(No Model.) 3 Sheets—Sheet 1.

L. B. BENTON.

PUNCH CUTTING MACHINE.

No. 332,990. Patented Dec. 22, 1885.

Fig. 1.

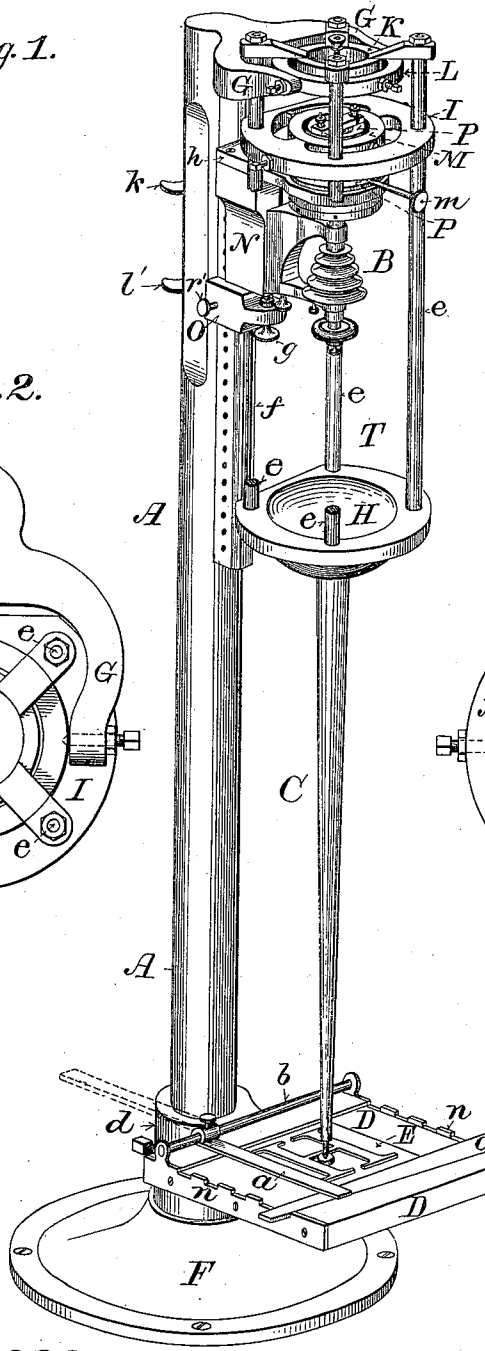


Fig. 2.

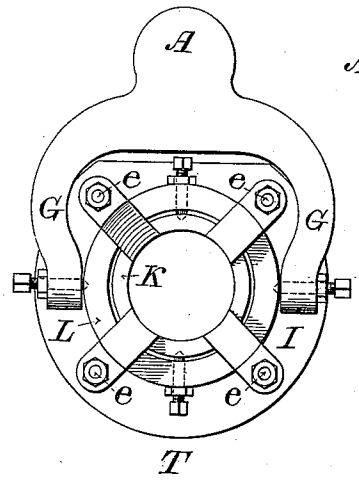
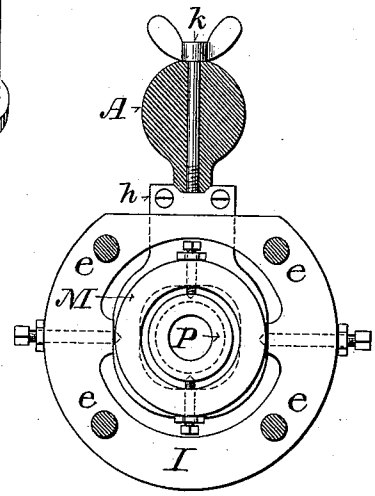


Fig. 3.



Witnesses:
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J. H. Hardy.

Inventor,
Linn Boyd Benton
per D. K. Luthum
Attorney.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

L. B. BENTON.

PUNCH CUTTING MACHINE.

No. 332,990. Patented Dec. 22, 1885.

Fig. 4.

