(No Model.)

3 Sheets—Sheet 1.

B. S. MOLYNEUX.

ENGRAVING MACHINE.

No. 549,146. Patented Nov. 5, 1895.

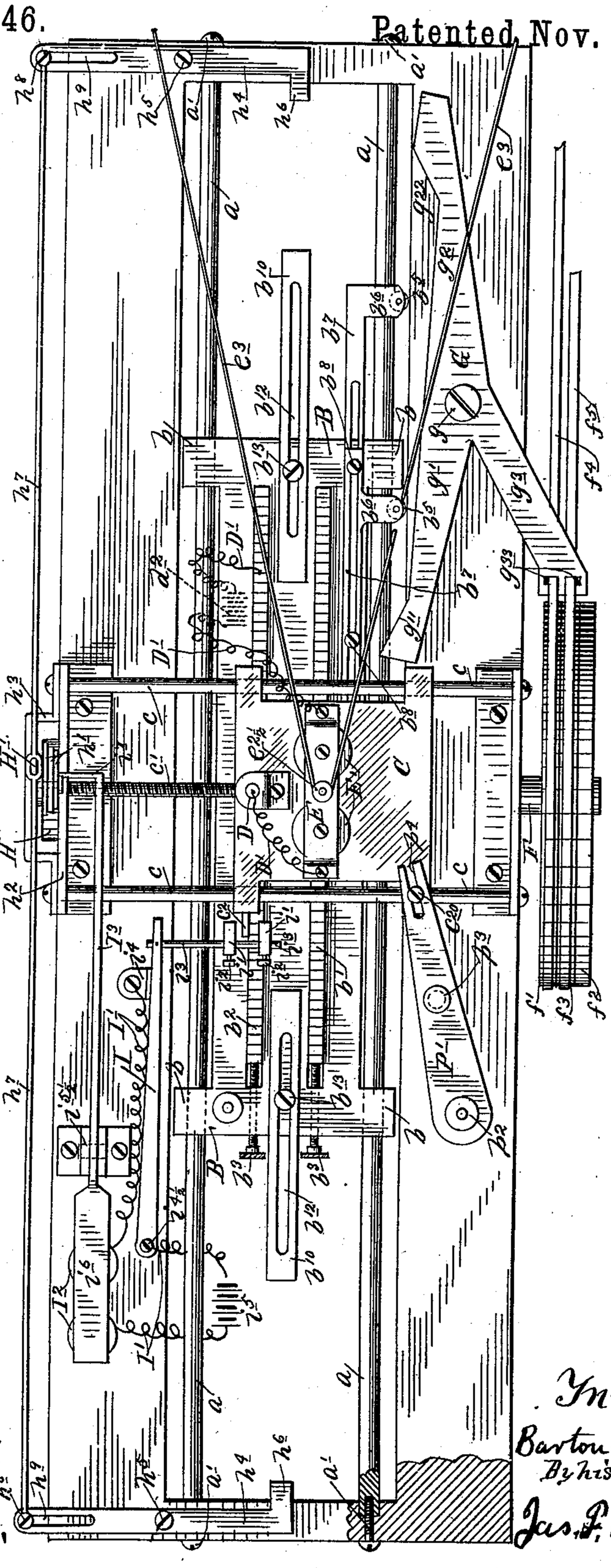

Fig. 1.

Witnesses,
E. F. Elmore
Frank D. Merchant.

Inventor.
Barton S. Molyneux
By his Attorney,
Jas. F. Williamson,

(No Model.) 3 Sheets—Sheet 2.

B. S. MOLYNEUX.

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Fig. 2.

