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COMPLETE SPECIFICATION.

[A communication from Linn Boyd Benton, of Milwaukee, State of Wisconsin,
United States of America, Type Founder.]

Improvements in Machines for Cutting Punches and the like.

I ALFRED JULIUS BOULT of 323 High Holborn in the county of Middlesex
Engineer do hereby declare the nature of this invention (a communication from
Linn Boyd Benton of Milwaukee State of Wisconsin United States of America,
Type Founder) and in what manner the same is to be performed, to be particularly
5 described and ascertained in and by the following statement:—

This 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
10 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 centre 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
15 hand processes by persons possessing a rare degree of skill.

To meet a great need in this branch of the manufacture of type a punch cutting
machine is produced 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
20 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.

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

Figure 1 is a perspective view of this machine Figure 2 is a plan view on an
enlarged scale of the universal joint by which the swinging frame is pivoted to
the standard Figure 3 is a like view of the universal joint support for the work
holder showing the standard and the swinging frame in cross section. Figure 4 is
30 a vertical, medial section of the machine cutting the standard through its centre.
Figure 5 is a like view on a greatly enlarged scale of the lathe head with the

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additions by which it is adapted for use with this machine Figure 6 is a similar view of the work holder together with its support Figure 7 is a vertical medial section of the lower end of the index bar or rod depending from the centre of the swinging frame in connection with its attachments for following the pattern Figure 8 represents a series of followers used in connection with the index rod— 5
Figure 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 Figure 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 10
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 pivoted 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 15
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 centre 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. 20

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 25
or the same thing in effect an index rod adjustable in length such as is shown in Figure 10 in which the lower segment B² of the rod telescopes into the upper segment C² and is set at any desired length by means of the screw D².

For holding the pattern in the desired position the leaf D is provided formed with the collar *d*, by means of which it is secured to standard A and may be 30
adjusted up and 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 of 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. 35

n, n are side guards by means of which the pattern may be blocked in position on the sides and *a* is a guage 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 40
cylinder P is provided with a horizontal flange *p p* which rests upon said plate *h* and 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 45
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 freely in perforation 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 50
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* 55
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

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adjusted therewith and with work supporter P. A small pin or lug G 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
5 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 I¹ passing through the slot in standard A.

To further assist in setting the block N for any particular series or size of type the block O is provided with a taper pin *r*¹ adapted to engage with a series of
10 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
15 block N the relative height of which may be adjusted thereby with the greatest nicety—For use with this machine the lathe head B is provided 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
20 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. Into the lower end of the hollow stem *u* is inserted the internally and externally threaded sleeve *r* provided with the small adjusted 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
25 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
30 position while the tool is being shaped or sharpened.

R is the work holder composed of the hardened-steel cylindrical-shell *a*¹ *a*¹ with the brass lining *h*¹ *h*¹ formed with a square socket in the centre for the reception of the punch blank *e*¹ and the cylindrical block *b*¹. It is provided with the finely threaded stem X formed with the circular head *i* which is retained in said holder
35 by the screw cap *d*¹ through which the stem X rises thereby allowing said stem to turn freely in said holder R. Between the cap *d*¹ and the block *b*¹ around the head *i* is inserted the ring *m*¹ 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
40 therein, which engages with a vertical groove in the shell *a*¹ 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
45 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 *z* by means of which it may be drawn tightly about said stem X and any wear readily taken up.

50 Above the cross head V is placed the finely graduated adjustable disk *y* 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.

55 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

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making a relatively larger square cut, the holder R and support P are made square which would necessitate some change in the construction and arrangement of those parts without departure from the principle of this Invention.

The Machine operates as follows:

The tool *o* having been properly ground so that its convex covering triangular 5 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 shewn in figures 1 and 4.

The block N controlling the position of the lathe head and the cylinder P with 10 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, as hereinbefore stated, rods *c* of various lengths, or preferably an index rod adjustable in length are provided as shewn in Figure 10 and adjust the leaf D to different heights on 15 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. 20

A blank *e*¹ 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*¹ *g*¹ all of which are secured in position by set screws *n*¹ passing through the shell *a*¹ and its lining *h*¹. The exposed end of the blank *e*¹ is carefully faced down even with the edges of the shell *a*¹ *a*¹ by means of a fine Scotch hone. 25

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 30 shallower and closer to the face of the latter, as shewn in Figure 9—For this purpose a graduated series of tracing wheels S are provided 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. 35

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 40 finished character and the single tracer caused to traverse each groove, thereby forming the punch by a series of cuts; or patterns of different sizes 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*, 45 4 and 5 shown in Figure 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, a tool is used, the point of which has been 50 slightly taken off in order to free the chips from the punch blank and for the finishing cuts, a pointed or four sided tool, having curved edges (as shown in Figure 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 Figure 9). The two tools used for making the complete punch are 55 exactly alike except that the first has its point taken off.

