No. 839,011. PATENTED DEC. 18, 1906.

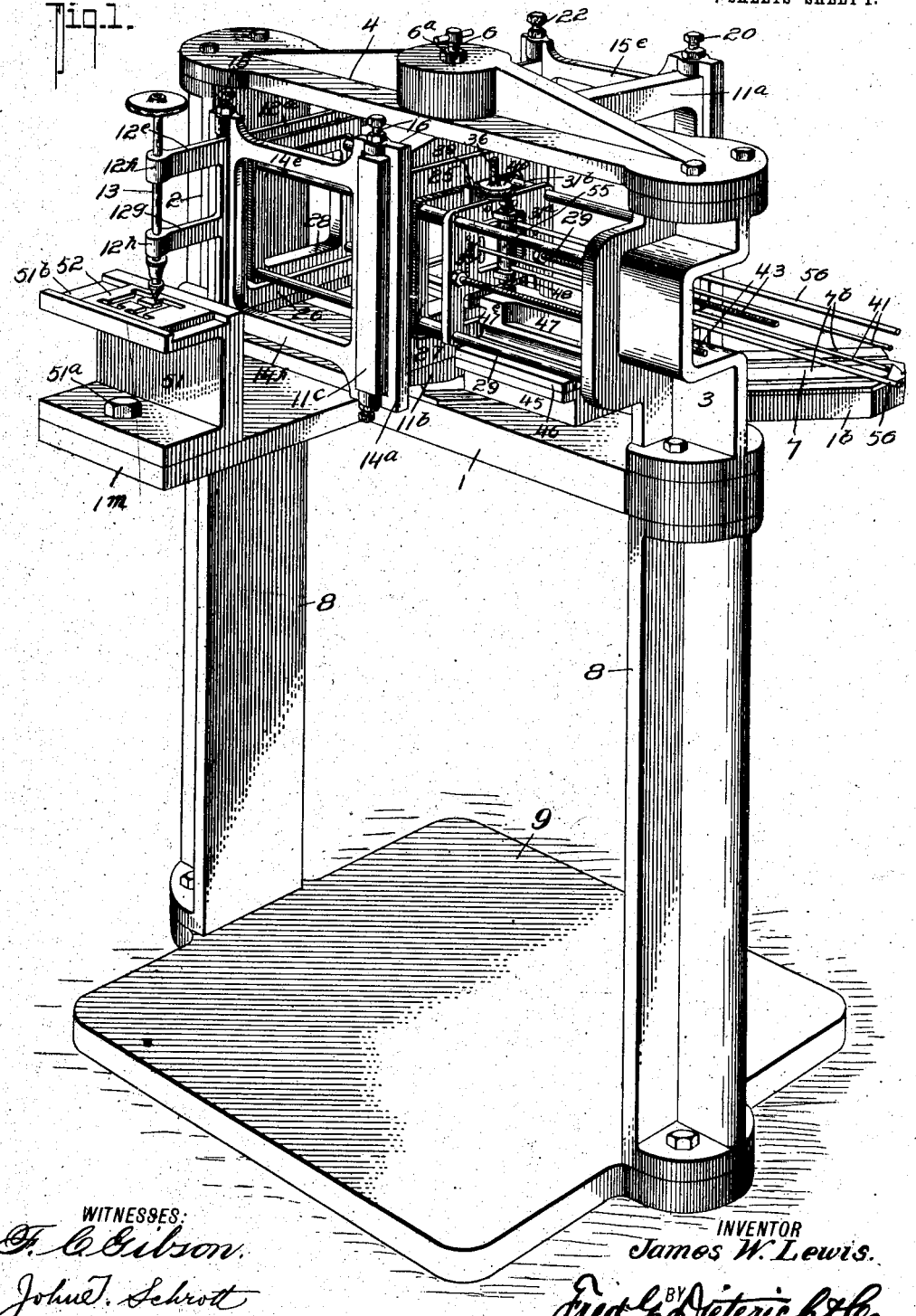
J. W. LEWIS.

PANTOGRAPHIC ENGRAVING MACHINE.

APPLICATION FILED NOV. 27, 1905.

7 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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7 SHEETS—SHEET 2.

Fig. 2.

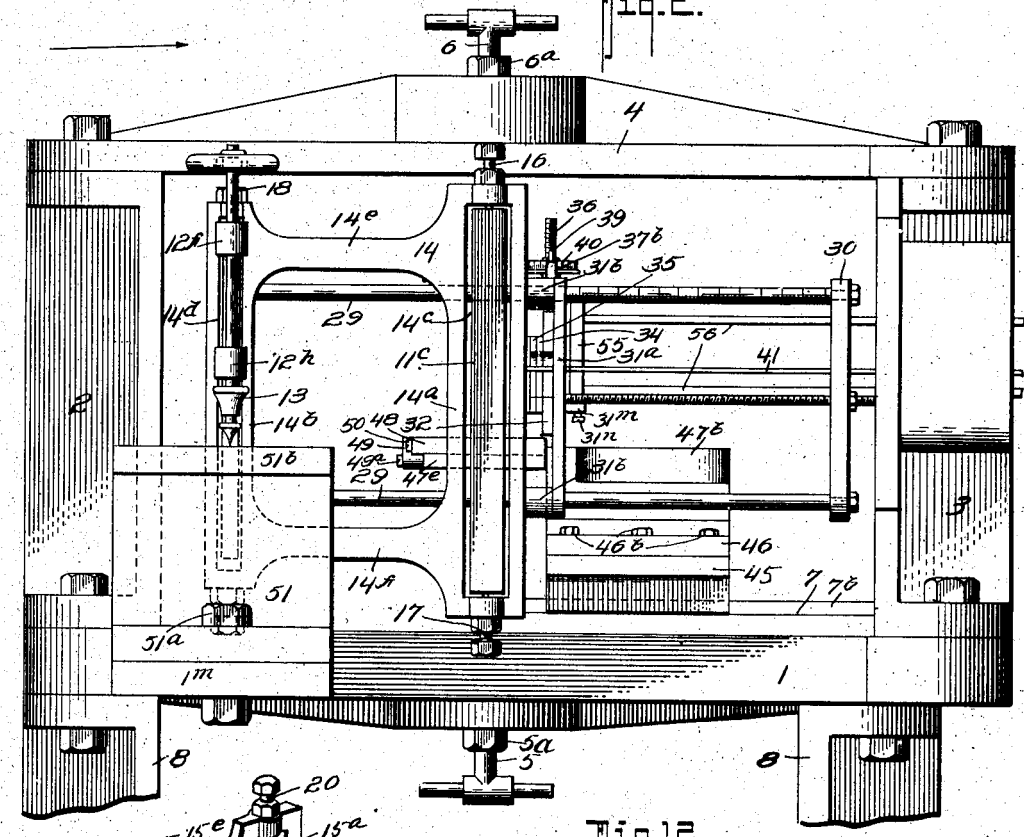
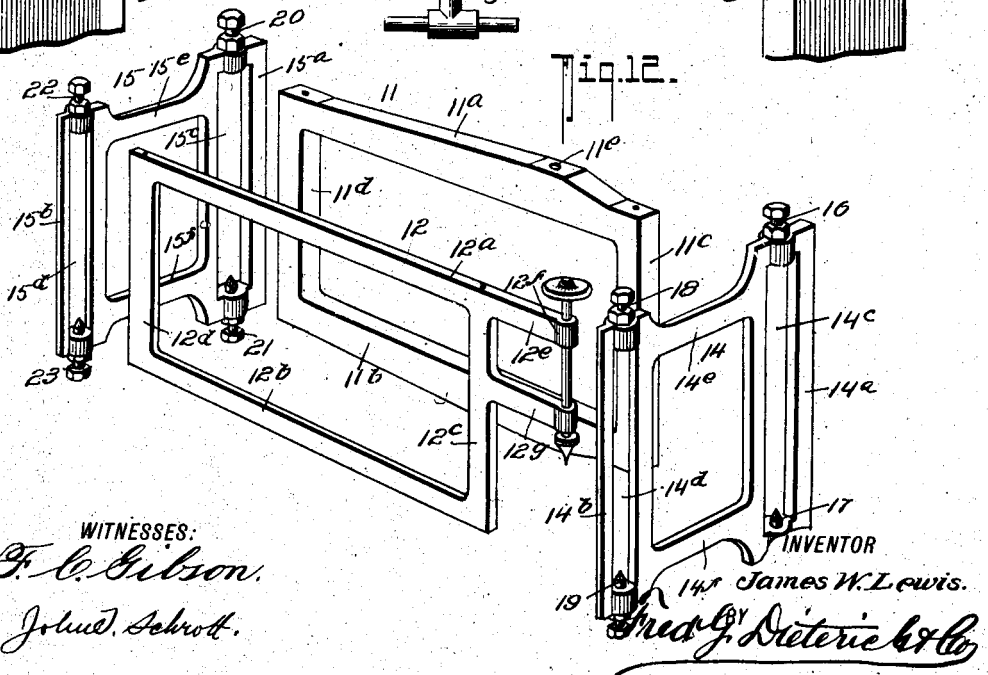


Fig. 12.



