



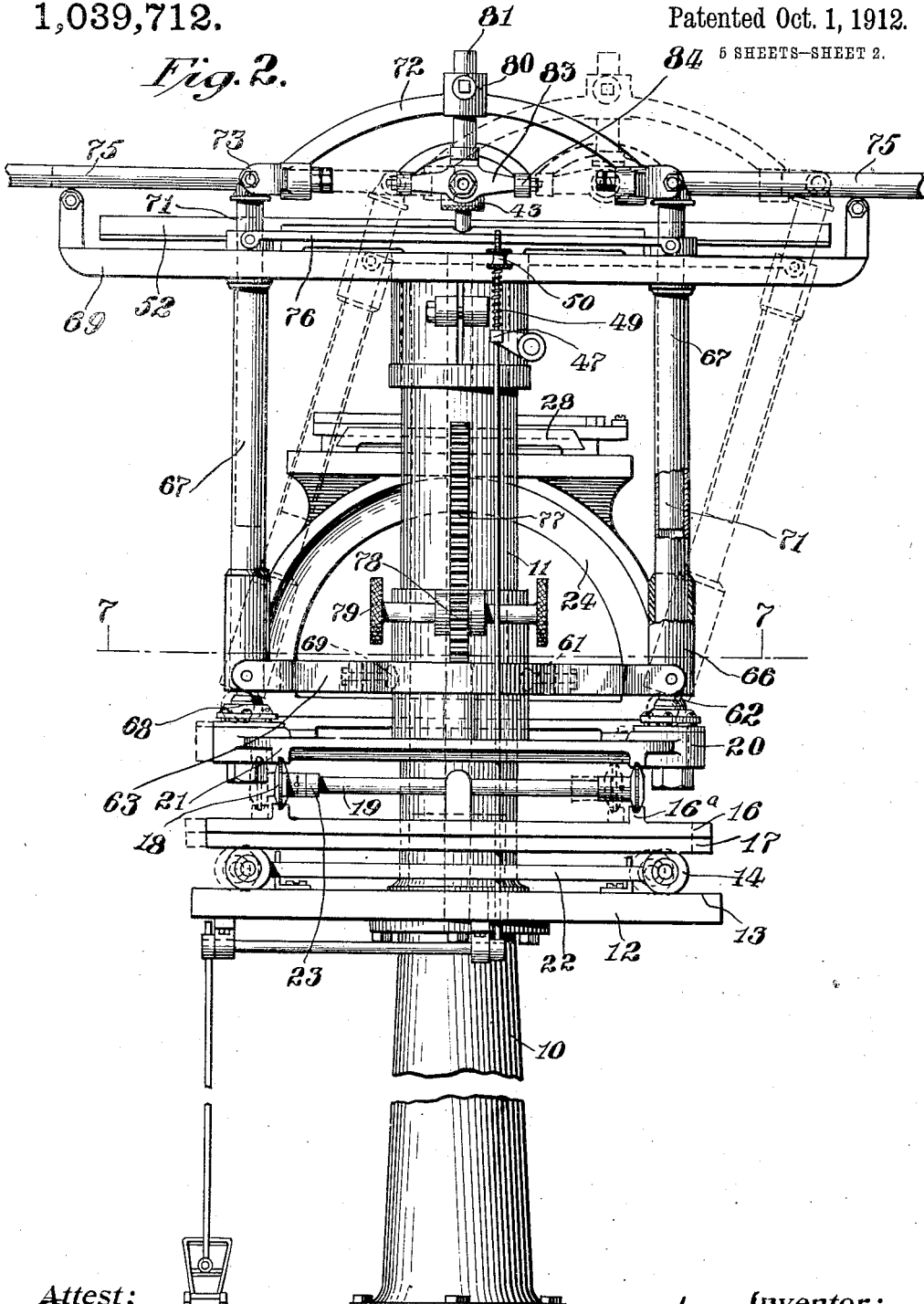
W. S. EATON.  
ENGRAVING MACHINE.  
APPLICATION FILED SEPT. 19, 1910.

1,039,712.

Patented Oct. 1, 1912.

84 5 SHEETS—SHEET 2.

Fig. 2.



Attest:  
*E. Mitchell*  
Engene Wering.

Inventor:  
*William S. Eaton*  
by *Frank P. Wentworth*  
his Atty.

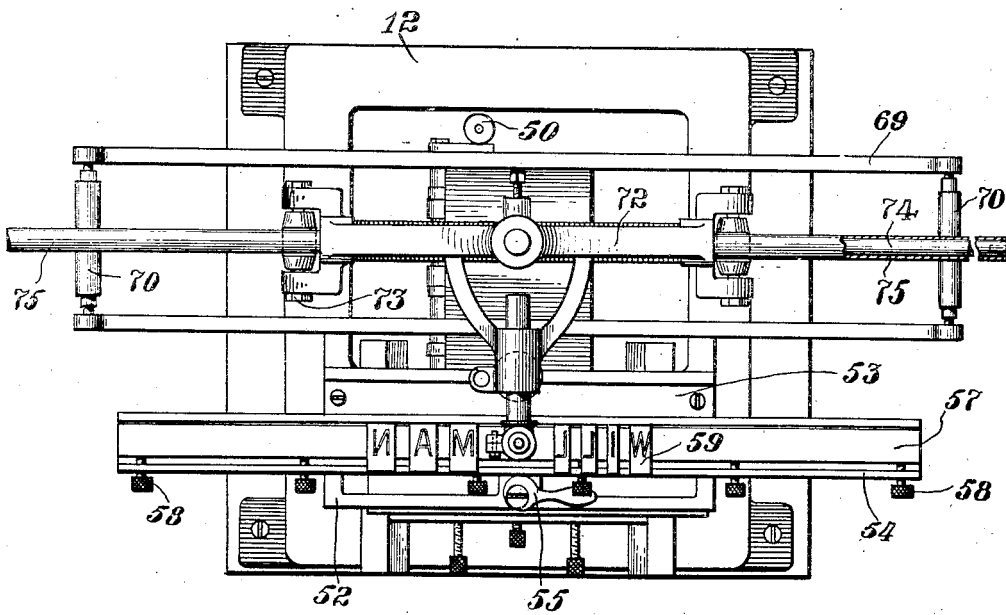
W. S. EATON.  
 ENGRAVING MACHINE.  
 APPLICATION FILED SEPT. 19, 1910.

