

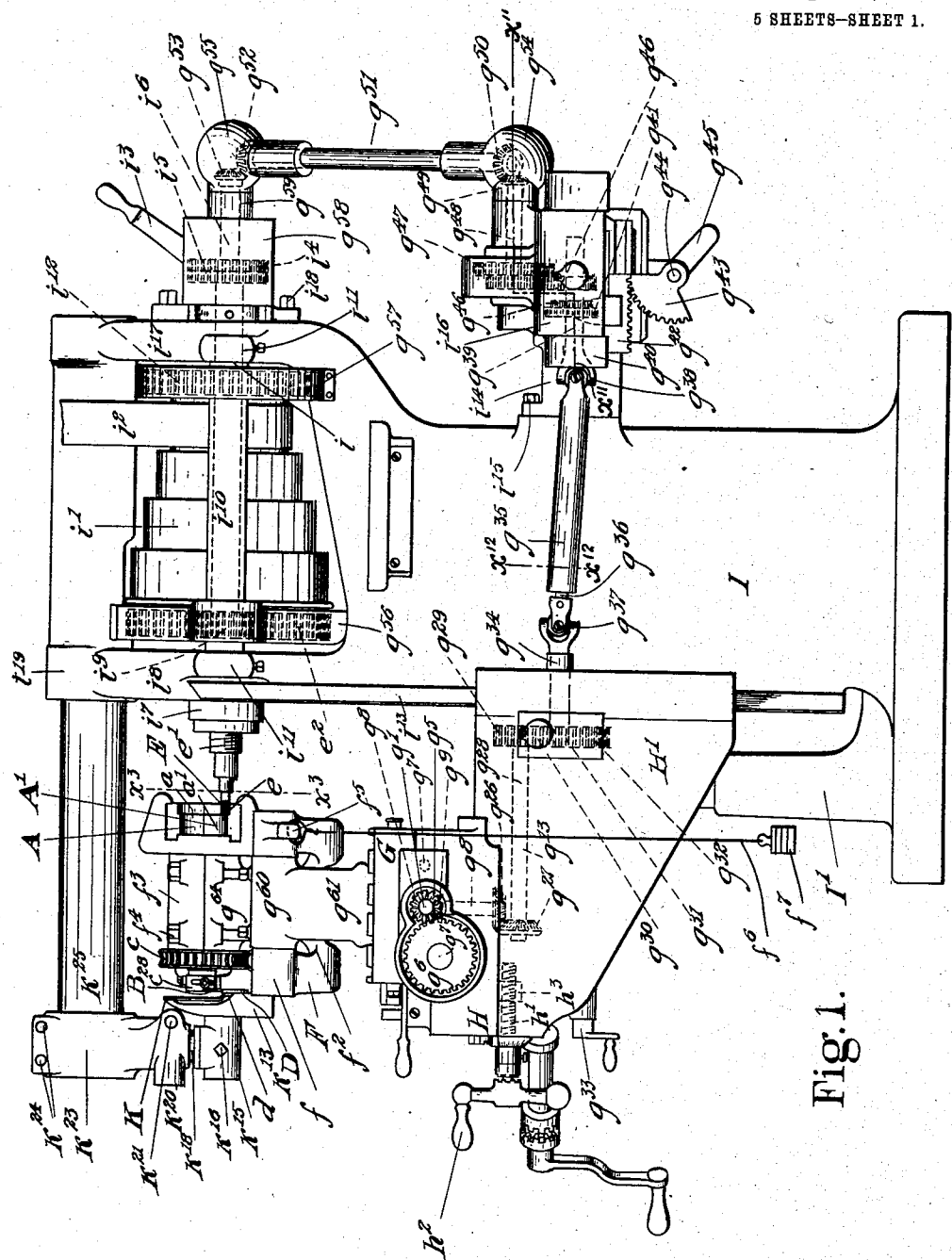
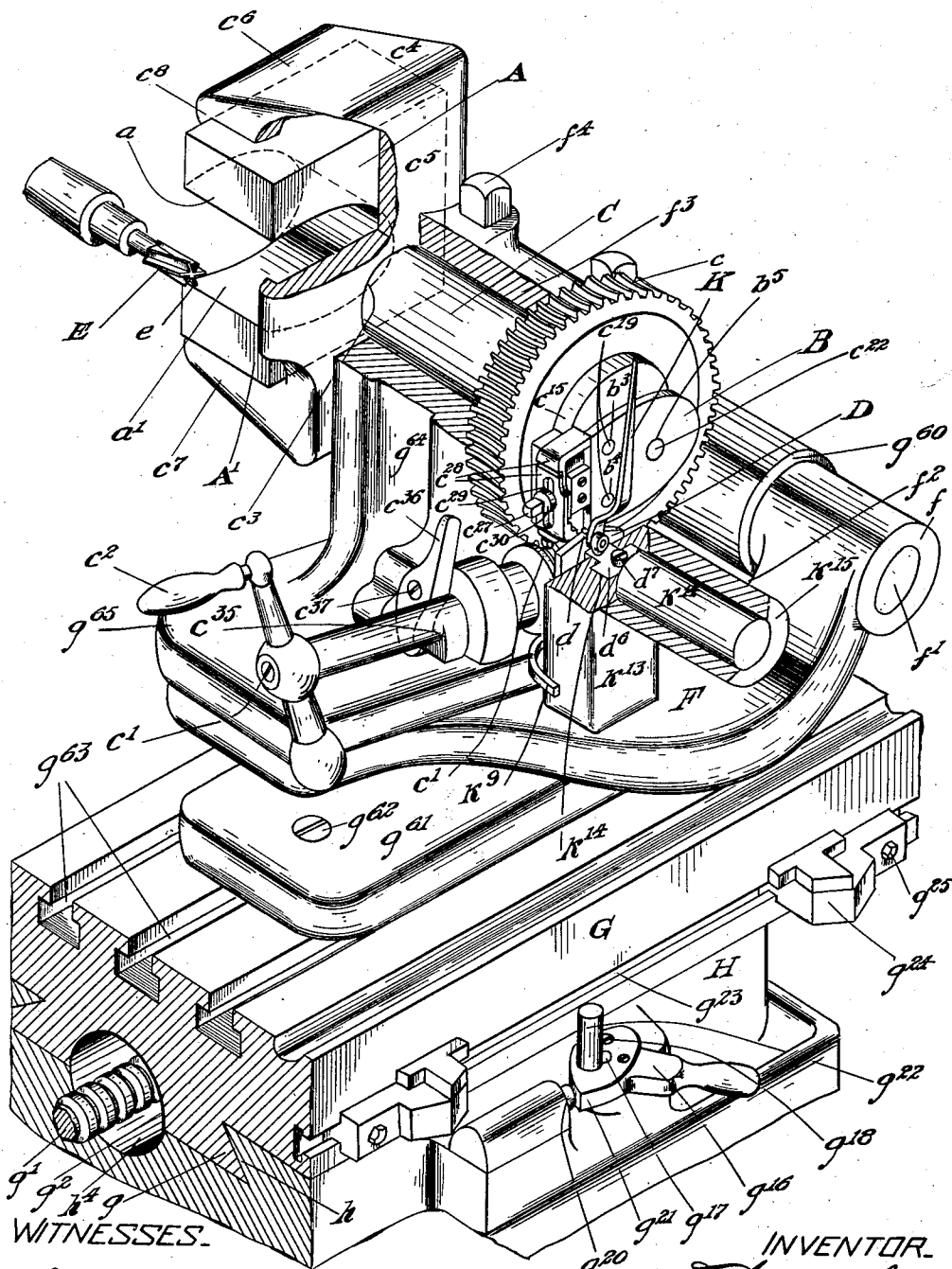


Fig. 1.

WITNESSES.  
 Edith C. Hollbrook  
 Elizabeth C. Coupl

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 Thomas Lund  
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WITNESSES.

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Fig. 2.

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MOLD FORMING MACHINE.

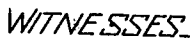
Patented Apr. 30, 1912.

5 SHEETS--SHEET 3.

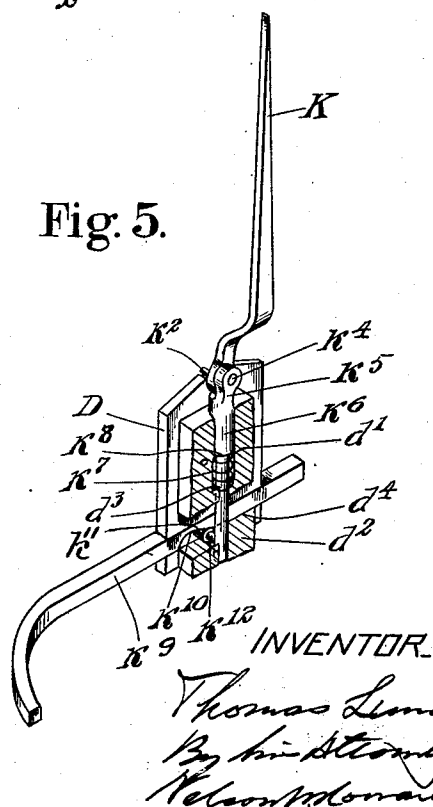
Fig. 3.