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7 SHEETS—SHEET 3.

Fig. 3.

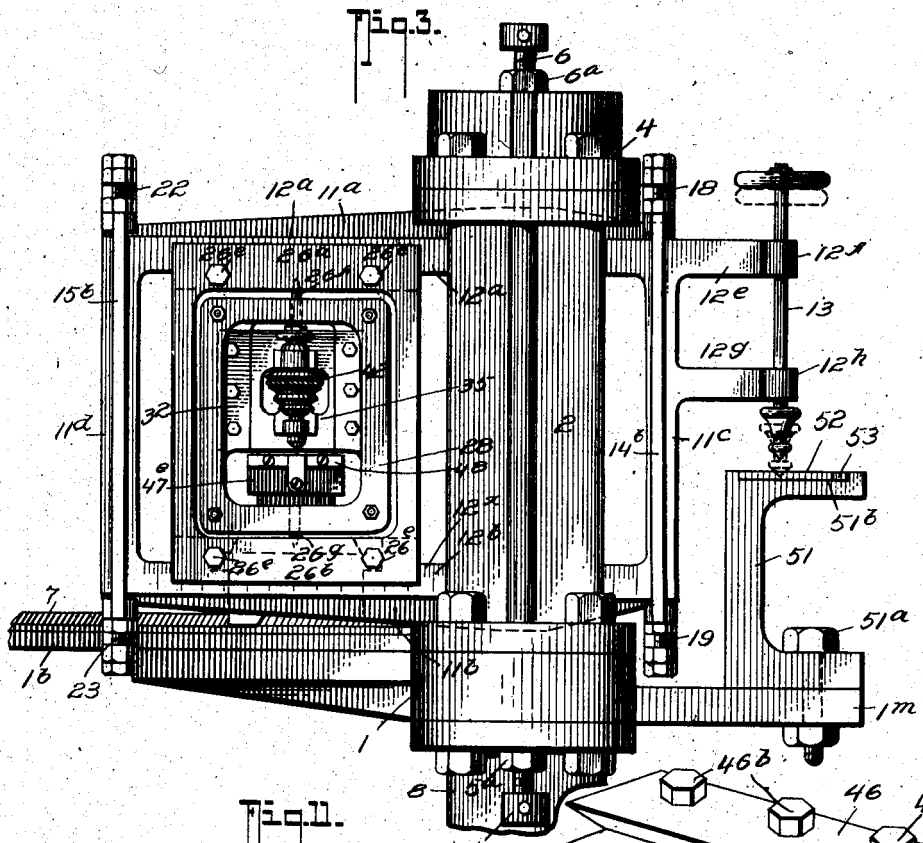
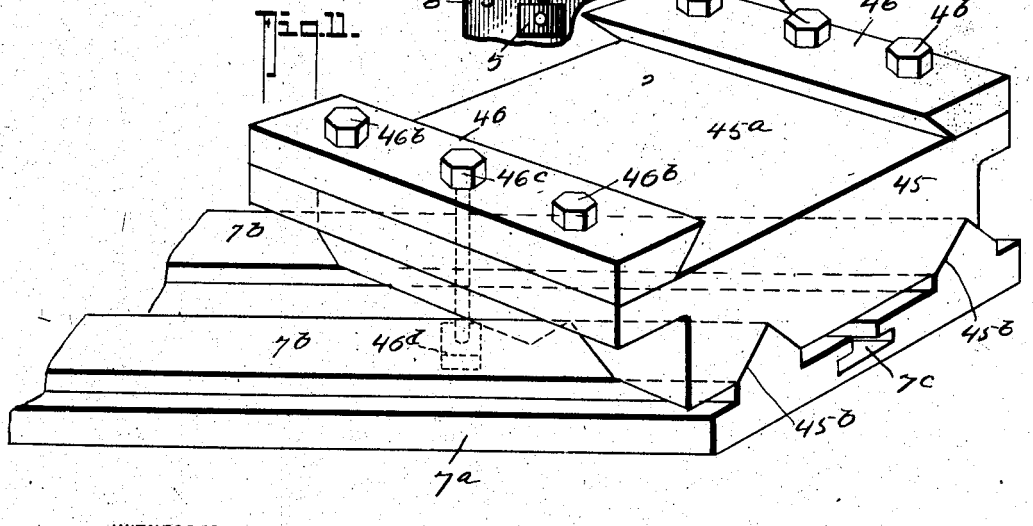


Fig. 11.



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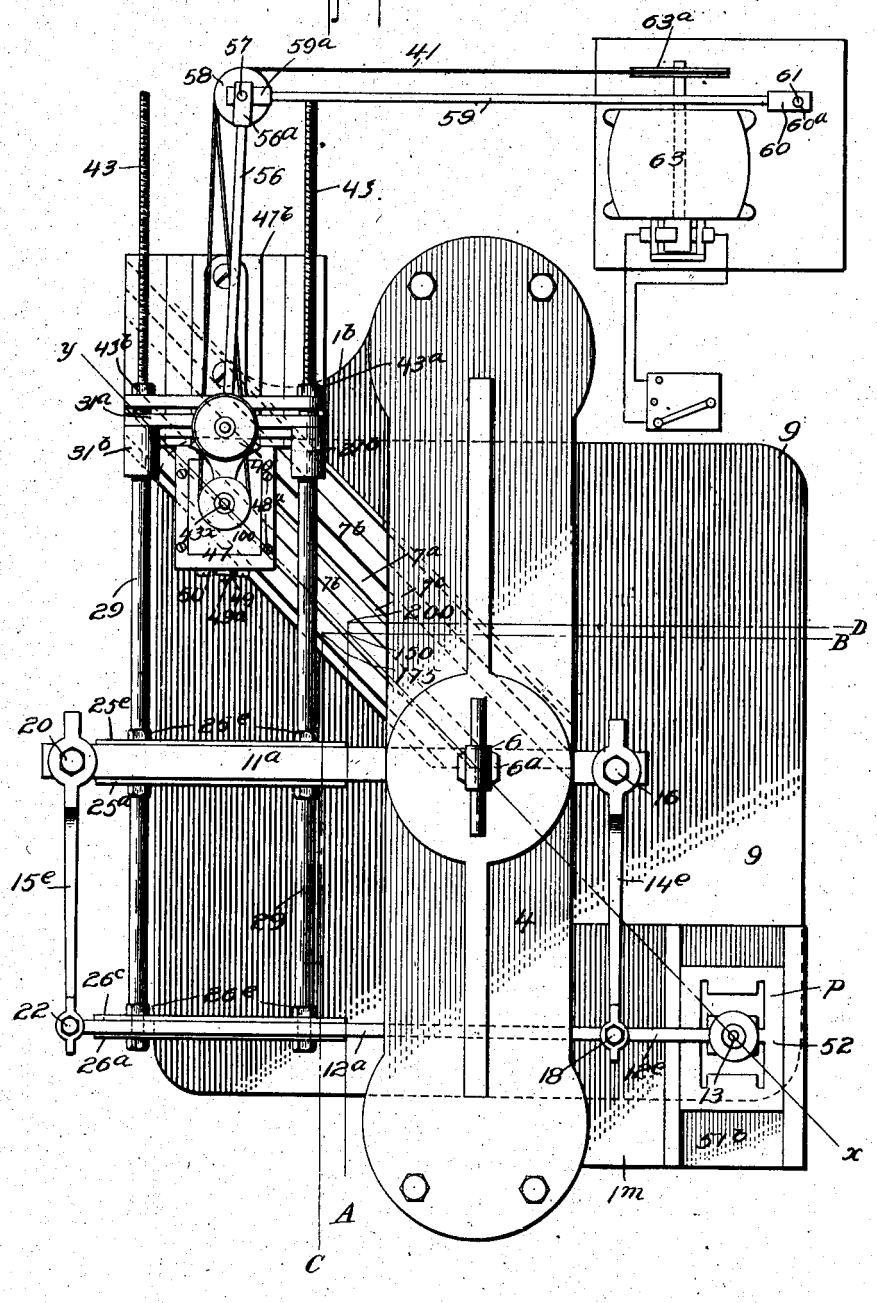
7 SHEETS—SHEET 4.