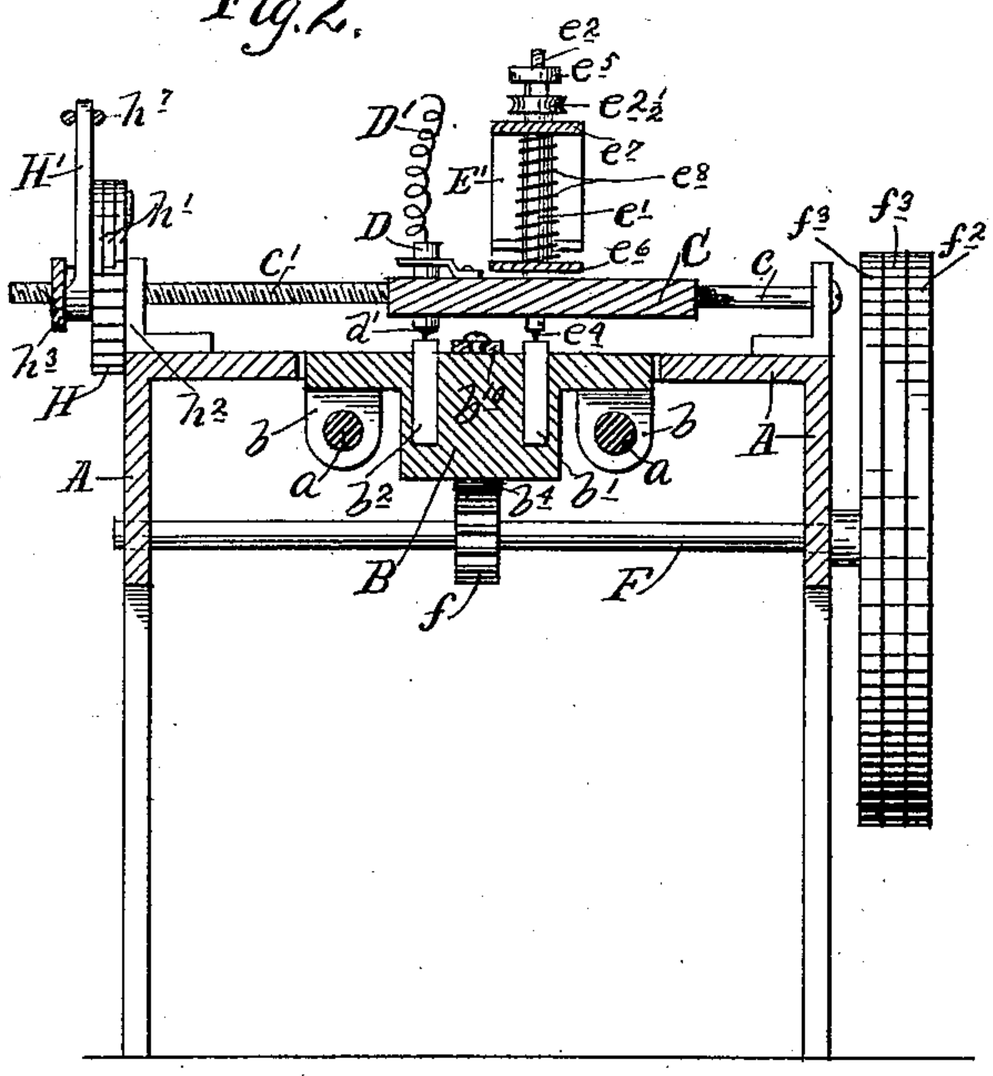


Fig. 3.

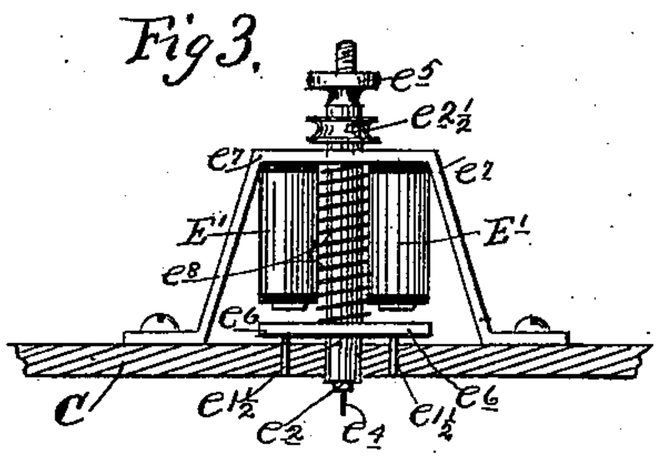


Fig. 3a

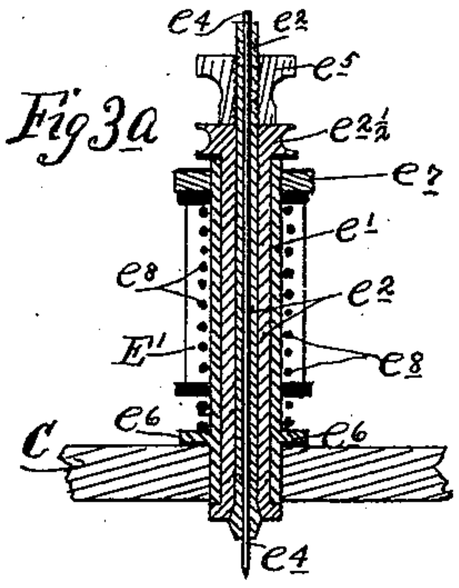


Fig. 4.

