L. A. DISS.

MACHINE FOR MAKING DIES FOR THE MANUFACTURE OF TYPE FOR TYPE WRITING MACHINES, &c.

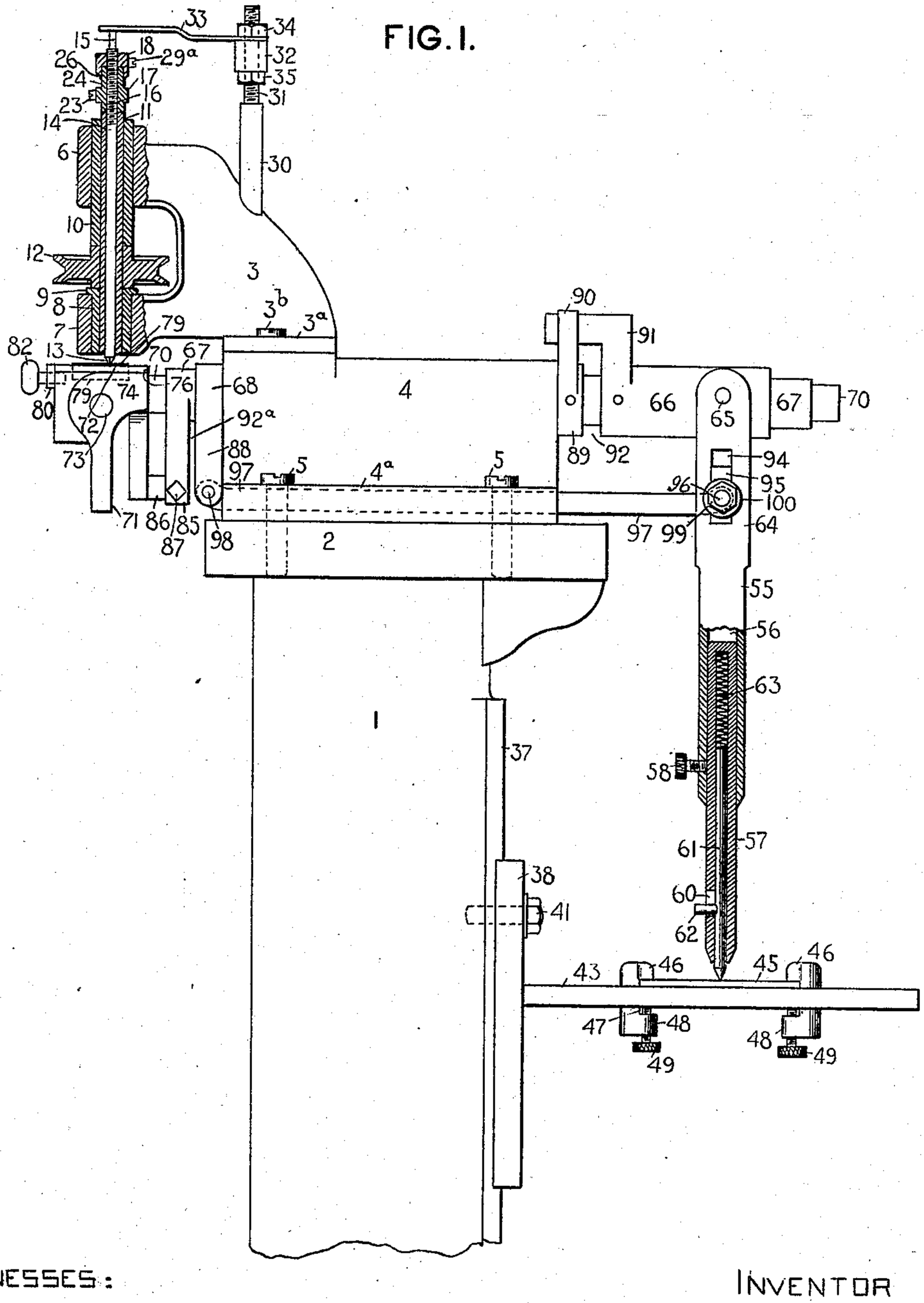
APPLICATION FILED MAY 1, 1901.

924,539.

Patented June 8, 1909.

3 SHEETS—SHEET 1.

FIG. 1.



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E. M. Wells.

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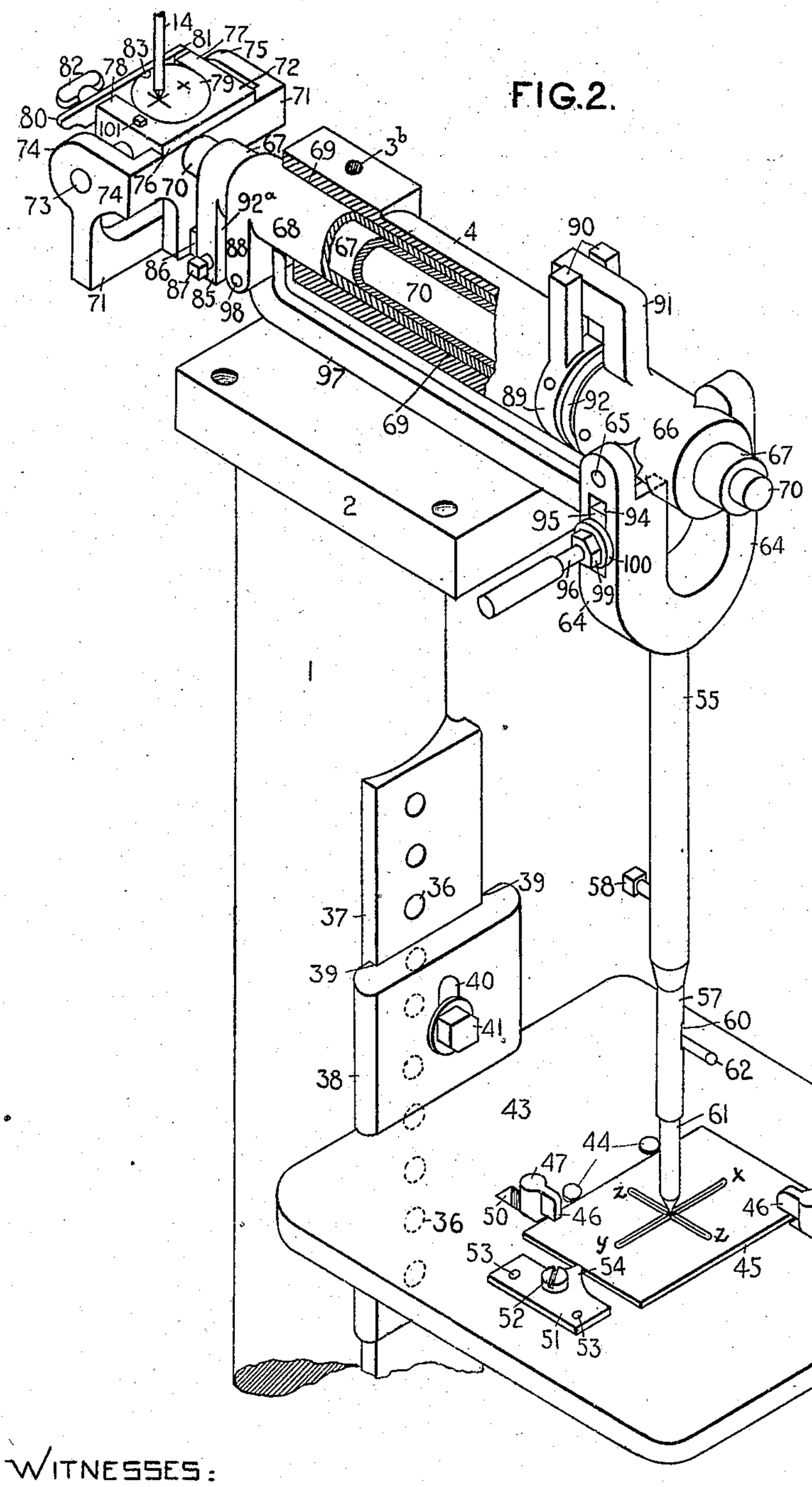
3 SHEETS—SHEET 2.

