E. W. ZEH.

DRAWING PRESS.

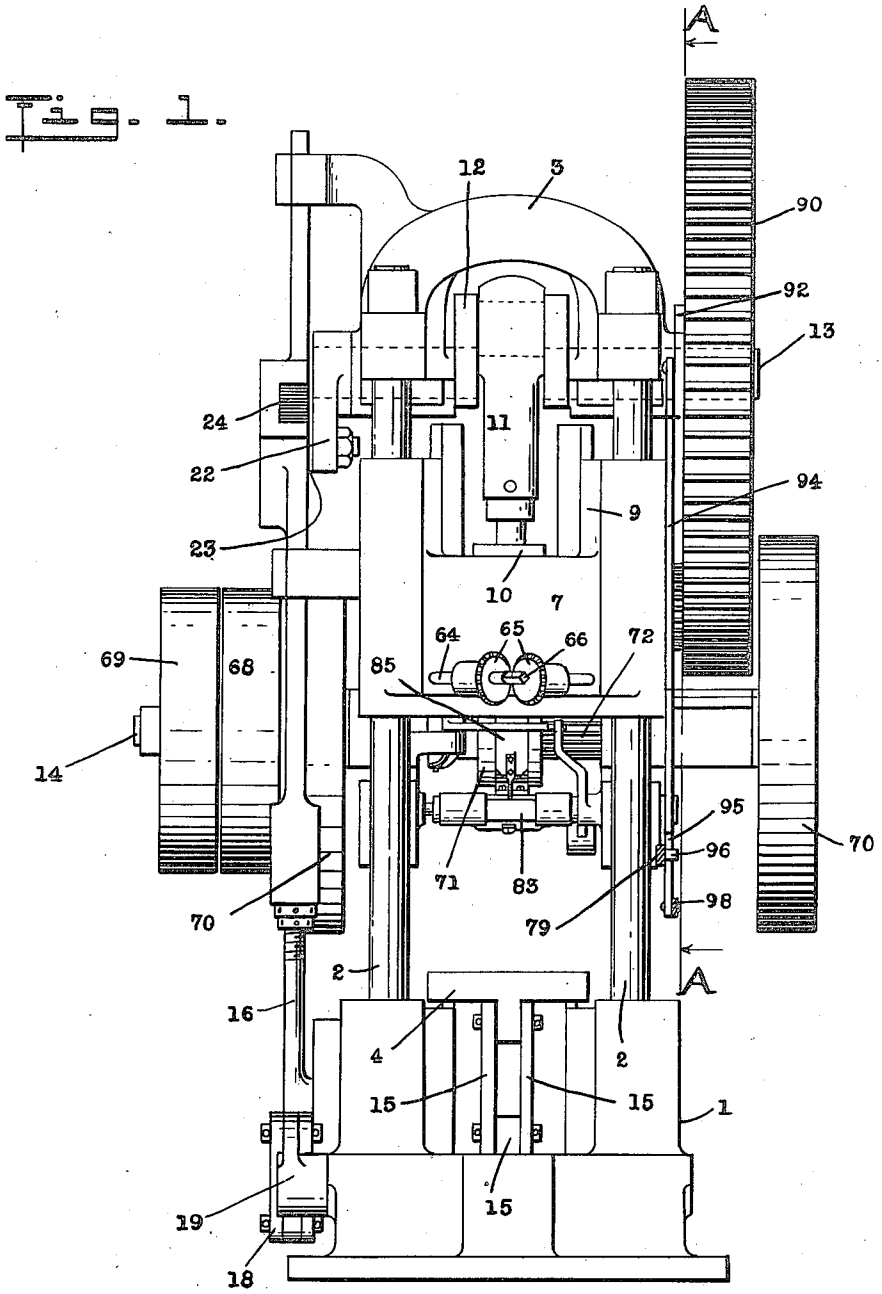
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Patented Nov. 25, 1919.

6 SHEETS—SHEET 1.

Fig. 1.



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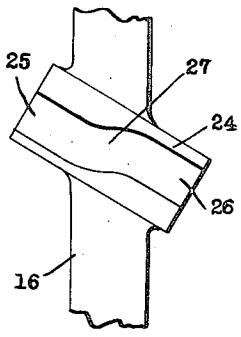


Fig. 3.