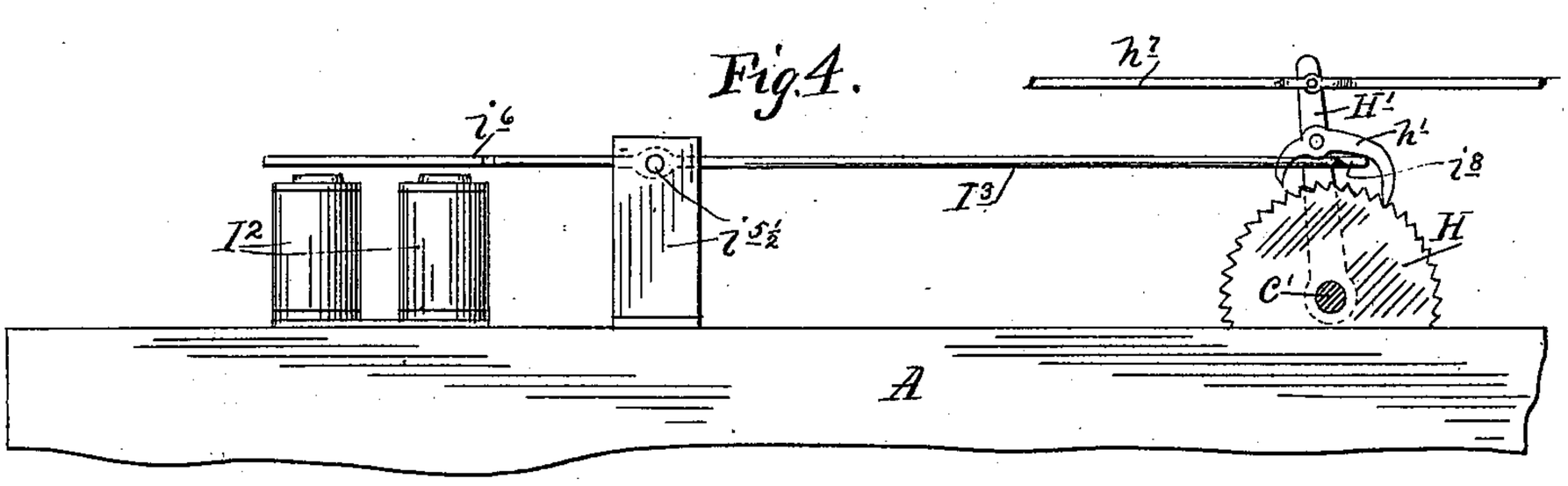


Fig. 8.

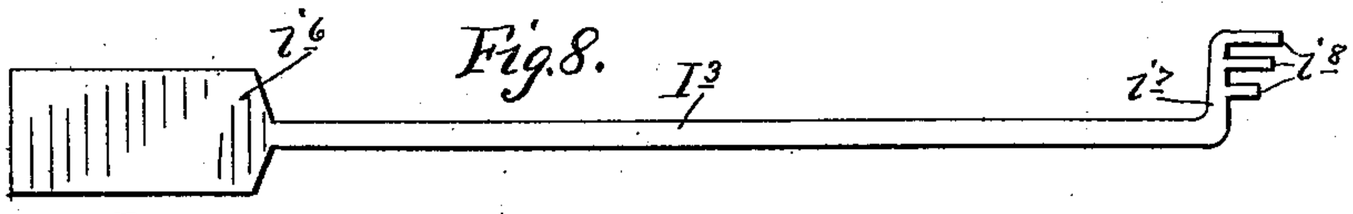


Fig. 5.

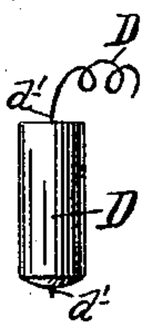
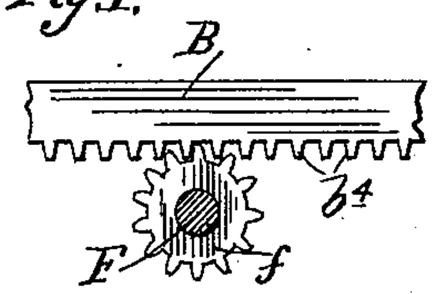


Fig. 6.

Fig. 7.



Witnesses.
E. F. Elmore
Frank D. Merchant.

Inventor.
Barton S. Molyneux,
By his attorney.
Jas. F. Williamson.

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B. S. MOLYNEUX.