**Fig. 5.**



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1,024,516.

T. LUND.  
MOLD FORMING MACHINE.  
APPLICATION FILED APR. 10, 1908.

Patented Apr. 30, 1912.

5 SHEETS-SHEET 4.

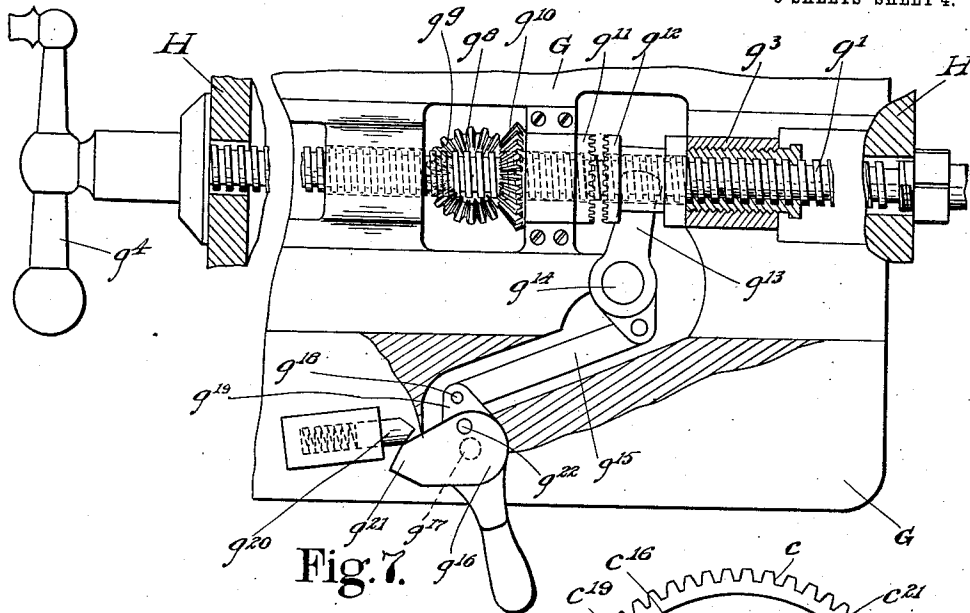


Fig. 7.

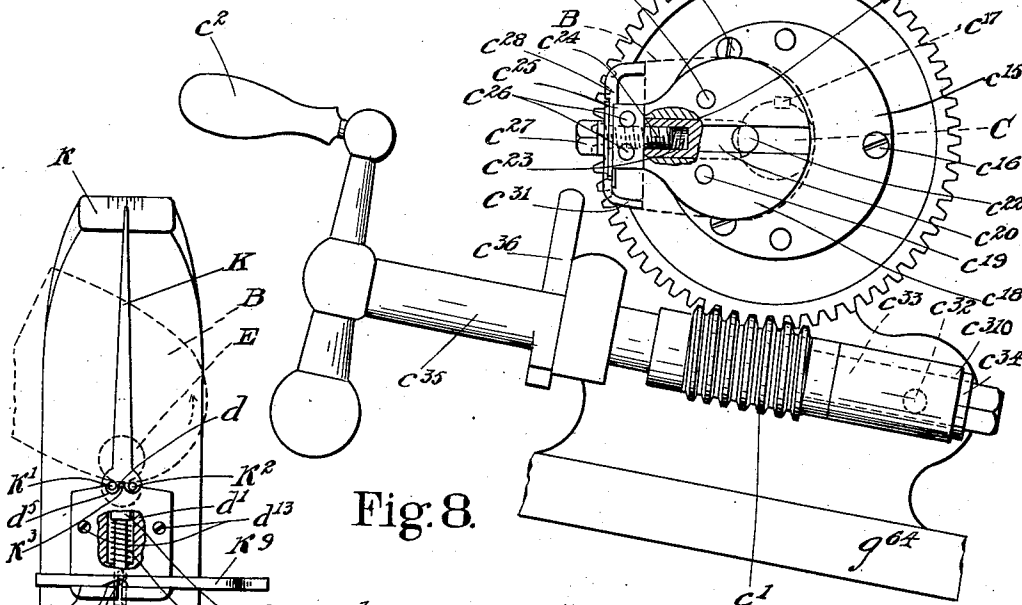


Fig. 8.

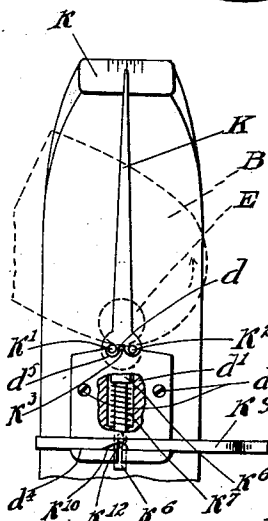


Fig. 6.

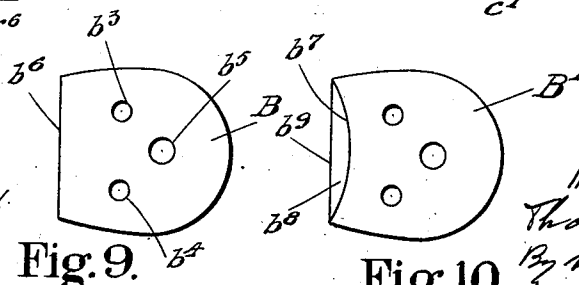


Fig. 9.

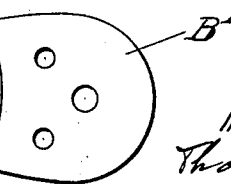
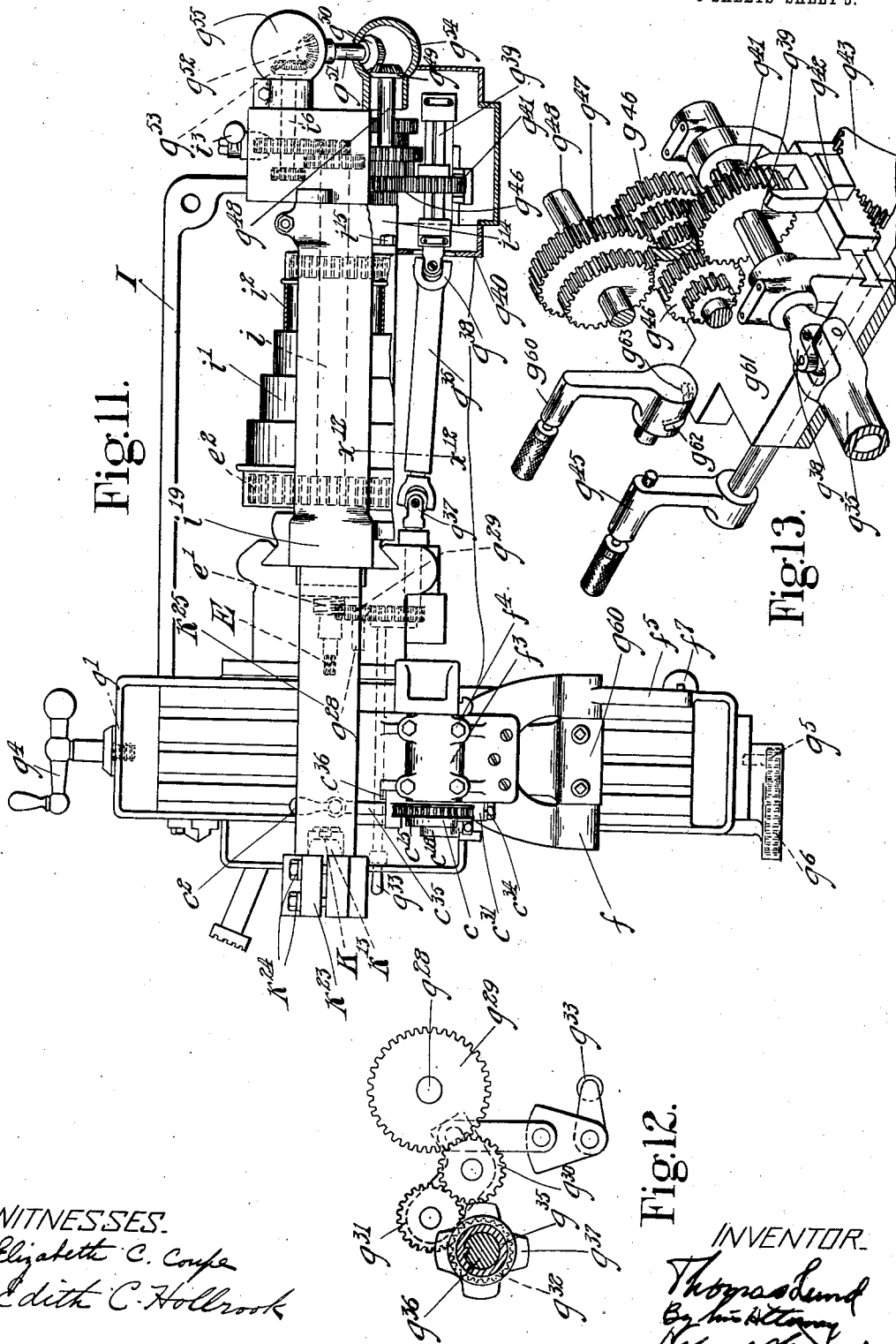


Fig. 10.