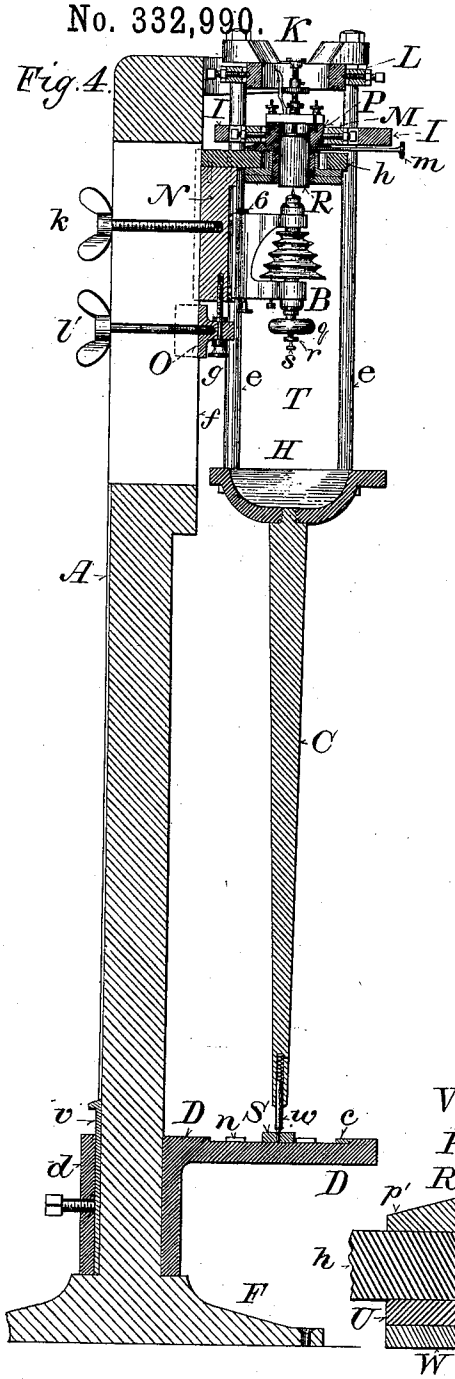


Fig. 5.

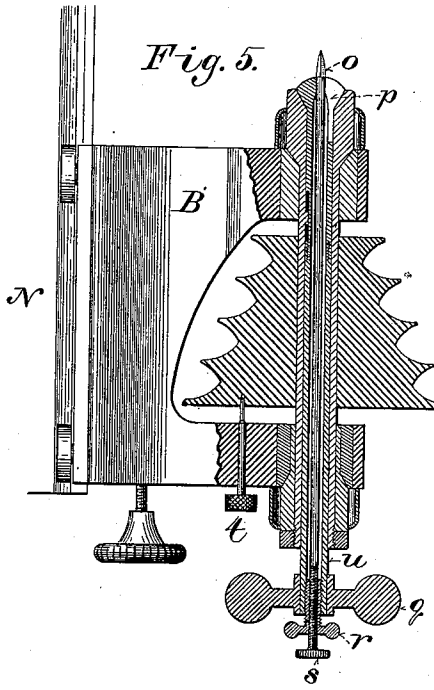


Fig. 6.

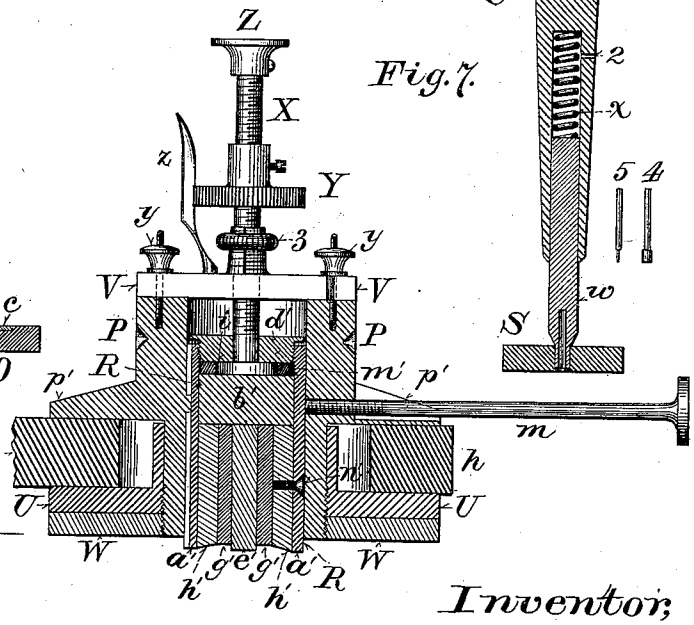


Fig. 7.