FIG. 2.



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3 SHEETS—SHEET 3.

FIG. 3.

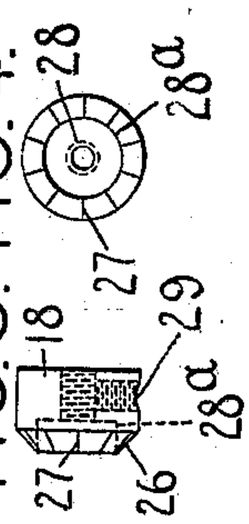


FIG. 4.

FIG. 6.

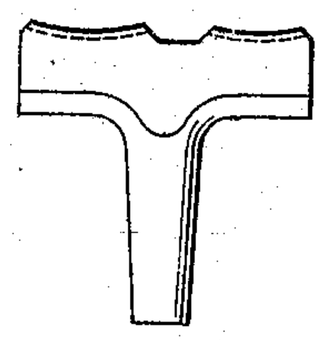


FIG. 8.

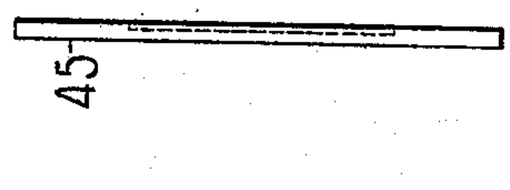


FIG. 5.

FIG. 7.

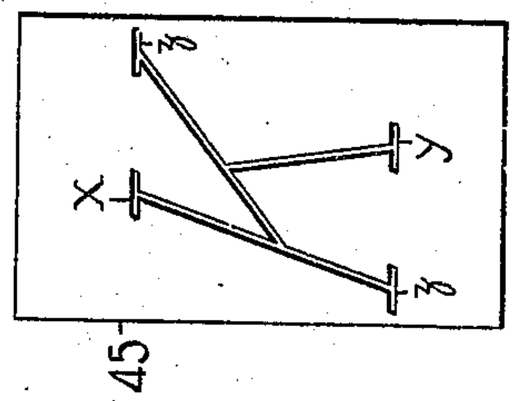


FIG. 9.

FIG. 10.

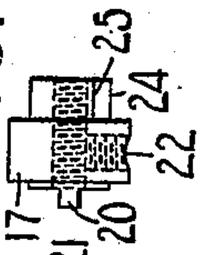


FIG. 16.

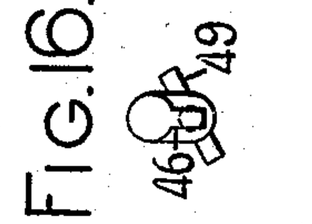


FIG. 15.

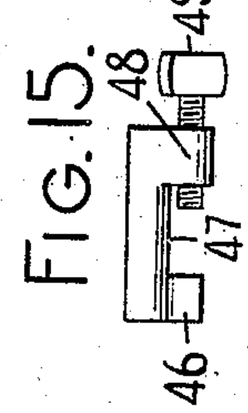


FIG. 17.

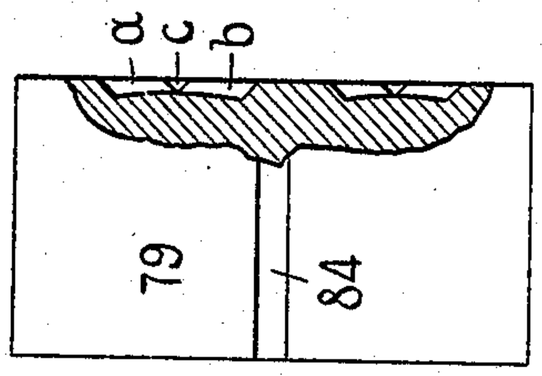


FIG. 14.

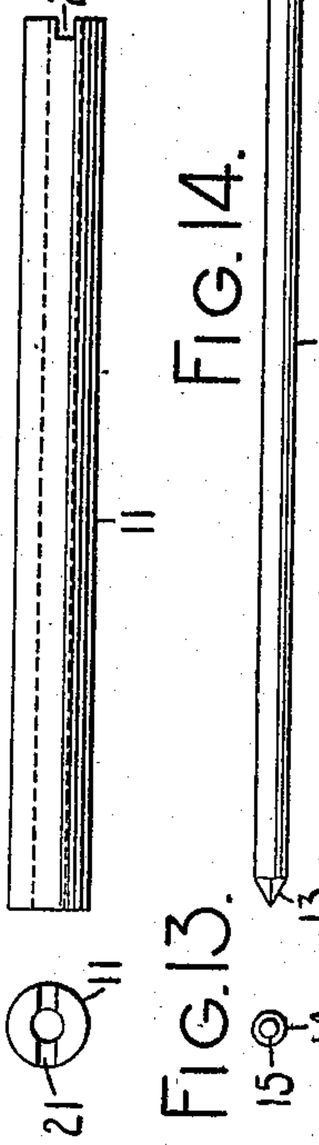


FIG. 12.

FIG. 13.

FIG. 18.