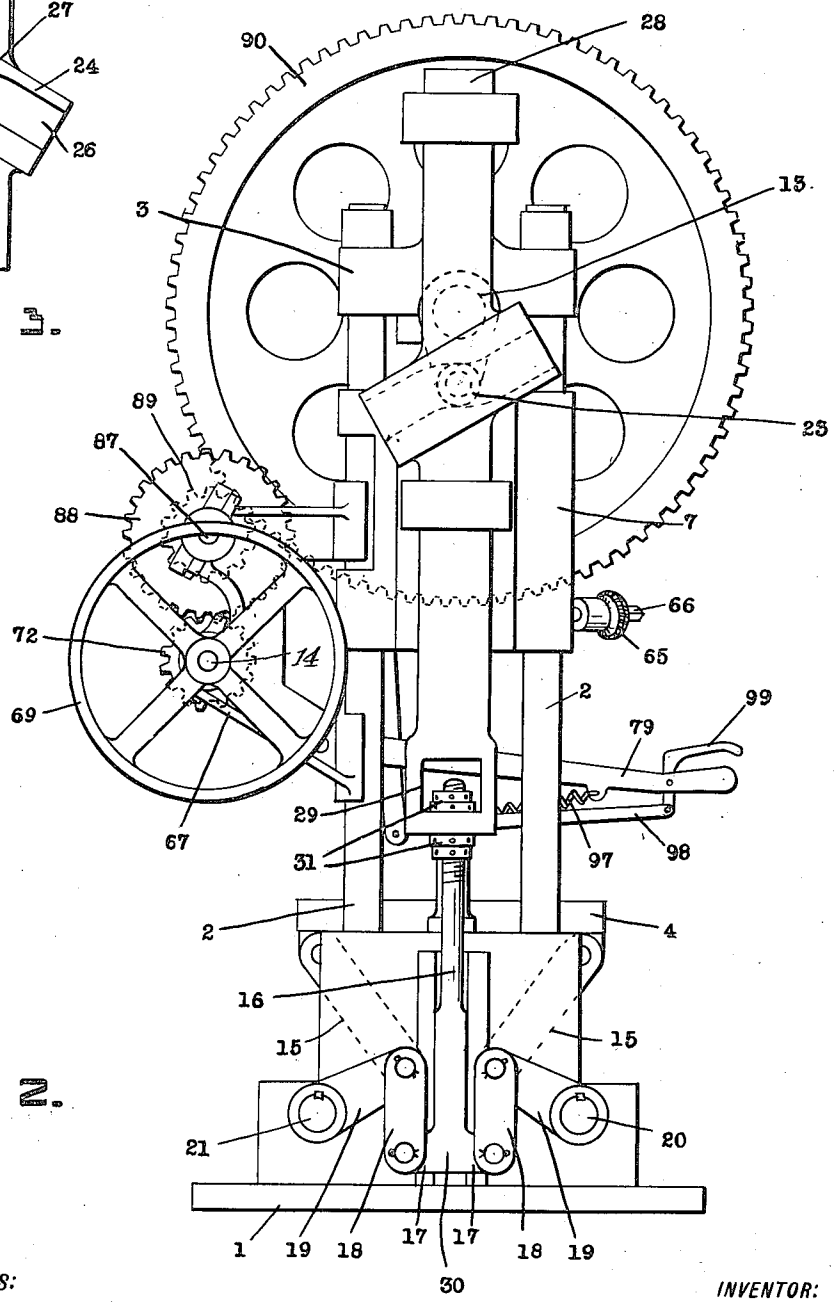


Fig. 2.

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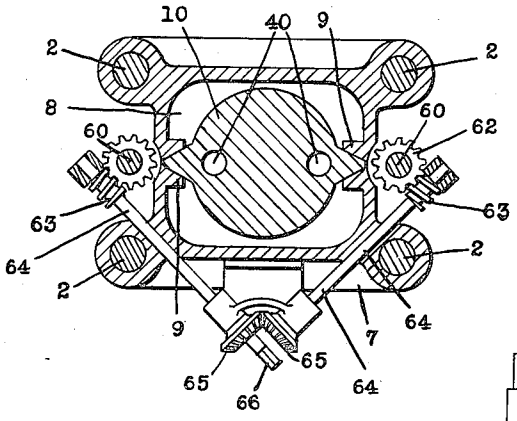


Fig. 5.

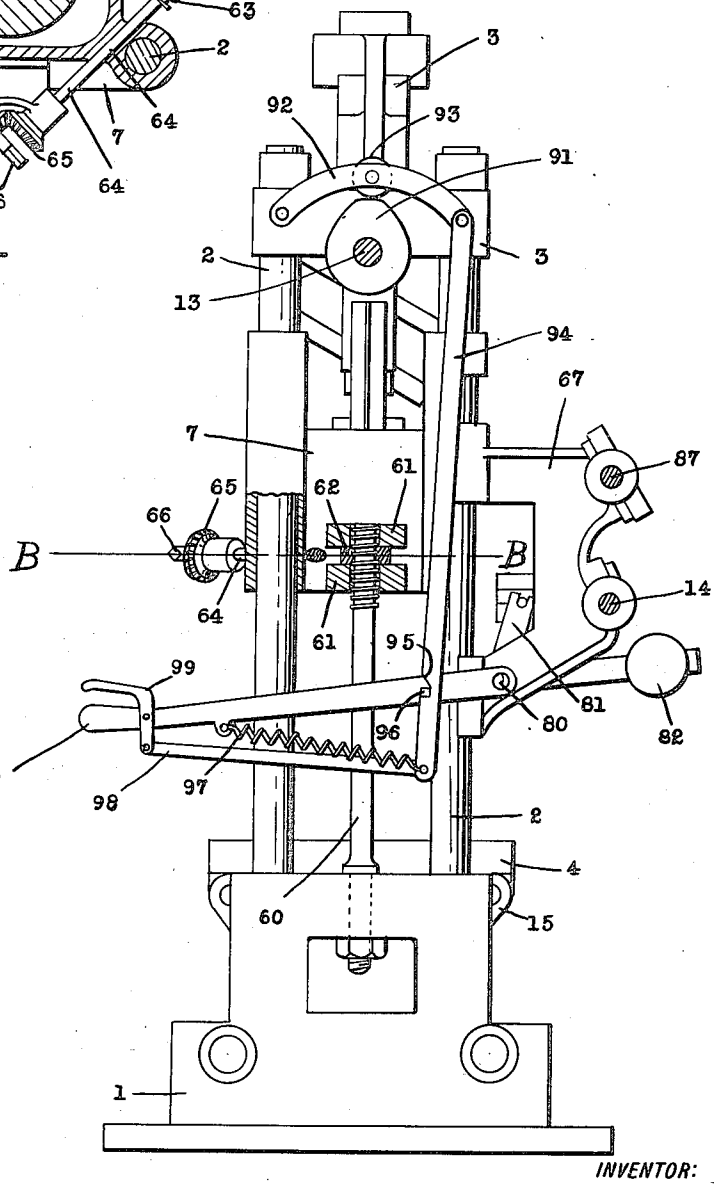


Fig. 4.

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6 SHEETS—SHEET 4.

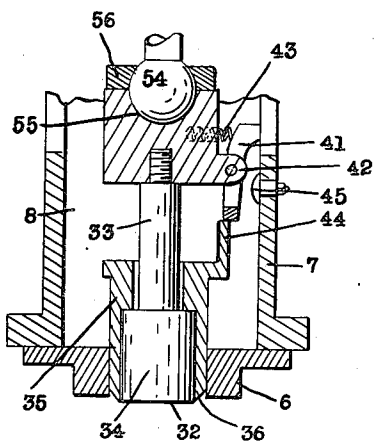


Fig. 6.