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(No Model.) 3 Sheets—Sheet 3.

L. B. BENTON.

PUNCH CUTTING MACHINE.

No. 332,990. Patented Dec. 22, 1885.

Fig. 8.

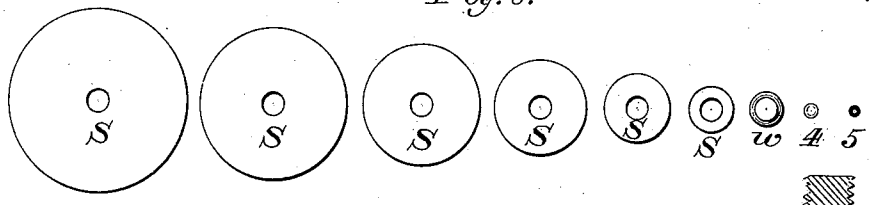


Fig. 9.

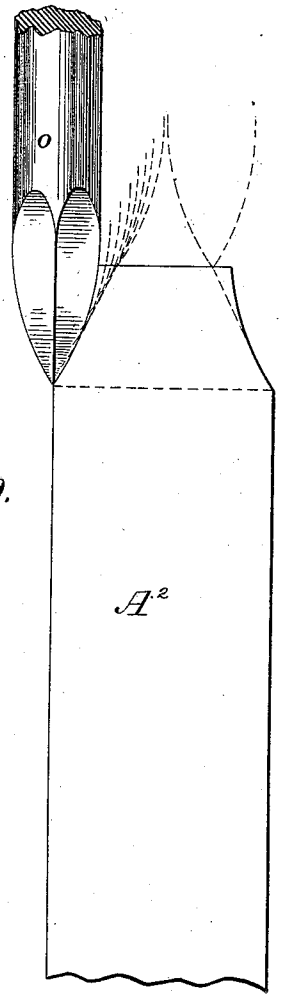
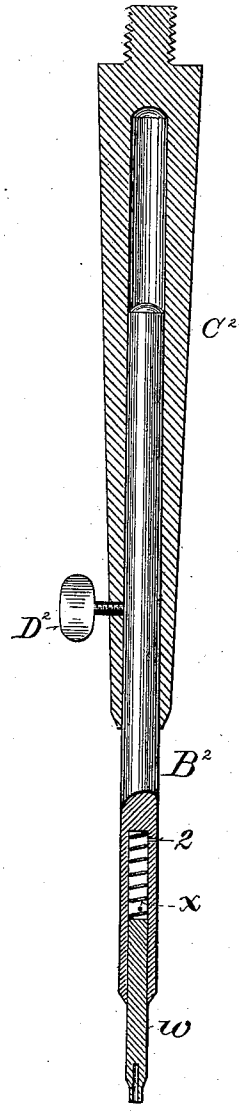


Fig. 10.



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UNITED STATES PATENT OFFICE.

LINN BOYD BENTON, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO BENTON, WALDO & CO., OF SAME PLACE.

PUNCH-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 332,990, dated December 22, 1885.

Application filed February 29, 1884. Serial No. 122,534. (No model.)

To all whom it may concern:

Be it known that I, LINN BOYD BENTON, of the city of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Punch-Cutting Machines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to machines for cutting type-punches; and it consists, essentially, of a frame suspended by a universal joint from a standard, of a holder for the work with a universal-joint support for the same attached to said frame and maintained in a horizontal plane by a bracket projecting from the standard, of a lathe-head provided with the cutting-tool and adjustably attached to said standard, of a table or leaf adjustably attached to said standard below the work for holding the pattern, and of an upright index-rod depending from the center of the swinging frame and provided at its lower end with a follower for tracing the pattern.

Heretofore type-punches have been successfully produced only by slow, laborious hand processes by persons possessing a rare degree of skill.