1,039,712.

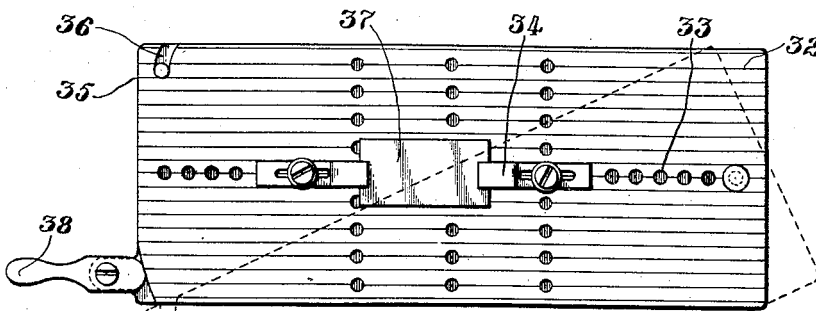
Patented Oct. 1, 1912.

6 SHEETS—SHEET 3.

*Fig. 3.*



*Fig. 4.*



Attest:  
*E. H. Miskell*  
 Eugene Miskell

Inventor:  
 William S. Eaton  
 by *Frank J. Wentworth*  
 his Atty.

W. S. EATON.  
 ENGRAVING MACHINE.  
 APPLICATION FILED SEPT. 19, 1910.

1,039,712.

Patented Oct. 1, 1912.

5 SHEETS—SHEET 4.

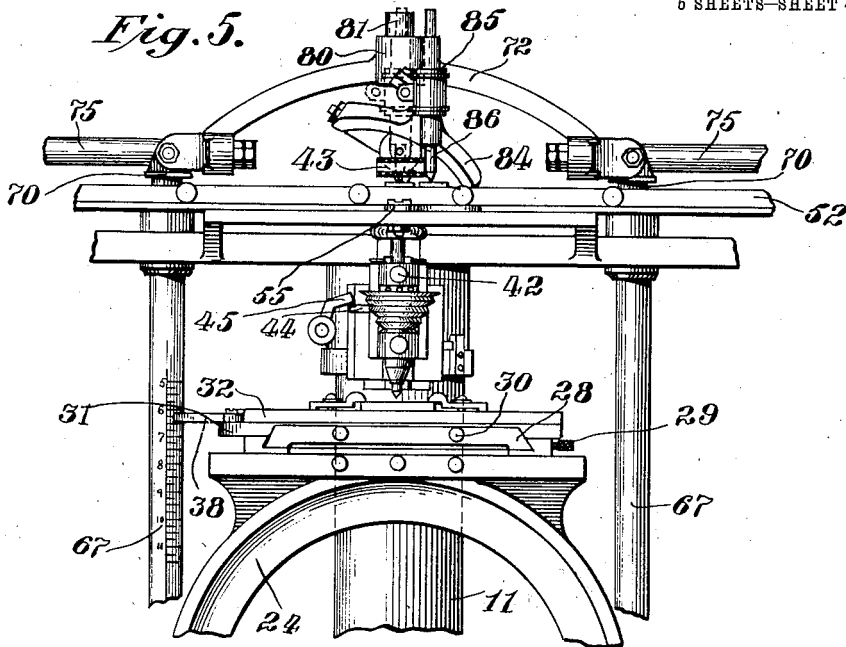
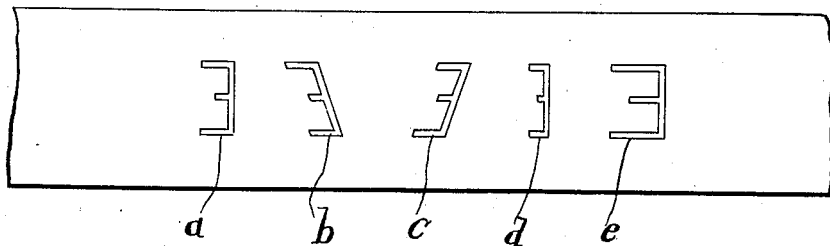


Fig. 6.



Attest:  
*E. W. Waring*  
 Eugene Waring.

William S. Eaton Inventor:  
 by *Frank J. Wentworth*  
 his Atty.

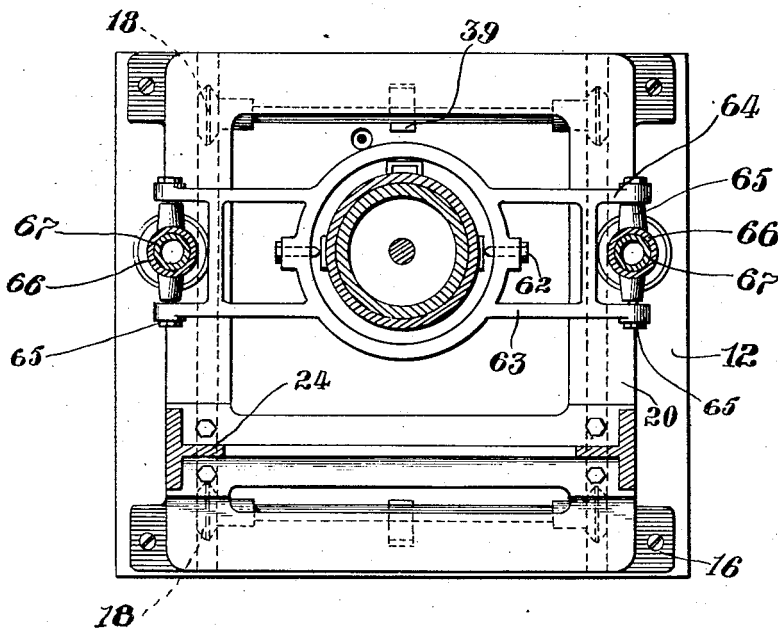
W. S. EATON.  
 ENGRAVING MACHINE.  
 APPLICATION FILED SEPT. 19, 1910.

