

No. 689,845.

Patented Dec. 31, 1901.

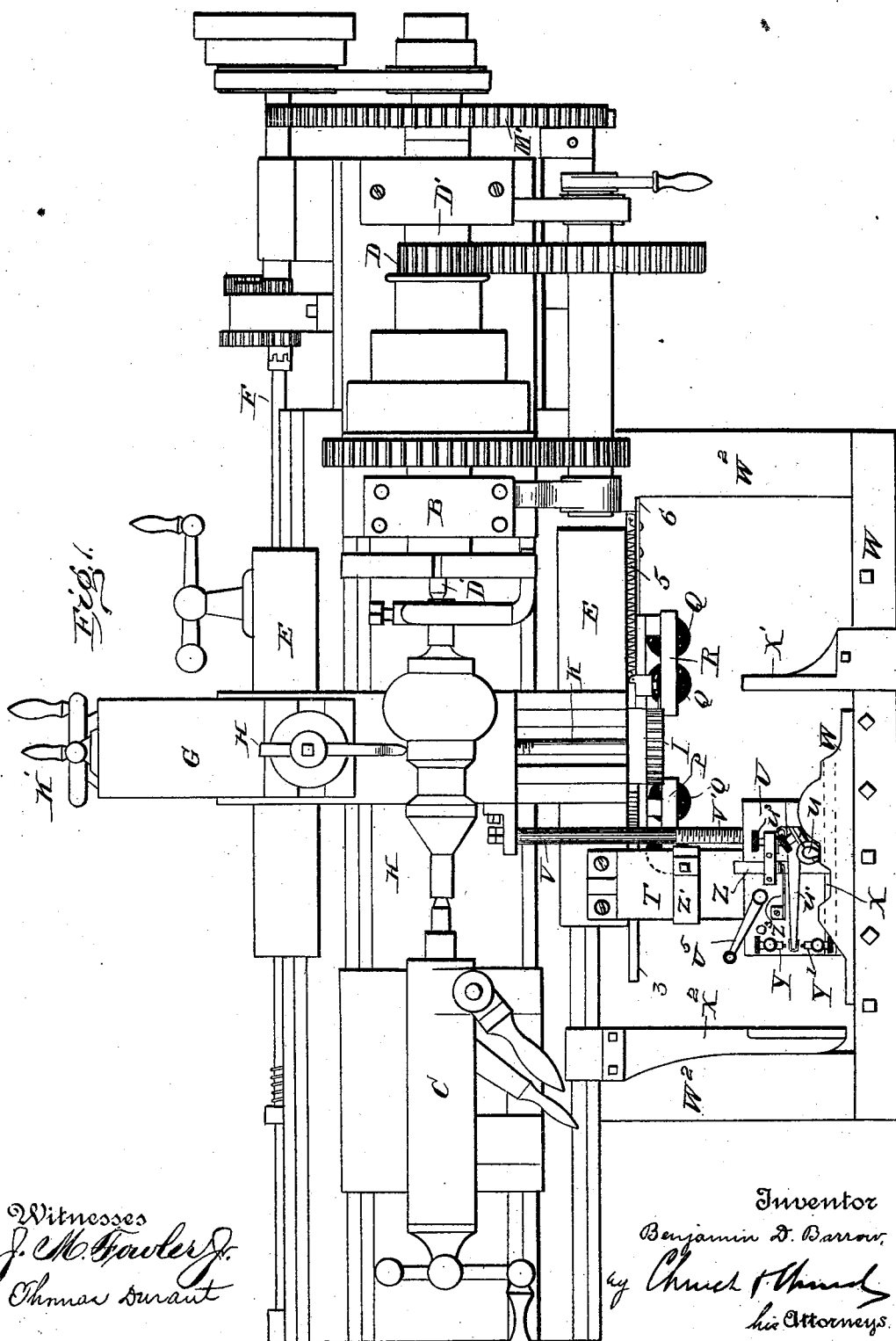
B. D. BARROW.

MECHANISM FOR CONTROLLING CUTTING TOOLS OF LATHES, &c.

(Application filed Apr. 13, 1901.)

(No Model.)