To meet a great need in this branch of the manufacture of type, I have produced a punch-cutting machine, the objects of which are, first, economy of time and labor in cutting type-punches, and the consequent diminution of the cost of the type manufactured therefrom; second, accuracy and uniformity of work; and, third, the simplification of the process of cutting the original characters by forming the patterns therefor on a greatly-enlarged scale and in their natural order or position—that is, as they appear when printed—the machine being constructed and arranged to make the proper reduction in size and reversal in order for the type-punches.

In the accompanying drawings like letters refer to the same parts in each figure.

Figure 1 is a perspective view of my machine. Fig. 2 is a plan view, on an enlarged scale, of the universal joint by which the swinging frame is pivoted to the standard. Fig. 3 is a like view of the universal-joint support for the work-holder, showing the standard and the swinging frame in cross-section. Fig. 4 is a vertical medial section of the machine, cutting the standard through its center. Fig. 5 is a like view, on a greatly-enlarged scale, of the lathe-head with the additions by which it is adapted for use with my machine. Fig. 6 is a similar view of the work-holder together with its support. Fig. 7 is a vertical medial section of the lower end of the index bar or rod depending from the center of the swinging frame in connection with its attachments for following the pattern. Fig. 8 represents a series of followers used in connection with the index-rod. Fig. 9 is a view, on a greatly-enlarged scale, of the cutting end of the tool in connection with a diagram illustrating the method of making the successive cuts by which a punch is formed; and Fig. 10 shows a vertical medial section of an index-rod adjustable in length.

A is the standard, provided with the broad base F, and at the top with the bifurcated arm G, between the limbs of which is pivoted the ring L, within which the ring K is pivoted on the line of a diameter at right angles to the pivotal line of the former and in such manner as to form therewith a universal joint for suspending the frame T. The ring K is provided midway between the axes upon which it swings with four radiating ears, from which depend the rods *e e*, the lower ends of which are secured in the rim of the disk H, thus forming, with the ring K and said disk H, the frame T. In the center of said disk H is rigidly secured the depending index-rod C, the axis of which lies exactly in the same line with the axis of the frame T. In the lower end of rod C is formed a small vertical socket, into which is inserted the small round bar *w*, with a spiral spring, *x*, above it. The bar *w* is turned down at its lower end to form a bearing for the small rollers S S, and provided also with a small socket to receive the small tracing-spindles 4 and 5, the functions of which will be hereinafter described.

For cutting punches of various series and sizes it becomes necessary, particularly for the larger sizes, to provide index-rods, as C, of different and shorter lengths, or, the same thing in effect, an index-rod adjustable in length, such as is shown in Fig. 10, in which the lower

segment, B^2, of the rod telescopes into the upper segment, C^2, and is set at any desired length by means of the screw D^2.

For holding the pattern in the desired position, I provide the leaf D, formed with the collar *d*, by means of which it is secured to standard A, and may be adjusted up or down upon the same. A vertical groove is cut in the back of standard A, and a corresponding groove or seat on the inner side of said sleeve just opposite. A spline, *v*, inserted therein, permits the vertical adjustment of said leaf D, but prevents its turning upon the standard A, and by means of a set-bolt passing through its sleeve *d* it may be set at any desired height.

n n are side guards, by means of which the pattern may be blocked in position on the sides, and *a* is a gage, adjustable at right angles to itself upon the rod *b*, for the purpose of accurately setting the pattern.

P is a small hollow cylinder, in general form, passing through an opening in the plate *h*, which projects from and is secured to the top of the adjustable block N. The cylinder P is provided with a horizontal flange, *p' p'*, which rests upon said plate *h*, and it is turned down below said flange to receive the upturned collar on the nut U, which in like manner bears against the lower face of the plate *h* and maintains the cylinder P in its proper position. The nut U is secured in position by means of the lock-nut W. The cylinder P forms a support for the work-holder R, and is connected with the swinging frame T by means of a universal-joint connection composed of the rings I and M, concentric therewith.

The rods *e e* pass through and are adapted to slide in perforations in the ring I, which is pivoted on each side to the ring M, which in turn is pivoted on the opposite sides to the upper part of cylinder P, which is thereby caused to partake of the lateral movement of frame T, while it is maintained throughout said movement in a plane at right angles to the axis of the machine by the fixed horizontal plate *h*.