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In Figure 9, representing on an enlarged scale a punch blank A² 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.¹

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, both a blunt and sharp tool are employed, 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, two interchangeable lathe heads are used, 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, the gauge *a* which is set on rod *b* is provided to meet the character at the right or left when thrown forward into the position shewn in Figure 1. When the pattern has been set, the gauge may be thrown back out of the way, as shewn by the dotted lines in the same Figure—Blocks may also be used to fill the space between the pattern and the guides *n n* on the sides of leaf D.

The proper adjustment 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 *a*, 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 the opposite direction and greatly reduced in size. It is found in practice that the best work can be produced by about twelve to fifteen 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 cuts, the small burr raised by the operation of cutting by lapping it upon the same stone is removed. The hardened shell *a*¹ of the holder R furnishes a guide or "facing jig" for lapping down the work as above described.

Without departing from the principal of this invention, the relative positions of the work and the tool may be changed, making the work stationary and the cutting tool movable with the index rod C, although the arrangement previously described is preferable.

Having now particularly described and ascertained the nature of the said Invention and in what manner the same is to be performed as communicated to me by my foreign Correspondent I declare that what I claim is

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.

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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 *ee*, 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 guage *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 pin 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 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 pin *r*¹ 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 oscillating 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*¹, lining *g*¹, back *b*¹, and cap *d*¹, 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 thereon 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.

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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 B 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*¹ 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 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 series of tracing followers S, *w*, 4 and 5, a blank holder R, a tool *o* having curved cutting edges formed by the intersection of its faces which are longitudinally curved, converging to a common point and mechanism for rotating said tool 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 workholder, said tool or workholder being adjustable in the line of the axis of said tool or in a line parallel thereto, a pattern and an index arranged to trace said pattern and at the same time to move said tool or workholder in a plane at right angles 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.

50 Dated this 6th day of October 1885.

ALFRED J. BOULT.

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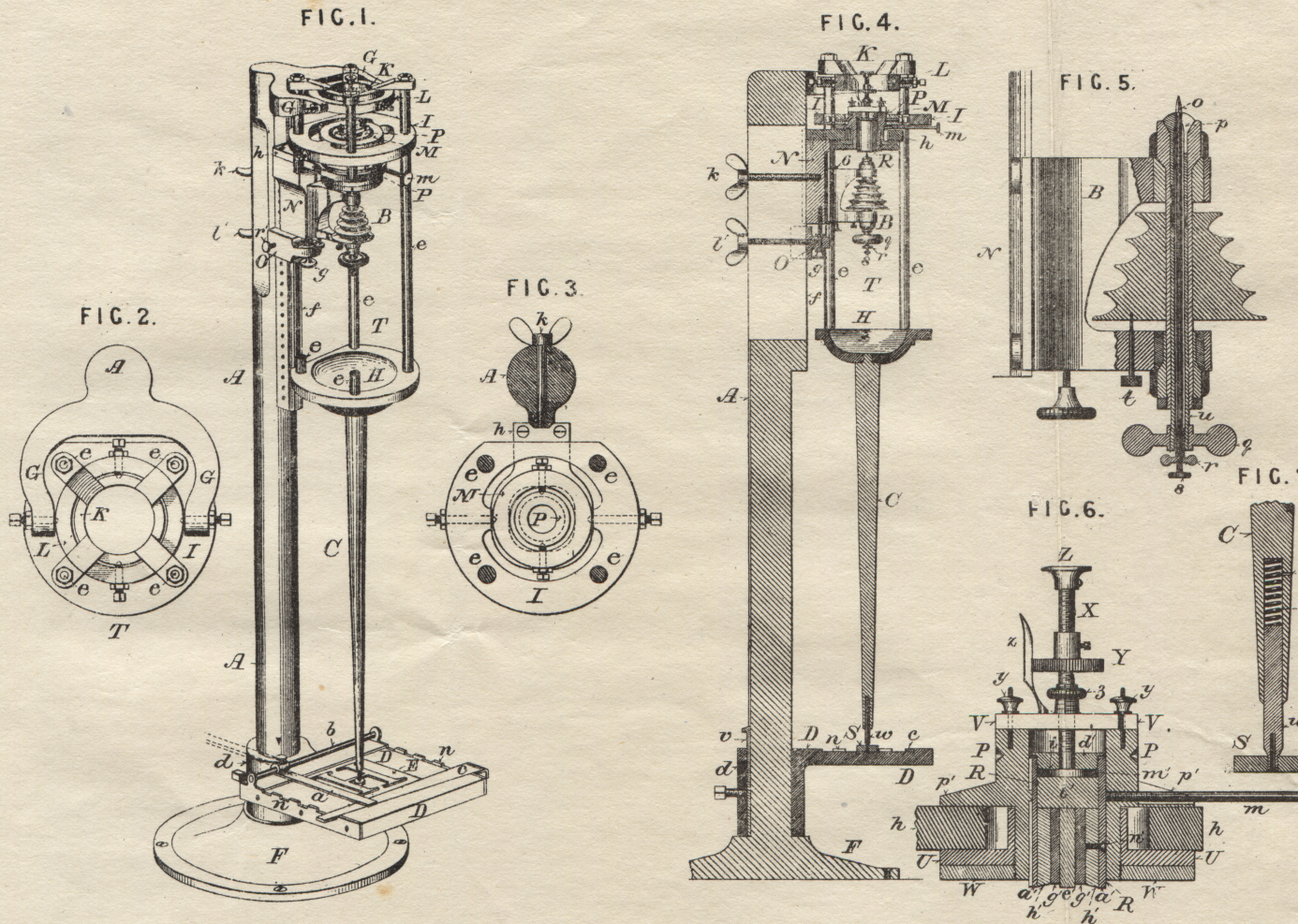