3 Sheets—Sheet 1.



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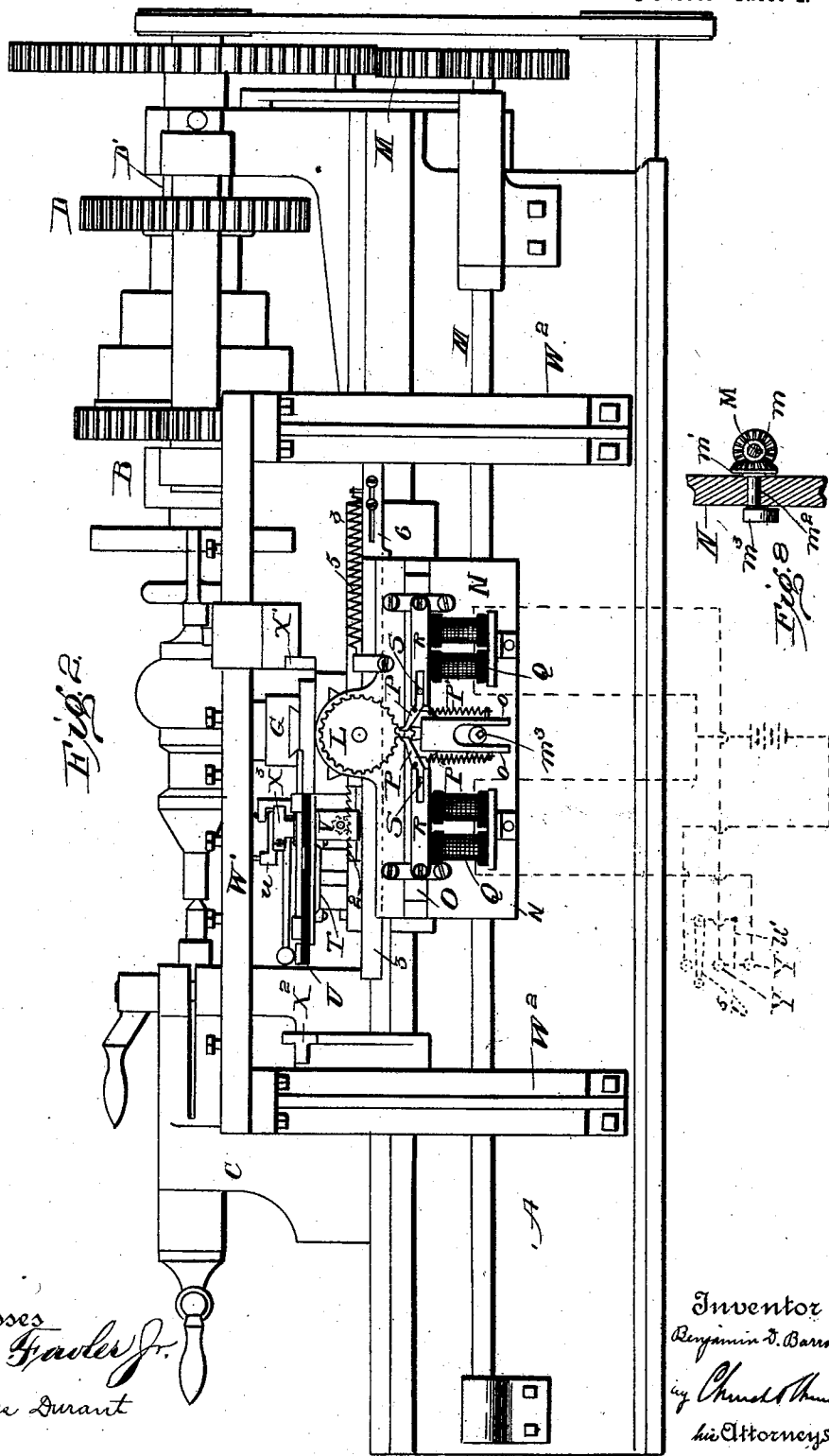
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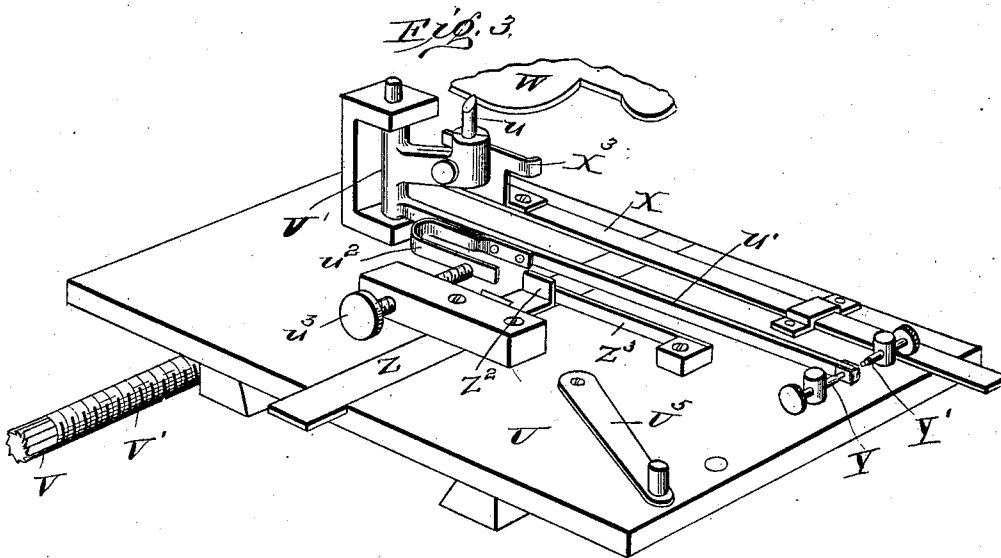
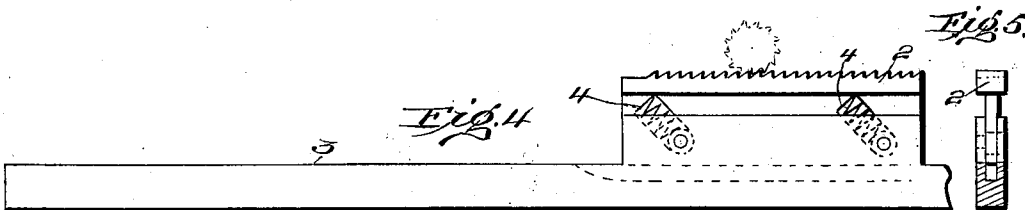
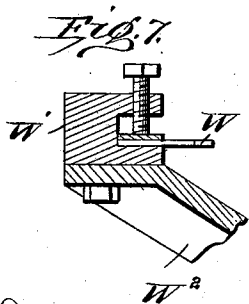
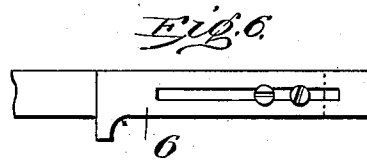
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