The block N is vertically adjustable on the way *f*, raised upon the front of standard A, and is retained in any desired position by means of the thumb-screw *k*, passing through a central vertical slot in said standard A and way *f*. To the front face of said block N is attached the lathe-head B, in such manner as to be vertically adjustable therewith and with the work-supporter P.

A small pin or lug, 6, projecting from the face of block N, serves as a guide in setting the lathe-head at all times in the same relative position to the cylinder P. A small adjustable block, O, provided with a vertically-perforated ear, in which is inserted the micrometer adjusting-screw *g*, is adapted to slide on the way *f*, just below the block N. Like said block N, it is secured at any desired point on said way by the thumb-screw *l'*, passing through the slot in standard A.

To further assist in setting the block N for any particular series or size of type, I provide the block O with a taper pin, *r'*, adapted to engage with a series of small holes drilled in the side of way *f*, and thereby hold said block O perpendicularly at any desired height. The holes may be graduated and numbered so that each one will represent the proper position for some particular size or member of a series.

The point of the screw *g* engages with a threaded socket in the lower end of the block N, the relative height of which may be adjusted thereby with the greatest nicety.

For use with my machine, I provide the lathe-head B with a small tool, *o*, firmly held when in use by the jaws *p*, which are provided with a small cylindrical shank inserted in the hollow shaft of the latter, and threaded at the end to engage with the internally-threaded cylindrical stem *u*, which is provided below with the head *q*, by means of which the jaws are drawn down into their conical seat, and thereby brought firmly together about the tool in the usual way. I insert into the lower end of the hollow stem *u* the internally and externally threaded sleeve *r*, provided with the small adjusting-screw *s*, the end of which bears against the shank of the tool *o*. By this means the tool can be advanced very slightly and accurately for purposes of grinding, which must be done with the greatest possible precision by a machine made specially for that purpose, since it is necessary that the tool should extend the same distance and occupy the same position relative to the work-supporter P, in order to save adjustments of the work after each sharpening. A small pin, *t*, engages with the pulley of the lathe and holds it in any desired position while the tool is being shaped or sharpened.

R is the work-holder, composed of the hardened steel cylindrical shell *a' a'*, with the brass lining *h' h'*, formed with a square socket in the center for the reception of the punch-blank *e'* and the cylindrical back block, *b'*. It is provided with the finely-threaded stem X, formed with the circular head *i*, which is retained in said holder by the screw-cap *d'*, through which the stem X rises, thereby allowing said stem to turn freely in said holder R.

Between the cap *d'* and the block *b'*, around the head *i*, is inserted the ring *m'*, which may be removed and ground down to take up any lost motion occasioned by the wear of the head *i*.

The holder R is prevented from turning in the cylinder P by a small lug or spline therein, which engages with a vertical groove in the shell *a'*, and it is secured in position by means of the set-screw *m*. The holder R is suspended in the cylinder P at the desired height by the adjustable cross-head V V, placed on the stem X, and the ends of which rest upon the upper end of cylinder P, and are notched on opposite sides to engage with small threaded pins fixed in said cylinder P, and provided with the set-nuts *y y*, by means of which the

cross-head V is retained in position. The cross-head V is provided with an internally and externally threaded tapered sleeve, slit to permit of its contraction about the stem X, and provided with the clamp-nut 3, by means of which it may be drawn tightly about said stem X, and any wear readily taken up.

Above the cross-head V, I place the finely-graduated adjustable disk Y, having numbered divisions on its upper surface, and provided with a threaded sleeve, by which it is screwed down upon the stem X, and a set-screw for securing it in any desired position on said stem. A spring-catch, *z*, rising from the cross-head V, engages with fine notches cut in the edge of disk Y, to correspond with its graduated face. By this means the holder may be raised or lowered with the greatest accuracy by very small intervals.

For the purpose of rendering the machine capable of making a relatively larger square cut, I may make the holder R and support P square, which would necessitate some change in the construction and arrangement of those parts without departure from the principle of my invention.