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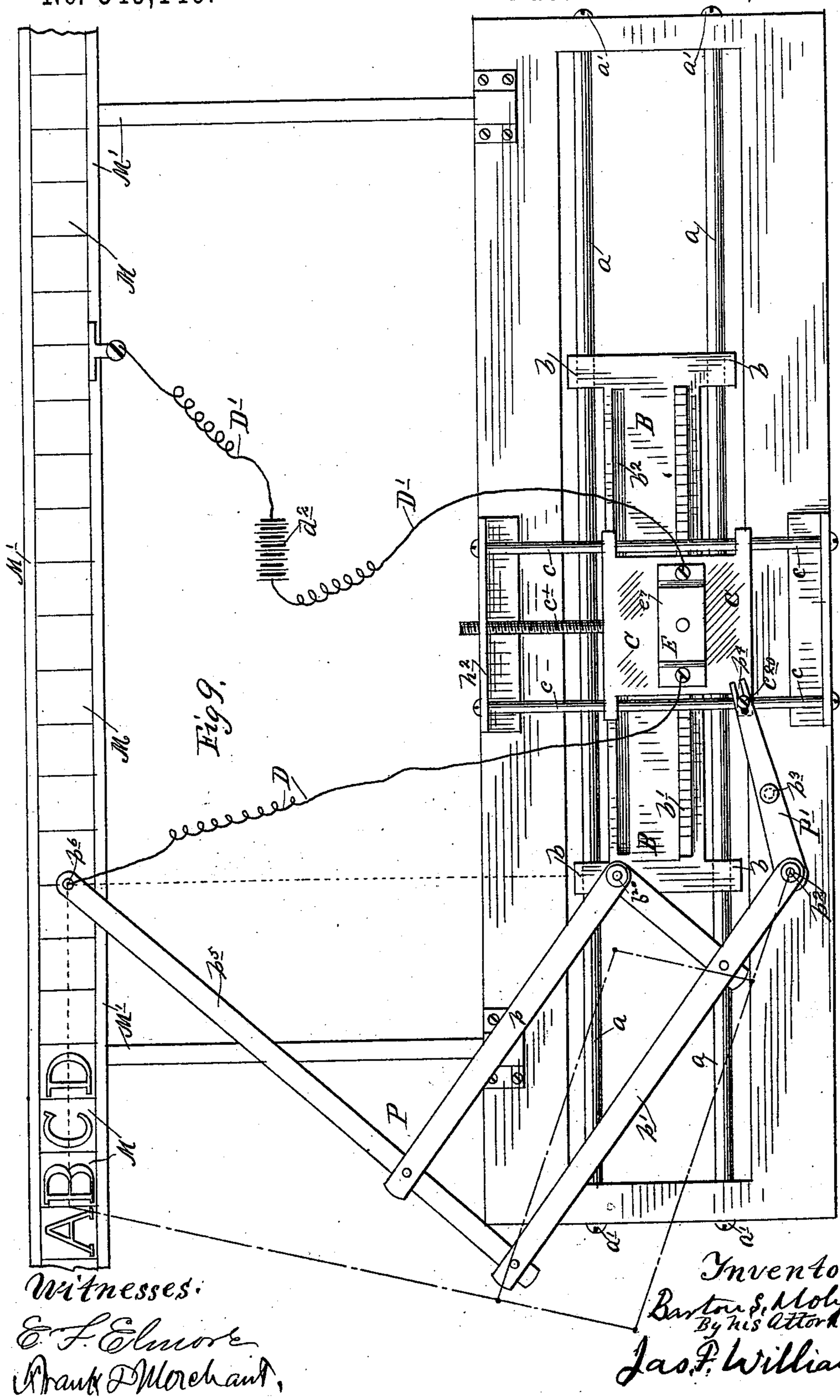

Fig. 9.

Witnesses:
E. F. Elmore
Frank D. Merchant.

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Barton S. Molyneux
By his Attorney.
Jas. F. Williamson

UNITED STATES PATENT OFFICE.

BARTON S. MOLYNEUX, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE MOLYNEUX ELECTRIC MANUFACTURING COMPANY, OF NEW YORK.

ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 549,146, dated November 5, 1895.

Application filed May 1, 1894. Serial No. 509,655. (No model.)

To all whom it may concern:

Be it known that I, BARTON S. MOLYNEUX, a citizen of the United States, and a resident of the city of Minneapolis, in the county of Hennepin, State of Minnesota, have invented certain new and useful Improvements in Die-Cutting and Engraving Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of machines in which a tracer traveling over a pattern controls the action of the burin, drill, or graver simultaneously traveling over a blank of metal or other suitable material upon which the letter or design is to be engraved.

The object of my invention is to provide a machine which shall be entirely automatic in its action and which will cut or engrave the design or letter with the necessary accuracy and depth to produce the dies, punches, and type employed in matrix-making and type-writing machines and in sinking the dies used in type-casting molds and machines. For this purpose the machine embodying my invention in its general construction comprises means for causing a tracer and a drill to travel in parallel lines back and forth over the entire surface of the pattern and block or blank to be engraved, and to reverse this motion for a number of times until the required depth of the engraving is reached. This means consists generally in a reciprocating carriage suitably guided and having mounted thereon the pattern and the block, plate, or blank to be engraved, in combination with a transversely-moving carriage actuated slowly with a step-by-step motion and carrying the tracer and the automatic drill or burin arranged over the pattern and blank, respectively.

The pattern may be made of an electrical conducting material, such as metal, and its sunken parts may be filled with some suitable non-conductor, such as enamel, and as the metallic point of the tracer passes over the conducting or non-conducting portions of the design or pattern a circuit controlling the drill is closed or broken, thus elevating the drill out of or throwing the same into operative position in respect to the blank. It is, however, not necessary to fill the sunken parts of the pattern, and the circuit controlled by the tracer may be made to act reversely upon the drill—that is to say, depress the same into operative position when the circuit is closed and elevate the same when the circuit is broken. On each complete back-and-forth motion of the carriage upon which the pattern and blank are mounted, and which for brevity I will term the "blank-carriage," the tracer and drill supporting carriage, which I will term, briefly, the "drill-carriage," is moved transversely a very slight distance by suitable step-by-step mechanism, such as a pawl and ratchet, so as to cause the tracer and drill to describe lines parallel and directly adjoining the lines previously described.