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# UNITED STATES PATENT OFFICE.

THOMAS LUND, OF BEVERLY, MASSACHUSETTS, ASSIGNOR TO UNITED SHOE MACHINERY COMPANY, OF PATERSON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## MOLD-FORMING MACHINE.

1,024,516.

Specification of Letters Patent.

Patented Apr. 30, 1912.

Application filed April 10, 1908. Serial No. 426,281.

*To all whom it may concern:*

Be it known that I, THOMAS LUND, a citizen of the United States, residing at Beverly, in the county of Essex and Commonwealth of Massachusetts, have invented certain Improvements in Mold-Forming Machines, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to machinery for working metal and other materials, and particularly to apparatus for engraving or de-forming various articles to reproduce in or upon such articles the contour of a suitable pattern or form; my invention being of special advantage when embodied in machines of the type in which the action of the milling, routing, or cutting tool, or other sort of engraving or de-forming device is usually governed by the relative movement between the templet, form or pattern and a suitable follower or tracer member.

An important object of my invention is to provide means to permit the use of a disk, or relief, male templet or form to control the operation of such a machine when milling out or otherwise de-forming the metallic female dies used for shaping the heels of shoes, and similar female or intaglio dies or molds, although I contemplate the use of my invention in any field for which it is adapted by the nature of my improvements.

A disk with a peripheral pattern track or cam is one of the cheapest types of pattern to produce, and it can be used as a master pattern in the formation of duplicate patterns with greater economy than can any other type of pattern, so that by my provision of means to permit the use of pattern disks or male templets or forms in the production of female dies as described hereinafter, I am enabled to reduce the cost of the form to about one half of the cost of a female form for the same purpose. In addition to the advantage secured by this initial economy in production of pattern disks, the disk type of pattern can be set and replaced in less time than can the female pattern, with resultant economy of time and expense, and furthermore the disk templet can be used without alteration in

the production by the same machine of male dies complementary to the female dies.

Heretofore a disk or male form or templet has not been used in machines of this character to control the de-formation of female heel dies and similar articles, for the reason that no satisfactory means has been devised to maintain the proper relation between the work and the milling cutter or other de-forming tool, which relation differs from that between the tracer and templet disk not merely in degree, but in kind. This is due to the fact that the ordinary milling cutter, in its operation first upon one side of the cavity of the female die and afterward upon the other side, engages the die parts with diametrically opposite portions of its periphery, so that a curve plotted to follow the milling cutter's center in the various operative positions of the cutter, will fall within the periphery of the heel area, while a similar curve following the center of the tracer member in its various operative positions will fall outside of the heel's area as defined by the periphery of the cam disk, around which the tracer runs, and, therefore, when cutting female dies of the same size as the form, the milling cutter cannot be connected to move at a fixed distance from the tracer as is usual in producing relief articles on such machines, nor has any satisfactory means been devised hitherto, so far as I am aware, to effect the necessary variation in movement of the cutter relatively to the tracer while the former moves under the action of the latter. Instead of a cam disk or male templet, therefore, it has been customary to provide a female form or templet whose interior contour is first laid out, from a male form usually, and is then chipped out with much labor and expense, to correspond with the female die to be produced, the female templet being mounted in the milling machine for engagement by a pilot arranged coaxially with, and to control the movement of, the miller tool which acts to de-form the die blanks.

In accordance with my invention, the same male pattern disk, cam or templet used in other stages of the manufacture of a shoe heel, (as, for example, in making the "follower", which corresponds closely with the periphery of the finished heel in shape and

size) is placed in a suitable machine provided with my improvements, as for example a milling machine or "miller", and is utilized to control the operation of the machine upon the work in such a manner that without the need for a female form or templet, or for a pilot, or similar device, a female die, mold or the like is produced by the miller, corresponding detail for detail with the aforesaid male templet, and if desired corresponding therewith in size.

While I do not limit myself to any specific mechanism to utilize a male form in the deformation of a female die by machines of the class described, I prefer to accomplish this important object by connecting the disk or other male templet or form with the die-blank or like work, moving them together as a unitary structure relatively to the milling cutter or similar de-forming tool, and controlling this relative movement during deformation by causing the patterned portions of the periphery of the form to move successively past an abutment bearing a predetermined position relatively to the cutting portion of the cutting tool. I thus avoid possibilities of inexact reproduction of the pattern due to inaccurate calculations, improper adjustments, loose connections, &c., and I prefer to provide for this by securing both the work and the form rigidly to a common movable member, suitable fastening means being provided to secure the work and form removably in position upon this movable member. Other features of notable importance comprise means by which this member may be moved to present different portions of the work successively for operative engagement by the operating means, which may, and preferably will, occupy a fixed position, the form, the work and their connected parts being mounted preferably on a balanced support carried by a suitable table and moved as desired relatively to the tool by rotative engagement of the form with the abutment, and by bodily displacement of the work relatively to the tool, to the extent requisite to pattern the work.

Suitable means for manual control of the apparatus are also included in my invention, and means to insure proper operative correlation of the work and tool by maintenance of the form and abutment in proper tangency at all times, which can be accomplished by imparting to the form the necessary rotational and bodily displacement to feed it and the work. This tangent relation is important, as its maintenance results in smooth, unbroken finish of the work according to pattern, and I have devised a convenient form of indicating-means to permit ready and continuous visual observation by the operator of the relative positions of the work and tool, the indication

being based preferably upon data furnished automatically and as a resultant motion from a plurality of members contacting with, and moved by, respectively different portions of the periphery of the templet, pattern or form. Convenient means may also be provided for adjustment of the indicator and for its disengagement from time to time to permit ready withdrawal of the form and its replacement by another form, or to permit change in position of the form.

In producing female heel dies with the aid of a disk templet, I find it convenient to mount the die-blank constituting the work-piece, transversely near one end of a rotating shaft, which presents the blank for operative engagement by a milling cutter which may rotate in fixed bearings on the machine base, and to mount the templet form near the other end of the shaft with its peripheral cam track in position to rotate in engagement with the abutment, the latter being preferably seated firmly upon a suitable portion of the frame of the machine, usually in alinement with the cutting edge of the cutting tool, when the die is to be cut of the same size and shape as the form.

The various features of my invention will be illustrated and described fully in the accompanying drawings and specification and pointed out in the claims.

In the drawings, Figure 1 is a view in side elevation of a milling machine in the construction of which my invention has been embodied; Fig. 2 is a view in perspective of the work shaft and its related parts, some of which are broken away at places to reveal the construction of other parts more clearly, the point of view being at the upper left hand corner of Fig. 1, looking from the side opposite to that shown in Fig. 1; Fig. 3 is a view taken on the line  $X^2-X^3$ , Fig. 1, looking from right to left, the work-supporting head being shown in elevation, partly in section, and the milling cutter also in section; while Fig. 3<sup>a</sup> shows, in a series of diagrammatic views, and on a smaller scale, various other positions of the die-blanks relative to the milling cutter; Fig. 4 is a fragmentary, sectional view of the tangency-indicator, taken on the vertical line  $X^4-X^4$ , Fig. 3; while Fig. 5 is a fragmentary view of the same in perspective, taken from the same point of view as Fig. 2; and Fig. 6 a fragmentary view thereof in front elevation; Fig. 7 is a fragmentary view in plan, partly in section, of a portion of the carriage H, with the work table removed, illustrating the controlling mechanism for the longitudinal traverse of the work table; Fig. 8 is a view in end elevation of the form support, and rotating means therefor; and Figs. 9 and 10 are respectively views in side elevation of the

preferred type of form and a modification thereof. Fig. 11 is a plan view of the machine shown in Fig. 1 with parts broken away to show the arrangement of gearing; Fig. 12 is a fragmentary view in vertical section on the line  $x^{12}-x^{12}$ , Fig. 1 looking from right to left; and Fig. 13 is a fragmentary view in perspective of the gears at the right of Fig. 11.