Fig. 4.



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7 SHEETS—SHEET 5.

Fig. 5.

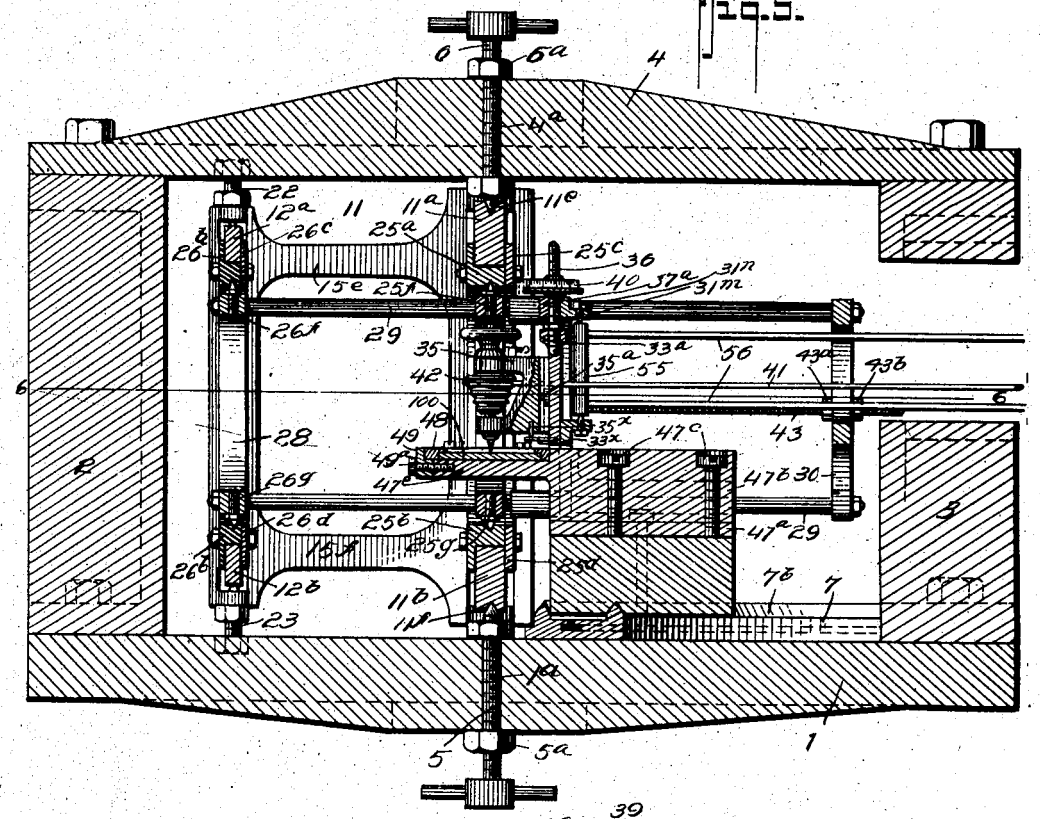
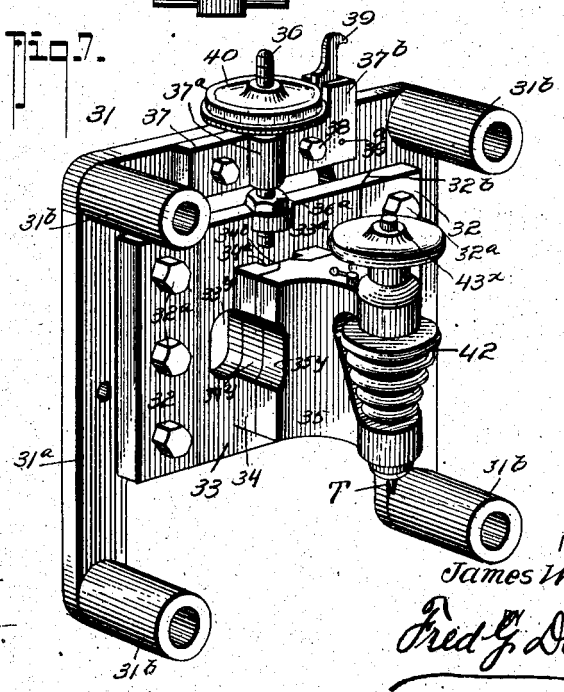


Fig. 7.



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7 SHEETS—SHEET 6.

Fig. 5.

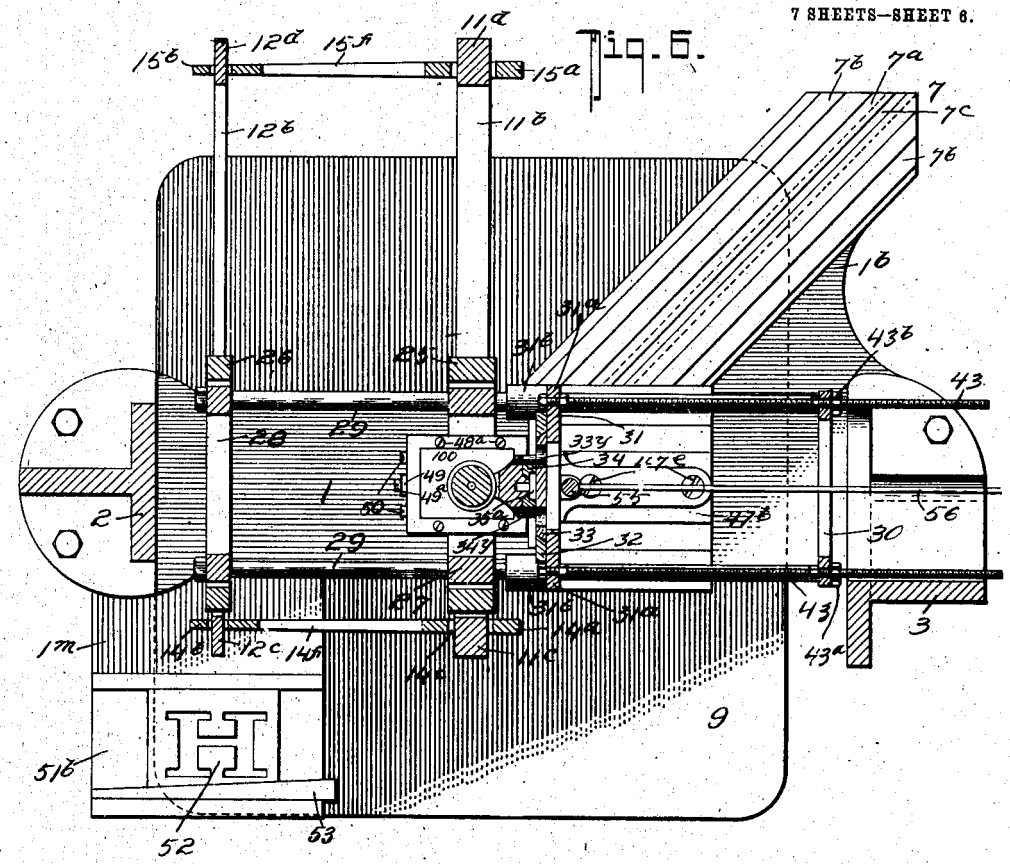
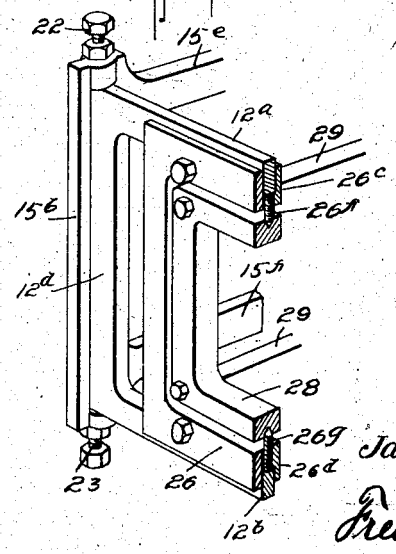


Fig. 8.



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7 SHEETS—SHEET 7.

Fig. 9.