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MECHANISM FOR CONTROLLING CUTTING-TOOLS OF LATHES, &c.

SPECIFICATION forming part of Letters Patent No. 689,845, dated December 31, 1901.

Application filed April 13, 1901. Serial No. 55,706. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN D. BARROW, of Danville, in the county of Pittsylvania, State of Virginia, have invented certain new and useful Improvements in Mechanism for Controlling the Cutting-Tools of Turning, En-
5 engraving, Milling, or Planing Machines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying draw-
10 ings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to improvements in machines designed for turning and similar work wherein the motions of the tools are adapted to be controlled, but not moved, di-
15 rectly by a previously-formed pattern corresponding to the work to be formed.

The objects of the invention are to provide a simple positively-acting mechanism which will control a cutting-tool with the greatest accuracy and throughout practically any de-
20 sired range of movement, whereby provision is made for following patterns having widely-different contour-lines or contour-lines requiring a relatively long movement of the tool in traveling from a crest to a valley, or vice versa.

The invention consists in certain novel details of construction and combinations and ar-
25 rangements of parts, all as will be now described, and pointed out particularly in the appended claims.

Referring to the accompanying drawings, Figure 1 is a top plan view of a lathe having my present improvements applied thereto. Fig. 2 is a rear elevation of the same with the covering-plate or housing for a portion of the
30 operating mechanism removed to show the feeding devices for the tool or carriage upon which the tool is mounted in a direction transversely of the lathe bed or center on which the work turns. Fig. 3 is a perspective view of the contacts and controlling devices there-
35 for through the medium of which the transverse feed of the tool is controlled. Fig. 4 is a detail side elevation of a section of the rack-bar for determining the depth of tool-cut. Fig. 5 is a section of the same. Fig. 6 is a
40 50

detail elevation of the end of the bar broken away in Fig. 4. Fig. 7 is a detail section showing the pattern holder and clamp. Fig. 8 is a detail section showing the driving mechanism for the cam of the transverse feed de-
55 vices.