Before proceeding to set forth in detail the mechanism constituting the preferred embodiment of my improvements, I will first describe briefly the operation of my machine selected for illustration herein to permit a ready and comprehensive understanding of my invention, as follows:—The work to be treated, in the instance illustrated, comprises two metal blanks A, A', (see Figs. 1, 2 and 3) which are eventually to constitute the dies used to shape the heels of shoes, and which present already a rough approximation of their final contour, having recessed portions  $a, a'$ , which form, when the blanks are placed together, a cavity corresponding peripherally to the shape of heel they are to make. In accordance with my invention, I provide means to deform this cavity accurately, *i. e.*, to engrave or fashion the inner walls of the die-parts A, A', into correspondence with a pattern, templet or form B (see Fig. 2) which controls the presentation of the die-blanks to the mechanism operating upon the die-blanks, the verb "de-form" and its derivatives being used herein to avoid confusion with the noun "form," which signifies, generally speaking, when used herein, the pattern, templet or shape to be reproduced.

Summary of operation: Briefly stating, then, the operation of the machine, the die-blanks A, A', are clamped (see Fig. 2) at one end of a rotatable shaft C, to the other end of which is clamped the form B, in position to engage an abutment D, the axis of tangency  $d$  being in alinement preferably (see Fig. 3) with a rotating milling cutter E which operates upon the die-blanks to deform the walls  $a, a'$ , of their cavity and to impart thereto accurately the shape of the form B; the shaft C is supported by a rock-arm F (see Fig. 2) carried by a work table G which has a traversing movement on a bed H and as the traverse of the table G carries the die-blanks A, A' bodily along from left to right, past the cutter E, (see Fig. 3) the weight of the shaft, blanks and form holds the die-blank A' downward, carrying with it the shaft C and form B as far as the abutment D will permit, the tool cutting the wall  $a'$  to match the form B, and as the respective lengths of the perpendiculars  $b', b''$ , &c., from the medial line of the form (see Fig. 3) to the axis of tangency  $d$  between the form's periphery and the abutment D vary, increasing more or less ab-

ruptly according to the shape of the heel-form used, the shaft is forced away from the abutment by the wedging action of the form B, and swings upward on its supporting rock-arm F about a rock-shaft or pivot bearing  $f f'$  carried by the work table G (see Fig. 2), and the cutter E continues to cut the wall  $a'$  to match the curved periphery of the form B; rotation of the shaft C, which may be effected manually by the worm-gear  $c$  and hand operated worm shaft  $c'$  (see Fig. 2), then turns the form B upon the abutment D and brings fresh portions of the more abruptly curved part of the die-blank walls  $a, a'$ , respectively into proper operative engagement with the tool E which cuts to the curved line  $a^3$  corresponding with the rear of the heel form (see Fig. 3); and the die-blanks A, A' are swung bodily as a resultant of these motions, into consecutive positions (a few of which are illustrated at  $ax, ay$  and  $az$  in Fig. 3<sup>a</sup>.) around an axis passing through (see Fig. 3) the point  $e$  on the periphery of the tool E, which point  $e$  remains the constant working point of the machine; thus the female die surface, or inner shape cut within the die blanks, is the same in curvature with the peripheral shape of the form B, and in the instance illustrated is the same in size also, for a line from the point  $e$  prolonged in parallelism with the axis of the tool, will pass through the axis  $d$  of tangency between the abutment D and the form B, and the die-blanks A, A' in all their positions will bear the same relation to the cutting point  $e$  that the form B bears to the tangency axis  $d$  in all the positions of the form.

The operating parts described thus briefly, may be of any suitable material and construction, and any suitable means for their support and actuation may be adopted, as, for example the metal pillar or frame I constituting the base of the machine and provided with an actuating shaft  $i$  operated by a coned pulley  $i'$  driven by a belt  $i^2$  from a suitable source of power (not shown), a shipping lever or other suitable controlling device  $i^3$  being also provided preferably to couple gears  $i^4$  on the shaft  $i$  with gears  $i^5$  on a parallel extension shaft  $i^6$ , to transmit power from the shaft  $i$  to the extension shaft  $i^6$  at various rates of speed.

The milling cutter, or other tool E which constitutes the de-forming means, in the instance illustrated, is mounted at the end of a spindle or shaft  $e'$  which rotates in bearings  $i^7$  in the part  $i^8$  of the frame, and may be actuated by a gear  $e^2$  meshing with a pinion or gear  $i^9$  on a shaft  $i^{10}$ , mounted in bearings  $i^{11}$ , and having a gear  $i^{12}$  driven by a pinion on the hub of the coned pulley  $i'$ .

The traversing work-table G may be mounted in any suitable fashion to carry the work past the tool E at an angle to the

axis of the latter, usually at right angles thereto, and in a horizontal direction, for the sake of convenience, and in the drawings, (see Fig. 2), is shown as having for that purpose the usual dove-tail tongue and groove sliding connection  $g$ ,  $h$ , with the carriage H, although I do not limit myself to this exact angle nor to any given plane for the traversing movement. The carriage H preferably has a transverse adjustment (see Fig. 1) to carry the work toward and away from the tool E, along the line of its axis and is shown as mounted to slide horizontally on a bed H', which in turn is adjustable vertically on the slide  $i^{13}$  upon the front of the pillar or base member I. To shift the carriage H horizontally I have provided a screw shaft  $h'$  operated by a handle  $h^2$  and engaging a threaded block  $h^3$  extending downward from the carriage.

To cause longitudinal traverse of the work-table G upon the carriage H, I have provided a screw shaft  $g'$  (see Fig. 2), lying in a channel formed by semi-cylindrical recesses  $g^2$ ,  $h^4$  in the table and carriage respectively, this screw shaft engaging a threaded block  $g^3$  (see Fig. 7) secured to the lower surface of the table G so that when the shaft  $g'$  is rotated in one direction or the other the block  $g^3$  is caused to travel along the screw shaft  $g'$  carrying the table with it.

I have shown a handle  $g^4$  (see Fig. 7) at one end of the shaft  $g'$ , and by means of which this shaft may be rotated manually in either direction, and I have shown also (see Fig. 1), a pinion  $g^5$ , at the other end of the shaft  $g'$ , and meshing with a gear  $g^6$  provided with a shaft  $g^7$  to which a handle may be applied if desired for the purpose of rotating the shaft  $g'$  manually at a higher rate of speed.

I prefer to provide for automatic actuation also of the work-table G and any suitable means may be provided for this purpose. One convenient form of such means is illustrated in Figs. 1 and 7, where the part designated by the reference letter  $g^8$  is a vertical shaft extending upward from the bed H' through the carriage H and having at its upper end a bevel gear  $g^9$  meshing with a bevel gear  $g^{10}$  connected rotatively with a clutch member  $g^{11}$  surrounding the shaft  $g'$  in position to be engaged by a co-operating clutch member  $g^{12}$  movable coaxially upon the shaft  $g'$  into and out of engagement with the clutch member  $g^{11}$  and splined on the shaft  $g'$ . To control the shifting clutch member  $g^{12}$ , I have provided in the instance illustrated a shifting lever  $g^{13}$  mounted pivotally at  $g^{14}$  upon the carriage H and connected by a link  $g^{15}$  to a hand lever  $g^{16}$  which is pivoted at  $g^{17}$  on the carriage H, has a pin  $g^{18}$  connecting the lug  $g^{19}$  with the link  $g^{15}$  and acts through the

link and shifting lever to throw the shifting clutch into and out of operative engagement with the clutch member  $g^{11}$ , a spring plunger  $g^{20}$  serving to hold the hand lever in adjusted position, by engaging the beveled edge  $g^{21}$  of the hand lever. The latter has a post  $g^{22}$ , in the instance illustrated, (see Fig. 2), extending upward adjacent an undercut groove  $g^{23}$ , in the side of the work-table, and a stop or stops  $g^{24}$  may be secured in this groove, by set screws  $g^{25}$ , in position to engage the post  $g^{22}$  at any desired point of traverse, and operate the lever  $g^{16}$  to stop the work-table automatically.