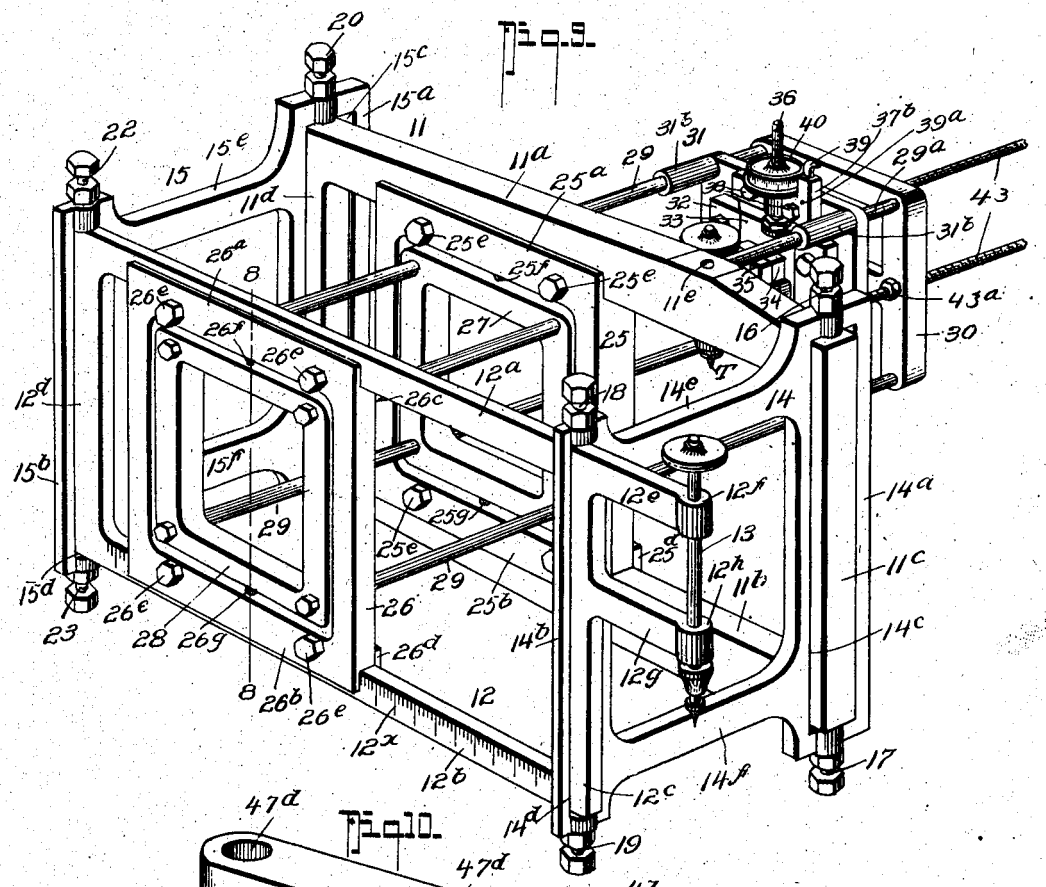
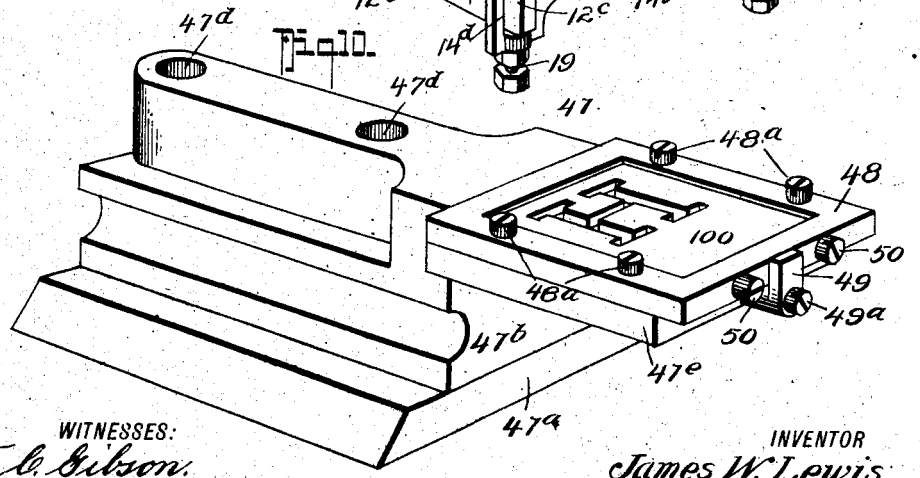


Fig. 10.



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PANTOGRAPHIC ENGRAVING-MACHINE.

No. 839,011. Specification of Letters Patent. Patented Dec. 18, 1906.

Application filed November 27, 1905. Serial No. 289,215.

To all whom it may concern:

Be it known that I, JAMES W. LEWIS, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Pantographic Engraving-Machines, of which the following is a specification.

This invention relates to certain new and useful improvements in engraving-machines, and it particularly relates to machines of the type known as "matrix" or "punch cutting" machines, in which means are provided for cutting matrixes or punches of varying sizes from "0" to "144" point, and in which means are also provided for varying the proportions of the letter to be cut, all of which operations may be done while using a single pattern.

Generically my invention has for its object to produce a machine of the type referred to of a very simple and economical construction, which will readily and effectively serve its intended purposes, and which will be capable of an almost universal range of work.

In its more detail nature my invention includes a pantographic parallelogram formed of pivotally-connected swinging rectangular members which are pivotally mounted on a stationary support, a sliding piece fitted in said parallelogram and carrying a member mounted in and connected thereto by two centers to move on a vertical axis, this member in turn carrying four rods on which the sliding carriage, which carries the tool-carrier and the micrometer adjustment, is mounted.

The invention also has for its object to provide a mechanism in which there are no sliding parts while the machine is at work, the parts being so arranged and constructed as to be adjustable and the tool-carrier removable without destroying their alinement. Trackways are also provided for permitting movement of the work-carrier at forty-five degrees from central line of machine, and means are provided whereby a separate adjustment of work-block from right to left, or vice versa, can also be had.

With other objects in view than have been heretofore specified the invention also includes certain novel construction, combination, and arrangement of parts, all of which will be first described in detail and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my invention. Fig. 2 is a front elevation thereof, the supporting-standards being broken away. Fig. 3 is an end elevation of the parts shown in Fig. 2 looking in the direction of the arrow. Fig. 4 is a top plan view of my machine. Fig. 5 is a vertical longitudinal section of the machine looking in the same direction as for Fig. 2. Fig. 6 is a horizontal section on the line 6 6 of Fig. 5. Fig. 7 is a detail perspective view, on an enlarged scale, of the sliding tool-carriage. Fig. 8 is an enlarged sectional perspective on the line 8 8 of Fig. 9. Fig. 9 is a perspective view of the pantograph mechanism and its carried parts detached from the supporting parts of the machine. Fig. 10 is an enlarged perspective view of a portion of the work-holder. Fig. 11 is a similar view, on the same scale, of the remaining portion of the work-holder. Fig. 12 is a detail perspective view of the rectangular frames and the yoke-frames separated.

Referring now to the accompanying drawings, in which like numerals and letters of reference indicate like parts in all of the figures, my machine comprises a bed-plate 1, vertical standards 2 3, bolted or otherwise secured to the plate 1, and a top or head plate 4, similarly secured to the standards 2 3 and parallel to the bed-plate 1.

The plates 1 and 4 each have a central aperture, the one in alinement with the other, to receive major pivots 5 and 6, respectively, which are adjustably held in place by nuts 5^a and 6^a, as shown.

The bed-plate 1 is provided with an extension 1^b at an angle of forty-five degrees to the longitudinal plane of the machine, to which extension 1^b a trackway 7, hereinafter again referred to, is secured.

The parts just described are mounted on legs 8 8 to raise the machine a sufficient distance above the floor-plate 9 to enable the operator to manipulate the same.

The complete operating parts of my machine are shown in perspective in Fig. 9, by reference to which and to Fig. 5 it will be seen that such parts comprise a main rectangular frame 11, consisting of parallel longitudinal horizontal bars 11^a 11^b, united at their ends by vertical webs or bars 11^c 11^d, as

shown. The frame 11 has its bars 11^a 11^b provided with bearing portions 11^e 11^f, respectively, which are in alinement with one another in a vertical line to receive the pivots 6 and 5, respectively, by means of which the operating mechanism is supported in the frame of the machine.

12 designates a second rectangular frame, consisting of longitudinal parallel bars 12^a 12^b, united at their ends by the vertical webs or bars 12^c 12^d. The bar 12^a is forwardly extended, as at 12^e, and terminates in a bearing 12^f to coöperate with a similar bearing 12^h on an arm 12^g, projecting from the bar 12^c in the same plane as the bar 12^a and parallel thereto. The bearings 12^f and 12^h receive the stylus or pattern-tracer 13 and hold it always in a vertical position, thus avoiding any wabbling. The stylus or tracer 13 is frictionally held in the bearings 12^f and 12^h so as to be longitudinally adjustable therethrough. The bars 11^a 11^b and 12^a 12^b, respectively, form tracks or guideways for the sliding support members 25 and 26, respectively, which will be hereinafter again referred to.