1,039,712.

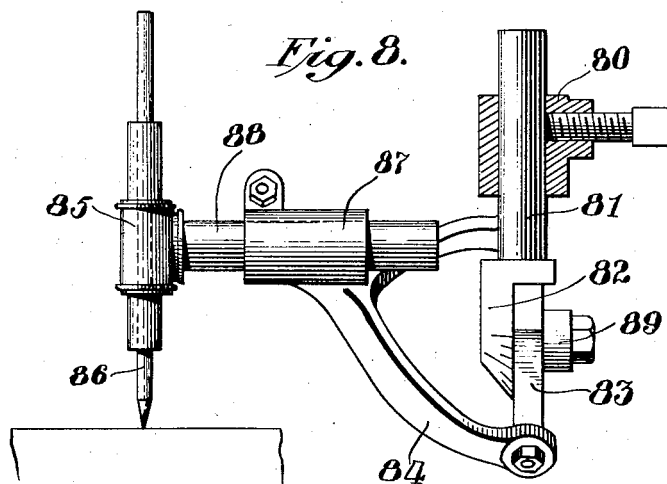
Patented Oct. 1, 1912.

5 SHEETS—SHEET 5.

*Fig. 7.*



*Fig. 8.*



Attest:  
*E. Mitchell,*  
*Eugene Waring*

*William S. Eaton* Inventor:  
 by *Frank P. Westworth*  
*his Atty*

# UNITED STATES PATENT OFFICE.

WILLIAM S. EATON, OF SAG HARBOR, NEW YORK.

## ENGRAVING-MACHINE.

1,039,712.

Specification of Letters Patent.

Patented Oct. 1, 1912.

Application filed September 19, 1910, Serial No. 582,629.

### *To all whom it may concern:*

Be it known that I, WILLIAM S. EATON, a citizen of the United States, residing at Sag Harbor, in the county of Suffolk and State of New York, have invented certain new and useful Improvements in Engraving-Machines, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to engraving machines and more particularly to a type of pantographical machine.

The main object of the invention is to provide a machine of the pantographic type which will have a large operating range of work, both as to the length of lines and as to the number of lines capable of being reproduced, without necessitating the readjustment of the machine.

A further object is to provide an engraving machine wherein the pattern or templet carrier and the work bed will lie on parallel planes and each occupy the same plane at all times, the scale of reproduction being varied without adjusting these parts, thus insuring the maintenance of the proper relative levels of these parts and avoiding the necessity of truing up the machine after each adjustment, with a resultant uniformity in the relation of the several parts during the making of any plate in its entirety.

A still further object is to provide an engraving machine which, while permitting the requisite minute adjustment thereof, will be so constructed and arranged as to be reasonably rigid throughout, thus avoiding such wear of parts as would, through the presence of lost motion, tend to impair the accuracy of the work done upon the machine.

A still further object is to provide a machine wherein the transmitter will be so supported as to avoid undue wear, or any variation in its operation, while capable of moving freely in perpendicular lines.

A still further object is to provide in an engraving machine a transmitter, the opposite ends of which are pivotally connected to the stylus arm, and, by universal joints, to the work bed carriage respectively, the transmitter being adapted to automatically adjust itself to the stylus arm or vice versa to compensate for the oscillatory movement of said

transmitter in conveying movement from the stylus to the work bed, irrespective of the direction of such movement.

A still further object is to provide an engraving machine wherein the character of the reproduction from a given pattern may be distorted without varying the adjustment of the transmitter mechanism.

A still further object is to provide an engraving machine wherein the carriage support will cause the work bed to have the desired universal movement on a single plane and the minimum of friction on the various parts.

A still further object is to provide a machine wherein the friction throughout will be reduced to a minimum for the twofold purpose of minimizing wear upon the various moving parts and permitting ease in the operation of the machine.

A still further object is to provide a machine of this character wherein the routing head support and the work bed will always be on the same relative parallel planes, the adjustment of the machine to vary the scale of reproduction not involving the readjustment of these parts.

A still further object is to provide an engraving machine embodying therein a transmitter mechanism the levers of which will have uniform motion as defined by the pattern, the scale of reproduction being determined by a variance in the leverage of said levers.

A still further object is to provide an engraving machine of this character wherein that portion of the transmitter mechanism carrying the stylus will always move upon the same horizontal plane, thus eliminating the necessity for making any allowance for the arc described by the transmitter in conveying movement from the stylus arm to the work bed.

A still further object is to provide a machine wherein the work bed may be readily brought forwardly of the machine from beneath the cutter head for the purpose of inspection and as readily returned and secured in its former position.

A still further object is to provide a machine of this character wherein all of the parts excepting the means varying the leverage of the transmitter levers will occupy the same relative positions, the variance of the

scale of reproduction being accomplished without affecting the relation of the various other parts of the machine toward each other.

5 A still further object is to provide in a machine of this character means for adjusting the leverage of the transmitter levers which will not be affected by the subsequent operation of the machine, thus avoiding the likelihood of a loss of adjustment during the  
10 production of a plate.