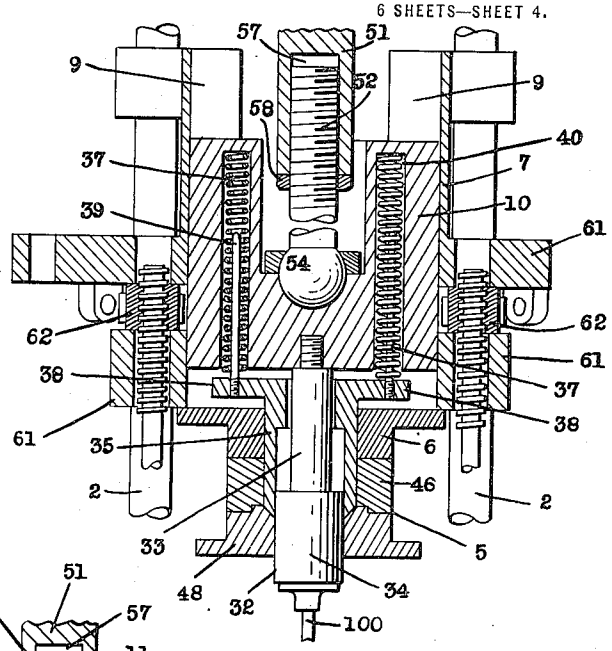


Fig. 7.

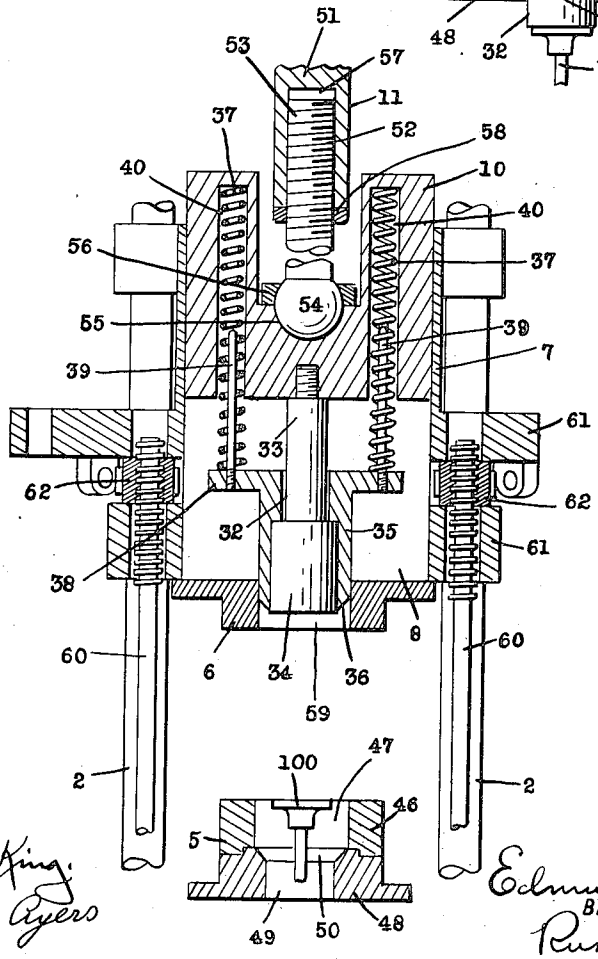


Fig. 8.

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6 SHEETS—SHEET 5.

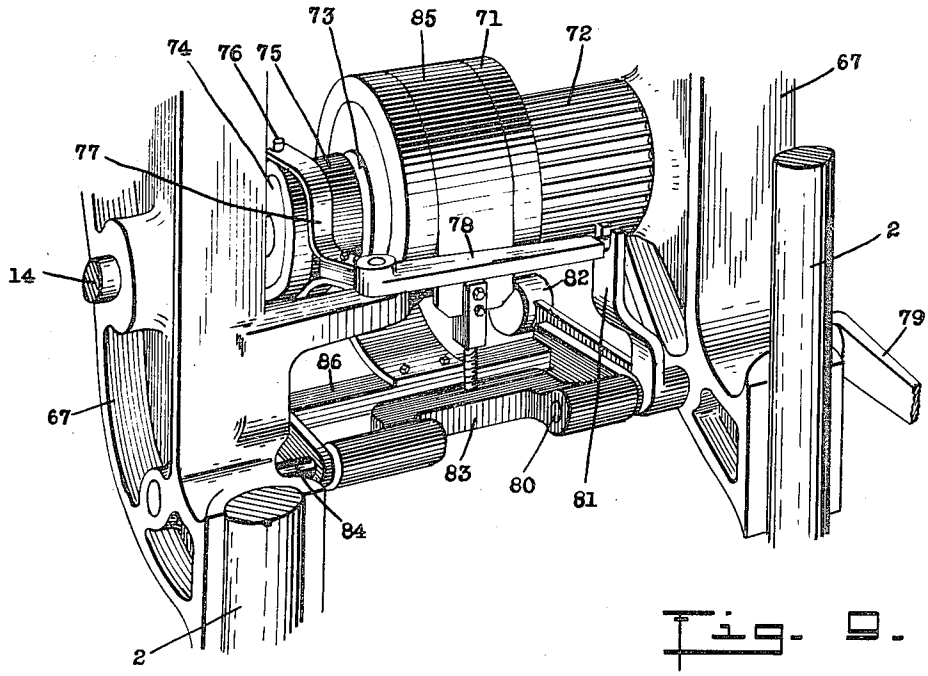
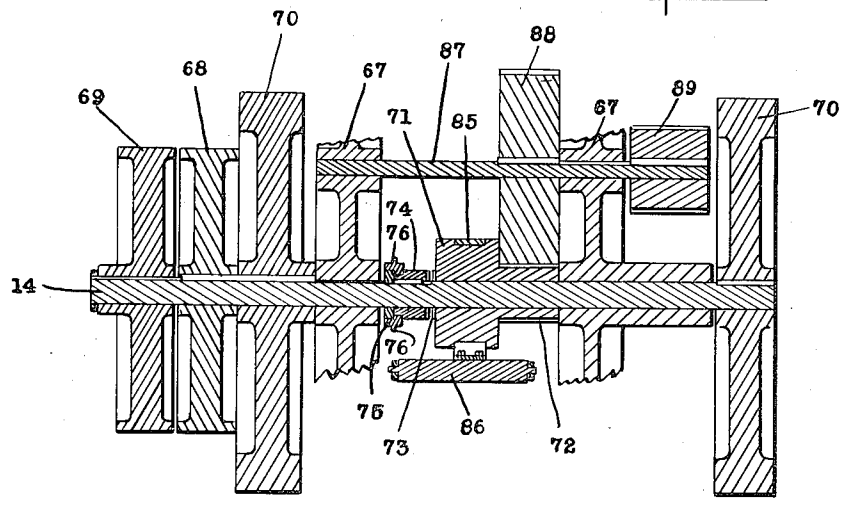