One arm 12^b of the frame 12 may be graduated, as indicated by 12^x, to enable a quicker adjustment of the sliding frames 26 and 25 in their respective guide-frames 12 and 11, as will be hereinafter more fully understood.

14 designates a yoke member comprising the vertical bars 14^a 14^b, which are vertically slotted, as at 14^c 14^d, respectively, to permit passage of the front ends of the frames 11 and 12, which frames 11 and 12 are pivotally secured to the yoke 14 by pivots 16 17 and 18 19, respectively, to permit swinging movement between the frames 11 and 12 and the yoke on vertical axes running through the pivots 16 17 and 18 19. The yoke member 14 also comprises the horizontal bars 14^e 14^f, which connect the bars 14^a 14^b together near the ends. A second yoke 15 of like construction as the yoke 14 and comprising the vertical bars 15^a 15^b, slotted, as at 15^c 15^d, respectively, to receive the frames 11 and 12, respectively, and the horizontal bars 15^e 15^f is provided, as shown. The bars 11 and 12 are pivotally connected to the yoke 15 by pivots 20 21 and 22 23, respectively, as shown.

The frames 11 and 12, together with the yokes 14 and 15 and the rods 29 and their supports, form a pantographic frame, consisting of the bars 11^a 14^e 12^a 15^e and the pivots 16 18, 22, and 20, and the upper bars 29, and the bars 11^b, 14^f, 14^b, and 15^f, and the pivots 17, 19, 23, and 21, together with the lower bars 29 and their supports.

Slidably mounted between the bars 11^a and 11^b is a frame 25, having upper and lower guides or flanges 25^a 25^b, as shown. The sliding frame 25 is clamped to the bars 11^a 11^b to be rigidly held in its set position by clamping-plates 25^c 25^d, secured by bolts 25^e, as shown. Centrally the frame 25 has a pair of pivots 25^f 25^g, arranged in vertical alinement, as indicated. A member 27 is fulcrumed within the sliding frame 25 on the pivots 25^f and 25^g.

26 designates a second sliding frame slidably mounted in the frame 12 between the bars 12^a 12^b, to which it is secured by the guides or flanges 26^a 26^b, the clamping-plates 26^c 26^d, and the bolts 26^e, similarly to the frame 25. The frame 26 also has a pair of pivots 26^f 26^g, by means of which a member 28 of like construction to the member 27 is fulcrumed within the frame 26.

The members 28 and 27 are connected by four parallel rods 29, one or more of which may be graduated, as at 29^a, if found desirable, for a purpose presently understood. The rods 29 project beyond the member 27 and are united at the ends by a frame 30.

The sliding tool-carriage 31 (shown in perspective in Fig. 7, by reference to which and to Figs. 5 and 9 it will be seen) includes the supporting-frame 31^a, having apertured bearing portions or hubs 31^b for receiving the rods 29. A pair of parallel plates 32 32 are bolted to the plate 31^a by bolts 32^a and have bevel edges 32^b 32^b to form guides for the adjusting-plate 33, to which the tool-carriage is detachably secured by means of a T-head 35^a and a pair of parallel plates 34 34, having grooves 34^a 34^a spaced apart to form a T-slot 34^b to receive the T-head 35^a. The plate 33 has a bearing 33^a, to which the micrometer-screw 36 is rigidly secured by a nut 36^a, as shown most clearly in Fig. 7. The screw 36 passes through a bearing 37^a in a plate 37, secured by bolts 38 to the frame 31^a, and the said plate 37 has a projecting portion 37^b, slotted to receive a finger 39, which is pivotally secured to the plate 37, as at 39^a, and bears against the micrometer-head 40. The head 40 is graduated to enable readings to be taken or adjustments made of a magnitude of one eight-thousandth of an inch, so that the proper depth cut can be made. The tool-carrier 35 and its carried parts may be of the ordinary construction, and the carrier 35 is prevented from dropping too far by a pin 35^x on its under side, which engages a similar pin 33^x on the plate 33, as shown. The plate 33 and the plates 34 34 and the carrier 35 are cut away, as at 33^y 34^y 35^y, respectively, to permit passage of the drive-belt 41, which takes around the pulley 42, as clearly shown in Fig. 7. Secured to the frame 31^a is a pair of adjusting-rods 43 43, which project loosely through the frame 30, being secured from longitudinal movement through such frame 30 by nuts 43^a 43^b, which hold the rods 43 43 in their adjusted positions.

The trackway 7 comprises a base-plate 7^a,

on which the tracks 7^b 7^b are formed. The tracks 7^b 7^b are spaced apart and extended in parallel planes at an angle of forty-five degrees to the central vertical planes of the machine. Between the tracks 7^b 7^b a T-slot 7^c is formed in the base 7^a to receive the securing-nut 46^d of the securing-bolt 46^c, which locks or firmly fastens the sliding carriage 45 to the track in its adjusted positions.

The carriage 45 has track-grooves 45^b 45^b on its under face and a bearing-surface 45^a on its upper side, to which the clamps 46 46 are secured by bolts 46^b 46^b, as shown.

47 designates the work-holder, which includes the base 47^a to seat on the bearing-face 45^a of the carriage 45 to be secured thereto by the clamps 46 46, and the work-holder 47 also comprises the body portion 47^b, secured to the base 47^a by the bolts 47^c 47^c, whose heads lie in the countersunk apertures 47^d 47^d. The body 47^b has a forward extension 47^e, to which the work-holding clamp member 48 is secured by screws 48^a 48^a, and a catch 49, that is fastened pivotally to the extension 47^e by the screw 49^a. Screws 50 50 in the clamp member 48 serve to tighten the work 100 in the clamp member 48. (See Fig. 10.)

From the foregoing it will be noticed that the work-holder has an adjustment at an angle of forty-five degrees to the central plane of the machine along the track 7 by movement of the carriage 45, and it also has an adjustment in a plane parallel to the central vertical cross-plane of the machine by virtue of the base 47^a and its connection with the carriage 45, thus enabling the operator to adjust the work from left to right in Figs. 2 and 5 to always keep it in proper position with respect to the tool, as well as to permit the carriage being moved along the track to keep the work in the same relative position when different-sized matrixes of the same general proportions are being cut.

The bed-plate 1 has a forward extension 1^m to receive the pattern-table 51, which is secured thereto by the bolt 51^a, and the table 51 has its top provided with the recess 51^b to receive the pattern 52, which is held in place by a key or wedge 53, as shown.

The frame 31^a of the tool-carriage 31 has a pair of rearwardly-projecting ears 31^m 31^m to receive pivot-bolts 31^n 31^n to pivotally secure the vertical bearing 55 of the belt-tightening devices between the ears 31^m 31^m. Rods 56 56, formed rigidly with the bearing 55, project rearwardly therefrom and terminate in bearings 56^a 56^a, in which a spindle 57 is held. Loose belt-pulleys 58 are mounted on the spindle 57 between the bearings 56^a 56^a.

59 59 designate a second pair of arms, secured to a bearing 60 at one end, which is pivotally fulcrumed, as at 60^a, to any desired stationary extension 61. The rods 59 59 have bearings 59^a 59^a at their other ends for receiving the spindle 57, to which they are pivotally secured.

The drive-belt 62 passes over the drive-pulley 63^a of the motor 63, the pulleys 58 58, and through the apertures 33^y 33^y and around the pulley 42 of the tool-shaft 43^x to impart motion thereto, as will be readily understood by reference to the drawings.