The invention consists primarily in an engraving machine having a work bed universally movable on a single plane, a pattern support, a stylus arm, a transmitter lever system the opposite ends of which are respectively connected to said stylus arm and to the support of said work bed, a universal connection between said transmitter arms and said stylus arm and said work bed support respectively, and a cutter head adapted to be adjusted toward and from the said work bed support to regulate the depth of cut of the tool; and in such other novel features of construction and combination of parts as are hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

Referring to the drawings:—Figure 1 is a side elevation of a machine embodying my invention; Fig. 2 is a rear elevation thereof with one of the transmitter lever arms broken away to disclose the interior construction and arrangement thereof; Fig. 3 is a plan view of the machine; Fig. 4 is a detailed view of the work bed with the opened position thereof indicated in dotted lines; Fig. 5 is a detailed view of the upper part of the machine including the work bed, the stylus, the upper part of the transmitter mechanism, and the routing head, the stylus frame being shown adjusted to that position which will give an oblique aspect to the reproduced characters; Fig. 6 is a diagrammatic view of the different characters which may be reproduced upon the machine from a single pattern character; Fig. 7 is a horizontal section on the lines 7—7 of Fig. 2, and Fig. 8 is a detailed view of the stylus and its carrying frame, showing it adjusted to form an oblique reproduction of a pattern letter.

Like letters refer to like parts throughout the several views.

55 In the embodiment of the invention shown in the drawings, I have shown at 10 a pedestal adapted to be secured to the floor, which pedestal is surmounted by a cylindrical column 11 of comparatively large diameter,  
60 extending upwardly from the pedestal of the machine. This cylindrical column supports all of the working parts of the machine thus not only imparting rigidity to the entire machine but establishing a fixed  
65 relation of parts, not affected by the ad-

justment of the scale of reproduction. Carried by the column 11 above the pedestal 10 is a rectangular frame 12 having laterally extending V-ways 13 therein. Moving in said ways are V-wheels 14 mounted upon  
70 axles 15. Mounted upon the V-wheels 14 is a carriage 16, the upper surface of which is provided with V-ways 16\* extending at right angles to the ways 13, and the lower surface of which is provided with V-tracks 17, en-  
75 gaging the top of the rollers 14. Mounted in the V-tracks 17 are the wheels 18 connected by axles 19, and in turn surmounting them is a second carriage 20 having downwardly presented V-tracks 21 at right angles  
80 to the tracks 17.

There are two pairs of rollers, 14 and 18 respectively, the axles thereof being connected by the reaches 22 and 23.

The carriage 20 supports the arch 24 carrying the top plate 25 which is dovetailed to a second plate 26 thus permitting the lateral adjustment of the plate 26, the thumb screw 27 being provided to lock said plate 26 in its adjusted position. The upper surface of the plate 26 is also dovetailed and mounted therein is a plate 28 locked by means of the thumb screw 29 in its relation to the plate 26. The plate 28 is channeled as shown in Figs. 1 and 2 and attached thereto by means of set screws 30 is a bi-part work bed consisting of an immovable plate 31 and a face plate 32 having a plurality of openings 33 therein and adjacent parallel straight gage lines to permit work  
100 of any size to be accurately positioned and secured thereto by means of ordinary dogs 34. The plate 32 is pivoted at one side thereof to the plate 31 so as to be readily swung outwardly, said plate 31 being provided with a stop 35 cooperating with the curved slot 36 in the plate 32, in order that, after being swung upon its pivot said plate 32 may be brought back accurately to its former position. To prevent the displacement of the plate 32 when the steel plate 37 is being engraved, I provide a lock, consisting of a cam 38 pivoted to the plate 31 and engaging the plate 32. This construction it will be observed, permits the plate 32 to  
115 be swung outwardly and brought back with accuracy to its former position, thus lending convenience to the inspection of the work being done, which is reasonably essential in the character of the work for  
120 which this type of machine is used. The plate 31 is made detachable from the plate 28 in order to permit the removal of the work, and to facilitate the removal of finished work and the substitution of new  
125 work in place thereof. This construction of work bed eliminates any substantial vibration while the cutter tool is working, as the arched support 24 affords a firm support to the work. The superposed carriages mount-  
130

ed upon independent V-wheels as described, permit the work bed to have a universal movement in the same horizontal plane without any substantial wear upon the co-operating members and without requiring the application of material force thereto.

Inasmuch as the wheels 14 and 18 are not journaled in bearings, stops 39 and 40 are provided to limit the movement of said wheels through the engagement of the axles therewith. This arrangement of supporting wheels reduces the friction between the various parts and minimizes wear, thus prolonging the life of the machine and preserving the level of the work bed 32. It will be observed that, by this construction, the plane of the work bed remains constant, any variance in the scale of reproduction being accomplished by adjusting the leverage of the transmitter system of levers, the entire range of adjustment being accomplished without disturbing the work bed in any way, thus eliminating all those difficulties incidental to leveling up the work bed after each adjustment.

Carried by the column 11 above the work bed 32 is a block 41 having therein vertical ways in which is mounted the spring supported reciprocatory tool head 42 which is fitted with a micrometer stop 43 for determining the depth of cut with each application of the cutting tool to the work. The details of construction of this head are immaterial to the invention as any desired or approved type of tool head may be employed.

Carried by the head 42 is an abutment 44 adapted to be engaged by a crank arm 45 mounted upon the shaft 46 extending longitudinally of the machine and carrying at its opposite end a crank arm 47 by means of which the tool head is advanced to bring the cutting tool or router into the desired operative engagement with the work. The shaft 46 is turned by the link 48 through the interposed spring 49, the tension of which spring is controlled by the nut 50, the spring 49 bearing between the nut 50 and the said crank arm 47. The link 48 is connected to a treadle 51, convenient to the foot of the operator. By this construction the pressure applied to the tool or router is governed by the tension of the spring 49, the action of the treadle 51 serving to first bring the tool into engagement with the work and then so tension the spring 49 as to cause the subsequent feeding movement of the tool to be under the control of this spring. This arrangement eliminates the necessity for skilled labor in operating the machine as the breakage of tools will not result from the depression of the treadle to the full extent. The cutter head and the work bed having a definite constant relation to each other, and the plates upon which

work is done being of substantially uniform gage, little difficulty is experienced in determining the moment of initial contact between the tool and the plate and the subsequent regulation of the depth of cut, with this moment of initial contact as the basis for such regulation.