Like characters of reference in the several figures indicate the same parts.

In the apparatus shown the letter A indicates the bed of a lathe, B the head-stock, C the tail-stock, and D gearing for driving the head-stock spindle D', such parts, together with the carriage E and the mechanism in-
60 cluding the feed-shaft F for giving said carriage longitudinal movement and reversing its movement when the carriage has made its full travel in either direction, being all of or-
65 dinary construction and need not be further described herein. For these parts as thus far described any of the ordinary lathe mech-
70 anisms may be substituted, or in lieu of a lathe mechanism a planer mechanism may be substituted, dependent upon the character of the work to be performed—that is to say, whether it requires a rotary or a lineal move-
75 ment to effect the desired cut. The carriage E, which constitutes the primary support for the cutting-tool, carries a secondary carriage G, movable transversely of the carriage E and adapted to hold the cutting-tool H, which latter is mounted in a tool-post of any
80 ordinary or preferred type. This secondary carriage G is adapted to be moved transversely of the machine-bed and transversely of the direction of movement of the carriage E, or, in other words, in a direction to move
85 the tool to the desired extent toward and from the work being done, so as to cut at different elevations or at different distances from the axis of the work when the latter is mounted
90 between the centers of the head and tail stocks B and C of the lathe.

For the purpose of moving the secondary carriage G transversely the carriage E is provided with the usual feed-screw K, which at its forward end carries a handle K', by means of which the transverse feed of the tool may be effected manually, while at its rear end said screw K' is provided with a toothed wheel L, through the instrumentality of which the
95 100

automatic feeding of the secondary carriage and tool is effected by instrumentalities to be now described.

Extending longitudinally of the lathe-bed and preferably on the rear side thereof is a shaft M, adapted to receive rotary motion through gearing M' from the spindle of the head-stock or other appropriate driving mechanism, and this shaft M has splined thereon a bevel-gear m , Fig. 8, which meshes with a corresponding bevel-gear m' on the rear end of a short shaft m^2 , journaled in a depending apron or guard N on the carriage E at the rear side of the machine-bed. Mounted on the shaft m^2 is a cam m^3 , adapted to work between the depending arms o of a slide O, mounted in a slideway in the upper portion of the apron N, whereby by the rotation of the shaft M said slide O is given a continuous reciprocatory movement, the extent of such movement being determined by the eccentricity of the cam m^3 , as will be readily understood. The slide O carries two oppositely-projecting pawls P, preferably pivotally mounted on said slide and adapted to be thrown into engagement with the toothed wheel L, but normally held out of engagement therewith by springs P', leaving said toothed wheel L and transverse feed-shaft free for manual manipulation. Said pawls P being set in opposite directions, it is obvious that when one of said pawls is thrown into position to engage with the wheel L said wheel L and transverse feed-shaft will be rotated in one direction, and when the opposite pawl is moved into position to engage with said wheel said wheel and shaft will be rotated in the opposite direction by the reciprocation of the slide O, and that said feed movement will take place at each movement of the slide O and will continue to take place as long as one or the other of the pawls is held in operative position. For the purpose of throwing these pawls into operative position electromagnets Q are employed, such magnets operating, when energized, on armatures R, pivotally supported on the apron N and at their inner ends having slots into which pins S on the rear ends of the pawls are adapted to work. Thus when said armatures R are drawn downwardly by the electromagnets Q the forward ends of the pawls will be raised into position to engage the feed-wheel L, and the shape of the pawls is such that they will ride over the teeth of the feed-wheel when moving in one direction, but will engage and rotate said feed-wheel when moving in the opposite direction. By maintaining a current through one or the other of the magnets it is therefore obvious that one or the other of the pawls may be thrown into operative position and held in such position as long as the circuit through the magnet remains unbroken. With such an arrangement in order to automatically effect the transverse feed movements of the tool it is only necessary to control the establishment of the circuits through the magnets Q, and this may be

conveniently accomplished by suitable contacts or switching devices, which are directly controlled by the pattern of the article to be cut or dressed.