The drill operates on both strokes of the blank-carriage, or, in other words, goes over the work twice before the lateral feed of the drill-carriage takes place; but by simply providing means for breaking the tracer-circuit the drill could be rendered inoperative during the return stroke of the blank-carriage, or provision could be readily made for effecting the lateral feed of the drill-carriage at the end of each stroke of the blank-carriage, in which event the drill could operate on both strokes of the blank-carriage without doubling on the work.

The motion of the blank-carriage is reversed automatically by a belt-shifter or other reversing mechanism actuated by some part of the said blank-carriage, and the transverse drill-carriage is reversed at the limits of its travel by suitable reversing mechanism, preferably in the shape of a shifting and reversing pawl action on a double ratchet-wheel mounted on a screw-shaft engaging the drill-carriage and preferably actuated by electrical contact mechanism. Thus it will be seen that the tracer and drill pass over the entire surface of the pattern and the blank in the parallel and adjoining lines in the manner of a planing-machine, but so that the graver, which I make in the form of a revolv-

ing drill, will only cut or rout the material from the blank when the controlling-tracer passes over the conducting or non-conducting or the elevated or depressed portions of the pattern, as the case may be. This action is repeated, moreover, by reversing the transverse drill-carriage as many times as desired until the desired depth is reached in the engraving.

For the purpose of availing myself of an enlarged pattern in the production of dies of the usual size, for the sake of greater accuracy, I employ a pantograph, and in this case I arrange the pattern upon a fixed bed outside the blank-carriage, and, dispensing with the tracer on the drill-carriage, I provide the movable arm of the pantograph with such a tracer to move over the pattern and control the action of the drill, which now produces a reduced engraving on the blank.

Instead of one blank or block or line of blanks being engraved a number of such blanks or lines of blanks may be engraved at the same time.

In the drawings accompanying this specification I have shown an engraving-machine illustrating my invention, in which, like letters referring to like parts—

Figure 1 represents a plan and Fig. 2 a transverse vertical section of the machine. Figs. 3 and 3ª represent, respectively, a front elevation and a transverse vertical section on line $x\,x$, Fig. 3, of the drill and its controlling mechanism. Fig. 4 is an elevation of pawl-shifting device. Figs. 5, 6, 7, and 8 are detail views, and Fig. 9 is a plan of the engraving-machine used in connection with a pantograph and enlarged pattern.

Upon a suitable frame A is mounted a carriage B, adapted to carry the blocks or blanks to be engraved, and in many cases also the pattern, which carriage is adapted to slide back and forth on suitable guides, preferably in the form of rods a, passing through ears b in the carriage and secured to the frame A by screws or bolts a', passing through the frame or table A into the ends of the said rods.

I prefer to mount the carriage B so as to be flush with the table A by placing the same in a recess a^2 of the same, as shown best in Fig. 2, although this arrangement can be modified. Upon this carriage B are secured the blanks to be engraved, and in many cases also the pattern from which the engraving operation is controlled. The means for mounting these blanks and patterns in the present instance consists in grooves or slots b' b^2 parallel to the rods a, and in which one or a series of blanks and one or a series of patterns may be lodged and securely held in place by set-screws b^3. These slots may be of such length that the entire set of dies for a matrix-making or type-writing machine may be engraved at once by placing in the slot b^2 a set of such dies or patterns for such dies and a corresponding number of blanks in the slot b'.

The carriage B, which I term the "blank-carriage," receives a reciprocating motion by means to be hereinafter described.

Above the blank-carriage B is arranged a transverse carriage C, adapted to slide transversely of the carriage B upon ways or guide-rods c, arranged transversely of and similar to the guide-rods a, or any other means for transversely guiding the transverse carriage C, which I term the "drill-carriage," may be employed. The motion of the drill-carriage C is distinguished from that of the blank-carriage B in being step by step and exceedingly small in comparison therewith. This drill-carriage carries the tracer D and the graver or drill mechanism E, adapted to travel over the patterns and blanks held in the slots b^2 and b', respectively, and is adapted to move slightly, one step at each to-and-fro motion of the blank-carriage B, and to be reversed at the end of its movement.

The motions of my engraving-machine may be resolved into, first, the to-and-fro movement of the blank-carriage B; second, the step-by-step motion of the drill-carriage C; third, the reversal of the drill-carriage C, and, fourth, the drill motion. I will now describe these in order named.