My machine operates as follows: The tool *o* having been properly ground, so that its convex converging triangular faces shall form cutting-edges of the required curve to produce the required bevel in the punch, the lathe-head is secured in place against the face of block N, with the point of the tool up and in the line of the axis of the machine, as shown in Figs. 1 and 4. The block N, controlling the position of the lathe-head and the cylinder P with reference to the pivotal point of the frame T, is set in the required position to produce the required proportion between the work and pattern. For cutting the various series and sizes of type-punches, especially the larger sizes, I provide, as hereinbefore stated, index-rods C of various lengths, or, preferably, an index-rod adjustable in length, as shown in Fig. 10, and adjust the leaf D to different heights on standard A. The nearer the work is brought to and the farther the pattern is placed from the pivot of frame T the greater will be the reduction of the work from the size of said pattern. By moving the work away from and the pattern toward said pivot the reduction of the work is proportionately diminished. A blank, *e'*, of the desired size is placed in the socket of the work-holder R, and if too small to fill the socket is built out on the sides by blocks *g' g'*, all of which are secured in position by set-screws *n'*, passing through the shell *a'* and its lining *h'*. The exposed end of the blank *e'* is carefully faced down even with the edges of the shell *a' a'* by means of a fine Scotch water-stone. An index-rod, C, of the proper length is employed to produce the required reduction for the desired size of letter from a given pattern. The pattern is placed on leaf D and secured in place by means of the wedge *c*. The holder R is then set so that the tool *o* will make the deepest cut at the outset, the letter being formed and finished by a succession of cuts, each successive cut being made a little shallower and closer to the face of the letter, as shown in Fig. 9. For this purpose I provide a graduated series of tracing-wheels, S, the larger sizes being used for the first cuts, which are made farthest from the face of the letter, while the smaller sizes and the ends of the rod *w* and the pins 4 and 5 are used for the last finishing cuts.

Various other means may be employed to perform the function of said series of followers. For instance, the edges of the patterns may be beveled or formed of a series of steps, and a single tracer caused to follow said bevel or steps at different heights varying in distance from the outline of the character. The pattern may consist of a series of grooves, the inner one of which forms the outline of the finished character, and the single tracer caused to traverse each groove, thereby forming the punch by a series of cuts; or patterns of different size with a single tracer may be employed in cutting each character.

For each successive cut the work is raised, and a smaller follower is used, according to a scale established by experiment between the series of followers S, *w*, 4, and 5, (shown in Fig. 8,) and the succession of fractional turns of the threaded stem X in the cross-head V, as determined by the graduated disk Y. The followers determine the nearness of each cut to the face of the letter, while the turns of the threaded stem in the cross-head determine the depth of each cut.

For making the first deep cuts I prefer to use a tool the point of which has been slightly taken off in order to free the chips from the punch-blank, and for the finishing cuts a pointed three or four sided tool having curved edges, as shown in Fig. 5, by which the bevel is formed from the body of the punch to the face of the character, the first cuts being nearest the body and the last cut finishing the face. (See Fig. 9.) The two tools used for making the complete punch are exactly alike, except that the first has its point taken off.

In Fig. 9, representing on an enlarged scale a punch-blank, A^2, and the cutting-tool *o*, making its deepest cut, the dotted lines show the successive cuts by which the bevel is formed from its base to the face of the character. Such a curve should be given to the cutting-edges of the tool (by grinding the faces forming those edges to the proper arc) that a succession of cuts made thereby a little above the point of the tool will produce the desired bevel in forming the punch. The sharper the curve of the cutting-edges or the blunter the tool, the greater will be the inclination of the bevel from a perpendicular, and vice versa.

The point of the tool, as well as the edges, to the depth of the required bevel, are used in making the first cut. Each succeeding cut, except the last, is made by a small portion of the cutting-edges above the point, which, owing

to the curve of the edges, does not touch the work after the first cut till the last finishing cut, and that is made by the very point of the tool.

Since a tool with the point taken off is preferable for making the deepest cuts and for forming the bottoms of the counters, and since a sharp tool used for that part of the work would be blunted and rendered unfit for making the finishing cuts, I employ both a blunt and sharp tool, as before stated, for cutting each punch; but instead of changing tools in the same lathe-head, which would disturb the adjustment for cutting any particular punch after the work was begun, I use two interchangeable lathe-heads, one provided with the blunt tool, the other with the sharp tool.