Continuing now the description of the mechanism shown in the instance illustrated for actuating the work-table traverse automatically, the lower end of the vertical shaft  $g^8$ , which extends downward into the bed H' is shown (see Fig. 1), as having a bevel gear  $g^{26}$  meshing with a bevel gear  $g^{27}$  on a horizontal shaft  $g^{28}$ . This in turn may be actuated through the medium of a gear  $g^{29}$  by a set of transmission and reversing gears  $g^{30}$ ,  $g^{31}$ ,  $g^{32}$  controlled by a handle rod  $g^{33}$  and actuated by the short shaft  $g^{34}$ . In order to permit free vertical movement of the bed H' without interfering with actuation of the table traverse mechanism, I have shown an intermediate counter-shaft  $g^{35}$ , comprising a sleeve and a member  $g^{36}$  splined loosely therein. A universal joint  $g^{37}$  connects the counter-shaft with the short shaft  $g^{34}$ , and the counter-shaft is connected at its other end by a universal joint  $g^{38}$  with a short shaft  $g^{39}$  mounted in bearings  $g^{40}$  on a bracket  $i^{14}$  secured by bolts  $i^{15}$  to the frame member I and provided with a protective housing  $i^{16}$  through which is indicated in dotted lines the gearing related with and to operate the short shaft  $g^{39}$ . The latter has a shifting gear  $g^{41}$  splined slidably on the shaft  $g^{39}$  and connected with a rack  $g^{42}$  in mesh with a segmental rack  $g^{43}$  upon a rock shaft  $g^{44}$  provided with a handle  $g^{45}$ , upon rotating which leftward from the position shown in Fig. 1, the sliding gear  $g^{41}$  will be carried from its position of mesh with the gear  $g^{46}$  into mesh with a gear  $g^{40}$  of different size, the gears  $g^{46}$  being connected for actuation by a gear  $g^{47}$  upon a shaft  $g^{48}$ , which receives its motion through bevel gears  $g^{49}$  and  $g^{50}$ , a vertical counter-shaft  $g^{51}$ , and bevel gears  $g^{52}$  and  $g^{53}$  from the extension actuating shaft  $i^6$ , the latter carrying the bevel gear  $g^{53}$ . The handle  $g^{66}$ , shown in Fig. 13, serves to move the table  $g^{67}$  forward and backward, carrying the gear  $g^{41}$  with it to clear the gears  $g^{40}$  during lateral shift of the gear  $g^{41}$ , and thereafter to move the gear  $g^{41}$  into mesh with the selected gear  $g^{40}$ . For this purpose, the handle  $g^{66}$  has a cam-slot  $g^{69}$ , which receives a stud  $g^{68}$  on the table  $g^{67}$ . The operation of this

variable speed transmission gearing is that usual to mechanism of the type illustrated and is not claimed by me as novel.

The reference letters  $g^{54}$ ,  $g^{55}$ ,  $g^{56}$ ,  $g^{57}$ ,  $g^{58}$ , 5 and  $g^{59}$ , designate protective casings which may be provided for the operating parts above described.

As already indicated, I prefer to make 10 provision for a nutative movement of the die-blanks A, A<sup>1</sup>, in a direction related angularly both to the axis of the de-forming means, and to the direction of traverse of the work-table, so that in the instance illustrated this nutative movement is substantially 15 vertical, across the axis of the tool E and toward and away from the plane of movement of the work-table G, the device which I have adopted for this purpose comprising a rock-arm F having a bearing  $f$ , through which passes a shaft  $f'$  mounted in a post  $g^{60}$  (see Fig. 1) extending from the upper surface of an auxiliary work-table  $g^{61}$  having an adjustable connection with the 20 work-table G as by means of screw draw bolts  $g^{62}$  cooperating with one of a series of undercut grooves  $g^{63}$  in the upper surface of the work-table G. The rock-arm F is preferably forked at  $f^2$ , having suitable bearings  $f^3$  to receive the work-shaft C, bolts  $f^4$  being 30 provided to hold the bearing in place upon a block  $g^{64}$  extending upward from a plate  $g^{65}$ . Another arm  $f^5$ , may be provided, (see Fig. 1) of suitable length and contour, and preferably of a suitable weight to balance 35 the greater part of the weight of the rock-shaft C with the blanks A, A<sup>1</sup> and form B in place but not of sufficient weight to withdraw the form B from normal contact with the abutment D. If found desirable, means 40 to load the arm  $f^5$  may be provided, as by attaching thereto a line  $f^6$  with a weight  $f^7$ . The bearing  $f^3$  will preferably be made of considerable breadth relatively to its length, and the work-shaft C therein will also be 45 broad preferably relatively to its length, thus securing great stability for the work under the stress of the milling cutter E at one end of the shaft, and the controlling engagement of the form B and abutment D 50 at the other end.

I prefer to mount the die-blanks A, A<sup>1</sup> directly across the broad end  $c^3$  of the work-shaft and for that purpose I show (see Figs. 2 and 3) a shaft-head-member  $c^4$  having a 55 portion  $c^5$  preferably formed as an integral casting with the shaft, over-hanging clamp portions  $c^6$ ,  $c^7$  (see Fig. 3) being also provided preferably, with retaining lips  $c^8$  to prevent axial displacement of the die blanks A, A<sup>1</sup>, and with seats  $c^9$  along which wedge 60 members  $c^{10}$  may be forced by suitable operating means, such as the bolts  $c^{11}$  to engage slotted lugs  $c^{12}$  on the wedge members  $c^{10}$  and crowd the latter into close and retentive 65 engagement with the die-blanks, and the die-

blanks with each other, centering them accurately and constituting them substantially a unitary structure for their engagement by the milling cutter or other de-forming mechanism E. Thumb screws  $c^{13}$  may also 70 be provided to hold the die-blanks A, A<sup>1</sup> against an end seat  $c^{14}$  which may and preferably does constitute the constant, fixed line at which to start operation by the de-forming mechanism on the work, whatever 75 the character of the latter. At the other end of the shaft C, I have shown (see Figs. 2 and 8) a form-support  $c^{15}$  comprising a facing piece secured by screws  $c^{16}$  to the worm gear  $c$  which is secured removably to 80 the shaft end by a key  $c^{17}$ . This attachment  $c^{15}$  is provided preferably with a boss  $c^{18}$  having a plurality of studs, projections or form-engaging portions  $c^{19}$  to receive, engage and hold in adjusted position the tem- 85 plet, pattern, or form B, which, in the instance illustrated, (see Fig. 9), takes the character of a male cam disk, having holes  $b^3$ ,  $b^4$  to receive the studs  $c^{19}$ , this cam disk or templet corresponding substantially in 90 shape and size with the tread of the heel in the finished shoe, such a templet being capable of many other uses with great economy, *e. g.*, as a master pattern in the manu- 95 facture of duplicate templets or cams for use in machines operating upon the heels of shoes in the various stages of their manufacture, and in the formation of the followers to be used with the heel dies A, A<sup>1</sup>, when 100 completed, the blanks for which followers can be secured to the shaft C in place of the die-blanks A, A<sup>1</sup>.

When a follower, or other male die or similar work-piece is to be treated, the abut- 105 ment  $d$  may be raised by means of the screw  $d'$  (see Fig. 4) or by bodily adjustment of the member D with its support  $k^{15}$ ,  $k^{18}$ , controlled by the clamping bolt  $k^{21}$  (see Fig. 1), until the axis of tangency  $d$  will coincide 110 with the upper cutting edge of the tool E, and thereafter the operation of the machine will proceed as before, using the same form B, to produce a follower which will be an exact replica in shape and size of the form B. Thus male and female work-pieces can 115 be de-formed under the control of the same form, obviating inaccuracies, and saving the time and expense incidental upon one change of forms.

I prefer to provide auxiliary means for 120 the retention of the form B upon its seat at the end of the work shaft C, and as one suitable device for this purpose, I have shown (see Fig. 8) a draw bolt  $c^{20}$  sliding in an undercut groove  $c^{21}$  in the boss  $c^{18}$  and 125 having a finger  $c^{22}$  which projects beyond the surface of the boss to enter a hole  $b^5$  in the central part of the form B, the shank of the bolt having a threaded recess  $c^{23}$  to receive a draft screw  $c^{24}$  extending through a 130

ledge  $c^{25}$  secured to the boss by screws  $c^{26}$ . When the form B has been placed upon the studs  $c^{19}$  and the draft screw  $c^{24}$  is rotated by its squared head  $c^{27}$  the finger  $c^{22}$  draws the form B toward the ledge  $c^{25}$  which performs for the edge  $b^6$  of the form the same function that the shoulder  $c^{14}$  on the blank support  $a^1$  performs for the blanks A, A' the seats formed by these shoulders being exactly in alinement with each other, so that as the form B starts to track over the abutment D, the cutter E starts to cut the wall  $a'$  of the die-blank A'.

When the form has a curved forward edge, as at  $b^7$ , on the form B' shown in Fig. 10, a filling piece  $b^8$  may be supplied, curved rearwardly to fit the curve  $b^7$  but presenting a straight forward edge  $b^9$  to engage the ledge  $c^{25}$ . I prefer to provide also one or more L-shaped clamps, each having one arm  $c^{28}$  slotted, as at  $c^{29}$  (see Fig. 2) to pass the shank of the clamping bolt screw  $c^{23}$ , which has a shoulder  $c^{30}$  to engage the arms  $c^{28}$  while the other arm  $c^{31}$  of each of the members adjoins the form B near its periphery, serving the function of a leader, in continuation of the tracking surface of said periphery. Thus the operator may start the operation of the machine while the leader portion at one end rests on the abutment D and stop the machine after the form has been rotated until the leader portion at its other end sustains the weight of the shaft, insuring a smooth start and finish of the cutting operation on the heel-shaping inner surfaces  $a, a'$ , of the dies. Fig. 2 shows the parts at the commencement of this operation and Fig. 3 shows the operation at a more advanced stage, the dotted line  $a^3$  indicating both the periphery of the form B and the inner contour of the die-blanks when finished.