Fig. 9.

Fig. 10.



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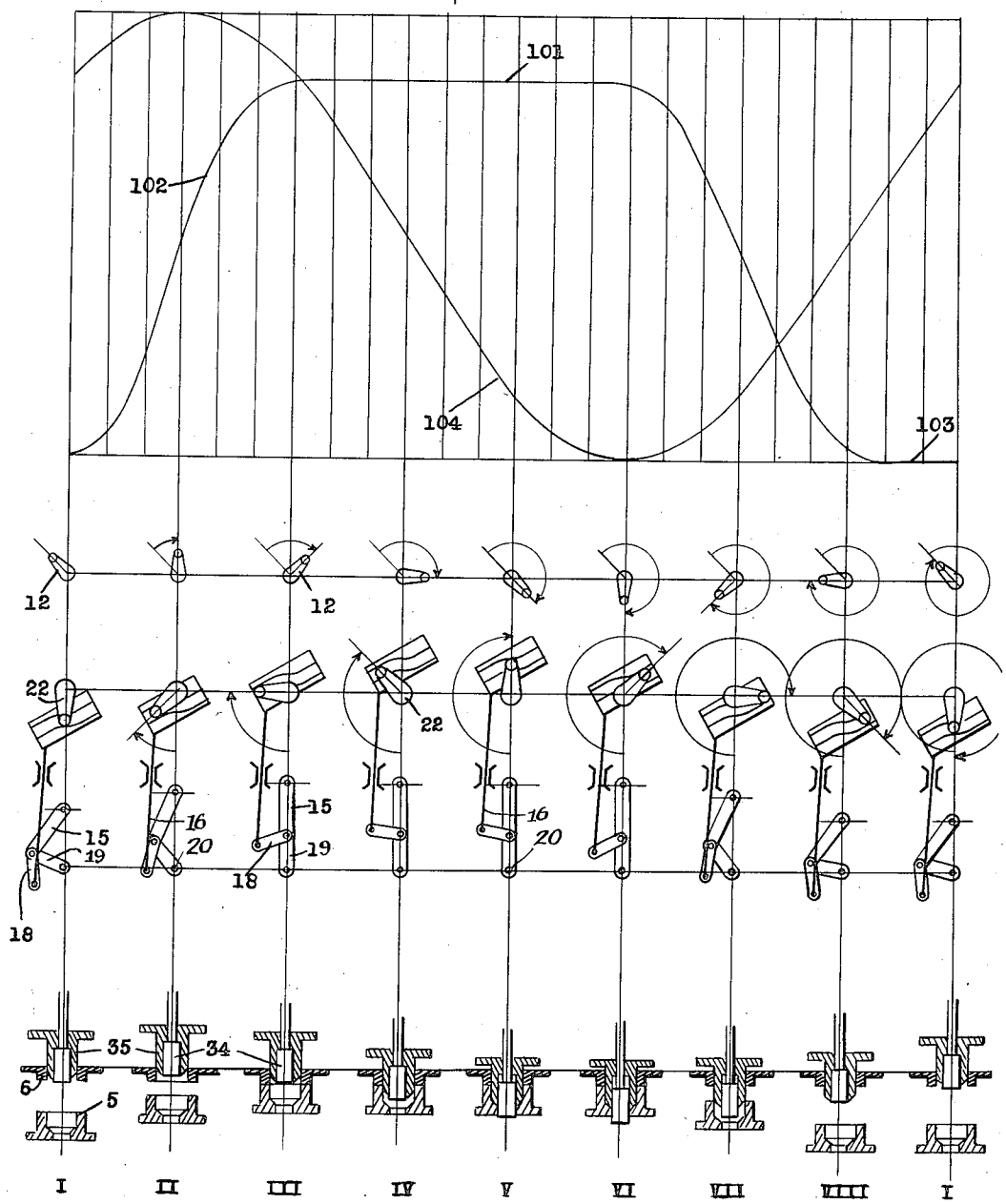
APPLICATION FILED JUNE 2, 1916.

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6 SHEETS—SHEET 6.

Fig 11.



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UNITED STATES PATENT OFFICE.

EDMUND W. ZEH, OF NEWARK, NEW JERSEY.

DRAWING-PRESS.

1,322,861. Specification of Letters Patent. Patented Nov. 25, 1919.

Application filed June 2, 1916. Serial No. 101,219.

To all whom it may concern:

Be it known that I, EDMUND W. ZEH, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Drawing-Presses, of which the following is a specification.