For accurately setting patterns for letters of any given series of the same character (curved or straight) and upon the same body, I provide the gage *a*, which is set on rod *b* to meet the character at the right or left when thrown forward into the position shown in Fig. 1. When the pattern has been set, the gage may be thrown back out of the way, as shown by the dotted lines in the same figure. I may also use blocks to fill the space between the pattern and the guides *n n* on the sides of leaf D.

The proper adjustments having been made the tool is set in rapid rotation, and the pattern is traced by means of the follower at the end of the index-rod C, each of the followers used with said rod being held snugly down against the pattern by the spring *x*, which also allows the follower to be raised and placed in the interior openings or counters of the patterns. While the follower is tracing the pattern below, the work is moved, and the tool is cutting the character above in reverse position and greatly reduced in size.

I find in practice that I am able to produce the best work by about twelve to fifteen separate cuts.

The end of the blank to be cut should be lapped down upon a fine Scotch water-stone before cutting is commenced, and after each of the last two cuts I remove the small burr raised by the operation of cutting by lapping it upon the same stone.

The hardened shell *a'* of the holder R furnishes a guide or "facing-jig" for lapping down the work, as above described.

Without departing from the principle of my invention, I may change the relative positions of the work and the tool, making the work stationary and the cutting-tool movable with the index-rod C, although I prefer the arrangement previously described.

I claim—

1. In a punch cutting machine, the combination of a fixed standard or frame, a swinging frame suspended therefrom by a universal-joint connection, a holder for the punch-blank, having a support connected with said swinging frame by a universal-joint connection, a cutting-tool, and mechanism for rotating the same, a leaf attached to the fixed standard for holding the pattern, an index-rod attached to the swinging frame for tracing the pattern, and a pattern, substantially as and for the purposes set forth.

2. In a punch-cutting machine, the combination of a fixed frame or standard, A, an oscillating or swinging frame, T, attached thereto by a universal-joint connection, a work-holder, R, a rotating cutter, a support, D, for the pattern, and an index-rod, C, for tracing said pattern, substantially as and for the purposes set forth.

3. In a punch-cutting-machine, the combination of a standard or frame, A, an oscillating frame, T, composed of the upright rods *e e*, ring K, and disk H, and suspended at the top from standard A by a universal-joint connection, an index-rod, C, attached to and depending from said frame, a leaf, D, adjustably attached to standard A, and provided with gage *a*, laterally adjustable on rod *b*, together with a lathe-head, B, attached to the standard A, and provided with a cutting-tool, a holder, R, for the reception of the punch-blank, and a support, P, for said holder R, connected with swinging frame T by a universal-joint connection, substantially as and for the purposes set forth.

4. In a punch-cutting machine, the combination, with a fixed frame or standard, A, of a lathe-head, B, provided with a tool, *o*, and adjustably attached to said standard, of a pattern, E, and a support, D, for said pattern, together with a support for the punch-blank, connected by a universal joint with said standard A, and provided with a rod for tracing the pattern and giving a corresponding movement to the work, substantially as and for the purposes set forth.

5. In a punch-cutting machine, the combination of the standard A, from which is suspended by a universal-joint connection the oscillating frame T, the work-holder support P, embracing and bearing upon the bracket *h*, which is secured to and projects from the block N, a universal-joint connection between said support P and frame T, together with a rotating cutter or tool, a support, D, for the pattern, and an index for tracing said pattern and moving the work correspondingly, substantially as and for the purposes set forth.

6. The combination, in a punch-cutting machine, of standard A, provided with a vertical way, *f*, a block, N, adjustably attached upon said way to the standard, and adjustable block O, also attached upon said way to the standard A, and provided with the micrometer adjusting-screw *g*, which engages with a threaded socket in block N, and with the pin *r'*, which engages with a graduated series of holes cut in the way *f*, the oscillating frame T, suspended by a universal-joint connection from standard A, a work-support, P, resting upon a bracket, *h*, attached to and projecting from the block N, and connected with said oscillat-

ing frame by a universal joint, together with a rotating cutter and an index-rod for tracing the pattern, substantially as and for the purposes set forth.

7. In a punch-cutting machine, the work-holder R, composed of shell *a'*, lining *g'*, back *b'*, and cap *d'*, and provided with the stem X, substantially as and for the purposes set forth.