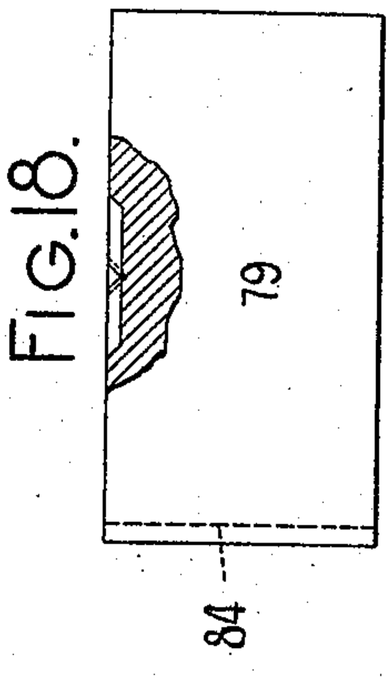
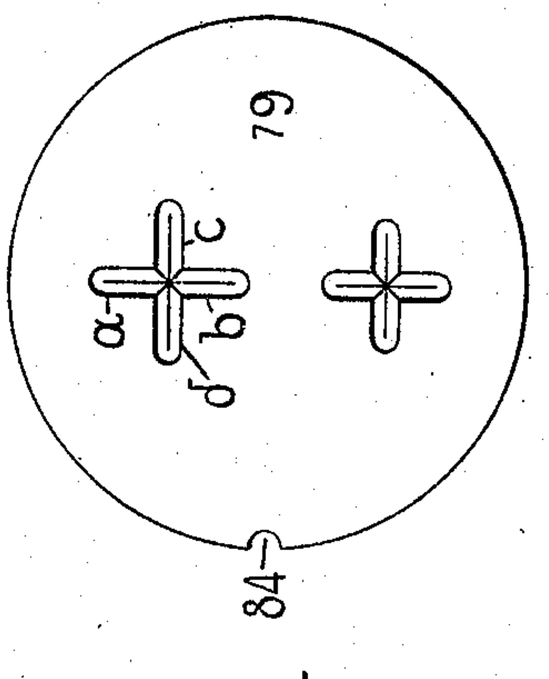


FIG. 19.



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UNITED STATES PATENT OFFICE.

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MACHINE FOR MAKING DIES FOR THE MANUFACTURE OF TYPE FOR TYPE-WRITING MACHINES, &c.

No. 924,539. Specification of Letters Patent. Patented June 8, 1909.

Original application filed June 4, 1898, Serial No. 682,542. Divided and this application filed May 1, 1901. Serial No. 58,274.

To all whom it may concern:

Be it known that I, LOUIS A. DISS, a citizen of the United States, and a resident of Ilion, in the county of Herkimer and State of New York, have invented certain new and useful Improvements in Machines for Making Dies or Matrices for the Manufacture of Type for Type-Writing Machines, &c., of which the following is a specification.

This application is a division of my application filed June 4, 1898, Serial No. 682,542.

The present invention relates to a machine for cutting dies or matrices from which to make writing machine types whose faces are concaved to fit the surface of the usual cylindrical platen. The dies or matrices have the form (inverted) of the finished types. The latter are made of iron or steel, and must therefore be produced from hardened steel matrices or dies. Heretofore such dies have been made by forcing master types into soft steel, and then hardening the latter. This method is open to two objections, the first of which arises from the necessity of hardening the master type after it is shaped, and which hardening causes the type to become somewhat deformed. The second objection arises from the necessity of forcing the master types into soft steel and of subsequently hardening the latter. In these operations the matrix is strained by the compression, and the strain is removed by the subsequent heating, and hence the impressions are disturbed or distorted. Thus from two independent causes deformities exist in matrices formed by the usual process. Both of these objections are overcome by my invention of forming a type matrix by a cutting process, since practically no deformation of the characters occurs in hardening a cut matrix.

The principal object of this invention is to provide a simple and efficient machine for cutting dies or matrices from which to form types whose faces are curved to match substantially the curvature of the cylindrical writing machine platen upon which they are intended to print.

The invention consists of certain features of construction and combinations of devices all as hereinafter described and more particularly pointed out in the appended claims.

In the accompanying drawings:—Figure 1 is a side elevation of the machine, partly in section. Fig. 2 is a perspective view, the cutter head being omitted. Fig. 3 is a side view of a graduated sleeve or nut for use in conjunction with the cutter carrier. Fig. 4 is a bottom view of the same. Fig. 5 is a face view on an enlarged scale of a double-case type and its shank. Fig. 6 is a side view of the same. Fig. 7 is a plan view of a plate having a skeleton pattern letter grooved therein. Fig. 8 is a side view of the same. Fig. 9 is a side view of the cutter carrier and adjuster. Fig. 10 is a plan view of the same. Fig. 11 is an end view of the cutter spindle. Fig. 12 is a side view of the same. Fig. 13 is an end view of the cutter rod. Fig. 14 is a side view of the same. Fig. 15 is a side view of a clamp for securing the pattern plate in place. Fig. 16 is an end view of the same. Fig. 17 is a side view partly in section, and on an enlarged scale of a die or matrix for use in the dropping or pressing process of making type. Fig. 18 is a like view of the same taken at right angles to the position shown in Fig. 17. Fig. 19 is a face or top plan view of the die.

The same part in the various views will be found to be designated by the same character of reference.

1 indicates a hollow standard or casting, provided at its top with a platform 2.

3 is a head or standard, whose base 3^a is secured by screws 3^b upon a bed 4, which is bolted to the platform 2 by screws 5, which pass through the opposite base plates 4^a of the bed 4 and engage threaded holes in the platform 2.

The head 3 is provided with a pair of bearings 6 and 7 disposed one over the other and drilled vertically, the lower bearing 7 being provided with a bushing 8, which has a flange 9 at one end thereof and inserted in the bearing 7 from above. The upper bearing 6 is provided with a bushing or sleeve 10; the cutter-operating spindle or sleeve 11 fits in and passes through the bushings 8 and 10, between which is a pulley-wheel 12 fast on the spindle 11. One end of the hub of the wheel 12 rests upon the bushing 8, while the bushing 10 rests upon the other end of said hub.

The cutter 13 is at one end of a rod 14, whose opposite end is reduced at 15; the main portion or shank of the rod 14 adjoining the part 15 being screw-threaded as at

16. This rod 14 fits within the sleeve or spindle 11 and is provided with an adjustable cutter-suspending nut or device 17 and graduated sleeve 18. The nut 17 is provided with an internally threaded longitudinal perforation 19 (Fig. 10) for engagement with the threaded portion 16 of the rod 14; and it may also be provided with a knurled surface. At one end of the nut 17 is provided with tongues 20 adapted to engage notches 21 in the upper end of the spindle 11, (Figs. 9 and 12) and the nut is provided with a transverse threaded hole 22, for a set screw 23 (Fig. 1), which bears against the threaded portion 16 of rod 14, so as to secure the nut 17 in any position to which it may be adjusted on the rod 14. The other end of the nut 17 is reduced in diameter at 24, and is provided with a mark or index 25 extending longitudinally thereof.

The graduated nut or sleeve 18 has a coned end 26, upon which are suitable graduations or marks 27, say ten, numbering from "0" to "9". The nut 18 is provided with a longitudinal threaded perforation 28, adapted to screw upon the threaded portion 16 of the rod 14; it is also counter-bored at 28ª to receive the reduced cylinder portion 24; and it is also provided with a transverse or radial threaded hole 29, to receive a set screw 29ª whereby it may be securely attached to the rod 14.

