevent overtravel of said rotary means beyond a predetermined point in each advance, means rendering said overtravel-preventing means operative when said advancing means is active, and means rendering said overtravel-preventing means inoperative when said advancing means becomes inactive.

21. In a press, cooperating dies, a plurality of slidable devices for moving one die, and means for moving said slidable devices comprising rotary means, cam means carried by said rotary means and causing movement of said slidable devices from a neutral position in a plurality of different directions to cause corresponding movement of said die, means to advance said rotary

means in a step by step movement, means to prevent overtravel of said rotary means beyond a predetermined point in each advance, comprising a catch engageable with notches in said rotary means, and a lost motion connection between said catch and said advancing means.

22. In a press, rotary means for causing operation of a die, means to advance said rotary means in a step by step movement, means to prevent overtravel of said rotary means beyond a predetermined point in each advance comprising a catch engageable with notches in said rotary means, and means rendering said catch inactive when said advancing means becomes inactive.

23. In a press, a plurality of slidable devices for moving a die, cam means acting on said devices to move them in angularly different directions from a central position, rotary means carrying said cam means and operating said devices as said cam means are moved into engagement with said devices, two of said cam means being positioned to cause successive movements of one slidable device in opposite directions and later to cause successive movements of another slidable device in an angularly different direction as said rotary means rotates.

24. In a press, a plurality of slidable devices for moving a die, cam means acting on said devices to move them in angularly different directions from a central position, rotary means carrying said cam means and operating said devices as said cam means are moved into engagement with said devices, one pair of said cam means being positioned to cause successive movement of one slidable device in opposite directions and another pair of said cam means being positioned to cause later successive movements of a second slidable device in angularly different directions from said first slidable device and a third pair of said cam means being positioned to cause said one slidable device to move again in said opposite directions after said second device has completed its movement, said movements of said slidable devices occurring during approximately 90° rotative movement of said rotary means.

25. In a press, a pair of slidable devices for moving a die, three pairs of cam means and a complete operation on a blank by said die comprising movements of one slidable device in two directions and of the second slidable device in two directions angularly different from the first slidable device, the first slide being moved in three operations by the first, third and second pairs of cam means in that order, the second slidable device being moved during said three operations by the second, first and third cam means in that order.

26. In a press, a plurality of slidable devices for moving a die in different directions from a given position, rotary means, cam members carried by said rotary means and operating on said slidable devices to move them in different directions, supporting means in which said rotary means is mounted for rotation, said supporting means and rotary means having cooperating tapered surfaces.

27. In a press, cooperating dies constructed and arranged to have relative transverse movement, one of said dies having a slidable part receivable within and movable with the other die while said one die remains stationary, means holding said sliding part against said one die, and movable means carrying and moving said other die, said holding means comprising a rod having a swivel connection with said sliding part and passing through a passage in said carrying means, said passage having an enlarged upper portion, a sleeve on said rod and received in said enlarged portion and having a curved bottom end seated in a complementary curved bottom of said enlarged portion, securing means on said rod engaging the upper end of said sleeve whereby said rod may pivot about the engagement of said curved portions.

28. In a press, cooperating dies constructed and arranged to have relative transverse movement, one of said dies having a slidable part receivable within and movable with the other die while said one die remains stationary, means holding said sliding part against said one die, and movable means carrying and moving said other die, said holding means comprising a rod having a swivel connection with said sliding part and passing through a passage in said carrying means, said passage having an enlarged upper portion, a sleeve on said rod and received in said enlarged portion and having a curved bottom end seated in a complementary curved bottom of said enlarged portion, securing means on said rod engaging the upper end of said sleeve and adjustable to give small clearance between said die and its sliding part, and resilient means to take up said clearance but permitting said rod to pivot about the engagement of said curved portions.

29. In a press, cooperating dies constructed and arranged to have relative transverse movement, one of said dies having a slidable part receivable within and movable with the other die while said one die remains stationary, means holding said sliding part against said one die, and movable means carrying and moving said other die, and means to guide the sliding movement of said slidable part comprising inserts slidably fitting in slots in said one die and having key projections into grooves in said sliding part, said key projections cooperating with said grooves to cause in and out movement of certain of said inserts within their slots as said slidable part is moved in the direction of the slots within which the certain inserts fit.

30. In a press, cooperating dies constructed and arranged to have relative transverse movement, one of said dies having a slidable part receivable within and movable with the other die while said one die remains stationary, means holding said sliding part against said one die, and movable means carrying and moving said other die, means to guide the sliding movement of said slidable part comprising inserts slidably fitting in slots in said one die and having key projections into grooves in said sliding part, said key projections cooperating with said grooves to cause in and out movement of certain of said inserts within their slots as said slidable part is moved in one direction, and similar keyed inserts similarly cooperating with similar slots and grooves in said die and slidable part as the latter is moved in a direction angularly different from said one direction.

31. In a press, cooperating dies constructed and arranged to have relative transverse movement, one of said dies having a slidable part receivable within and movable with the other die while said one die remains stationary, means holding said sliding part against said one die, and movable means carrying and moving said one die, means to guide the sliding movement of said

slidable part comprising inserts slidably fitting in slots in said one die and having key projections into grooves in said sliding part, said key projections cooperating with said grooves to cause in and out movement of certain of said inserts within their slots as said slidable part is moved in one direction, and similar keyed inserts similarly cooperating with similar slots and grooves in said die and slidable part as the latter is moved in a direction angularly different from said one direction, the groove receiving the key projection of an insert being at right angles to the slot in which said insert fits whereby on movement of said sliding part in the direction of the groove said insert will remain stationary.

32. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, cooperating rotary means and sliding means comprising a plurality of cam-actuated members working in a single path for moving said second die in said directions, and means to move said rotary means step by step.

33. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, cooperating rotary means and sliding means comprising a plurality of cam-actuated members working in a single path for moving said second die in said directions.

34. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, cooperating rotary means and sliding means for moving said second die in said directions, and means on said rotary and sliding means comprising a plurality of cam-actuated means working in a single path to complete all the forming movements of said second die for one blank in a fraction of each rotation of said rotary means.

35. In a press, a die movable up and down between idle and operative positions, a second die movable transversely to said up and down movement in a plurality of directions from a central position to perform a plurality of forming operations on a hollow blank while the first die remains stationary, cooperating rotary means and sliding means movable step by step for moving said second die in said directions, and means on said rotary and sliding means comprising a plurality of cam actuated means working in a single path to complete all the forming movements of said second die for one blank in a fraction of each rotation of said rotary means.

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