FIG. 4.

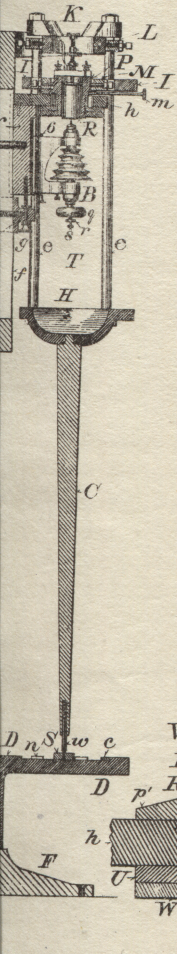


FIG. 5.

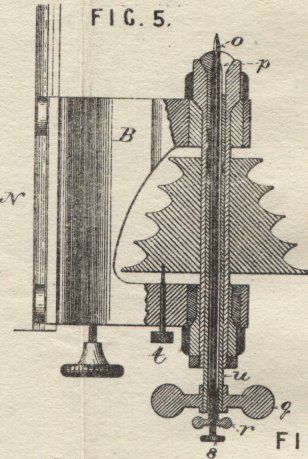


FIG. 8.

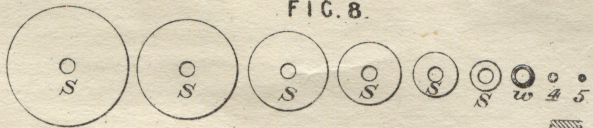


FIG. 9.

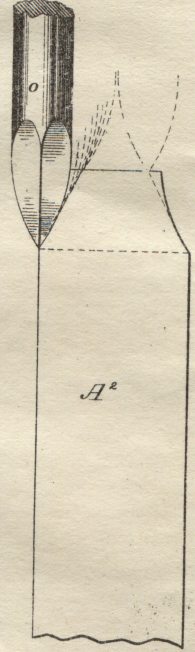


FIG. 10.

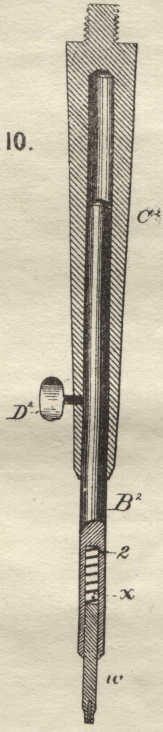


FIG. 6.

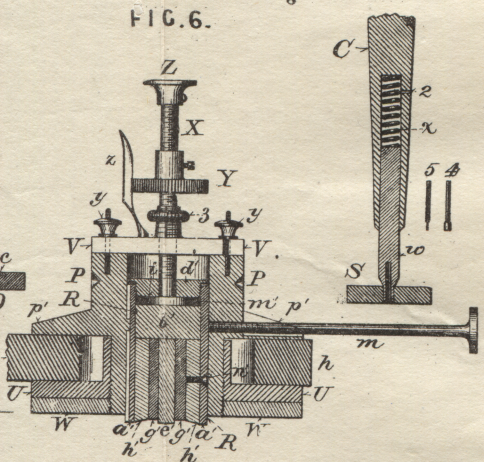


FIG. 7.