To the head 3 is fixed an upright rod 30, whose upper end 31 is threaded. A sleeve 32 fits loosely over the threaded portion 31 and is provided with a flat or leaf spring 33, which bears upon the upper end of the cutter rod 14. Nuts 34 and 35 above and below the sleeve 32, allow of the adjustment of the latter, so that the desired amount of spring pressure upon the upper end of the cutter rod may be secured. The spring 33 forces the point of the cutter down (before the tracing operation begins) so far as the nut 17 will allow, and thereafter operates to maintain the tool in that position, so that during the tracing operation the point of the tool remains at a fixed and invariable point, without attention on the part of the operator. The spring may be swung aside to permit the removal of one cutter rod and insertion of another, and may then be swung back to working position.

The pulley 12, sleeve 11, nut 17, sleeve 18, and cutter rod 14, are rotated by means of a cord or belt connected with a suitable source of power.

When it is desired to adjust the cutter 13 closer to or farther from the work, the spring 33 is swung aside; the set screw 23 in nut 17 is loosened, and the nut 18 and rod 14 are rotated together (nut 17 being held stationary the while), or nut 17 is rotated, the sleeve 18 and rod 14 being held stationary the while in the direction which will increase or decrease the distance between nut 17 and the point of the cutter 13, according as it is desired to lower or raise the cutter. As a guide to obtain accurate adjustments, the mark 25 and the graduations upon the cone 26 are provided. When the mark 25 reaches the graduation on cone 26 which corresponds to the amount by which it is desired to raise or lower the point of the cutter 13, the said set screw 23 is tightened up and spring 33 is returned to working position.

The distances through which the point of the cutter 13 is adjusted are, relatively speaking, not large; a complete turn of the rod 14 in either direction probably covering all the adjustments that will be required after nut 17 has once been set. The effect of increasing the distance between the point of the cutter 13 and the work is to increase the radius of the curved working faces of the dies formed. Conversely, decreasing the distance between the point of the cutter 13 and the work decreases the radius of said working faces. The nut 17, in conjunction with the spindle 11, performs several functions; it forms a support or carrier for the rod 14, and with the tongues 20 and notches 21 forms a clutch or coupling for connecting sleeve spindle with rod 14; and the said nut 17 also acts as an adjustable stop for rod 14.

The column or standard 1 is provided with a front vertical row of screw threaded holes 36 (Fig. 2) formed in a rectangular piece or guide 37. A slide 38 is formed with jaws 39 which embrace the edges of the guide, and is also provided with a vertical slot 40, a fastening screw 41 passing through the slot and engaging with one of the holes 36, so as to secure the slide 38 in its adjusted position. A platform 43 projects horizontally from the slide 38 and is provided with gage pins 44 arranged to co-act with an edge of a rectangular grooved pattern plate 45. The platform is also provided with clamping jaws 46 projecting from shanks 47 (Figs. 15 and 16), which are formed with projections 48, carrying clamping screws 49, opposed to the jaws 46. The platform 43 is provided with suitably shaped openings 50 for the insertion of the clamps, which are then turned so as to bring them over the pattern plate 45, after which the screws 49 are set up, and the jaws 46 thereby drawn down upon the pattern carrier, clamping it in position. In Fig. 2 a gage plate 51 for one end of the pattern plate is attached to the platform 43 by means of a screw 52 and dowel pins 53, and having a projecting gage 54.

A tracing lever 55 is bored at 56 to receive an internal sleeve 57, a set screw 58 securing the sleeve 57 against endwise displacement. The sleeve 57 is closed at its upper end and provided with a slot 60 near its lower end. A tracing pin 61 fits within the sleeve 57

and is provided with a lateral pin 62, which passes through the slot 60, thus limiting its motion longitudinally of the sleeve and providing a handle for lifting it. A compression spring 63 inserted in the sleeve 57 bears against the closed end of the sleeve and pushes the tracing pin downwardly.

The tracing lever 55 is provided with prongs or forks 64, pivoted at their upper ends at 65 upon a long collar 66 which is rigidly secured upon a hollow shaft 67, the latter extending through the bore of a tube 68, which is rotatably mounted in a horizontal bore 69 formed longitudinally in the bed 4. Said hollow shaft 67 contains a longer shaft 70, which has a vise-head 71 just beneath the cutter 13.

The blank holding vise consists of a block of metal perforated to slide upon a transverse rod 73, which is fixed in side arms or forks 74 and 75 of the cross head 71, the latter being fast upon the central rock shaft 70. The vise 72 is provided with an overhanging flange 76 which rests upon the top of the cross head 71, and is also provided with side arms or forks 77 and 78, which are united by a semi-circular part adapted to the circular or disk-like die blank 79, which rests upon a flat part or seat in the vise above the transverse rod 73. A keeper or jaw 80, hinged to the arm 77 at 81 and provided with a thumb-screw 82 which is tapped into the arm 78, secures the die-blank 79 in position. The jaw 80 is provided with a locking and registering rib 83 adapted to a groove 84 in the side of the die blank 79, so that the latter may be removed and replaced without change of position relatively to the cutter.

The hollow shaft 67, wherein the central shaft 70 is adapted to slide, is provided near the vise-head 71 with a forked head 85, and said vise head is provided with a rectangular arm 86 fitting between the prongs of the fork 85. Opposite set screws 87, passing through the prongs of the fork 85 are adapted to secure the arm 86, so that the central shaft 70 is compelled to rock with the hollow shaft 67, and may also be adjusted, together with its attached parts, both rotatively and longitudinally of said hollow shaft. The tube 68 is provided at its rear end with a fork 88, and at its front end with a fixed collar 89 having a fork 90. The fork 88 and collar 89 abut against the ends of bed 4 and prevent endwise movement of the tube. The intermediate hollow shaft 67 projects beyond the tube 68 at the front of the machine, and the long fixed collar 66, with which it is provided, has an elbow 91 which fits between the prongs of the fork 90, so that any rocking motion of either hollow shaft 67 or tube 68 is communicated by the one to the other, while the shaft 67 may slide lengthwise in the tube 68 to a limited extent, suitable spaces 92 and 92[a], the former between the collars 89 and 66, and the latter between forks 85 and 88, being left for the purpose. One of the forks 64 of the tracing lever 55 is slotted at 94 for the reception of an adjustable slide 95, having a pin 96 which provides a pivotal connection for a horizontal rod or link 97 with lever 55. At its rear end the link, which occupies a position between the opposite base plates 4[a] of the bed is pivoted in the fork 88 by means of a pin 98. A nut 99 and washer 100 secure the slide 95 in any adjusted position. The link 97 is longitudinally immovable, so that the pin 96 serves as a fulcrum for the lever 55, whereby the latter is enabled to move the shafts 67 and 70 together endwise.

The matrices or dies shown at Figs. 17, 18 and 19, are intended for producing type by the dropping process.