8. In a punch-cutting machine, the work-holder R, provided with a socket for the reception of the blank, and with the stem X, substantially as and for the purposes set forth.

9. In a punch-cutting machine, the combination of the work-support P with the detachable holder R, provided with the threaded stem X, pivoted therein, cross-head V, and graduated disk Y, together with spring-catch *z*, substantially as and for the purposes set forth.

10. The combination, in a punch-cutting machine, of the standard A, work-support P, the bracket *h*, attached to the block N, the oscillating frame T, and the universal-joint connection, as described, between said swinging frame and said work-support P, substantially as and for the purposes set forth.

11. In a punch-cutting machine, the combination of the standard A, block N, adjustably attached thereto and provided with bracket *h*, the work-support P, secured in and bearing upon said bracket *h*, and the rotary cutter, both attached to block N, substantially as and for the purposes set forth.

12. In a punch-cutting machine, the combination of the holder R, constituting a facing-jig, and a clamping device, substantially as and for the purposes set forth.

13. The combination, in a punch-cutting machine, of a graduated series of followers, S, *w*, 4, and 5, by which the distance of the cut from the face of the character is determined, and the work-holder R, with means, as described, for adjusting its height, whereby the depth of the cut is regulated, substantially as and for the purposes set forth.

14. The combination, in a punch-cutting machine, of the work-holder R, cross-head V, and graduated disk Y, together with the cutting-tool, substantially as and for the purposes set forth.

15. The combination, in a punch-cutting machine, of a follower, S, for tracing the pattern, a work-holder, R, an adjustable cross-head, V, for regulating the height of said holder, and a cutting-tool, substantially as and for the purposes set forth.

16. In a punch-cutting machine, the combination of an index-rod, C, a series of tracing-followers, S, *w*, 4, and 5, the blank-holder R, and the rotary cutting-tool, substantially as and for the purposes set forth.

17. In a punch-cutting machine, the blank-holder R, composed of a hardened shell, *a'*, that constitutes a facing-jig, and an interior clamping device, substantially as and for the purposes set forth.

18. In a punch-cutting machine, the combination of an index-rod, C, and a tracing-follower, S, constructed so that a follower of one size may be substituted for one of another size, substantially as and for the purposes set forth.

19. In a punch-cutting machine, a graduated series of followers, S, *w*, 4, and 5, for tracing the pattern, whereby the punch is cut and finished by a succession of cuts, substantially as and for the purposes set forth.

20. In a punch-cutting machine, the combination of a rotary cutter, and the means for holding and giving the proper lateral movement to the punch-blank and for maintaining the same throughout its movement in a plane at right angles to the axis of the cutter, substantially as and for the purposes set forth.

21. In a punch-cutting machine, the combination of an index-rod, C, adjustable in length, so as to reproduce patterns according to different scales, as desired, and a rotary cutter, *o*, substantially as and for the purposes set forth.

22. In a punch-cutting machine, the combination of a tapering tool, the work-holder, the pattern, and an index by which said pattern is traced and the cut of the tool directed, said tool and holder being adjustable so as to permit a series of cuts varying in depth and proximity to the outline of the finished character or design to be made, substantially as and for the purposes set forth.

23. In a punch-cutting machine, the combination of a tapering tool, a work-holder, a pattern, and an index by which said pattern is traced and the cut of the tool directed, said tool or work-holder being adjustable in the line of the axis of said tool, or nearly so, and in a plane at right angles, or nearly so, to the axis of said tool, so as to produce, by the movement of the index about said pattern, a series of cuts varying in depth and proximity to the outline of the finished character or design, substantially as and for the purposes set forth.

24. In a punch-cutting machine, the combination of a tapering rotary tool and a work-holder, said tool or work-holder being adjustable in the line of the axis of said tool or in a line parallel thereto, or nearly so, a pattern, and an index arranged to trace said pattern and at the same time to move said tool or work-holder in a plane at right angles, or nearly so, to the axis of said tool in paths corresponding to the travel of said index, and varying in proximity to the outline of the finished character or design, substantially as and for the purposes set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

LINN BOYD BENTON.

Witnesses:

E. H. BOTTUM,

J. H. HARDING.