Machines of this type are especially adapted for making plates for under surface printing wherein uniformity in the depth of cut is desirable, the quality of the work produced resulting from the amount of ink retained in such cuts. The definite relation of the work bed and the cutter head tends to preserve a relation of parts which facilitates the production of plates having uniform depth of cut, notwithstanding frequent readjustments of the machine to vary the size and style of the letters of emblems being reproduced.

The remaining mechanisms of the machine to be considered are the pattern or templet support, the stylus and its support, and the transmitter mechanism and its appurtenances, through which the scale of reproduction is determined and may be varied.

Supported upon the top of the column 11 is a forwardly projected shelf 52 forming a rigid support for the pattern and having a fixed relation to said column. Toward the rear of the shelf 52 is a plate 53 against which the form frame 54 is thrust and locked by the lock cam 55. This form frame comprises a laterally extended channel having a soft friction surface 56 between the rear thereof and the movable block 57 which is adapted to be thrust against said friction surface by the thumb screws 58. This construction of frame permits the type plates 59 to be set in the proper position and properly spaced apart, and firmly held in this position so as not to be disturbed by the repeated movement of the stylus thereover.

Each separate pattern 59 consists of an L shaped individual plate having a letter or other emblem countersunk therein, the short arm of each plate being inserted between the block 57 and the friction surface or pad 56 and firmly held thereagainst by the said block. This construction permits the pattern to be readily set up with master type thus materially reducing the cost of the pattern and at the same time permitting the quick substitution of one pattern for another.

Mounted upon the cylindrical column 11 with a close sliding fit, is the sleeve 60 having side bosses 61 in which is mounted, by means of pivot screws 62, an oscillatory frame 63 open in the center to clear the sleeve 60. The pivotal support of the frame 63 permits it to move freely, and any wear upon the pivot may be readily taken up by said screws. The frame 63 oscillates about



a single axis only, which axis extends laterally of the machine. On opposite sides of the frame 63 are bearings 64, the axis of each of which is at right angles to the axis of the pivot pins 62. Mounted in the bearings 64 by means of pivot screws and cooperating bosses 65, is a collar 66 slidably mounted upon the lower member 67 of the transmitter levers, the lower ends of which levers are connected, by a ball and socket joint 68, with the carriage 20. This manner of mounting the transmitter levers permits the universal movement of the carriage 20 carrying the work bed 31 32, said arrangement of pivots forming a well known type of universal joint.

Mounted upon the top of the column 11 is the frame 69 having laterally extended forked arms carrying anti-friction rollers 70 at widely divergent points, said rollers forming a support for the upper portion of the transmitter mechanism to limit the movement thereof to a single horizontal plane, thus eliminating any arc of the stylus due to the oscillatory movement of the transmitter levers 67. Slidably mounted in the transmitter sections 67, (which are hollow) are cylindrical sections 71, having a vertical movement within the section 67. The upper end of each section 71 is pivotally connected to the frame 72 by means of pivots 73 extending parallel with the pivots 65. These pivots 73 permit the free lateral movement of the frame 72, the longitudinal movements thereof resulting in a slight tilting action thereof as shown in Fig. 1 in dotted lines. The frame 72 is also provided with laterally extended arms 74, upon each of which is rotatably mounted a sleeve 75 adapted to engage the anti-friction roller 70 and minimize the friction between said rollers and said sleeve when the frame is moved longitudinally of the machine, the rollers 70 minimizing the friction upon the lateral movements of said frame. The sleeves 75, through their engagement with the rollers 70, insure movement of the frame 72 in a single horizontal plane, the arc described by the transmitter lever 67 being compensated for by the automatic adjustment of the nested sections 67 and 71.

The upper ends of the sections 67 of the transmitter levers are connected by a reach rod 76 to insure unison in the movement of both of these levers, while permitting the automatic telescopic action of the two members 67 and 71, above referred to.

The sleeve 60 is adjustably secured relative to the column 11 by means of a rack 77 carried by said column, and a pinion 78 carried by said sleeve, provided with operating handles 79. By this construction it will be observed that the entire frame 63 may be moved vertically of the column 11 and of the transmitter sections 67, thus varying the

leverage of said sections 67. To facilitate this adjustment of the machine which results in determining the scale of reproduction, I provide one of the sections 67 with a scale as shown in Fig. 5. This means of adjustment of the fulcrum about which the lever 67 acts is one which may be readily operated and will, by reason of the absence of vibration of the collar 60 and column 11, remain in the set position without likelihood of a loss of adjustment through the operation of the machine.

The frame 72 is provided centrally thereof with a vertical boss 80 and adjustably mounted therein is a stud 81 carrying the plate 82 on which is mounted the cross head 83 having pivotally attached thereto the frame or yoke 84 carrying the mount 85 for the stylus proper 86. The yoke 84 is provided with a split collar 87 in which the stem 88 carrying the mount 85 is adjustably clamped. This construction permits the stylus to follow the pattern irrespective of the slight tilting action of the frame 72 as well as permitting that adjustment of the machine to form oblique letters from a straight pattern. The cross head 83 is secured to the plate 82 by means of a pivot screw 89, clearance being provided in said plate 82 to permit the lateral tilting of the yoke 84 to accomplish that adjustment of the machine above referred to. The vertical adjustment of the stem or stud 81 will accomplish either the extension or condensation of the pattern in the reproduction in a manner which will more fully appear hereafter.