The circuit-controlling devices are preferably mounted to move longitudinally with the carriage E as well as transversely with the secondary carriage G, a relative movement of said controlling devices and carriage G being effected for determining the depth of cut to be made by the tool.

By reference to Fig. 1 it will be seen that the rear portion of the carriage E carries a rearwardly-projecting arm preferably in the form of a slideway or bed T, and upon this slideway is mounted, so as to move parallel with the movement of the secondary carriage G, a contact and stylus bed or support U. (Shown on an enlarged scale in Fig. 3.) This bed U may be of insulating material, or, if not of insulating material, the contacts for the circuit connections, to be hereinafter described, should be suitably insulated therefrom. The bed U is connected with the secondary carriage G by a shaft V, which latter is journaled at one end in the secondary carriage G, but held against independent longitudinal movement, and at its opposite end is connected with the bed U by a threaded portion V', whereby by the rotation of said shaft V the distance between the bed U and secondary carriage G may be varied, and the degree of such rotation determines the depth of cut of the tool, as will be hereinafter more fully explained.

The contact and stylus frame U' is mounted on the bed U, preferably on vertical pivots, so as to swing horizontally, said stylus-frame U' having one arm provided with a stylus u , preferably conforming in transverse section to the nose of the cutting-tool and being adapted to follow the contour-lines of a pattern W, which latter may be of sheet metal or other material and conveniently held in position by being clamped in a pattern-holder W', Fig. 7, supported by arms W², extending rearwardly from the machine-bed. A second arm u' of the stylus-frame constitutes a contact-arm and is preferably made of very much greater length than the stylus-arm and is adapted to play between fixed but adjustable contact-points Y Y', mounted on the bed U and between which the electric circuits controlling the electromagnets Q is made or broken.

The stylus and frame is adapted to be yieldingly held with the contact-arm u' engaging the fixed contact Y' by a spring u^2 , bearing against a set-screw u^3 , and it is adapted to be moved in the opposite direction by the contact of the stylus u with the pattern W. Thus, assuming that the bed U is traveling longitudinally with the main carriage E, should the stylus u contact with the pattern the circuit would be established for energizing the electromagnet Q, which would feed the tool back away from the work, such feed movement of the tool and its carriage imparting a

similar movement to the bed U, and consequently allowing the circuit to be again broken. On the other hand, should the stylus u move out of contact with the pattern, as in going into a depression, the spring u^3 will assert itself and establish the other circuit, thereby energizing the other electromagnet to feed the carriage, bed U, and tool in the opposite direction.

The system of circuits will be readily understood from an inspection of Fig. 1, where said circuits are shown in dotted lines, and in order to permit the electrical attachment to be thrown into or out of operation provision is preferably made for making and breaking the circuit at some point by means of a switch—as, for instance, the switch U^3 in Fig. 3.

Provision is made for backing off the tool from the work and the stylus from the pattern during the return movement of the carriage E, and to accomplish this end the contact-arm u' is adapted to be shifted when the end of the cut has been reached, so as to establish the circuit for feeding the carriage G, tool, and bed U backwardly a sufficient distance to clear the work and pattern and during the actual return travel of the carriage E. During the return travel of the carriage E the contact-arm u' is held out of contact with either of the fixed contacts Y or Y' and only thrown in again when the carriage E has reached its initial or starting position. A simple mechanism for accomplishing these important movements consists of a slide X, mounted on the bed U and adapted to project at each end thereof into position to strike one or the other of the adjustable stop-arms X' or X², whereby said slide X is shifted from one position to the other. Upon the slide X a spring shifting-arm X³ is secured in position to engage the stylus-arm whenever the slide X is moved by the stop X', as when the carriage E has reached the limit of its forward travel. The spring shifter-arm X³ moves the stylus-arm and contact-arm so as to establish the circuit through the contact Y and maintain the circuit until the arm u' is again shifted to break the circuit. While the circuit through the contact Y is maintained, the carriage G and bed U continue to be moved backwardly, and a second slide Z, arranged at right angles to the slide X, is adapted to contact with an adjustable stop Z' on the slideway T when the tool and bed U have been moved rearwardly a sufficient distance, and a stop or projection Z² on the slide Z is adapted to strike the contact-arm u' , breaking the circuit. The instant the circuit is broken the further rearward feed of the carriage G and tool is arrested, and with the contact-arm u' in an intermediate position between the fixed contacts the carriage E makes its return movement. Just as the initial position or starting-point is reached the slide X strikes the stop X² and moves the spring shifting-arm X³ out of engagement with the stylus-arm,

permitting the circuit to be established through the contact Y', whereupon the tool-carriage G and bed U will be fed forwardly until the stylus comes into contact with the pattern and breaks the circuit. As the bed U feeds forwardly the slide Z is returned to its normal position by a spring Z³, and the parts are ready to make another cut.