This invention relates more particularly to presses for drawing sheet metal blanks into cup-shaped products, and particularly cups of small diameter compared with their depth. It will be understood by those familiar with the art that especial care has to be exercised to prevent splitting the metal when forming deep cups of small diameter from sheet metal. The present invention utilizes a multiple drawing of the metal, that is, first draws a cup of larger diameter than required, and then redraws the metal to a smaller diameter, and so on until the desired size is reached.

The objects of the invention are to provide such a machine in which the reciprocating parts have slow individual movement; to thus avoid abruptness and undue strain on the metal; to move the lower die upward for clamping the blank and the hammer downward for drawing the metal; to obtain a dwell in the movement of the table carrying the lower dies in its extreme upper and lower positions; to obtain this dwell partly by toggles and partly by offsets in the slot of a crank and slot drive for the toggles; to clamp the blank to the table or blank holder by raising the table and maintaining it in raised position with the metal in engagement with an adjustable head during drawing of the metal; to provide tension members for said head whereby blanks of various thickness may be accommodated; to secure the adjustment of said head at the front of the machine convenient to the operator; to maintain the same in accurate parallel relation to the table or blank holder for insuring uniform distribution of presssure on the blank; to secure an improved control for automatically throwing the clutch out and simultaneously applying the brake to stop the machine upon completion of each cycle; to provide means whereby the operator may manually throw out this control before the completion of the cycle so that the press will continue to operate through another cycle; to provide an improved multiple drawing hammer; to insure positive action thereof; to secure simplicity of construction and operation, and to obtain other advantages and results as may be brought out in the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate the same parts throughout the several views,

Figure 1 is a front elevation of a drawing press embodying my invention;

Fig. 2 is a side view thereof;

Fig. 3 is a detail view of a certain cam slot;

Fig. 4 is a section on line A—A of Fig. 1;

Fig. 5 is a sectional view taken on line B—B of Fig. 4;

Fig. 6 is a vertical sectional view centrally through the head, hammer and lower die showing the hammer raised;

Fig. 7 is a similar sectional view showing the parts in operation;

Fig. 8 is a vertical sectional view of the head at right angles to the sections of Figs. 6 and 7;

Fig. 9 is a perspective view of the driving and brake mechanisms;

Fig. 10 is a vertical section taken longitudinally thereof, and

Fig. 11 is a diagrammatical illustration of the movement and relation of the parts during operation of the machine.

In order to give a brief general idea of my improved machine, I would say that in the said drawings the reference numeral 1 indicates a suitable bed or base from the four corners of which guideposts 2 extend upward and are secured at their upper ends in a suitable top piece 3. Between the four guideposts 2, is a table 4 adapted to be raised from and returned to the bed 1 as the machine operates, and it is to be understood that in use, a suitable lower die 5, (see Figs. 6 and 7), is mounted on top of said table. As the table is raised, a flat metal blank placed on the lower die is clamped against an upper die or clamp 6 carried by an opposing head 7 adjustably mounted on said four guideposts 2. Said head 7 is vertically recessed or hollow as at 8 and provides tracks or ways 9, 9 on the inner walls of its recess or chamber to guide a hammer 10 vertically up and down within said head. In the use of my machine, I first clamp the metal between

the clamp 6 and lower die 5, and then draw the metal down into the lower die by causing the hammer to descend. Said hammer is reciprocated by a pitman 11 operated by a crank 12 of a crank shaft 13 extending from side to side of the machine in suitable journals in the top piece 3, as shown in Figs. 1 and 2. A driving shaft 14 is located at the back of the machine and adapted to rotate the crank shaft 13 through a train of gearing with a suitable clutch.

Describing more in detail the specific embodiment of the invention illustrated in said drawings, the table 4 is shown as adapted to be raised and lowered by means of a plurality of toggles 15, see Figs. 1 and 2, said toggles receiving their movement from a vertically sliding bar 16 at the side of the machine and actuated from the crank shaft 13. The lower extremity of this slide bar 16 has suitable ears 17, 17 extending toward the front and back of the machine and connected by links 18, 18, adapted to swing in a vertical plane at the side of the machine, to the ends of cranks 19, 19 secured to rock shafts 20, 21 at the front and back of the machine respectively below the table. Said shafts carry fast on themselves the lower members of the toggles 15, whereby said toggles are operated as the cranks are swung up or down, and the upper member of the toggles being pivoted to the table. It will be obvious that as the slide bar is raised the links 18 will push upwardly on the cranks 19 and will approach horizontal position, and when said links are in substantially horizontal position, the slide bar may have a considerable vertical movement without materially disturbing the position of the toggles. I prefer to have the toggles in substantially vertical alinement when the links 18 approach the horizontal and when the table is at its highest point, thereby obtaining a pause for the table in this position. It is also preferable to operate the slide bar 16 so as to obtain a pause thereof at its raised or uppermost position, and thus increase the length of time or pause of the table at its upper position. To this end a crank 22 terminates the crank shaft 13 at its end adjacent said slide bar, an outwardly extending roller 23 on the end of said crank engaging in a transverse and preferably inclined slot 24 of the slide bar. Although this slot may be straight, it is preferable to form it as shown in Fig. 3, with its ends 25, 26 offset out of alinement but still parallel, the upper end 25 of the slot being offset downwardly and the lower portion 26 of the slot offset upwardly and said offset portions 25 and 26 being joined to form a continuous slot by a middle portion 27 the center line of which is a reverse curve with its radii of curvature both equal to the radius of the circle of revolution of the center of the crank 22 about the crank shaft 13. Obviously, therefore, as the crank revolves and the roller 23 travels in the curved portion of the slot 24 with the center of curvature coincident with the center of the shaft, a pause in the movement of the slide bar will result, and this pause I have arranged to occur not only when the table 4 is at its highest position but will also occur when the table is at its lowest position.