First. The to-and-fro motion of the blank-carriage.—Motion is imparted to the blank-carriage B by a pinion f, engaging with the rack-teeth b^4, (see Figs. 1, 2, and 7,) preferably upon the under side of the carriage B. Said pinion f is keyed to a shaft F, upon one of whose extremities are mounted two fixed pulleys f' f^2 and an intermediate loose pulley f^3. Two belts f^4 and f^5, one straight and the other crossed, run from these pulleys through the loops or eyes g^{33} of the belt-sifter G, and thence to the pulley on the power-shaft, and are so arranged that one belt will always be on the loose pulley, and hence inoperative. The belt-shifter G consists of a three-armed lever pivoted at g, of whose arms g' and g^2 are provided with inclines or wipers g^{11} and g^{22}, so arranged that one of them is in the path of the carriage when the other has been forced out of said path. The third arm g^3 is provided with the eyes or loops g^{33} above noted. In order to facilitate the act of tilting the belt-shifter G, the carriage B is provided with the antifriction-rollers b^5, mounted upon lugs b^6 on the carriage. These lugs may be fixed or, preferably, as shown, adjustable with respect to each other, so as to decrease or increase the intervals between the reversing motions of the belt-shifter, and hence to decrease or increase the stroke of the blank-carriage B. The lugs b^6 are preferably made adjustable by providing them with slotted arms b^7, whose slots are engaged by the set-screws b^8, which permit of the ready adjustment of the lugs and of tightly clamping them in place in their various positions of adjustment.

The operation of these parts is as follows: Assuming the blank-carriage B to occupy the

position indicated in Fig. 1 and as moving in the direction indicated by the arrow 1, the motion of the power-shaft is then imparted to the carriage by the straight belt f^4 through fixed pulley f', shaft F, pinion f, and rack-teeth b^4. When the carriage arrives at the end of its stroke, however, the one roller b^5 rides over the wiper g^{11} on arm g' of belt-shifter G and tilts the said belt-shifter, thereby throwing the other wiper g^{22} into the path of the carriage B and by the arm g^3 shifting the belts, so that the straight belt f^4 is now on the loose pulley f^3 and the crossed belt f^5 is shifted onto the fixed pulley f^2. The shaft F is hence revolved in the opposite direction and the stroke of the blank-carriage reversed. At the end of this return stoke the other roller b^5 impinges against the second wiper g^{22} and the belt-shifter is shifted in the opposite direction, whereupon the first motion again takes place, and so on until the engraving operation is completed. By moving the lugs b^6 close together a large stroke is imparted to the machine, and the same is adapted to engrave a long line of dies or punches—as, for example, an entire set of dies for a matrix-making machine. By placing them far apart, on the other hand, short and quick strokes may be produced—as, for example, in engraving but a single die or punch.

Second. The step-by-step motion of the drill-carriage.—At every return stroke of the blank-carriage B the traverse drill-carriage C, as already explained, is fed forward across the carriage B a space equal to the width of the path traversed by the tracer and drill in their movement along the pattern-blanks, so that the next return stroke will carry the said tracer and drill over paths parallel and contiguous to the former paths. This step-by-step motion is preferably effected by the following means: To the drill-carriage C is secured a screw-rod c', in the present instance extending rearwardly of the same, and upon the said screw-rod is threaded the ratchet-wheel H, while a lever H', carrying three double shifting-pawls h', is loosely mounted on the screw-rod. The pawl-lever and ratchet are in the present instance held against longitudinal movement by the casing H^2, consisting of the bracket h^2 and guard h^3, secured thereto. The compound pawl h' consists of three pawls or dogs of different lengths, so that one of them will be sure to engage the ratchet-wheel at the required time and turn the same, and hence move the drill-carriage the necessary distance. This pawl-and-ratchet device is operated at every stroke of the blank-carriage, preferably by providing the same with the striker-pieces b^{10}, adjustably mounted thereon by slot and set-screw connection b^{12} b^{13}, which strikers are arranged to operate at each stroke pawl-and-ratchet-actuating devices, which consist, essentially, of a lever h^4 at each end of the table A, pivoted at h^5 and having a bumper-lug h^6, and of the pawl-impelling rod h^7, suitably guided in the table A, as shown, and connected to the upper end of the pawl-lever H'. These pawl-impelling rods h^7 preferably consist of a continuous rod connecting the two levers h^4, the connection being by pin h^8 and slot h^9, as shown in Fig. 1. The operation of these parts is obvious. At the end of each stroke of the blank-carriage B one of the strikers b^{10} strikes against the contact-lug h^6 on one of the levers h^4, and, forcing one of the arms h^7 forward, rocks the pawl-lever H', thereby causing the pawls or dogs h' to travel over the ratchet H at the forward stroke of carriage B and to turn said ratchet at its return stroke. This action may be adjusted to the various strokes of which the blank-carriage is capable by simply releasing the set-screws b^{13} and moving the contact-pieces outward or inward and then tightening the set-screws.