The operation of the apparatus is as follows:—Assuming that it be desired to form a double case die for the "plus" mark shown in Fig. 19, the guide or pattern plate 45 is placed upon the platform 43 against the pins 44 and stop 54, as shown in Fig. 2, and secured by means of two or more clamps 46 with the top *x* bottom *y* and sides of the letter pattern disposed as shown. The pattern letter is preferably much larger than the corresponding character to be cut in the blank, and hence the parts of the machine are so proportioned as to greatly reduce the movement of the die as compared with that of the pattern tracer. Assuming that it is desired to form the larger die at Fig. 19, the slide 95 is adjusted to say the position shown in Fig. 2, and the die blank is secured in the vise. The tracing pin 61, which is movable longitudinally in sleeve 57, is placed in the center of the cross or "plus" mark (Fig. 2), which is formed by intersecting V-shaped grooves. The rod 14 is inserted in the spindle 11, and the spring 33 is placed over its upper end, pressing the cutter 13 down upon the surface of the die blank. The cutter is next rotated by means of the pulley 12 and spindle 11; as soon as the cutter, under the force of spring 33, has cut its way into the die blank as far as the nut 17 will allow it, the tracing pin 61 is slowly moved by means of the lever 55 along one of the four arms of the pattern, the point of the tracing pin being kept in the bottom of the V-shaped groove by means of the spring 63, which moves the pin outwardly longitudinally of the lever. Assuming that the latter is swung sidewise, the rock shafts 67 and 70, as well as the tube 68, are rotated upon their axis, so that one end of the vise swings up and the opposite end swings down; the corresponding groove cut in the die is the branch *a* of the upper or larger "plus" mark shown in Fig. 19. When the point of the tracing pin has

reached the end or limit of the groove, it is moved back to its starting point, thus swinging the blank back to its first position, and another branch of the cross is begun, say the branch *b* opposite the one just formed. In this case, the vise will tip oppositely. The tracing pin is then brought back to the center of the pattern, which, of course brings the center of the upper die under the cutter, and the formation of the cross groove is begun. The tracing pin is now moved forwardly along the groove of the pattern, and there is no rotation of the shafts 67 and 70, but the lever swings upon its axis or fulcrum 96, and through the described connections moves the shafts 67 and 70 rearwardly together with the die blank, so that the cutter forms the branch *c*. The tracing pin is now brought back to the center of the pattern, and moved rearwardly along the groove, thus causing the formation of the branch *d*.

The fork 90, arm 91, and the other parts secure that the rear end of the link 97, to wit, that end pivoted on pin 98, shall rotate about the axis of shaft 70 in unison with the front end, or that pivoted on the pin 96. The vise 72 is rotated about the axis of the central shaft 70, and the convex curve in the matrix groove shown at Fig. 17 is produced by moving the tracing pin along from side to side. The straight bottom of the groove produced by the forward and rearward operation of the tracer is shown at Fig. 18.

The above described operations of the machine assume the use of but one cutter only. In practice, however, I prefer to use two or more cutters successively, to avoid putting an undue amount of work upon a single tool, and also to obtain a fine finish by means of a suitable tool. Preferably the depth of the first cut is less than the depth of the completed groove. For the second cut, a finishing cutter may be substituted for the said first cutter, and adjusted to take a slight cut. However, a third cut may be taken if desired. In making each cut the tracing pin and the same fixed pattern are used. If now it is desired to form the smaller cross shown in Fig. 19, it may be done from the same pattern, or the latter may be replaced by a smaller pattern, the vise block 72 being adjusted along the rod 73 from the position shown in Fig. 2 over against the arm 74 of the vise head and there secured by set screw 101. In case a smaller pattern is employed for grooving the smaller cross in the matrix, no adjustment of the tracing devices is necessary, and the described grooving operation is repeated. If, however, it is desired to obtain the smaller die from the same large pattern, the following adjustments are made:—the screw 41 is removed and the platform 43 is moved downward so that the tracing lever may be lengthened or drawn out, so as to cause a diminution in the movements of the die block when the same pattern is being traced by the lever. The screw 41 is then inserted in a new hole 36, and the platform secured in place. The slot 40 and screw 41 allow of delicate adjustments of the height of the platform so as to secure the exact degree of reduction desired. Then the set screw 58 is loosened and the telescopic sleeve 57 is slid out until the pin 62 occupies a position at the upper part of slot 60, the point of the tracer 61 being at the center of the pattern and resting on the bottom of the groove therein. This adjustment of the pins 62 or of the tracing pin 61 secures free longitudinal motion of the latter as it is moved to all parts of the pattern. The set screw 58 is then tightened up. The operation of grooving the smaller "plus" mark is substantially the same as that hereinbefore described, except that the die blank makes smaller motions. It will be understood, of course, that the blank may be swung or moved simultaneously crosswise and lengthwise of the axis 70, so as to move in any desired direction, and hence enables the cutter 13 to groove any desired letter, figure or other character.

In order to vary the width of the types produced from one pattern, provision is made for the increase or reduction of the motion of the vise and die in one direction, without affecting the extent of its motion in the other direction, so that from a single set of pattern letters there may be formed a set of dies for the production of types for use in a machine whose letter feed movement is one-tenth (1/10) of an inch, and also a set of dies for making types for use in a machine whose feed movement is greater or less than one-tenth (1/10) of an inch, without, however, making any change in the height of the several sets of letters. This result is secured by means of the slide 95 and the slot 94. The closer the fulcrum pin 96 is set to the pivotal connection 65 of the lever 55, the less is the longitudinal throw of the shaft 70 and the vise thereon; while by moving the slide 95 farther from the axis 65, the greater is said throw. The lines of the dies, formed by the cutter when the vise moves longitudinally of the axis 70, are those lines which determine the width of the character grooved in the die; and hence it will be seen that the width of the character may be varied by varying said throw of the vise as described. The cutter 13 is three-sided and V-pointed; that is, it is substantially an inverted, equilateral, triangular pyramid, and may come to a fine point, or the point may be slightly rounded in order to avoid the formation of too sharp an edge upon the working face of the type produced from the matrix. The lines of the finished

or printing type face equal in thickness the diameter of the extreme point of the cutter. Only a skeleton outline of the type is generated in the matrix by the point of the cutter, owing to the use of a grooved skeleton pattern letter and a follower which constantly fits the groove. The letter is cut intaglio in the pattern plate, that is, in the form of a channel or groove, the tracer being positively guided by the said groove throughout the cutting operation. As will be noticed by reference to Fig. 7, the groove or grooves in the pattern plate are parallel sided and of uniform width throughout.