It may here be noted that it is preferable to construct the slide bar 16 longitudinally adjustable, and to this end I have shown the same comprising an upper section 28 transversely recessed adjacent its lower end as at 29, see Fig. 2, and a lower section 30 screw-threaded at its upper end and inserted in a suitable hole drilled upwardly from the bottom of the upper section 28 into the recess 29. This lower section 30 is then clamped in adjusted position to the upper portion by suitable nuts 31, 31, and by thus varying the length of the slide bar, the toggles are regulated in their movement to elevate the table.

As the table is raised I arrange to have the hammer 10 descend, and for shaping the blank, I provide an upper die on the hammer to coöperate with suitable dies on the table 4, said upper die depending axially from the bottom of the hammer and being preferably removable so that different sizes and shapes of dies can be used in the machine. Said upper die comprises a punch 32 fast with respect to the hammer, as by screwing thereinto, and a sleeve 35 adapted to slide on the punch. Preferably the punch has an upper shank 33 with an enlarged lower end 34, and the sleeve is correspondingly shaped so that its downward movement is limited by engagement with the enlarged end of the punch. When in its lowest position with respect to the punch, said sleeve preferably terminates at the bottom of the punch, and preferably the lower edge of the sleeve is beveled upwardly outward as shown at 36. Said sleeve is normally held in such lowest position upon the hammer by a pair of compression springs 37, 37 spaced peripherally of the sleeve and seated on suitable ears 38, 38 projecting radially from the upper end of said sleeve with pins 39 entering the springs; the upper ends of said springs are positioned within suitable sockets 40, 40 in the bottom of the hammer 10, and thus the sleeve 35 is normally held downward away from the hammer.

It is to be understood that the dies now being described are for double drawing of metal, that is, a sheet of metal is first drawn into cup shape of one diameter and then redrawn to a smaller diameter, and this operation I effect with one downward descent of the hammer. The first draw of the

metal is to a cup having an inside diameter substantially equal to the outside diameter of the sleeve by the simultaneous descent of the punch and sleeve, and the second draw is effected by the further descent of the punch alone, shaping the cup to the diameter of the punch and elongating it. In many instances where the thickness of the metal being drawn is not prohibitive, the sleeve 35 would descend with the punch by no other means than the pressure of the springs 37, 37, but to insure the positive descent of the sleeve to effect its draw, I provide a spring-actuated detent, see Fig. 8, for locking the punch and sleeve together for the portion of the stroke necessary to complete the metal drawing imposed upon the sleeve. This detent comprises a vertically disposed finger 41 pivoted to a laterally projecting lug 42 at the bottom of the hammer 10, and forced normally outward therefrom at its upper end by a spring 43. The lower end of said finger is arranged to engage on top of a bracket 44 projecting from the sleeve 35 and carry the sleeve and punch downward together, until the upper end of said finger 41 engages a lateral protuberance 45 arranged on the inner wall of the head 7 and swings the lower end of said finger off the bracket 44 and allows the hammer and punch to descend farther while the sleeve remains stationary.

Carried by the table 4 is the lower or drawing die 5, axially coincident with the upper or punching die. This lower die consists of an upper member 46 which acts as a blank holder, being centrally apertured, at 47, to receive the sleeve 35 surrounding the punch 32 with of course sufficient clearance to accommodate the blank within the aperture 47 and around the sleeve. The lower or second drawing member 48 has an aperture 49 large enough to receive only the punch 32, with the material, and is chamfered at its upper periphery, as at 50, to correspond to the chamfer 36 on the sleeve. (See Figs. 6 and 7.)

The relation of the hammer to the lower die and table 4 may be adjusted or regulated vertically by varying the length of the pitman 11. To this end, the pitman is constructed with an upper portion 51 and a lower portion 52 adjustably connected, (see Figs. 6 and 7). The lower portion comprises a screw 53 the lower end of which is globular, as at 54, and is carried in a socket 55 in the top of the hammer by a clamping plate 56 surrounding the upper and smaller part of the globular end 54 thereby preventing its withdrawal. The upper end of the screw 53 is inserted in a threaded socket 57 extending longitudinally upward from the bottom end of the upper portion 51 of the pitman. Obviously by revolving the screw 53 any desired adjustment up or down may be given the hammer, and this adjustment may be maintained by a suitable lock nut 58 on said screw.

As the table is raised in operation of the machine, a blank laid upon the upper member 46 of the drawing die 5 will engage and be clamped against the under surface of the blank holder 6 secured on the under side of the head 7. This holder 6 provides a central hole 59 which slidably receives the sleeve 35 on the punch 32 and guides the same to accurately enter the aperture of the lower die. In order to adjust the elevation of this blank holder 6 to the particular lower dies and metal blanks being used, the head 7 to which the blank holder is secured is adapted to be moved vertically upon the four guide-posts 2. To this end the head 7 is supported accurately in adjusted position by a pair of opposite bolts 60 parallel to the posts 2 and extending upwardly from the base 1 at opposite sides of the machine between the front and rear posts. These bolts are preferably long enough and of a sufficiently small cross-section so as to elastically elongate slightly as occasion may require to accommodate variations in the thicknesses of the metal or blank. The particular disclosure of the invention shown in the drawings illustrates these bolts slidably passing each through a pair of upper and lower spaced ears 61, 61 on the sides of the head 7, (see Figs. 6 and 7), and between the ears of each pair and centrally threaded to receive the threads of the bolts 60 is a pinion 62 the teeth of which mesh with a horizontally disposed worm 63 on a shaft 64 extending diagonally to the front and center of the machine through the head 7, (see Fig. 5). On the front ends of these shafts are bevel gears 65, 65 meshing with each other so that rotation of one results in rotation of the other, and one of said shafts has an end 66 projecting beyond the bevel gear for receiving a crank (not shown) or other means for turning the same. Obviously as these shafts are thus rotated, the worms 63 revolve the pinions 62 which thereby either move up or move down the stationary bolts 60, simultaneously, and carry the head 7 with them. In this manner, it will be seen, a very accurate adjustment upward or downward may be effected and the head maintained in true parallel relation to the table.