The operation of the herein described engraving machine is substantially as follows:—In setting the machine for operation, the lock cam 55 is released and the form frame 54 removed from the machine. The master types are then set up in this frame with the short arm or pendant lug thereof inserted between the block 57 and the friction pad 56. The proper master types having been thus positioned in the form, they are spaced apart the required distance and the block 57 set up hard against said short arm or pendant lug, by means of the screws 58 holding the types firmly in this position. The form frame 54 is then replaced upon the shelf 52 and locked in this position. The block or plate to be reproduced is then secured to the work bed 32 by means of the dogs 34, the proper alinement of this plate being secured by means of the gage lines on the top plate.

When it is desired to secure a reproduction of the pattern upon a reduced scale, the sleeve 60 is lowered by means of the rack and pinion 77—78, carrying with it the frame 63 and the collar 66. The proper adjustment may be readily procured by means of the scale on one of the lever arms 67. It will be observed that by this adjustment the

scale of reproduction may be upon either a reduced or an enlarged scale according to which side of the longitudinal center of the nested transmitter lever the pivots 62 are positioned.

The machine having been set to form a reproduction upon a definite scale, the pattern and the work plate are brought into such relation as to properly position the reproduced matter upon the plate. When these things have been done, the cutter or routing tool is advanced to establish an initial contact between the tool and the work, the tool head being depressed to the full extent when this initial contact is determined. Thereafter the tool head is set to advance a maximum distance with each full depression of the treadle 51. The stylus 80 is then moved slowly over the pattern transmitting a movement, similar in direction, but varying in quantity, to the work bed, thus bringing different portions thereof into operative relation to the cutting tool or router. This movement is imparted to the work bed through the transmitter mechanism, consisting of the nested levers 67 and 71, the frame connecting the latter, and the stylus supporting frame or yoke; the connecting frame 72 always moving upon a horizontal plane. The arc described by the nested levers is compensated for by the automatic extension or contraction of said nested levers, the tilting of the levers being permitted by the pivotal connection between them and the said frame, as to the lateral movements thereof, and by the pivotal connection between the stylus frame or yoke and said frame, as to the longitudinal movements thereof, said frame being tilted only with such last named movements.

The manner of mounting the frame 63 relative to the sleeve 60, and the levers 67 relative to said frame, permits the simultaneous movement of said lever arms in lines perpendicular to each other, so as to permit a universal movement within the limits of this mechanism. The lower end of the levers 67 being connected to the carriage 20 by a ball and socket joint, a similar movement is imparted to said carriage, that arrangement of wheels and tracks described permitting the free movement of the carriage in any direction without material resistance or resultant wear.

The arch 24 supporting the work bed being rigidly attached to the carriage 20, affords a rigid support for the work bed moving with said carriage, thus minimizing the vibration resulting from the operation of the cutting tool, and relieving the entire transmitter mechanism from the effects of such vibration; thus tending to avoid a loss of adjustment in the different parts.

During the operation of cutting, the tool having been set to make the maximum cut

desirable, the treadle 51 is depressed to the full extent the spring 49 supplying that pressure necessary to automatically advance the tool as required to make such maximum cut, the feeding of the tool thus being automatic within the limit set.

With the lateral reciprocation of the frame 72, the roller 70 will act upon the sleeves 75 in a manner to accomplish the elongation of the bi-part telescopic transmitter levers, the return of these levers to normal being through gravity. The friction between the rollers 70 and sleeves 75, with a lateral movement of the frame 72, is counteracted by the free rotation of the said rollers, and with a longitudinal movement thereof, by the free rotation of said sleeves.

When it is desired to exactly reproduce the pattern upon either a reduced or an enlarged scale, the stylus holder 85 will be located upon a plane above the plane of the point of pivotal connection of the frame or yoke 84 with the cross head 83, in a machine so set up as to permit that adjustment to accomplish the extension or condensation of the reproduction from the pattern. When the machine is so set, the reproduction from the block pattern will be as indicated by the letter *a* in Fig. 6.

If it be desired to have the reproduction oblique as indicated by the letter *b* in Fig. 6, the cross head 83 will be tilted with the left hand side thereof down and the right hand side thereof raised, the extent of such tilting being governed by the desired angle of inclination of the height lines of the letter or pattern. If, however, it is desired to tilt the letter in the manner indicated at *c*, Fig. 6, the cross head 83 will be tilted in the opposite direction as shown in Figs. 5 and 8. This distortion of the reproduction results from the slight lateral deflection of the transmitter mechanism due to the pivotal action of the frame or yoke 84 resulting from the slight tilting of the frame 72 upon a longitudinal movement thereof, such pivotal movement giving a slight side thrust to said frame through the reaction from the resistance encountered to the lateral movement of the stylus in oscillating obliquely from the normal line of movement of the head 72. The direction of this reaction is determined by the direction of inclination of the frame or yoke 84, and the quantity thereof, by the degree of inclination thereof. It will be observed that in effecting this oblique distortion of the letter, none of the dimensions in the reproduction are varied from the original scale reproduction.

When it is desired to condense the reproduction, as indicated at *d* in Fig. 6, the stud 81 is raised in the boss 80, thus raising the point of application of power from the stylus relative to the frame 63 and increasing the leverage as to the lateral movement of

the frame 72, the increased leverage as to the longitudinal movement being compensated for by the readjustment of the work bed in restoring the stylus to the starting point upon the pattern, the said stylus having been advanced from the starting point by the arc described thereby in adapting itself to the raised position of its pivots. No such readjustment being possible as to the lateral movement, the increased leverage at which the stylus frame or yoke acts upon the frame 72 results in a proportionate reduction in the quantity of lateral movement of the carriage 20 under the control of the levers 67, 71, and a consequent condensation of the reproduction produced. By the reversal of this adjustment, the extended reproduction may be made as indicated by the letter *e* of Fig. 6, the lowering of the yoke 84 reducing the leverage of the levers 67, 71, and increasing the relative lateral movement of the work bed.