So far as described the manner in which my invention operates will be explained best as follows: Assume the parts to be in the position shown in Figs. 1, 2, and 5, with the tool T in alinement with the pivots 5 and 6, the pattern P being shown under the tracer or stylus 13. Now as the operator grasps the stylus 13 and follows the lines of the pattern P therewith no motion will be imparted to the cutter other than the rotary motion on its axis, due to the power applied through the medium of the pulley 42 and its driving mechanism. Thus a letter of zero degree will be cut on the matrix 100—namely, a mere point. Now supposing the operator desires to cut a letter of, say, one-half the size of the pattern P, he then moves the sliding frame 26 along the frame 12 from right to left in Fig. 9 until the proper mark on the scale 12^x indicates that the sliding frame 26 is set for a letter one-half the size of that of the pattern P. This will be in the position indicated by the line A in Fig. 4, and the tool-carriage 31 will be moved from left to right in Fig. 5 along the bars until the proper division-mark on the scale 29 is reached to indicate that the carriage is in the proper correlative position with the frame 26 to place the tool in proper position to cut a letter one-half the size of the pattern. The carriage 31 will be moved from left to right in Fig. 5 until the tool is on the line indicated by dot-and-dash lines B in Fig. 4, thus placing the tool at the point 150, Fig. 4, at a distance from the central axis of the machine passing through the pivots 5 and 6 equal to one-half the distance from such central axis to the stylus along the line x y in Fig. 4. Thus when the stylus 13 is moved over the pattern to trace its outlines the tool will perform the same movements through a distance equal to the distance of one-half the movement of the stylus, and thereby cut a letter equal to one-half the size of the pattern and of the same proportions, it being understood that when the carriage 31 and the frame 26 are moved to their proper positions the frame 26 is clamped by the screws 26^e and plate 26^d to firmly hold it in such position, and the carriage 31 is held in its adjusted position by the screw-rods 43 and their nuts 43^a.

Any other adjustments of the frame 26 and the carriage 31 may be made to move the tool along the line x y in Fig. 4 to vary the size of the cut letter. The farther the tool T is moved along the line x y in Fig. 4 away from the central axis of the machine which

passes through the pivots 5 and 6 the nearer the cut letter will become in size to the pattern, so that when the parts are in the position shown in Fig. 4 a letter will be cut the same size as the pattern. Now assume that the carriage is adjusted to bring the tool T at the point 150 in Fig. 4 to cut a letter of the same proportions as that of the pattern P, but of one-half the size, and that it is desired to cut a letter of the same height as before but slightly wider. The operator then allows the carriage 31 to remain in its adjusted position, but moves the frame 26 farther along the frame 12 from right to left in Fig. 5 to the position, say, indicated by the line C in Fig. 4, thus throwing the cutter off the line $x\ y$ to a point 175, as indicated. This will cause a letter to be cut of one-half the height of the pattern and more than one-half the width thereof, thus varying the proportionate width of the letter cut without varying its height.

Should it be desired to vary the height of the letter cut without varying the width thereof, when the cutter is at the point 150 in Fig. 4 the frame 26 is maintained at such adjustment and the carriage 31 is moved backward to any point—say the point 200 in Fig. 4 along the line D in Fig. 4—thus throwing the cutter-tool off the line $x\ y$ to the other side thereof. This will set the tool in a position to cut a letter one-half the width of the pattern and more than one-half the length thereof.

By combining such adjustments just referred to letters of any proportion can be made from zero size to full size of pattern, depending upon the position of the carriage 31 with respect to the line $x\ y$ and the central axial line passing through the pivots 5 and 6 of the machine.

It should be understood that every time the carriage 31 is adjusted the work-holding carriage, which slides on the tracks 7, is moved along such track and the base 47^a moved along its support until the work 100 is placed in the proper position under the tool, it being understood that by varying the adjustments of the tool-carriage along the track 7 and the member 47^a along its support the work 100 can be so set with respect to the tool as to give the proper line-space to the letter, as well as the proper letter-space to the same.

By arranging the carriage 31 and the tool-carrier 35 in the manner shown and described the tool-carrier 35 can be removed from the plate 33 to change tools or to permit another carrier to be placed in the position of the carrier 35 or to permit removal of the carrier 35 to sharpen the tool.

By constructing the belt-tightening devices as shown, whenever the carriage 31 is adjusted along the rods 29 or the carriage 26 is adjusted along the frame 12, or both, the arms of the belt-tightening devices will adapt themselves to such adjustments, always keeping the belt drawn to the desired tension, so that proper power can be applied to the pulley through the pulley 42, as will be readily understood by reference to Fig. 4 of the drawings.

From the foregoing description, taken in connection with the accompanying drawings, it is thought the complete construction, operation, and many advantages of my invention will be readily understood by those skilled in the art to which it appertains.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted therein, said pantographic frame including a pair of parallel rectangular frames, a pair of yoke-frames for yoking said rectangular frames together and pivotally connected thereto, a pattern-tracer carried by one of said rectangular frames, a supplemental frame held in said rectangular frames, a tool-carriage held on said supplemental frame, a tool-carrier held on said tool-carriage, a tool mounted on said tool-carrier, means for operating said tool, a pattern-holder and a work-holder arranged to coöperate with the tracer and tool respectively, substantially as shown and described.

2. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted therein, said pantographic frame including a pair of parallel rectangular frames, a pair of yoke-frames for yoking said rectangular frames together and pivotally connected thereto, a pattern-tracer carried by one of said rectangular frames, a supplemental frame held in said rectangular frames, a tool-carriage held on said supplemental frame, a tool-carrier held on said tool-carriage, a tool mounted on said tool-carrier, means for operating said tool, a pattern-holder and a work-holder arranged to coöperate with the tracer and tool respectively, and means for locking said supplemental frame in its adjusted positions, substantially as shown and described.

3. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted therein, said pantographic frame including a pair of parallel rectangular frames, a pair of yoke-frames for yoking said rectangular frames together and pivotally connected thereto, a pattern-tracer carried by one of said rectangular frames, a supplemental frame held in said rectangular frames, a tool-carriage held on said supplemental frame, a tool-carrier held on said tool-carriage, a tool mounted on said tool-carrier, means for operating said tool, a pattern-holder and a work-holder arranged to coöperate with the tracer and tool respectively, means for locking said supplemental frame in its adjusted positions,

and means for locking said tool-carriage to its adjusted positions, substantially as shown and described.

4. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted therein and comprising a pair of rectangular frames, and a pair of yoke-frames pivotally secured to the rectangular frames, a pattern-tracer carried by one of the rectangular frames, a pattern-holder supported by the supporting-frame and coöperatively arranged with the pattern-tracer, a supplemental frame adjustably held in said rectangular frames, means for locking said supplemental frame to its adjusted positions on the rectangular frames, a tool-carriage held on the supplemental frame, a tool carried by said tool-carriage, means for rotating said tool, a work-holder adjustably mounted on the supporting-frame for coöperating with the tool and scale-marks on one of said rectangular frames for indicating the adjustments for the supplemental frame, substantially as shown and described.

5. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted therein and comprising a pair of rectangular frames, and a pair of yoke-frames pivotally secured to the rectangular frames, a pattern-tracer carried by one of the rectangular frames, a pattern-holder supported by the supporting-frame and coöperatively arranged with the pattern-tracer, a supplemental frame adjustably held in said rectangular frames, means for locking said supplemental frame to its adjusted positions on the rectangular frames, a tool-carriage held on the supplemental frame, a tool carried by said tool-carriage, means for rotating said tool, a work-holder adjustably mounted on the supporting-frame for coöperating with the tool and scale-marks on one of said rectangular frames for indicating the adjustments of the supplemental frame, means for holding said tool-carriage to its adjusted positions and a tool carried by said tool-carriage for coöperating with the work-holder, substantially as shown and described.

6. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted therein and comprising a pair of rectangular frames, and a pair of yoke-frames pivotally secured to the rectangular frames, a pattern-tracer carried by one of the rectangular frames, a pattern-holder supported by the supporting-frame and coöperatively arranged with the pattern-tracer, a supplemental frame adjustably held in said rectangular frames, means for locking said supplemental frame to its adjusted positions on the rectangular frames, a tool-carriage held on the supplemental frame, a tool carried by said tool-carriage, means for rotating said tool, a work-holder adjustably mounted on the supporting-frame for coöperating with the tool and scale-marks on one of said rectangular frames for indicating the adjustments for the supplemental frame, means for holding said tool-carriage to its adjusted positions, a tool carried by said tool-carriage for coöperating with the work-holder, and a micrometer attachment on said tool-carriage for adjusting the depth of cut of said tool, substantially as shown and described.

7. In an apparatus of the class described, the combination with a pair of parallel rectangular frames, and a pair of parallel rectangular yoke-frames pivotally uniting the first-mentioned rectangular frames, of a supplemental tool-carrying frame slidably adjustably mounted in said rectangular frames, substantially as shown and described.

8. In an apparatus of the class described, the combination with a pair of parallel rectangular frames, and a pair of parallel rectangular yoke-frames pivotally uniting the first-mentioned rectangular frames, of a supplemental tool-carrying frame slidably adjustably mounted in said rectangluar frames, a tool-carriage slidably adjustably mounted on said supplemental frame and means for securing the tool-carriage in its adjusted positions, substantially as shown and described.