From the two posts 2 at the back of the machine, see Fig. 2, suitable brackets 67 project rearward in which is journaled the driving shaft 14 having at one end fast and loose pulleys 68, 69 and provided with fly wheels 70, 70 at opposite sides of the machine. Rotatably loose upon this shaft is a drum 71, see Fig. 9, disposed centrally between the brackets 67, 67 and secured at one end to a pinion 72, also rotatably mounted on said shaft. At its other end the drum is formed

as a clutch member 73 to coact with a slidable clutch member 74 splined to the shaft 14. This slidable clutch member 74 is provided with a rotatable collar 75 having diametrically opposite trunnions 76, 76 which are engaged in the forked end 77 of a horizontally disposed bell-crank lever 78. Obviously by swinging the bell-crank lever in one direction, the clutch is thrown in and by swinging the bell-crank lever in the other direction the clutch is thrown out. For so swinging the bell-crank lever, I provide an operating lever 79 outside of the bracket 67, preferably on the right-hand side of the machine as an operator stands in front of it, and extending forwardly toward the front of the machine within convenient reach of the operator. Said lever is non-rotatably secured at its rear end upon a rock-shaft 80 projecting through the bracket 67 below the bell-crank lever 78, and an upwardly directed arm 81 fixed to said rock-shaft and slotted at its upper end engages the free end of the bell-crank lever 78 transversely thereof. Obviously by swinging the operating lever 79, the rock-shaft 80 is turned and the arm 81 thereon swings the bell-crank 78 to shift the slidable clutch member 74, and in the particular construction and arrangement of parts herein shown to depress the forward end of the operating lever results in throwing in the clutch. A suitably positioned counter-weight 82 normally holds the clutch thrown out and the levers swung into corresponding position.

In the drawings, I have shown the rock-shaft 80 extending inwardly beyond the arm 81 and carrying one end of a U-member 83 non-rotatably fixed thereon, the other end of said U-member being supported upon a pivot rod 84 secured in the bracket 67 opposite the rock-shaft 80 and in alinement therewith. Adjustably attached to the middle portion of the U-member is a band brake 85 extending around the drum 71, and thus when the operating lever 79 is swung up to throw the clutch out, the middle portion of the U-member is swung down which tightens the band 85 upon the drum and stops the machine. Although the other end of the brake band may be secured in any way, I have shown the same attached to the middle portion of a yoke 86, the free ends of the arms of which loosely swing upon the rock-shaft 80 and pivot rod 84.

Journaled within the brackets 67, 67 and disposed in parallel relation to and above the driving shaft 14 is a counter-shaft 87, (see Figs. 2 and 10), having keyed to itself a transmission gear 88 meshing with the pinion 72. Said counter-shaft also has keyed to itself upon the outside of the bracket 67 a pinion 89, meshing with a large gear wheel 90 on the crank shaft 13 carried by the top piece 3 and extending from side to side of the machine. Obviously, with the clutch thrown in, the crank shaft 13 is driven slowly from the pulley 68.

In order to automatically throw out the clutch 73—74 with each revolution of the crank shaft 13, a cam 91 is placed on the end of said crank shaft above the operating lever 79, and at one side of this cam a rocking arm 92 is fulcrumed to the top piece 3, (see Fig. 4). Said rocking arm extends over the cam 91 and is provided with a roller 93 to engage the same and thus reduce wear and friction so as to insure accuracy of operation. The free end of this rocking arm which extends beyond the cam 91 pivotally receives a depending upright link 94 which crosses the operating lever 79, contiguous to the same, and on the front edge of this link 94 is a notch 95 which will take under a stud 96 projecting laterally from said operating lever. A helical tension spring 97 secured to both the depending link 94 and the operating lever 79 normally draws the front edge of said link against the stud 96 on said lever. The lower edge of this notch is preferably perpendicular to the front edge of the link, so that the stud 96 will lodge thereagainst, but the top edge of the notch is inclined so the stud will ride out of the notch. With the operating lever 79 raised, as in Fig. 4, and the machine standing idle, the operator disengages the notch 95 of the link 94 from the stud 96 and lowers the operating lever 79, throwing in the clutch and thus causing the crank shaft 13 to operate. The cam 91 likewise revolves and in doing so allows the link 94 to lower so the notch 95 passes the stud 96. Then the cam operates to raise the link as it comes back to initial position, and in doing so the stud 96 is engaged within the notch 95 whereby the operating lever is raised, throwing out the clutch, applying the brake and stopping the machine. In this manner the machine completes one cycle when started by the operator and then stops, but of course if the operator desired to stop the machine before that cycle is complete he could readily do so by manually raising the operating lever.

For conveniently swinging the link 94 to disengage the notch 95 from the stud 96 I have shown the link prolonged below the operating lever 79 and pivotally supporting therebelow an arm 98 extending to the front of the machine where it is pivoted to one arm of a bell-crank lever 99 fulcrumed to the operating lever and arranged so the operator can conveniently grip both the operating lever and the other arm of the bell-crank lever in one hand. By thus gripping the two parts, the link 94 is swung to clear the notch from the stud and it will be obvious that if the operator so desire, he could thus hold the link back from the stud so as to prevent the stud from entering the

notch at all and thereby allow the machine to continue upon another cycle, and so on.

In operation the blank is laid upon the upper member 46 of the lower die 5 and as the table is raised the blank is thereby clamped against the blank holder 6 on the head. Then as the hammer descends the sleeve 35 and punch head 34 first act in unison, drawing the blank from between the member 46 and blank holder 6 into the large aperture 47 of the upper member 46 of the lower or drawing die. The sleeve 35 then reaches its lowest position and presses the material between the chamfered edge 36 of itself and the chamfered edge 50 of the aperture 49 of the second or lower member 48 of the drawing die. Meanwhile the punch head 34 forces the metal blank into this lower or smaller aperture 49 to form the cup. When the punch reaches its lowest point, the forming operation is complete and the hammer, punch and sleeve are raised to initial position and the table lowered. The cup may be removed from the lower die by a stationary stand 100 extending upwardly into the apertures of the die members and upon which the cup rests as the table is lowered and which is on a level with the top of the upper member of the lower die when the same is at its lowest position, (see Figs. 6 and 7).