It will be seen that I have combined a cutter and a die or work holder, one of said parts being arranged to swing on an axis and move along said axis at right angles to its swinging movement, the relative movements of the cutter and blank holder, whereby the predetermined convex curves are grooved in the matrix, being controlled by said axis. By the above phrase "relative movements of the cutter and blank holder", I refer particularly to the automatic swinging movements about said axis which produce the desired curve, as distinguished from the manually controlled or surface movements which determine the outline of the letter. By this construction the matrices are cut uniformly and automatically with a predetermined curve. The operator may manipulate the tracer to vary the outlines of the groove in the matrix, but not to vary the curve upon which the grooves are cut. The curved bottom lines of the grooves shown in Fig. 17 produce that surface of the type which is to fit the cylindrical surface of the platen, and have substantially the same radius as the latter, said radius being equal to the distance from the axis of the shaft 70 to the point of the cutter 13. Although preferable, it is not essential that the type shall be formed upon a curve having the exact radius of the platen, so long as it is so curved as to fit the platen in practice, and enable all portions thereof to bear with substantial evenness upon the platen. At Fig. 5 it will be noted that the two letters upon the type are arranged one above another, so that the top of the lower letter is next the bottom of the upper letter, the space between the letters depending upon the extent of the "shift" of the writing machine platen relatively to the type. It will be seen that the curves of the two letters on the type, although having equal radii, are eccentric to each other, that said curves would intersect if produced, and that the curve of each letter extends from top to bottom, or in other words, the upright lines or vertical axes of the letters are formed on curves.

Heretofore in producing a master punch or a matrix it has been found nearly impossible to position two or more characters thereon with the exactness required, and hence when placed in a writing machine at least one of the letters has usually been found to be out of line, either vertically or sidewise, or both, or perhaps canted over, rendering it necessary to file, cut, twist, bend, compress, expand and otherwise treat the type in order to get both letters in perfect alinement with the other types in the machine. Such treatment of the types is difficult and requires special tools and appliances, as well as the skill of a trained workman. By my invention this difficulty is wholly avoided and each of the characters on the type may be produced and positioned with perfect accuracy, and by a workman having vastly less skill than that heretofore required to make type, and in consequence the subsequent expense of alining the types in a writing machine is materially reduced. By my invention if a special type is desired, say one having both the figure "3" and the question mark, a matrix blank is placed in the blank holder, the usual pattern for the figure "3" is placed in the pattern holder, and the character "3" is formed upon the matrix blank in the described manner. Then the pattern is removed, and the usual pattern for "?" substituted; the blank shifted, and the "?" formed thereon, both characters being formed in absolutely correct positions upon the blank. When the writing machine type is produced from the matrix, it is found to be perfect.

Of course the invention or improvement is equally well adapted for making dies for single type or characters and many changes may be made without departing from the spirit of my invention.

It will be seen that I have combined a pointed cutter and a die or work holder, one of said parts (preferably the work holder) having a swinging movement and also a straight line movement parallel to the axis of the swinging movement, and the cutter being unvarying in its distance from said axis during its operation; that means are provided for communicating the movement of the manually-controlled pattern tracer 61 to said swinging part, said tracer being guided by the grooves in the pattern plate 45; that the work holder swings upon a longitudinally movable journaled shaft 70; that the tracing lever swings upon said shaft and may move the latter endwise, together with the work holder; that the face of the work lies between the axis of the shaft 70 and the point of the cutter; that the pattern letter is so mounted in the machine that the grooves extending from the top to the bottom of the letter cut in the matrix are curved concentrically with the axis upon which the work holder swings; that the work holder is shiftable transversely of the shaft 70, and hence that means are provided

for effecting relative straight line movements between the cutter and work holder in directions parallel with and at right angles to the axis of the shaft 70; that means are provided for causing the cutter to groove a plurality of skeleton letters in the work, said means including a pattern tracer and also including automatically operating devices for causing the cutter to cut the grooves which extend in the direction of the work shifting movement upon predetermined uniform convex curves, and the grooves which extend at right angles to said shifting movement upon straight lines; that the work may be shifted to different set positions, the work holder swinging upon an axis arranged at right angles to the direction of said shifting movement; that stops 74 and 75 are provided for limiting said shifting movements; that means are provided for varying the ratio between all the movements of the pattern tracer 61 and the length of the corresponding grooves cut in the work; that means are also provided for varying the ratio between the motion of said tracer in one direction and the corresponding motion of the work holder, without varying the ratio of motion in the other direction; that the pattern letter is so fixed in the machine that the vertical axis of the type face produced from said pattern letter lies in the direction of the work shifting movement; that the pattern holder is shiftable toward and away from the shaft 70; that by varying the position of the forward end of the link 97 the ratio may be varied between the movement of the tracer and the corresponding letter cutting movement only in a direction parallel with the axis 70; that said shaft may be rocked by said tracer; that a vise head is mounted upon said shaft and may be rotatively adjusted thereon by means of screws 87; that the pivot or bearing 96 for the tracing lever is parallel with the pivot 65, said pivots being relatively adjustable, whereby the dimensions of the letters grooved in the work may be varied in a direction parallel with the axis of the shaft 70; that the link 97 is mounted so as to rock with the shaft 70 and afford an adjustable fulcrum for the tracing lever; and that the blank holder is adjustable in the vise head 71 at right angles to the shaft 70.

From the foregoing it will also be seen that the mountings of the cutter and of the work holder are such as to constrain these parts to move with relation to each other in such a manner that the bottom of the groove always lies in the geometrical surface of a cylinder irrespective of what form the surface of the blank may have, and irrespective of the form of the pattern. The bottom of the groove is in the surface of a cylinder, not because the blank has a cylindrical surface and notwithstanding the fact that the pattern shown in the present instance is flat. It is the mountings of the cutter and work holder themselves that make it impossible for the cutter to cut any other character of groove than one, the bottom of which lies in the surface of a cylinder. It will, of course, be understood that in practice the radius of this geometrical cylinder is equal to the radius of the cylindrical platen with which the types to be formed from the dies are intended to coöperate.

What I claim as new and desire to secure by Letters Patent, is:—

1. In a machine for cutting dies for type-faces, the combination of a pointed cutter and a die or work-holder, one of said parts having a swinging movement on a fixed axis and being so mounted that said part remains at an invariable distance from the fixed axis and having a straight line movement parallel to the axis of the swinging movement, the other of said parts being unvarying in its distance from said fixed axis during its operation.

2. In a machine for cutting dies for type faces, the combination of a pointed cutter, a die or work holder, one of said parts having a swinging movement on a fixed axis and being so mounted that said part remains at an invariable distance from the fixed axis and having a straight line movement parallel to the axis of the swinging movement, the other of said parts being so mounted that it remains at an invariable distance from said axis during its operation, a pattern and pattern tracer, and means for effecting all of the movements of the swinging part by the movements of the pattern tracer.

3. The combination of a pointed rotary cutter, a work holder, a longitudinally movable shaft having a fixed axis about which one of said parts swings in arcs having predetermined fixed radii, means for holding the other part at a fixed distance from the axis of said shaft, a tracer mounted upon said shaft, and means for enabling the tracer to move the shaft endwise.