For effecting the movement of the bed U and stylus with relation to the tool in order to determine the depth of the cut the shaft V at its inner end is toothed longitudinally, the teeth V², Fig. 3, being preferably in the form of long ratchet-teeth adapted to mesh with a spring-pressed rack 2, mounted on the sliding bar 3, held in suitable guides or ways on the carriage E. The spring-pressed rack 2 is preferably held upwardly by means of springs 4, Fig. 4, and the arrangement is such that said bar and ratchet are free to move in one direction without turning the shaft V; but when moved in the opposite direction it will rotate said shaft in a direction to draw the bed U toward the carriage G, and hence it is obvious that by causing the slide 3 to contact with the stop X² as the carriage reaches its initial position the slide or rack-bar will be moved and the shaft V rotated a distance proportionate to the length of movement of the rack-bar. The rack-bar and slide 3 are held against such movement by a spring 5, Fig. 2, which at one end is connected with the carriage and at the opposite end with the slide, and in order to determine the range of movement of the slide an adjustable stop 6, Fig. 6, is mounted thereon and adapted to contact with one side of the apron N, so as to limit the advance movement of the slide under the influence of the spring 5. By allowing said slide and its rack to advance further a longer range of movement may be given said slide and a correspondingly-greater depth of cut will be made. On the other hand, by limiting the range of movement of said slide and its rack-bar a very delicate or finishing cut may be made and thus the machine is adapted for both rough and finishing work, as will be readily understood.

In operation now the pattern having been previously formed is clamped in the pattern-clamp W' and the parts adjusted for coöperation therewith. If the blank from which the work is to be formed is of much larger dimension than actually required, the machinist may manipulate the cutting-tool manually, so as to reduce the size of the same, and it is preferred in the practical operation of the machine to manually rough out the deep holes or valleys, inasmuch as by so doing a material saving of time is effected, for otherwise the machine would first operate on only those portions of the work opposite the deepest cuts and the tool would be inoperative throughout a large portion of its traverse until the blank assumes somewhat the form of the pattern.

Having thus described my invention, what

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

1. In a machine of the character specified, the combination with the transversely-movable tool-holder, carriage and feed-screw for moving said carriage, of a toothed wheel on said screw, a reciprocatory pawl-carrier, oppositely-arranged pawls thereon adapted to engage said toothed wheels to turn the screw in one direction or the other, electromagnets controlling said pawls and a pattern-controlled contact-arm included in circuits with said magnets; substantially as described.

2. In a machine of the character specified, the combination with the work-holder, transversely-movable tool-carriage, and feed-screw for said carriage with means for controlling said screw manually, of an automatic controlling mechanism for said screw embodying a toothed wheel on the screw, a reciprocatory pawl-carrier, oppositely-arranged pawls on said carrier adapted to engage said wheel but normally out of operative position whereby the screw is free for manual operation, electromagnets controlling said pawls, and a pattern-controlled contact-arm included in electric circuits with said electromagnets; substantially as described.

3. In a machine of the character specified, the combination with the work-holder; the reciprocatory carriage the secondary carriage mounted thereon and a feed-screw for moving said secondary carriage, of a toothed wheel connected with the feed-screw, a reciprocatory pawl-carrier, oppositely-arranged pawls on said carrier adapted to engage the toothed wheel, electromagnets controlling said pawls, a pattern and a contact-arm controlled by said pattern for making or breaking the circuits through the electromagnets; substantially as described.

4. In a machine of the character specified, the combination with the rotary work-holder, longitudinally-movable carriage, transversely-movable tool-carriage carried by the longitudinally-movable carriage and the feed-screw for the transversely-movable carriage having the toothed wheel thereon, of the reciprocatory pawl-carrier mounted on the longitudinally-movable carriage, the eccentric and gears for reciprocating said pawl-carrier, the oppositely-arranged pawls on said carrier, the slotted armatures for moving the pawls, the electromagnets controlling said armatures and the pattern-controlled contact-arm for establishing the circuit through one or the other of said magnets; substantially as described.