If it is desired to condense or extend the reproduction throughout the entire plate, or line, the stylus 86 need not be readjusted, but if it is desired to preserve the previously fixed base line, the stylus may be restored to the starting point of the pattern by lowering it in its holder 85 until the stud 88 is restored to its former level.

By the use of transmitter levers having adjustable pivots intermediate of the ends thereof, the scale of reproduction may be determined or varied by the mere adjustment of the position of these pivots without disturbing the adjustment of any other parts of the machine, and the entire range of adjustment may be used without disturbing the work bed in any way. This permits the work bed to be mounted upon a perfect level and avoids the necessity for leveling up the same after each adjustment of the scale of reproduction. This is a matter of considerable importance, as the loss of level of the work bed would result in a lack of uniformity in the depth of the cut made by the tool or router. In under surface work the intaglio cut retains the ink with which the printing is done and a variance in the depth of this cut results in the same mottled effect as would result from the use of types of different heights.

The tool head, in the making of a plate, must be adjusted several times to secure the desired depth of cut, thus making permanency in the pattern necessary. Frequent inspection and cleaning of the plate is required, which is provided for by the bi-part work bed, the work bearing member of which may be swung outwardly and the work removed from under the tool.

Having described my invention, what I claim as new and desire to have protected by Letters Patent is:—

65 1. In an engraving machine, a work bed

universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system, a universal connection between one end of said transmitter lever system and said work bed, a pivotal connection between the other end thereof and said stylus arm, a universal pivotal bearing for said levers intermediate their ends, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

2. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system, a universal connection between one end of said transmitter lever system and said work bed, a pivotal connection between the other end thereof and said stylus arm, a universal pivotal bearing for said levers intermediate their ends, means adjusting said bearings longitudinally of said levers to vary the scale of reproduction, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

3. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a central column extending between said members, a transmitter lever system extending from adjacent to said pattern support to said work bed, a universal joint between one end of said lever system and said work bed, a stylus arm, a pivotal connection between the other end of said lever system and said stylus arm, a frame pivotally supported upon said column, a pivotal connection between said frame and a point of said levers intermediate the ends thereof, the pivots of said frame and said last named connection being perpendicular to each other, and a tool head adapted to be adjusted relative to the said work bed to regulate the depth of cut of the tool.

4. In an engraving machine, a plurality of superposed carriages, supports therefor whereby said carriages may move perpendicularly relative to each other in parallel planes, a work bed rigidly mounted upon the uppermost of said carriages whereby said work bed is universally movable in a single plane, a pattern support, a central column extending between said members, a transmitter lever system extending from adjacent to said pattern support to said work bed, a universal joint between one end of said lever system and said work bed, a stylus arm, a pivotal connection between the other end of said lever system and said stylus arm, a frame pivotally supported upon said column, a pivotal connection between said frame and a point of said levers intermediate the ends thereof, the pivots of said frame and said last named connection being perpendicular to each other, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

5. In an engraving machine, a plurality of superposed carriages, supports therefor whereby said carriages may move perpendicularly relative to each other in parallel planes, a work bed rigidly mounted upon the uppermost of said carriages whereby said work bed is universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system, a universal connection between one end of said transmitter lever system and said work bed, a pivotal connection between the other end thereof and said stylus arm, a universal pivotal bearing for said levers intermediate their ends, means adjusting said bearings longitudinally of said levers to vary the scale of reproduction, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

6. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system embodying therein a plurality of telescopic levers, a universal connection between one end of said levers and said work bed, means holding the other end of said levers in a single plane, a pivotal connection between said other end of said levers and said stylus arm, a universal pivotal bearing for said levers intermediate the ends thereof, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

7. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system embodying therein a plurality of telescopic levers, a universal connection between one end of said levers and said work bed, a rigid head frame pivotally connected to the other end of said levers, guides adjacent to said frame, a projection carried by said frame cooperating with said guides to cause said frame to move in a single plane, pivotal connection between said head frame and said stylus arm, a universal pivotal bearing for said levers intermediate the ends thereof, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

8. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system embodying therein a plurality of telescopic levers, a universal connection between one end of said levers and said work bed, a rigid head frame pivotally connected to the other end of said levers, roller guides adjacent to said frame, a projection having an anti-friction sleeve thereon carried by said frame cooperating with said guides to cause said frame to move upon a fixed plane, pivotal connection between said head frame and said stylus arm, a universal pivotal bearing for said levers inter-

mediate the ends thereof, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

9. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a stylus arm, a transmitter lever system embodying therein a plurality of telescopic levers, a universal connection between one end of said levers and said work bed, means supporting said stylus arm by a universal connection with the other end of said levers, roller guides adjacent to said stylus arm, anti-friction means moving simultaneously with said levers and cooperating with said guides to cause one end of said levers to move in a single plane, a universal pivotal bearing for said levers intermediate their ends, and a tool head adapted to be adjusted relative to the said work bed to regulate the depth of cut of the tool.

10. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a central column extending between said members, a transmitter lever system extending from adjacent to said pattern support to said work bed, a universal joint between one end of said lever system and said work bed, a stylus arm, a pivotal connection between the other end of said lever system and said stylus arm, a sleeve adjustably mounted upon said column, a frame pivotally supported upon said sleeve, a pivotal connection between said frame and a point of said levers intermediate the ends thereof, the pivots of said frame and said last named connection being perpendicular to each other, and a tool head adapted to be adjusted relative to said work bed to regulate the depth of cut of the tool.