I prefer to have the downward stroke of the hammer lag 45° behind the upward movement of the slide bar 16 and table, that is, the machine comes to rest with the table in its lowest position and the hammer not entirely raised. This may be seen by reference to Fig. 11, where the upper row of cranks diagrammatically represents the positions of the crank 12 operating the hammer through a complete cycle, each position showing an advance of 45° from the former. The next lower row of cranks represents the positions of the cranks 22 operating the slide bar through a complete cycle. In connection with this line of cranks is shown a pair of toggles 15 and their operating link 18. The lowest row in the figure shows the resultant movements and relation of the hammer 10 and lower die 5. At the start, or on vertical line I, the slide bar operating crank 22 is on its lower dead center and the hammer operating crank 12 is 45° from its upper dead center. On line II the hammer crank 12 has reached its upper dead center and is ready to descend; meanwhile the toggles 15 are being straightened, this being accomplished by the slide bar operating crank 22 on line III. At that time the metal blank is clamped by the lower dies against the blank holder 6 and is held so during the entire down stroke of the hammer and until the hammer is starting to rise. Then, as the lower die is lowered, the punch head 34 by its upward retraction into the sleeve 35 pushes the cap off of itself and leaves said cup upon the stand 100.

By reason of the dwell produced by the middle portion 27 of the slot 24 in which the crank 22 operates, the lower die 5 carried by the table 4 remains stationary in its lowest position through the period between vertical line VIII and I as shown in Fig. 11, whereas in its highest position the said lower die remains stationary through the three periods between vertical line III and VI. The reason for this longer dwell when the lower die is up is that the link 18 which operates the toggles 15 is then in substantially horizontal position, so that movement of it to swing the toggles is very slight indeed and the longer dwell thus secured is utilized to give time for the double drawing which I have described to take place. The long dwell is indicated by the upper straight portion 101 of the curve 102 at the top part of Fig. 11, while the short dwell is indicated by the straight portion 103. The other curve 104 is the usual sine curve of the crank motion.

Having thus described the invention, what I claim is.

1. In a press of the character described, the combination of a table adapted to move up and down, a slide bar connected to said table to move the same and having a transverse slot with inclined ends offset parallel to each other and a substantially horizontal middle portion, and a crank having a pin working in said slot to raise and lower the table.

2. In a press of the character described, the combination of a member adapted to be reciprocated, a slide bar connected to said member to move the same and having a transverse slot with end portions extending in the same direction but offset with respect to each other and a middle portion extending in a different direction from said end portions, and a crank having a pin working in both said portions of the slot.

3. In a press of the character described, the combination of a table, a slide bar connected to said table to reciprocate the same and having a transverse slot with end portions inclined to the length of the bar and a middle portion at right angles thereto, and a crank having a pin working in said slot to reciprocate said bar.

4. In a press of the character described, the combination of a base, a table for lower dies, means on said base for raising and lowering the table, a blank holder above said base, bolts capable of stretching for slight differences in thickness of the metal being drawn extending from said base and spacing said blank holder therefrom, a plunger working through said blank holder, and means for operating said plunger.

5. In a press of the character described,

the combination of a base, a table for lower dies, means on said base for raising and lowering the table, four posts extending upward from said base, a blank holder slidable on said posts and guided thereby, a pair of opposite bolts each between two of the posts extending from the base and spacing said blank holder therefrom, said bolts being capable of stretching for slight differences in thickness of the metal being drawn, a plunger working through said blank holder, and means for operating said plunger.

6. In a press of the character described, the combination of a base, a table for lower dies, means on said base for raising and lowering the table, a blank holder above said base, bolts capable of stretching for slight differences in thickness of the metal being drawn fixed to said base and spacing said blank holder therefrom, nuts on said bolts secured to the blank holder as to movement longitudinally of the bolts and loose as to rotation, a plunger working through the blank holder, and means for operating said plunger.

7. In a press, the combination of driving means including a clutch, braking means, a control lever for operating said clutch and brake means together, means actuated by the press for automatically swinging said control lever to stop the press, and a release pivotally connecting said swinging means and control lever for manually disengaging them.

8. In a press, the combination of driving means including a clutch, braking means, a control lever for operating said clutch and brake means together, means actuated by the press for automatically swinging said control lever to stop the press, and a release pivotally connecting said swinging means and control lever for manually disengaging them, said release having a handle adjacent the handle of the control lever and adapted to be grasped therewith.

9. In a press of the character described, the combination of a table, a slide bar connected to said table to reciprocate the same and having a transverse slot with end portions inclined to the length of the bar in the same direction and a middle portion at right angles to the length of the bar, and a crank having a pin working in said slot to reciprocate said bar.

10. In a press of the character described, the combination of a table, a slide bar connected to said table to reciprocate the same and having a transverse slot with a middle portion and opposite inclined end portions which are parallel and offset with relation to each other, and a crank having a pin working in said slot to reciprocate said bar.

11. In a press of the character described, the combination of a table, a slide bar connected to said table to reciprocate the same and having a transverse slot with a middle portion at right angles to the length of the bar and end portions inclined thereto, and a crank having a pin working in said slot to reciprocate said bar.

12. In a press of the character described, the combination of a table, a slide bar connected to said table to reciprocate the same and having a transverse slot with a middle portion at right angles to the length of the bar and opposite inclined end portions which are parallel and offset with relation to each other, and a crank having a pin working in said slot to reciprocate said bar.

EDMUND W. ZEH.