Third. The reversal of the drill-carriage.—It will be noted that the compound pawl h' consists of double pawls having dogs extending to both sides of their pivots, so as to adapt them to be shifted or tilted to act in opposite directions on the teeth h of the double ratchet-wheel H, which are formed, as shown, to be acted on in both directions. The said pawl is shifted by the following mechanism: The drill-carriage is provided with a pin or stud c^2, which plays between two contacts i', adjustable by set-screws i^2 on a rod i^3, forming a part of a circuit-breaker or switch I, adapted to open and close the circuit I' by making and breaking contact with the contact-piece i^4. The circuit I' passes by wire from the pivotal point $i^{4\frac{1}{2}}$ of the switch I to the battery i^5 or other source of electricity, thence to the electromagnet I^2, and thence by wire to the contact-piece i^4. A pawl-shifting lever I^3 is pivoted at $i^{5\frac{1}{2}}$ and provided at one end with the armature i^6, located over the electromagnet, and at the other with pawl-supporting arm i^7, having in the present instance the prongs i^8, bearing under the three dogs of the shifting-pawl h' to one side of the pivot. These parts operate as follows: The contacts i' are so adjusted on the rod i^3 as to leave a space between them somewhat larger than the width of the slots b', so as to permit the drill-carriage to traverse the entire width of the patterns and blanks before the stud c^2 strikes one or the other of the said contacts. Assuming the circuit I' to be open and the drill-carriage to travel in the direction of the arrow, then immediately after the said carriage arrives at the end of its stroke and the drill E and tracer D have cleared the blanks and patterns, respectively, the pin c^2 strikes against the inner contact i', and, closing the switch I, closes the circuit through the electromagnet I^2, whereby the armature i^6 is drawn down, tilting the lever I^3 and the shifting-pawl h' on lever H, thereby causing the opposite dogs on the same to engage the ratchet to turn the same in the

opposite direction and reverse the stroke of the drill-carriage in the further operation of the machine. At the end of this reverse stroke the stud c^2 strikes the opposite contact, and, opening the circuit, causes the first stroke of the drill-carriage to be repeated. This reciprocation is repeated until the blanks have been engraved to the required depth. By adjusting the contacts i' they may be adapted to various widths of patterns and blanks.

Fourth. The drill motion.—The tracer D, as shown best in Fig. 5, consists of a keeper d, of non-conducting material, extending down through the drill-carriage, and through which a wire d', of platinum or other suitable conducting material, passes centrally and into contact with the elevated parts of the pattern. This tracing-wire d' is in the circuit D′, which passes thence to an electromagnet E′, forming part of the drill-operating mechanism E, and thence through the battery or other source of electricity d^2 to the pattern. Referring more particularly to Figs. 3 and 3ª, it will be noted that the drill in the present instance consists of a hollow sliding sleeve e' or other support for an armature e^6, which parts are held from turning by dowel-pins $e^{1\frac{1}{2}}$, in which supporting-sleeve e' is guided the revolving drill-chuck e^2, preferably passing centrally therethrough, which is longitudinally movable therein and has fixed thereto, above the sleeve e', a pulley $e^{2\frac{1}{2}}$, to which a rapidly-revolving motion is imparted by the belt e^3, passing thence to some source of power. A small drill e^4 passes centrally through the chuck e^2 and is secured in position by the clamp screw or nut e^5. The sleeve e' is secured to an armature e^6, located below the electromagnet E′, which is supported by the bracket-yoke e^7. When the circuit D′ is open, the armature, and with it the drill, drops onto the blank to be engraved, which tendency may be aided by a spring e^8, placed around the sleeve e' and between the armature and the bracket e^7. The operation of this part of the machine is clear from the foregoing. As the carriage B passes under the drill-carriage the tracer passes alternately in contact with the elevated portions and the depressions or the conducting or non-conducting portions of the patterns. In passing over the conducting or elevated portions the circuit D′ is closed and the magnet E′, being energized, holds the revolving drill e^4 away from the blank to be engraved. When, however, the tracer passes over the depressions or the non-conducting portions of the pattern, the circuit is broken and permits the drill to drop into contact with the blanks and to rout or cut a groove coincident with the depressed or non-conducting portion of the pattern traveled over by the tracer.

It is the intention with this machine to cut dies, punches, or type with vertical walls; but it is evident that they may be cut with beveled edges by simply tapering the end of the drill, as shown in Fig. 6, which shows a view on an enlarged scale of such a drill. Generally it is preferred to use a drill so small in diameter as to be hardly perceptible to the naked eye.

By arranging the armature e^6 above the electromagnet the operation of the drill may be reversed—that is to say, the drill will engrave or cut the body of the letter or design and leave the background elevated. Such an arrangement would be employed in producing matrices from given types or patterns.

It will be observed that the circuit D′ through magnet E′ is distinct and separate from the circuit I′ for obvious reasons.