There remains to be described the mechanism for effecting rotation of the workshaft C, with the work blanks A, A' in engagement with the de-forming tool E, and with the form B in regulating contact with the abutment D; also the mechanism by which I secure a proper rate of rotative feed of the workshaft, including means to guide the operator by visual indication of the position of the operating parts relative to each other. The object to be attained by this portion of my invention is to provide that the form B shall at all times be tangent with the abutment D at an axis of tangency lying in the vertical plane passing through the working edge or trace  $e$  of the milling cutter; *i. e.*, the form B and abutment D must be tangent at the transverse axis of the abutment designated by the reference letter  $d$  (see Fig. 3), for if the axis of tangency varies to one side or the other of the axis of the working trace  $e$ — $d$  the shaft C will hold the die-blank at such an angle to the plane of traverse of the

table G that as the latter carries the die-blanks along bodily, the cutter E will cut beyond the line  $a^3$ , or not near enough to the line  $a^3$ , and a gouge or a lump on the die-wall will mar the curvature sought.

The essential feature of my indicating device, in the embodiment illustrated, is an indicator member K with which the form B is engaged in such a manner that the indicator occupies a predetermined position as long as the form B is in normal tangent relation to the abutment D at the axis of tangency  $d$ , *i. e.*, the position shown in Figs. 3 and 6, in which the indicator member takes the form of a pointer, for convenience in visual observation, moving past a graduated scale  $k$ , although it will be understood that I do not limit myself to a visible indicator, nor to the specific means to be described hereinafter for feeding the work in proper relation to the die-forming mechanism by varying the tangency relation between the form and abutment.

Any suitable mode of engaging the indicating mechanism with the form may be adopted, and as a convenient means for so engaging the pointer K with the form D, I have shown the pointer as provided with two pins, projections or form-engaging portions  $k^1, k^2$ , respectively at one side and the other of the axis  $k^3$ , about which the pointer oscillates on a pivot  $k^4$  mounted in the instance illustrated in a lug  $k^5$  at the upper end of a plunger  $k^6$  (see Figs. 4 and 5).

The plunger  $k^6$  is mounted to move longitudinally in a bearing slot  $d'$  of the abutment member  $d^2$ , the slot being enlarged at  $d^3$  to receive a coil spring  $k^7$  which bears against a shoulder or other suitable restraining portion  $k^8$  on the plunger, the spring tending normally to hold the plunger as far upward as permitted by a dog  $k^9$  mounted to slide in a transverse slot  $d^4$  of the abutment D and having a cam recess, the inclined wall  $k^{10}$  of which is arranged to engage an anti-friction roller  $k^{11}$  (see Fig. 4) on a pin  $k^{12}$  projecting from the plunger  $k^6$ . When the dog  $k^9$  moves toward the left (see Fig. 5) it draws the plunger and pointer downward against the action of the spring  $k^7$  and until the pins  $k^1, k^2$ , (see Fig. 6) rest against the upper edge of the abutment D, preferably in notches  $d^5$  provided to receive them (see Fig. 6), the walls of these notches serving to hold the pointer upright when not engaged with a form, and protecting the pins and pointer from injury. This position of the pointer is best shown in Fig. 5, which illustrates clearly the dog  $k^9$ , the tail of which may be curved as indicated to afford a convenient handle, projecting as shown in Fig. 2 around the indicator head  $k^{13}$  which is shown as having a vertical undercut groove  $k^{14}$  to receive the sliding cross-head  $d^6$  of the abutment member  $d^2$ . This cross-head

is secured to the abutment D by suitable means, as the screws  $d^{13}$  shown in Fig. 6, and has suitable fastening means to regulate its vertical position and to maintain it in adjusted position, as for example, the set-screw-bolt  $d^7$  (see Fig. 4) playing in a threaded recess  $d^8$  in the indicator head  $k^{13}$  and engaging with its shoulder  $d^9$  and cap  $d^{10}$  (see Fig. 4) the bottom and top respectively of the abutment member  $d^6$ , which is slotted at  $d^{11}$  to embrace the reduced neck  $d^{12}$  of the set-screw-bolt  $d^7$ .

In order to provide for very accurate adjustment of the abutment D to permit its axis  $d$  to be brought into exact alinement with the working axis  $e$ , I prefer to supply the head with a universally adjustable support, and for this purpose I may mount the head  $k^{13}$  on a rock-shaft  $k^{14}$  extending horizontally through a sleeve  $k^{15}$  within which sleeve the rock-shaft  $k^{14}$  may be secured in adjusted rotative position by suitable means, as the set screw  $k^{16}$  (see Fig. 1).

The sleeve or coupling  $k^{15}$  has a post  $k^{18}$  the upper end of which is grasped and supported by a split vertical clamping member  $k^{20}$  provided with a draft screw  $k^{21}$ , the upper end of this vertical clamping member being connected with a split sleeve  $k^{23}$  secured by draft bolts  $k^{24}$  in adjusted position upon a horizontal supporting arm  $k^{25}$  extending from a bearing  $i^{10}$  near the upper portion of the pillar or frame I of the machine.

By means of the devices above described, the indicator head may be adjusted rotatively in a vertical plane; also in a horizontal circle around the axis of the post  $k^{18}$ ; vertically with said post; toward and away from the form B; and with the clamping member  $k^{20}$  in a circle around the arm  $k^{25}$ ; universal adjustment being thus rendered possible.

Prior to operation of the machine, while the form B is being set in place (see Fig. 2) on the studs  $c^{19}$ , the dog  $k^9$  is drawn into the position shown in Fig. 5 retracting the pointer K and its pins  $k^1$ ,  $k^2$ , from their operative position, to avoid injury, and when the form has been set, the dog  $k^9$  is pushed into the position shown in Figs. 2, 3 and 4, and allows the spring  $k^7$  to force the plunger  $k^6$  and pointer K upward, bringing the axis  $k^3$  of the pointer pivot into alinement with the tangency axis  $e-d$ , and bringing the pins  $k^1$ ,  $k^2$  into engagement with the lower edge of the form's periphery, one on each side of the tangency point  $d$  of the abutment which then coincides with the point of the form's periphery midway between the pins  $k^1$ ,  $k^2$ , as indicated in Fig. 3, and passes through the pivot axis  $k^3$  of the pointer, the working axis  $e$  of the tool E, and the axis  $d$  of the abutment.

Starting now from the position shown

in Fig. 3, with the pointer K pointing to the zero on the scale  $k$ , when the traverse of the table G brings the die-blank  $A'$  past the cutter E as far as the perpendicular  $b^2$ , the operator will begin to turn the handle  $c^2$  (see Fig. 2) of the worm shaft  $c'$  toward the right hand, and the worm shaft  $c'$  will engage the worm gear  $c$  and impart right hand rotation through it to the shaft C, form B and die blanks A,  $A'$ .

If the operator rotates the form at exactly the right speed, the normal to each successive portion of the convex peripheral curve of the form's tracking edge will bear a constant relation to the normal position of the pointer K, and the latter will continue in its vertical position opposite the zero on the scale, as shown in Fig. 3; if the operator turns the form too fast, the forward part of the lower edge of the form will be tilted upward too soon from the position shown in Fig. 3, and the pin  $k^1$  will be depressed more than the pin  $k^2$ , tilting the pointer toward the left; then the operator will back the worm shaft  $c'$  slightly until the pointer indicates zero again, and will rotate the worm shaft more slowly *i. e.*, at proper speed to maintain the pointer at the zero mark. This method of actuation is continued through the various positions of the form and die-blanks, including the positions "ax," "ay" and "az" illustrated in Fig. 3<sup>a</sup>, in all of which it will be observed that the die-blanks are engaged with the lowest edge  $e$  of the cutter E, which as already stated constitutes, in the instance illustrated, the constant working axis, from start to finish of the die-walls  $a$ ,  $a'$ . When the cutter reaches the dividing line between the blanks A,  $A'$ , the operator reverses the direction of rotation of the worm shaft to meet the reverse curve of the die wall  $a$ . Before replacing the finished die-blanks with another work piece, or at any time at which it may be desirable, the dog  $k^9$  may be pulled to clear the pins  $k^1$ ,  $k^2$ , from the form, and the table G may be run along to carry the die-blanks A,  $A'$ , away from the tool E, and I prefer to provide means to free the shaft C also, by clearing the shaft worm  $c'$  from the worm gear  $c$ . To permit this disengagement, the screw-shaft may be mounted in any suitable manner, and as one convenient form of mount I have shown (see Fig. 8) a swivel bearing  $c^{310}$  carried by a pivot  $c^{32}$  extending from the member  $g^{64}$  and having a recess  $c^{33}$  into which takes the end  $c^{34}$  of the worm shaft, the other end of the worm shaft being supported normally in a sleeve  $c^{35}$  by a latch  $c^{36}$  carried by a pivot screw  $c^{37}$  extending into the part  $g^{64}$  (see Figs. 2 and 8). The latch  $c^{35}$  may be released and the shaft  $c$  swung downward to carry the worm  $c'$  away from the worm gear  $c$ , and the shaft C can then rotate freely in its

bearings, so that the weight of the shaft head  $c^4$  will cause the shaft to return quickly to starting position saving the time involved in turning it back by means of the worm shaft  $c'$ .