9. In an apparatus of the class described, the combination with a fixed support, and a main frame pivotally mounted therein and comprising a pair of rectangular frames, and rectangular yoke-frames pivotally uniting said rectangular frames, of a supplemental frame adjustably supported by said rectangular frames and comprising a sliding frame held in each rectangular frame, a rod-carrying member pivotally mounted in each sliding frame, parallel rods carried by said rod-carrying member and projecting beyond the rectangular frames, means on the rectangular frames for indicating the adjustment of the supplemental frame, means for securing the supplemental frame to its adjusted positions on the rectangular frame, a tool-carriage mounted on the projecting portion of the supplemental frame, and means coöperating with the tool-carriage and the supplemental frame for locking the tool-carriage to its adjusted positions, substantially as shown and described.

10. In an apparatus of the class described, the combination with a fixed support, of a main frame pivotally mounted therein and comprising a pair of parallel rectangular frames and rectangular yoke-frames pivotally connecting said parallel rectangular frames together, a pattern-tracer carried by one of said rectangular frames, a pattern-holder secured to the fixed support below the pattern-tracer, a supplemental frame slidably adjustably mounted in said rectangular

frames and projecting beyond the same, a tool-carriage slidably adjustably held on said supplemental frame, means for adjusting the tool-carriage and the tool to various distances from the pivot of the main frame to cut designs of varying proportions and varying sizes, and a work-holder adjustably mounted on the fixed support to be adjusted coöperatively with the tool substantially as shown and described.

11. In a machine of the class described, a main rectangular frame having a pair of parallel longitudinal bars and connecting webs or bars at the ends, a second rectangular frame of similar form, a pair of yoke members having slots to receive the ends of the main and second rectangular frames, pivots carried by the yoke members for pivotally securing them to the rectangular frames, substantially as shown and described.

12. In a machine of the class described, a main rectangular frame having a pair of parallel longitudinal bars and connecting webs or bars at the ends, a second rectangular frame of similar form, a pair of yoke members having slots to receive the ends of the main and second rectangular frames, pivots carried by the yoke members for pivotally securing them to the rectangular frame, said second rectangular frame having a pair of projecting portions terminating in bearings, a pattern-tracer longitudinally adjustably held in said bearings, and a cutter-tool-carrying frame carried by the main and second rectangular frames, and a work-holder coöperating with the cutter-tool-carrying frame substantially as shown and described.

13. In a machine of the character stated, a pantograph-frame having a pivot-axis and comprising a main rectangular frame having longitudinal bars and connecting webs or bars at the ends, a second rectangular frame of similar form, a pair of yoke members having slots to receive the ends of the main and second rectangular frames, pivot members carried by the yoke members for pivotally securing them to the rectangular frames, said second rectangular frame having a pair of projecting portions terminating in bearings, a pattern-tracer longitudinally adjustably held in said bearings, a supplemental frame supported by the pantograph-frame and comprising supports adjustably mounted in the rectangular frames of the pantograph-frame, a rod-carrying member pivotally mounted in each support on axes parallel with the pivot-axis of the pantograph-frame, rods carried by said rod-carrying members and projecting therefrom, and cutter devices connecting with and supported by raid rods.

14. In a machine of the character stated, a pantograph-frame having a pivot-axis and comprising a main rectangular frame having longitudinal bars and connecting webs or bars at the ends, a second rectangular frame of similar form, a pair of yoke members having slots to receive the ends of the main and second rectangular frames, pivot members carried by the yoke members for pivotally securing them to the rectangular frames, said second rectangular frame having a pair of projecting portions terminating in bearings, a pattern-tracer longitudinally adjustably held in said bearings, a supplemental frame supported by the pantograph-frame and comprising supports adjustably mounted in the rectangular frames of the pantograph-frame, a rod-carrying member pivotally mounted in each support on axes parallel with the pivot-axis of the pantograph-frame, rods carried by said rod-carrying members and projecting therefrom, cutter devices connecting with and supported by said rods, said cutter devices comprising a tool-carriage consisting of a supporting-plate having supporting-bearings, a second plate adjustably held on said supporting-plate, micrometer devices for adjusting said second plate on said supporting-plate, a tool-carrier removably held on said second plate, and a tool mounted in said tool-carrier.

15. In a machine of the character stated, a fixed supporting-frame, a pantograph-frame having a pivot-axis and comprising a main rectangular frame having longitudinal rods and connecting webs or bars at the ends, a second rectangular frame of similar form, a pair of yoke members having slots to receive the ends of the main and second rectangular frames, pivot members carried by the yoke members for pivotally securing them to the rectangular frames, said second rectangular frame having a pair of projecting portions terminating in bearings, a pattern-tracer longitudinally adjustably held in said bearings, a supplemental frame supported by the pantograph-frame and comprising supports adjustably mounted in the rectangular frames of the pantograph-frame, a rod-carrying member pivotally mounted in each support on axes parallel with the pivot-axes of the pantograph-frame, rods carried by said rod-carrying members and projecting therefrom, cutter devices connecting with and supported by said rods, said cutter devices comprising a tool-carriage consisting of a supporting-plate having supporting-bearings, a second plate adjustably held on said supporting-plate, micrometer devices for adjusting said second plate on said supporting-plate, a tool-carrier removably held on said second plate, a tool mounted in said tool-carriage, and a work-holder adjustably mounted in said fixed supporting-frame, substantially as shown and described.

16. An apparatus of the class described, comprising in combination with a main pantographic frame having a pivot-axis, of a supplemental frame, supported by the pantographic frame and comprising supports ad-

justably mounted in the pantographic frame, a rod-carrying member pivotally mounted in each support on an axis parallel with the pivot-axis of the pantographic frame, rods carried by said rod-carrying members and projecting therefrom, and cutter devices connected with and supported by said rods, substantially as shown and described.

17. An apparatus of the class described, comprising in combination with a fixed supporting-frame, a main pantographic frame fulcrumed therein, a tracer carried by said main pantographic frame, a pattern-holder supported by said fixed supporting-frame to coöperate with the tracer, of a supplemental frame supported by the main pantographic frame and comprising supports adjustably mounted in the pantographic frame, a rod-carrying member pivotally mounted in each support on an axis parallel with the pivot-axis of the pantographic frame, rods carried by said rod-carrying members and projecting therefrom, cutter devices connected with and supported by said rods, said cutter devices comprising a tool-carriage consisting of a supporting-plate having supporting-bearings, a second plate adjustably supported on said bearing-plate, micrometer devices for adjusting said second plate on said supporting-plate, a tool-carrier removably held on said second plate, a tool mounted in said tool-carrier, and a work-holder adjustably mounted on the fixed supporting-frame, substantially as shown and described.

18. In a machine of the class described, the combination with supporting-rods of a tool-carriage comprising a supporting-frame having bearing portions projecting therefrom to receive said rods, a pair of guide-plates secured to said frame, an adjusting-plate held to said frame by said guide-plates, micrometer devices carried by said adjusting-plate and said supporting-frame for adjusting the adjusting-plate on the supporting-frame, a slotted holder on said second plate, a tool-carrier removably connected thereto, means for limiting the movement of the tool-carrier, and a tool rotatably mounted in the tool-carrier.

19. In a machine of the class described, the combination with supporting-rods of a tool-carriage comprising a supporting-frame having bearings therein to receive said rods, a guide on said supporting-frame, an adjusting-plate held in said guide on said supporting-frame, micrometer-adjusting devices connecting said adjusting-plate with said supporting-frame to adjust the adjusting-plate along the supporting-frame, parallel grooved members forming a T-slot secured to the said last-named plate, a tool-carrier having a T-head for entering said T-slot to hold it against the guides, a pin in the bottom of said tool-carrer, a second pin on said second plate, for coöperating with the pin on the tool-carrier to limit the downward movement thereof, a cutting-tool rotatably mounted in said tool-carrier, substantially as shown and described.

20. In a machine of the class described, the combination with supporting-rods of a tool-carrier, comprising a supporting-frame having bearing portions to receive said rods, a pair of plates removably secured thereto and having beveled edges to form guideways, a plate held against said supporting-frame by said guides, a micrometric adjusting means connecting said last-named plate with said supporting-frame to adjust the plate on the frame, and a tool-carrier-receiving member secured to said last-named plate substantially as shown and described.

21. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame fulcrumed therein and comprising a pair of parallel rectangular frames, a pair of parallel yoke-frames pivotally uniting the rectangular frames, a tracer carried by one of said rectangular frames, a sliding support adjustably held in each rectangular frame, means for securing said sliding supports from movement, a rod-carrying member fulcrumed in each sliding support, parallel rods joining said rod-carrying members, a connecting-frame for joining the free ends of said rods, a carriage mounted on said rods, a cutter-tool carried thereby, a pattern-holder and a work-holder supported on said stationary support to coöperate with the tracer and the cutter-tool, respectively, substantially as shown and described.

22. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame fulcrumed therein and comprising a pair of parallel rectangular frames, and a pair of parallel yoke-frames pivotally uniting the rectangular frames, a tracer carried by one of said rectangular frames, a sliding support adjustably held in each rectangular frame, means for securing said sliding supports from movement, a rod-carrying member fulcrumed in each sliding support, parallel rods joining said rod-carrying members, a connecting-frame for joining the free ends of said rods, a carriage mounted on said rods, and comprising a supporting-frame, a plate slidably mounted thereon, a micrometer mechanism connecting said plate and its supporting-frame by means of which the plate can be adjusted on the supporting-frame, a grooved member secured to said plate and spaced apart to form a T-groove, a tool-carrier having a T-head to enter said T-groove, means for limiting the movement of said tool-carrier on said grooved member, a tool rotatably mounted in the carrier, and a pattern-holder and a work-holder supported on said stationary support to coöperate with the tracer and the

cutter-tool, respectively, substantially as shown and described.

23. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame fulcrumed therein, and comprising a pair of parallel rectangular frames, and a pair of parallel frames pivotally uniting the rectangular frames, a tracer carried by one of said rectangular frames, a sliding support adjustably held in each rectangular frame, means for securing said sliding supports from movement, a rod-carrying member fulcrumed in each sliding support, parallel rods connecting said rod-carrying members and projecting beyond the same, a connecting-frame for the free ends of said rods, a carriage mounted on said rods, a cutter-tool carried by the carriage and adjustable thereon, and a pattern-holder and a work-holder support on said stationary support to coöperate with the tracer and the cutter-tool respectively.

24. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame fulcrumed therein and comprising a pair of parallel rectangular frames, and a pair of parallel yoke-frames pivotally uniting the rectangular frames, a tracer carried by one of said rectangular frames, a sliding support adjustably held in each rectangular frame, means for securing said sliding supports from movement, a rod-carrying member fulcrumed in each sliding support, parallel rods connecting said rod-carrying members and projecting beyond the same, a connecting-frame for the free ends of said rods, a carriage mounted on said rods, a cutter-tool carried by the carriage, connections between the carriage and the rod-connecting frame for holding the carriage in its adjusted positions along the rods, substantially as shown and described.

25. In an apparatus of the class described, the combination with a pantograph mechanism, of a tool-carriage, means for holding said tool-carriage at various adjustments on the pantograph mechanism to permit letters of different sizes to be cut, a rotary tool carried by said tool-carriage, drive-motor mechanism for imparting motion to said tool, said drive-motor mechanism comprising an endless belt and a drive-motor therefor, and means connected with the tool-carriage and the drive-motor mechanism for maintaining the drive-belt always at its proper tension regardless of the position of the tool-carriage, said last-named means comprising parallel arms pivotally secured to the tool-carriage and projecting rearwardly therefrom and parallel arms pivotally secured to the drive mechanism and to the first-mentioned parallel arms, and pulleys loosely mounted at the connection of the first-mentioned with the second-mentioned parallel arms around which pulleys the endless belt takes substantially as shown and described.

26. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted in said supporting-frame, on a major vertical axis, said pantographic frame comprising a pair of rectangular parallel frames, parallel yoke-frames pivotally uniting said first-mentioned parallel frames at their ends, one of said rectangular frames having extending arms terminating in bearings, a tracer vertically mounted in said bearings for longitudinal adjustment, a sliding frame mounted in each rectangular frame, clamping devices carried by said sliding frames for securing them to their respective rectangular frames in their adjusting positions, a rod-carrying member pivotally mounted in each sliding frame on an axis parallel to the major axis of the pantographic frame, a plurality of rods passing through said rod-carrying members and secured thereto and projecting beyond the same, a connecting-frame for the free ends of the rods to which said rods are connected, a carriage having bearing portions for receiving such rods, said carriage including a supporting-frame, a plate adjustable thereon, micrometer devices for adjusting said plate, a tool-carrier removably secured to said plate, a tool rotatably mounted in said tool-carrier, a pair of adjusting-rods secured to the supporting-frame of the carriage and projecting rearwardly therefrom through the connecting-frame of the rods, means for securing said adjusting-rods to said connecting-frame to hold the carriage in its adjusted positions along the first-mentioned rods, a pattern-holder secured to the supporting-frame beneath the tracer, said supporting-frame including trackways, a carriage adjustably mounted on said trackways, said last-named carriage having clamp-guides arranged at an angle of forty-five degrees to the trackway, a work-holder adjustably held in said clamp-guides on said last-named carriage, for cooperating with said cutter-tool, substantially as shown and described.

27. In an apparatus of the class described, the combination with a stationary supporting-frame, of a pantographic frame pivotally mounted in said supporting-frame on a major vertical axis, said pantographic frame comprising a pair of parallel frames, parallel yoke-frames pivotally uniting said first-mentioned parallel frames at their ends, one of said rectangular frames having extending arms terminating in bearings a tracer vertically mounted in said bearings for longitudinal adjustment, a sliding frame mounted in each rectangular frame, clamping devices carried by said sliding frames for securing them to their respective rectangular frames

in their adjusted positions, a rod-carrying member pivotally mounted in each sliding frame on an axis parallel to the major axis of the pantographic frame, a plurality of rods passing through said rod-carrying members and secured thereto and projecting beyond the same, a connecting-frame for the free ends of the rods to which said rods are connected, a carriage having bearing portions for receiving such rods, said carriage including a supporting-frame, a plate adjustable thereon, micrometer devices for adjusting said plate, a tool-carrier removably secured to said plate, a tool rotatably mounted in said tool-carrier, a pair of adjusting-rods secured to said supporting-frame of the carriage and projecting rearwardly therefrom and through the connecting-frame of the rods, means for securing said adjusting-rods to said connecting-frame to hold the carriage in its adjusted positions along the first-mentioned rods, a pattern-holder secured to the supporting-frame beneath the stylus, said supporting-frame including trackways, a carriage adjustably mounted on said trackway, said last-named carriage having clamp-guides arranged at an angle of forty-five degrees to the trackway, a work-holder adjustably held on said last-named carriage, for cooperating with said cutter-tool, a pair of parallel arms secured to said first-mentioned carriage and projecting rearwardly therefrom, a pair of loose pulleys adjustably held in the free ends of said arms, a second pair of arms pivotally secured at one end to said first-named arms at the free ends of said first-mentioned arms, a drive mechanism, said second pair of arms being pivotally mounted at their other ends adjacent said drive mechanism, said drive mechanism including a drive-motor, a drive-shaft including a pulley, said cutter-tool having a pulley, and an endless belt taking over all of said pulleys substantially as shown and described.

28. In an apparatus of the class described, the combination with a support, of a pantographic frame operatively mounted therein, and including parallel rectangular frames and yoke-frames for the rectangular frames, means coöperatively connecting said parallel frames and said yoke-frames, a pattern-tracer carried by one rectangular frame, a supplemental frame carried by the rectangular frame, a tool-carriage mounted on the supplemental frame, a tool carried by the tool-carriage, means for operating said tool, and a pattern-holder and a work-holder cooperatively arranged with the tracer and tool respectively, substantially as shown and described.

29. In a machine of the class described, a main rectangular frame having parallel longitudinal bars, connecting webs or bars at the ends thereof, a second rectangular frame of similar form, yoke members having slots to receive the ends of the main and second rectangular frames, means pivotally connecting the yoke members to the rectangular frames, a supplemental tool-carrying frame supported by the rectangular frames, and a stationary supporting-frame for the whole, substantially as shown and described.

30. In an apparatus of the class described, the combination with a support, of a pantographic parallelogram pivotally mounted therein, and comprising rectangular frames pivotally secured together, a pattern-tracer carried by one of said rectangular frames, a supplemental frame held in said parallelogram, a tool-carriage held on said supplemental frame, a tool carried by the tool-carriage, means for operating the tool a pattern-holder and a work-holder arranged to coöperate with the tracer and tool, and means for adjusting the cutter-tool and the supplemental frame to vary the proportions of the work cut.

JAMES W. LEWIS.

Witnesses:
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