Engraving on a reduced scale.—When for the sake of accuracy and expeditiousness it is desired to engrave the dies, punches, or type on a reduced scale from an enlarged pattern, a pantograph is used in connection with my apparatus, as shown in Fig. 9, the tracer D on the drill-carriage being in that case dispensed with. The enlarged pattern M is shown in Fig. 9 as mounted on a fixed bed M′, secured to the table in any suitable or desired manner, preferably so as to be removed therefrom when the pantograph is not employed. The pantograph P is secured to the machine as shown—that is to say, the inner joint p is secured to the blank carriage B by a thumb-screw b^{20}, while the "fixed arm" p' is by a similar thumb-screw p^2 secured to the lever P′, pivoted to the table A at p^3 and engaging a pin c^{20} on the drill-carriage with the forked end p^4. The free arm p^5 of the pantograph is provided with the tracer p^6, which takes the place of the tracer D. As in the arrangement first described, a circuit D′ runs from the tracer p^6 to the electromagnet E′ of the drill mechanism, and thence through the battery to the pattern M. The operation of this device is as follows: As the blank-carriage B passes under the drill the tracer p^6 is caused to travel in a parallel but proportionately longer line over the pattern and the non-conducting or depressed portions of the patterns, through the electrical drill-controlling device, serve to cut grooves or lines into the blanks which are smaller but in exact proportion to the corresponding portion of the pattern traveled over by the said controlling-tracer. The tracer p^6 is shifted transversely and by a width proportionate to the ratio to which the pantograph is adjusted at every transverse movement of the drill-carriage through the mechanism of the pivoted lever p' engaging the said drill-carriage. It will thus be seen that, as in the arrangement first described, every part of the pattern and the blanks is traveled over by the tracer p^6 and the drill E, only in the present instance the non-conducting or intaglio portions of the pattern and the portions of the blanks engraved are not equal but bear a fixed ratio to each other. As in the first arrangement, the armature of the drill controlling the magnet E′ may be so located as to reverse the action

of the machine—*i. e.*, to produce a matrix or intaglio design from the elevated or conducting portion of the pattern.

Having regard to the drill action, the fact that the armature e^6 is on the sleeve e', in which the drill-chuck e^2 is guided, with the electromagnets E′ adjacent to said sleeve, is an important feature of the construction for controlling the longitudinal motion of the drill, inasmuch as thereby the forces applied to effect the in-and-out motions of the drill are rendered direct, instantaneous, and true.

It should be noted that all that is required from the pattern and tracer is the control of the circuit through the drill-magnets E′. It is not necessary that the pattern or pattern-block should itself be in the circuit. The contacts might be otherwise provided for and be mechanically controlled from the pattern and the tracer.

While I consider the machine hereinbefore described the best embodiment of my invention, it is manifest that the same may be greatly modified in many particulars without departing from the spirit of my invention. I do not, therefore, desire to be limited to the construction and arrangement herein shown and described.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In an engraving machine, the combination with a reciprocating carriage, provided with a striker, and a revolving shaft for actuating the same having two fixed and an intermediate loose pulley mounted thereon, of a pivoted belt-shifting lever having two arms, provided with wipers in the path of said striker and a third arm provided with eyes, a straight and a crossed belt passing from the pulleys through the eyes of the third arm to a power shaft, substantially as set forth.

2. In an engraving machine, a carriage provided with a screw-rod, in combination with a double ratchet-wheel and a pawl-lever provided with a double tilting pawl, and a pawl shifting device for reversing the action of said double pawl, controllable by, and operative at the limits of the movement of said drill carriage, substantially as described.

3. In an engraving machine, a drill-carriage provided with a screw-rod in combination with a double ratchet-wheel threaded on the screw-rod, a pawl-lever provided with a double tilting pawl, a pawl shifting-lever provided with an armature, an electro-magnet and means for making and breaking the circuit of the electro magnet at each stroke of the drill-carriage, substantially as set forth.

4. In an engraving machine, a drill-carriage provided with a screw-rod in combination with a double ratchet threaded thereon, a pawl lever provided with a double tilting pawl, a pawl shifting lever provided with an armature, an electro-magnet and a switch for closing and breaking the circuit of the electro-magnet at each stroke of the drill-carriage, substantially as set forth.

5. In an engraving machine, a drill-carriage provided with a screw-rod and a contact-stud in combination with a double ratchet threaded thereon, a pawl-lever provided with a double tilting pawl, a pawl shifting lever provided with an armature, an electro-magnet, a switch for closing and breaking the circuit and a rod, as i^3, provided with contacts on both sides of the contact stud on the drill carriage, substantially as set forth.

6. In an engraving machine, an electro-magnet comprised in a circuit passing through a tracer and pattern in combination with a sleeve provided with an armature, a drill chuck passing through the said sleeve and provided with a pulley for imparting rotary motion to the drill, substantially as set forth.

7. In an engraving machine, an electro-magnet comprised in a circuit passing through a tracer and a pattern in combination with a sleeve provided with an armature, a drill chuck passing through said sleeve and provided with a pulley and a drill wire secured in the drill chuck, substantially as set forth.

8. In an engraving machine, a reciprocating blank-carriage, a fixed bed provided with a pattern and drill-carriage in combination with a pantograph having a tracer to travel over the pattern and secured at one joint to the blank-carriage and a pivoted lever, as p', engaging the drill-carriage with one arm and secured with its other arm to the fixed arm of the pantograph, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

BARTON S. MOLYNEUX.

Witnesses:

JAS. F. WILLIAMSON,

FRANK D. MERCHANT.