5 Having described my invention thus fully, what I claim and desire to secure by Letters Patent of the United States is:—

1. In a machine of the class described;  
10 mechanism for de-forming articles of the class described; mechanism arranged to receive a male pattern form; and mechanism to support a blank for an intaglio form, female die or similar article and means controlled by said male pattern form to cause  
15 relative movement of said blank and de-forming mechanism for the de-formation of said blank in like proportion to said male pattern form.

20 2. In a machine of the class described; de-forming mechanism; a support for an intaglio workpiece; and a form movable with, and to control the movement of, said work relatively to said de-forming mechanism.  
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3. In a machine of the class described; de-forming mechanism; an abutment; a support for an intaglio work-blank; and a relief form movable with said work-blank and arranged to engage and be displaced by said  
30 abutment, and by said displacement to move said work-blank relatively to said de-forming mechanism.

4. In a machine of the class described;  
35 de-forming mechanism; a work-blank support and a form connected to constitute a unitary structure movable bodily relatively to said de-forming mechanism; and means to be engaged by said form during said  
40 movement to control the de-formation of said blank by said de-forming mechanism.

5. In a machine of the class described; de-forming mechanism; a work-blank support and a form movable together relatively  
45 to said de-forming mechanism; and adjustable means to be engaged by said form under the influence of gravity during said movement to control the de-formation of said blank by said de-forming mechanism.

6. In a machine of the class described;  
50 a rotatable shaft provided with means to receive and support rotatably therewith a work-blank and a form respectively; an abutment with which said form is engaged  
55 by the weight of said shaft and related parts; and means to cause bodily displacement of said shaft automatically at times to control the de-formation of said work; substantially as described.

7. In a machine of the class described; a  
60 rotatable shaft provided with means to receive and support rotatably therewith in predetermined position and in alinement with each other a work-blank and a form  
65 respectively; means to support said shaft

for universal bodily movement and means to rotate said shaft; substantially as described.

8. In a machine of the class described; a  
70 rotatable shaft provided with means to secure rigidly thereto, and to rotate therewith, a work-blank and a form; means to move said shaft bodily relatively to said de-forming mechanism, and a device to be engaged movably with said form and thereby operated  
75 automatically to control said shaft-moving means; substantially as described.

9. In a machine of the class described; a  
80 rotatable shaft provided with means to secure rigidly in adjusted position near its one end a work-blank, and near its other end a form, both to rotate as a unitary structure with said shaft; a tool operating in predetermined position; and an abutment in alinement with said tool and to be engaged by said form to cause bodily movements of said unitary structure; substantially as described.  
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10. In a machine of the class described; a  
90 rotatable shaft provided with means to secure rigidly in adjusted position across its one end an intaglio work-blank, and across its other end a relief form, both to rotate in axial alinement with said shaft and with each other.  
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11. In a machine of the class described; the combination with a work-supporting shaft, of means to support a form in predetermined position near one end of said shaft, and a slideway extending across said shaft near its other end, said slideway having a stop in alinement with said form to receive a work-blank, and means to retain said work-blank in said slideway, against said stop.  
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12. In a machine of the class described; the combination with a work-supporting shaft, of a plurality of ways, extending transversely across one end of said shaft opposite each other, clamping members operating in said ways to engage a work-blank and couple the same to said shaft; and means to actuate said clamps.  
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13. In a machine of the class described; the combination with a work-supporting shaft, of a plurality of overhanging clamping members on opposite sides of the face of said shaft, a plurality of wedge members one for each of said overhanging members and a screw device to drive said wedge devices into engagement with a work-blank, to clamp the same upon the face of said shaft.  
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14. In a machine of the class described; a shaft; a shaft-head having a stop occupying a predetermined position and means to retain a form upon and across the face of said shaft head; said retaining means comprising a clamping member arranged to engage said form and draw the same remov-  
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ably into secure engagement with said stop; substantially as described.

15. In a machine of the class described; a shaft; and means to retain a form upon said shaft; and a leader member to be arranged adjacent to, and in continuation of, the tracking surface of said form; substantially as described.

16. In a machine of the class described; a shaft; and means to retain a form upon and across the face of said shaft; said retaining means comprising a clamping member arranged to engage said form and secure the same removably in place; and an adjustable leader member to be arranged adjacent to, and in continuation of, the tracking surface of said form; substantially as described.

17. In a machine of the class described; a shaft; and means to retain a form upon and across the face of said shaft; said retaining means comprising a clamping member arranged to engage said form and secure the same removably in place, and a plurality of leader members to be arranged adjacent to, and in continuation of, the tracking surface of said form; substantially as described.

18. In a machine of the class described; a shaft; means to retain a form upon and across a face of said shaft; said retaining means comprising a clamping member arranged to engage said form and secure the same removably in place; and a leader member to be arranged adjacent to, and in continuation of, the tracking surface of said form; said leader being apertured to pass a fastening member; and a fastening member passing through said leader into said retaining member to secure them in adjusted position at the end of said shaft; substantially as described.

19. In a machine of the class described; a shaft; a shaft-head provided with projections parallel with the axis of said shaft to engage and position a form; and means to retain said form in place upon said shaft-head; substantially as described.

20. In a machine of the class described; a shaft; a shaft-head arranged to receive a form across its face; a clamping member to engage an inoperative portion of said form to secure the same to said shaft-head; a draft screw for said clamp; and a leader member having a slotted retaining portion to be traversed by said screw, and a leading portion to form a continuation of said form; substantially as described.

21. In a machine of the class described; de-forming mechanism; an abutment, a bearing, and a work-supporting and form supporting shaft mounted rotatably therein; means to rotate said shaft with said work relatively to said de-forming mechanism and with said form in constant contact with said abutment; and means to move said shaft and bearing bodily relatively to said

de-forming mechanism; said bodily movement being controlled by the progressive contact of said form and abutment.

22. In a machine of the class described; a support; de-forming mechanism and an abutment supported thereby, and a work-supporting table movable on said frame or base transversely with respect to said de-forming mechanism and abutment; a shaft-bearing carried by said table, and movable bodily at an angle to the line of movement thereof; a shaft mounted rotatably in said bearing and provided with a work-blank support near its end adjacent said de-forming mechanism, and with a form-support near its end adjacent said abutment; means to feed said table; and means to feed said shaft rotatively; said feeding means being arranged to operate when said work-blank and form are respectively in place, to rotate said form and move it bodily in engagement with said abutment, and said blank in working engagement with said de-forming mechanism, thereby to de-form said blank according to the pattern of said form, substantially as described.

23. In a machine of the class described; a support; a rock-arm mounted rotatably thereon and provided with a bearing; and a shaft mounted rotatably in said bearing, said shaft having a form-support and a work-blank-support rotatable therewith, substantially as described.

24. In a machine of the class described; a support provided with de-forming mechanism and a sliding table movable transversely with respect to the axis of operation of said de-forming mechanism; a rock-arm carried by said table and rotatable about an axis thereon parallel to the axis of said de-forming mechanism, and in a path at an angle to said sliding movement, said arm having a work-shaft-bearing in its free portion; and a work-shaft rotatable in said arm-bearing about an axis parallel to the plane of said sliding movement; substantially as described.

25. In a machine of the class described, a support; a work-table mounted to traverse said support, and provided with a bearing for a rock-arm; a rock-arm mounted in said bearing and rotatable in a path at an angle to the traversing movement of said table; said arm having in its free portion a bearing for a work-shaft; and a work-shaft mounted rotatably in said arm-bearing and having means to receive a work-blank and a form; substantially as described.

26. In a machine of the class described; a horizontal base, having a horizontal milling spindle and an abutment in alinement therewith; a sliding table movable at right angles to said spindle; a balanced rock-arm mounted on said table and rotatable about an axis parallel to said spindle; and a work-shaft

carried by said arm and rotatable about an axis parallel with said rock-arm axis, and having a work-blank support and form-support to receive a work-blank and a form  
5 respectively and present the same in position for engagement by the milling tool and abutment respectively; substantially as described.