5. In an automatic operating mechanism for the tools of lathes and the like, the combination with a feed-screw, toothed wheel carried thereby, reciprocating pawl-carrier and oppositely-arranged pawls carried thereby and adapted to engage the wheel to rotate the screw in one direction or the other, of electromagnets, pivoted armatures controlled thereby and slot-and-pin connections between the armatures and pawls, a pattern-controlled

contact-arm and electric circuits including said arm and the electromagnets; substantially as described.

6. In an automatic operating mechanism for the tools of apparatus such as described, the combination with the longitudinally-movable carriage, the transversely-movable carriage mounted thereon adapted to support the cutting-tool, a slideway on said longitudinally-movable carriage extending parallel with the direction of movement of the transversely-movable carriage and a stylus-base mounted to slide on said slideway of a screw connecting said stylus-base and transversely-movable carriage, and a rack-bar carried by the longitudinally-movable carriage and adapted to rotate said screw when the movement of said rack-bar in unison with the longitudinally-movable carriage is arrested and a stop with which said rack-bar is adapted to contact for arresting its movement; substantially as described.

7. In an automatic operating mechanism for the tools of apparatus such as described, the combination with the longitudinally and transversely-movable carriages, a stylus-base movable in unison with both of said carriages, a stylus and contact-arm mounted on said base, a fixed pattern with which said stylus coöperates to move the contact-arm, electromagnets controlling the transverse movement of the transversely-movable carriage and electric circuits including said electromagnets and the contact-arm; substantially as described.

8. In an automatic operating mechanism for the tools of apparatus such as described, the combination with the longitudinally-movable carriage, the transversely-movable carriage and stylus-base mounted thereon, a toothed and threaded shaft connecting said transversely-movable carriage and stylus-base, a longitudinally-movable rack-bar mounted on the longitudinally-movable carriage and adapted to mesh with said toothed shaft, a stop for arresting the movement of said rack-bar to rotate said shaft, electromagnets controlling the transverse movement of the transversely-movable carriage and stylus-base, a stylus and contact-arm mounted on said base and controlling the circuits through said magnets and a pattern with which said stylus is adapted to coöperate; substantially as described.

9. In an automatic operating mechanism for the tools of apparatus such as described, the combination with a longitudinally-movable carriage, the transversely-movable carriage mounted thereon and the transversely-movable stylus-base also mounted on said longitudinally-movable carriage and connected with the transversely-movable carriage for transverse movement, of electromagnets controlling the transverse movement of the transversely-movable carriage, of a stylus and contact-arm mounted on said stylus-base and adapted to coöperate with a fixed pattern, a yielding shifter-arm adapted to coöperate

with the stylus to move the contact into position to retract the transversely-movable carriage and stylus-base and fixed stops for moving said shifter-arm into and out of operative position; substantially as described.

10. In an automatic operating mechanism for the tools of apparatus such as described, the combination with the longitudinally-movable carriage, the transversely-movable carriage and stylus-base mounted thereon, electromagnets controlling the transverse movements of said carriage and stylus-base, a stylus and contact-arm mounted on said base, a slide carrying a shifter-arm for moving said contact-arm into position to energize the magnet for retracting the transversely-movable carriage, fixed stops with which said slide co-operates in the longitudinal movement of said base and a second slide co-operating with said contact-arm to move the same and break the circuit against the tension of the shifter-arm and a stop with which said second slide co-

operates in the transverse movement of the stylus-base; substantially as described.

11. In an automatic operating mechanism for the tools of apparatus such as described, the combination with the longitudinally and transversely movable carriages, a stylus-base mounted on the longitudinally-movable and connected with the transversely-movable carriage, the connection between the said base and transversely-movable carriage being established through a rotary screw-shaft, of a spring-pressed rack-bar mounted on said longitudinally-movable carriage and adapted to rotate said shaft to establish the depth of cut of the tool, a fixed stop with which said rack-bar co-operates and an adjustable stop for determining the travel of the rack-bar and rotation of the shaft; substantially as described.

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