4. In a machine for producing writing machine type matrices, the combination of a pointed rotary cutter, a work holder, one of said parts being mounted to swing upon a fixed axis and at an unvarying distance therefrom and being movable in a straight line parallel with said fixed axis, and the face of the work lying between said axis and the point of the cutter, a pattern tracer connected to said swinging part, and a pattern letter so mounted in the machine that the grooves extending from the top to the bottom of the letter cut in the matrix by said cutter are curved concentrically with said axis.

5. The combination of a journaled shaft, a matrix holder mounted upon said shaft, a tapering cutter, means for holding said cut-

ter at a fixed working distance from the axis of said shaft during the cutting operation, a tracing lever swinging about the axis of said shaft, and means for enabling said lever to move the matrix holder in a direction parallel with the axis of said shaft.

6. The combination of a shaft, a pattern tracer mounted thereon, a work holder also mounted upon said shaft and shiftable transversely thereof, means connected to said tracer and to said shaft for moving said work holder in a straight line parallel with said shaft, and a pointed rotary cutter.

7. The combination of a rotary groove-cutter, a work-holder, a shaft, a pattern-tracer operative to turn said shaft, one of said cutter and work-holder elements being mounted upon said shaft and maintained at a fixed working distance from the axis of said shaft, and means for providing relative straight line cutting movements between the cutter and the work holder in a direction parallel with the axis of said shaft, a pattern, and means independent of the pattern and pattern tracer for affording relative straight line shifting movements between the cutter and the work holder in a direction at right angles to the axis of said shaft.

8. The combination of a pointed rotary groove-cutter, a work-holder, means for providing a relative shifting movement between the cutter and the work-holder to different set positions, so that the cutter may produce a plurality of letters upon a single blank, and means for causing the cutter to groove skeleton letters in the work, said means including a pattern-tracer, a pattern bearing a character to be reproduced and mountings for the work holder and cutter of such sort as to cause the cutter to cut the grooves which extend in the direction of said shifting movements on convex curves of predetermined uniform radius and the grooves which extend at right angles to said shifting movements on straight lines, cuts of the character set forth being produced irrespective of the character of the surface of the work operated upon and irrespective of the design to be produced.

9. The combination of a rotary pointed groove-cutter, a work-holder, a pattern, a pattern-tracer connected to said work-holder, and means independent of the pattern tracer for shifting the work-holder to different set positions so that the cutter may produce a plurality of letters upon a single blank, said work-holder and cutter being so mounted as to cause the cutter to cut the grooves which extend in the direction of the work-shifting movements upon convex curves of uniform radius and the grooves which extend at right angles to the direction of said shifting movements upon straight lines irrespective of the form of the pattern or of the work.

10. The combination of a rotary pointed cutter, a work-holder, one of said cutter and work-holder elements swinging upon a fixed axis, a pattern-tracer connected to said swinging part and also connected to means whereby it may effect a relative movement of the cutter and work-holder in a straight line parallel to the axis of said swinging part, and means independent of the pattern-tracer for providing a relative shifting movement between the cutter and the work-holder to different set positions and in a direction at right angles to said fixed axis.

11. The combination of a rotary pointed cutter having a fixed working position, a work-holder swinging upon a fixed axis, said holder being shiftable in a direction at right angles to said axis, stops for limiting the shifting movements of the holder, and a tracer for swinging said holder upon said axis and moving said holder in a straight line parallel with said axis.

12. The combination of a pointed rotary groove cutter, a work-holder, one of said parts being mounted to swing upon a fixed axis and to move in a straight line parallel with said axis and both of said parts being maintained at a fixed working distance from each other, a pattern tracer, a pattern-letter, and means for varying the ratio between the movement of the pattern tracer and the length of the corresponding groove cut in the work.

13. The combination of a pointed rotary cutter, a work-holder, one of said parts swinging upon a fixed axis and being so mounted that said part remains at an invariable distance from the fixed axis and having a straight line movement parallel to the axis of the swinging movement, means for holding the other of said parts at a set distance from said fixed axis, a manually-controlled tracer connected to said swinging part, and means for varying the ratio between the motion of the tracer in one direction and the corresponding motion of said swinging part, without varying the ratio of motion in the other direction.

14. The combination of a cutter, a work holder, a pattern tracer connected to one of said parts, the work holder and cutter having a relative shifting movement independent of the pattern tracer, so that the parts may be adjusted for cutting a plurality of letters upon a single blank, a pattern letter so fixed in the machine that the vertical axis of the type face produced from said pattern letter lies in the direction of said shifting movement, said work holder and cutter being so mounted as to cause the cutter to cut grooves which extend in the direction of said shifting movements upon convex curves of uniform radius and grooves which extend at right-angles to the direction of said shifting movements upon straight lines irrespective of the form of the pattern or work

operated upon, the pattern tracer effecting a swinging movement of one of said cutter and work holder elements in the direction of said shifting movement and also moving one of said cutter and work holder elements in a straight line parallel with the axis of said swinging movement, and means for varying the ratio between the movement of the pattern tracer and the corresponding letter cutting movement.

15. The combination of an oscillatory and longitudinally movable shaft, a pattern tracer swinging about the axis thereof, a work-holder mounted upon said shaft and adjustable transversely thereof, a pattern-holder shiftable toward and away from said shaft, a tapering rotary cutter, and means for enabling said tracer to move one of said work-holder and cutter elements in a straight line parallel with said shaft.

16. The combination of a tapering rotary cutter, a work-holder, a shaft upon which one of said cutter and work-holder elements swings, means for enabling a relative straight-line shift to be made between the cutter and the work in the direction of said swinging movement, so that a plurality of letters may be cut upon a single blank, a manually controlled tracer, means for enabling said tracer to effect a straight-line movement of one of said cutter and work-holder elements in a direction parallel with the axis of said swinging movement, and means for varying the ratio between the movement of the tracer and the corresponding letter-cutting movement only in a direction parallel with said axis.

17. The combination of a rotary pointed cutter, a shaft that is mounted to receive a longitudinal movement but which is fixed against lateral movement, a blank-holder operatively connected to said shaft and having a swinging movement about the axis of said shaft and also having a straight-line movement parallel with said shaft, the blank-holder in its swinging movement being at an invariable distance from the shaft and the cutter being maintained during its cutting operation at a fixed distance from said shaft, a tracer, and connections between said tracer and shaft, whereby said tracer is effective to turn said shaft and to move it longitudinally.

18. The combination of a tapering cutter, a manually actuated pattern tracer, a shaft 70 moved endwise and rocked by said manually actuated pattern tracer, a vise-head mounted upon said shaft, a surrounding hollow shaft 67 and screws 87 carried by the latter for rotatively adjusting said vise-head upon said shaft 70.