27. In a machine of the class described; a  
10 base; a table movable thereon; a cross-bearing on said table, and a rocker rotatable about said cross bearing one arm of said rocker having a shaft-bearing, and a rotatable shaft therein provided with means to  
15 support a work-blank and a form rotatable with said shaft, the other arm of said rocker being weighted to balance said rotatable shaft and its connected parts; substantially as described.

28. In a machine of the class described; a  
20 base; a table movable thereon; a cross-bearing on said table, and a rocker rotatable about said cross-bearing one arm of said rocker having a shaft-bearing, and a rotatable shaft therein provided with means to  
25 support a work-blank and a form rotatable with said shaft, the other arm of said rocker being weighted to balance said rotatable shaft and its connected parts; and de-forming mechanism and an abutment mounted on  
30 said base and presented in position respectively to engage operatively said work-blank and said form; substantially as described.

29. In a machine of the class described; a  
35 shaft provided with a work-blank support, a worm or gear and a form-support; a bearing and bearing-support for said shaft; and a screw-shaft meshing with and to operate said gear to rotate said shaft with said  
40 work-blank and form; substantially as described.

30. In a machine of the class described; a  
45 shaft provided with a work-blank support, a form-support and a gear; a bearing and bearing-support for said shaft; and a screw-shaft movable into mesh with said gear and there rotatable to rotate said shaft, work  
50 and form, and movable out of mesh, to free said work-shaft; substantially as described.

31. In a machine of the class described; a  
55 shaft provided with a work-blank-support, a form-support and a gear; a bearing and bearing support for said shaft; and a screw-shaft having near one end a bearing mounted pivotally on said bearing support; and a retaining latch on said support near and to engage a bearing at the other end of said  
60 screw-shaft; said screw-shaft being movable about said pivot bearing into mesh with said gear, and there rotatable to rotate said shaft, work and form, and movable out of mesh, to free said work-shaft; substantially as described.

32. In a machine of the class described;

the combination with de-forming mechanism, and a connected work-blank-support and form support, of an indicator arranged to indicate the position of said blank relatively to said de-forming mechanism, substantially as described. 70

33. In a machine of the class described; the combination with de-forming mechanism, and a connected work-blank-support and form support, of an indicator controlled  
75 by said form and arranged to indicate the position of said blank relatively to said de-forming mechanism, substantially as described.

34. An indicating device for apparatus of  
80 the class having a form-support and means to rotate the same, said device comprising a pointer and means connected therewith to engage said form, said pointer being arranged to assume a predetermined position  
85 at all times when said engaging means are in normal tangency with said form.

35. The combination with a form-support and means to move the same; of an indicator device comprising a pointer and a plurality  
90 of contact members arranged respectively to engage said form, said members being connected with, and to cause movement of, said pointer, to indicate the position of said form relatively to said members; substantially as  
95 described.

36. The combination with a support for a form, of a pointer, and a plurality of contact members arranged respectively to engage  
100 said form, said members being connected with, and to cause movement of, said pointer upon movement of said form relatively to said members otherwise than in a predetermined path; and means to move said form  
105 in said path, substantially as described.

37. The combination with a support for a form, of a pointer, and a plurality of contact members arranged respectively to engage  
110 said form; said members being connected with, and to cause movement of, said pointer upon movement of said form relatively to said members otherwise than in a predetermined path, and manually controlled means to move said form in said  
115 path; substantially as described.

38. The combination with a form-support and means to move said form rotatively and bodily; of an indicator device adjacent said support and provided with  
120 means to engage said form at a plurality of points simultaneously during said movements; and means to indicate when said form is tangent to a predetermined axis of tangency intermediate said points of engagement; substantially as described. 125

39. In a machine of the class described; a base; a form-support movable thereon, and an indicator-support mounted adjustably on said base adjacent the path of said form-support; an indicating device carried by  
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said indicator support, and arranged to engage said form and indicate its position relatively to said indicator support; and means to regulate the position of said form according to said indications; substantially as described.

40. In a machine of the class described; a base; de-forming mechanism mounted thereon; an arm also mounted on said base overhanging said mechanism and presenting an abutment and an indicating device in alignment with said mechanism; and a support-member provided with a work-support and a form-support movable together bodily and rotatively, to engage said form with said abutment, and said work with said de-forming mechanism, substantially as described.

41. In a machine of the class having a form-support movable bodily and rotatively to engage a form continuously with an abutment; an abutment-support having an abutment and an indicator, both carried by said abutment-support adjacent the path of, and to be engaged by, said form, said indicator being moved from its normal position by bodily or rotative departure of said form from normal engagement with said abutment; substantially as described.

42. A tangency indicator for apparatus in which the work and form rotate together and are movable bodily as a unitary structure relatively to a tool, said indicator comprising a pointer mounted pivotally on a suitable support adjacent an abutment also carried by said support in axial alignment with the region at which said work is to be engaged by said tool, said abutment being arranged to be engaged continuously by said form, and said pointer having a plurality of form-engaging portions, one on each side of the axis of normal tangency between said form and abutment, so that said pointer occupies a predetermined position while said normal tangency continues, said form acting upon one or another of said portions to rotate said pointer into a different position when said form is moved rotatively or bodily out of normal tangency and said work out of proper engagement with said tool.

43. In a machine of the class described; an indicator comprising a pointer provided with means to engage a form at a plurality of points, thereby to determine the angular position of said pointer relatively to said form; and means to bring successively different regions of said form into engagement with said form-engaging means.

44. An indicating device of the class described; comprising a support; and a pointer mounted rotatably thereon, said pointer being provided with means to engage a form at a plurality of points, there-

by to determine the angular position of said pointer relatively to said form.

45. An indicating device of the class described; comprising a support; an abutment member carried thereby; a plunger arranged to slide adjacent said abutment; and a pointer mounted rotatably on said plunger, said pointer being provided with means to engage a form at a plurality of points, thereby to determine the angular position of said pointer relatively to said form; and means to operate said plunger to move the axis of said pointer into and out of alignment with the abutment portion of said abutment member, and to move said means into and out of position to engage with said pattern.

46. An indicating device of the class described; comprising a support; an abutment-member mounted to slide thereon; and an indicator mounted rotatably on said abutment-member and provided with a plurality of form-engaging portions; and a member movable on said support to engage said abutment-member to move said abutment-member into adjusted position and there secure it; substantially as described.

47. An indicating device of the class described; comprising a support provided with a scale and having a sliding plunger; an indicating pointer mounted rotatively on said plunger in conjunction with said scale and having a plurality of projections to engage a form; a spring operating on said plunger and tending normally to hold said projections toward the path of said pattern; and manually controlled means to withdraw said plunger and projections from operative position at times and to release said pointer at times for indicative rotation; substantially as described.

48. An indicating device of the class described; comprising an abutment-member having a medially arranged abutment portion to be engaged with a form, and provided with recesses on each side of said abutment portion; a pointer-carrying-member movable adjacent said abutment-member, and provided with a rotatable pointer having form-engaging projections; and means to move said pointer-carrying-member into position to engage said projections with a form and permit rotation of said pointer by said form when so engaged; and also into position to engage said projections with said recessed portion of said abutment-member to protect said projections from injury and to maintain said pointer erect; substantially as described.

49. In a machine of the class described; the combination with a movable form-support, of an abutment-member, and universally adjustable abutment-supporting means to present said abutment in desired position

for engagement with said form; substantially as described.

5 50. Form and work-supporting means for mechanism of the class described, comprising a movable member provided with a plurality of shoulder devices in alinement with each other, and arranged respectively for engagement, one with a form, and another with a work-blank; substantially as described.

10 51. Form-supporting means for mechanism of the class described; comprising a form-engaging shoulder occupying a predetermined position and a member arranged to engage said form and hold it in direct engagement with said shoulder; substantially as described.

15 52. Form-supporting means for mechanism of the class described; comprising a form seat; a form-engaging shoulder; a draw-bolt lying beneath the surface of said seat and provided with a finger to engage

said form; and a draft-screw extending through said shoulder, to draw said bolt and form toward said shoulder; substantially as described.

25 53. A filling-piece to complement the support-engaging edge of forms when used in apparatus of the class described; said filling-piece comprising a member presenting on one side a contour corresponding with the edge 30 of said form, and on the other side a contour suitable for engagement with the form-engaging portion of the form-support; substantially as described.

In testimony whereof I have signed my 35 name to this specification in the presence of two subscribing witnesses.

THOMAS LUND.

Witnesses:

ELIZABETH C. COUPE,  
ARTHUR L. RUSSELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

Correction in Letters Patent No. 1,024,516.

It is hereby certified that in Letters Patent No. 1,024,516, granted April 30, 1912, upon the application of Thomas Lund, of Beverly, Massachusetts, for an improvement in "Mold-Forming Machines," an error appears in the printed specification requiring correction as follows: Page 8, line 37, for the words "movable bodily" read *having a universal body movement*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of June, A. D., 1912.

[SEAL.]

C. C. BILLINGS,

*Acting Commissioner of Patents.*