11. In an engraving machine, a work bed universally movable in a single plane, a pattern support, a central column extending between said members, a transmitter lever system extending from adjacent to said pattern support to said work bed, a universal joint between one end of said lever system and said work bed, a stylus arm, a pivotal connection between the other end of said lever system and said stylus arm, a sleeve slidably mounted upon each of said levers intermediate the ends thereof, a pivotal connection between each of said last mentioned levers and said frame, the pivots of said frame and said last named sleeve being perpendicular to each other, and a tool head adapted to be adjusted relative to the work bed to regulate the depth of cut of the tool.

12. In an engraving machine, the combination with a work bed, a pattern support, and a tool head, of oscillating transmitter arms adapted to move said work bed universally, a frame adapted to move longitudinally and laterally of the machine in a single plane, a pivotal connection between said frame and said lever arms, the pivots

thereof extending longitudinally of the machine, a stylus frame having vertical adjustment in said last named frame, and a stylus arm pivotally mounted in said stylus frame, said last named pivots extending laterally of the machine, whereby, by the vertical adjustment of said stylus frame, the operative leverage of said transmitter levers may be varied to vary the lateral dimension of the scale of reproduction.

13. In an engraving machine, the combination with a work bed, a pattern support, and a tool head, of oscillating transmitter arms adapted to move said work bed universally, a frame adapted to move longitudinally and laterally of the machine in a single plane, a pivotal connection between said frame and said lever arms, the pivots thereof extending longitudinally of the machine, a stylus frame carried by said first mentioned frame, a cross head having offset bearings mounted upon said stylus frame, means whereby said cross head may be adjusted about an axis parallel to the axis of the pivots connecting said transmitter arms with said first mentioned frame, and a stylus arm mounted in said cross head, the axis of said last mentioned bearings extending laterally of the machine whereby the tilting of said cross head will give a lateral coefficient of motion to the transmitter arm upon the longitudinal movement of the stylus.

14. In an engraving machine, the combination with a work bed, a pattern support, and a tool head, of oscillating transmitter arms adapted to move said work bed universally, a frame adapted to move longitudinally and laterally of the machine in a single plane, a pivotal connection between said frame and said lever arms, the pivots thereof extending longitudinally of the machine, a stylus frame carried by said first mentioned frame, a cross head having offset bearings mounted upon said stylus frame, means whereby said cross head may be adjusted about an axis parallel to the axis of the pivots connecting said transmitter arms with said first mentioned frame, a stylus arm mounted in said cross head, the axis of said last mentioned bearings extending laterally of the machine whereby the tilting of said cross head will give a lateral coefficient of motion to the transmitter arm upon the longitudinal movement of the stylus, and means whereby said stylus frame may be adjusted vertically of the machine to vary the effected leverage of the transmitter arms and change the lateral dimension of the reproduction whereby a pattern reproduction may be varied from the pattern as to the lateral dimension, and made oblique as to the longitudinal dimension.

15. In an engraving machine, the combination with a work bed, a pattern support, a

stylus arm, and a transmitter mechanism between said stylus arm and said work bed, of means for adjusting the stylus arm to vary the scale of the lateral dimension of the reproduction, and means for adjusting said stylus relative to said transmitter mechanism whereby a lateral coefficient of movement is imparted to said transmitter mechanism to change the direction of the longitudinal dimension of, or impart obliquity to, the reproduction.

16. In an engraving machine, a fixed frame having mounted thereon a plurality of superposed carriages, said frame and the lowermost carriage having thereon tracks or ways extending in perpendicular lines, anti-friction devices moving in said tracks and supporting said carriages respectively, means connecting the devices supporting such carriage whereby they act simultaneously and in the same degree and a work bed carried by and fixed relative to the uppermost of said carriages.

17. In an engraving machine, a fixed frame having mounted thereon a plurality of superposed carriages, said frame and the lowermost carriage having thereon tracks or ways extending in perpendicular lines, anti-friction devices moving in said tracks and supporting said carriages respectively, and a work bed carried by and fixed relative to the uppermost of said carriages, said work bed comprising a plurality of superposed plates adjustable relative to each other in perpendicular lines, means locking said plates respectively in the adjusted position, the uppermost of said plates being composed of two parts, one of which is pivotally mounted relative to the other, means for securing definite register of said plates, and locking means whereby said pivotal plate may be secured in position when in register, said pivotal plate being provided with a plurality of openings and with gage lines whereby the plate being engraved may be accurately positioned thereon.

18. In an engraving machine, a transmitter mechanism embodying therein an oscillating lever, universal pivotal support for said lever intermediate the ends thereof, a work bed adapted to have universal movement in a single plane, and a universally movable stylus arm the opposite ends of said lever being connected respectively to said work bed and said stylus arm.

19. In an engraving machine, a cutter mechanism embodying therein a spring sustained tool head, means advancing said tool head to bring the tool into contact with the work, and means automatically advancing said head as the tool makes its cut.

20. In an engraving machine, a cutter mechanism embodying therein a spring sustained tool head, an abutment upon said head, a crank shaft having an arm engaging

said abutment whereby said head may be advanced to bring the tool into contact with the work, a second arm said shaft, a link having an abutment thereon, a spring set  
5 between said abutment and said last named arm, and means adapted to operate said link whereby the maximum movement of said link will first bring the tool into contact with the work, and thereafter automatically  
10 feed said tool through the compression of said spring.

21. In an engraving machine, the combination with a work bed, a pattern support, a stylus arm, and a transmitter mechanism

between said stylus arm and said work bed, 15 of means whereby said stylus arm may be adjusted to impart a lateral coefficient of motion to the transmitter mechanism and to the work bed, to vary the direction of the longitudinal dimension of, or impart ob- 20 liquity to, the reproduction.

In witness whereof, I have hereunto affixed my signature in the presence of two witnesses, this first day of September, 1910.

WILLIAM S. EATON.

Witnesses:

R. P. CHAPMAN,  
I. P. CUNNINGHAM.