19. The combination of a rotary pointed cutter, a blank holder, a rocking and endwise movable shaft with which one of said cutter and blank holder elements has a swinging movement, and a tracing lever pivoted at 65 upon said shaft and also having a pivot or bearing 96 parallel with said pivot 65, said pivots being relatively adjustable, whereby the dimensions of the letters grooved in the work may be varied in a direction parallel with the axis of said shaft.

20. The combination of a rotary pointed cutter, a shaft 70 carrying a work-holder, means for effecting a relative adjustment between said work-holder and shaft transversely of the latter, and a pivoted tracing lever having connections whereby it can rock the shaft and work-holder and can also move the shaft longitudinally together with the work-holder.

21. The combination of a rotary pointed cutter, a work holder, shaft 70 upon which the work holder is mounted, hollow shaft 67 through which the shaft 70 extends, said hollow shaft being provided with screws 87 bearing upon a part 86 of the work holder, whereby the latter may be adjusted relatively to said shaft 67, and also whereby the work holder and shaft 70 are caused to rotate with the hollow shaft, and a tracing lever pivotally mounted upon the hollow shaft 67 and having connections whereby it can both rock said shafts and move them endwise.

22. The combination of a pointed rotary cutter, a work holder, shaft 70 whereon the work holder is mounted, hollow shaft 67 through which the shaft 70 extends, forks 85 upon the hollow shaft 67, lug 86 upon the work holder, screws 87, collar 66 fixed upon the hollow shaft 67, tracing lever 55 having forks which are pivoted upon said collar, and a bearing for said tracing lever.

23. The combination of a pointed rotary cutter, a work holder, a rocking and endwise movable shaft 70 upon which said work holder is mounted, link 97 operatively connected to the shaft so as only to rock with the shaft 70, and tracing lever 55 fulcrumed on said link and also pivotally connected to said shaft.

24. The combination of a pointed rotary cutter, a work holder, a rocking and endwise movable shaft 70 upon which said work holder is mounted, link 97 operatively connected to the shaft so as only to rock with the shaft 70, and tracing lever 55 adjustably fulcrumed on said link and also pivotally connected to said shaft.

25. The combination of a rotary pointed cutter, shaft 70, a work holder thereon, tube 68 mounted to rock with the shaft 70, link 97 pivotally connected to said tube, and tracing lever 55 pivotally connected to said shaft and said link.

26. The combination of a rotary pointed cutter, shaft 70, a work holder thereon, tube 68 mounted to rock with the shaft 70. link 97 connected to said tube, and tracing lever 55

swinging upon said shaft and adjustably connected to said link.

27. The combination of a pointed rotary cutter, a work holder, shaft 70 upon which the work holder is mounted, hollow shaft 67 through which the shaft 70 extends, lug 86, screws 87, forks 85, collar 66 fixed upon hollow shaft 67, tracing lever 55 pivotally mounted upon the collar 66, tube 68 having arm or fork 88, link 97 pivoted to the arm 88, said link being pivoted at its other end to said lever 55, arm 91 upon said collar 66, and fork 90 upon said tube 68.

28. The combination of a pointed rotary cutter, a work holder, shaft 70 upon which the work holder is mounted, hollow shaft 67 in which the shaft 70 extends, lug 86, screws 87, forks 85, collar 66 fixed upon the hollow shaft 67, tracing lever 55 pivotally mounted upon the collar 66, tube 68 having arm or fork 88, link 97 pivoted to the arm 88, said link being adjustably pivoted at its other end to said lever 55, arm 91 upon said collar 66, and fork 90 upon said tube 68.

29. The combination of a pointed rotary cutter, a work holder, shaft 70 that carries said work holder at an unvarying distance therefrom and turns upon a fixed axis, and a tracing lever 55 that is connected to swing said shaft and to move it endwise and which has an adjustable fulcrum to vary the ratio of movement between the tracer and work holder in one direction without changing the radii in the other direction.

30. The combination of a rotary pointed cutter, a work holder, shaft 70, lug 86, screws 87, hollow shaft 67, forks 85, collar 66, tube 68, arm 88, forks 90, arm 91, tracing lever 55 pivoted at 65 upon the collar 66, link 97, slot 94, slide 95, and pin 96.

31. The combination of a rotary pointed cutter, shaft 70, tracing lever operatively connected to the shaft 70 for positively rocking said shaft and moving it endwise, vise head 71 mounted upon said shaft, and a blank holder adjustable in said head at right angles to said shaft, and the point of the cutter being at a fixed distance from the axis of said shaft during the cutting operations in all positions of the blank and blank holder.

32. The combination of a pointed rotary cutter, shaft 70, a tracing lever operatively connected to the shaft 70 for rocking said shaft and moving it endwise, vise head 71 mounted upon said shaft, a transverse rod 73 and a blank holder on said adjustable transverse rod in said head at right angles to said shaft, and said blank holder having flange 76 overhanging the vise head.

33. The combination of a rotary pointed cutter, a vise head, a shaft 70 connected thereto, a tracing lever operatively connected to the shaft 70 for rocking said shaft and moving it endwise, and a work holder in said vise head adjustable transversely of said shaft and having a keeper 80 provided with a key 83 for engaging the blank to be cut.

34. The combination of a pointed rotary cutter, a shaft 70 movable endwise, a work holder mounted on said shaft and adjustable transversely thereof, tracing lever 55 swinging upon said shaft and having an adjustable pivot 96 for varying the ratio of the endwise movement of the shaft, and a pattern holder adjustable toward and away from said shaft.

35. The combination of a pointed rotary groove-cutter, a work-holder, a pattern, a pattern-tracer, and means for so mounting the work-holder and cutter as to allow of relative movements between the cutter and work holder in two directions and to cause the cutter to cut the grooves which extend in one direction on predetermined uniform convex curves and the grooves which extend in the other direction on straight lines, cuts of the character set forth being effected irrespective of the character of the surface of the work operated upon and irrespective of the design to be produced.

36. The combination with a pointed groove-cutter and a work-holder mounted for relative motion in two directions, of mountings for said cutter and work-holder constraining said parts to effect the cutting of grooves, the bottoms of all of which, irrespective of the directions of the grooves, lie in the surface of a cylinder, and a pattern and pattern tracer for controlling the relative movements between said work-holder and said cutter.

37. The combination with a pointed groove cutter and a work-holder mounted for relative motion in two directions, of mountings for said cutter and work-holder constraining said parts to effect the cutting of grooves, the bottoms of all of which, irrespective of the directions of the grooves, lie in the surface of a cylinder, a pattern and pattern-tracer for controlling the relative movements between said work-holder and said cutter, and means for providing a relative shifting movement between said work-holder and cutter in a direction at right angles to the axis of said cylinder in order to cut a plurality of grooves in a single blank, said grooves having their bottoms lying in the surfaces of parallel cylinders.

Signed at Ilion, in the county of Herkimer, and State of New York, this 29th day of April A. D. 1901.

LOUIS A. DISS.

Witnesses:
LOUIS P. DISS,
RALPH W. GOUGH.