

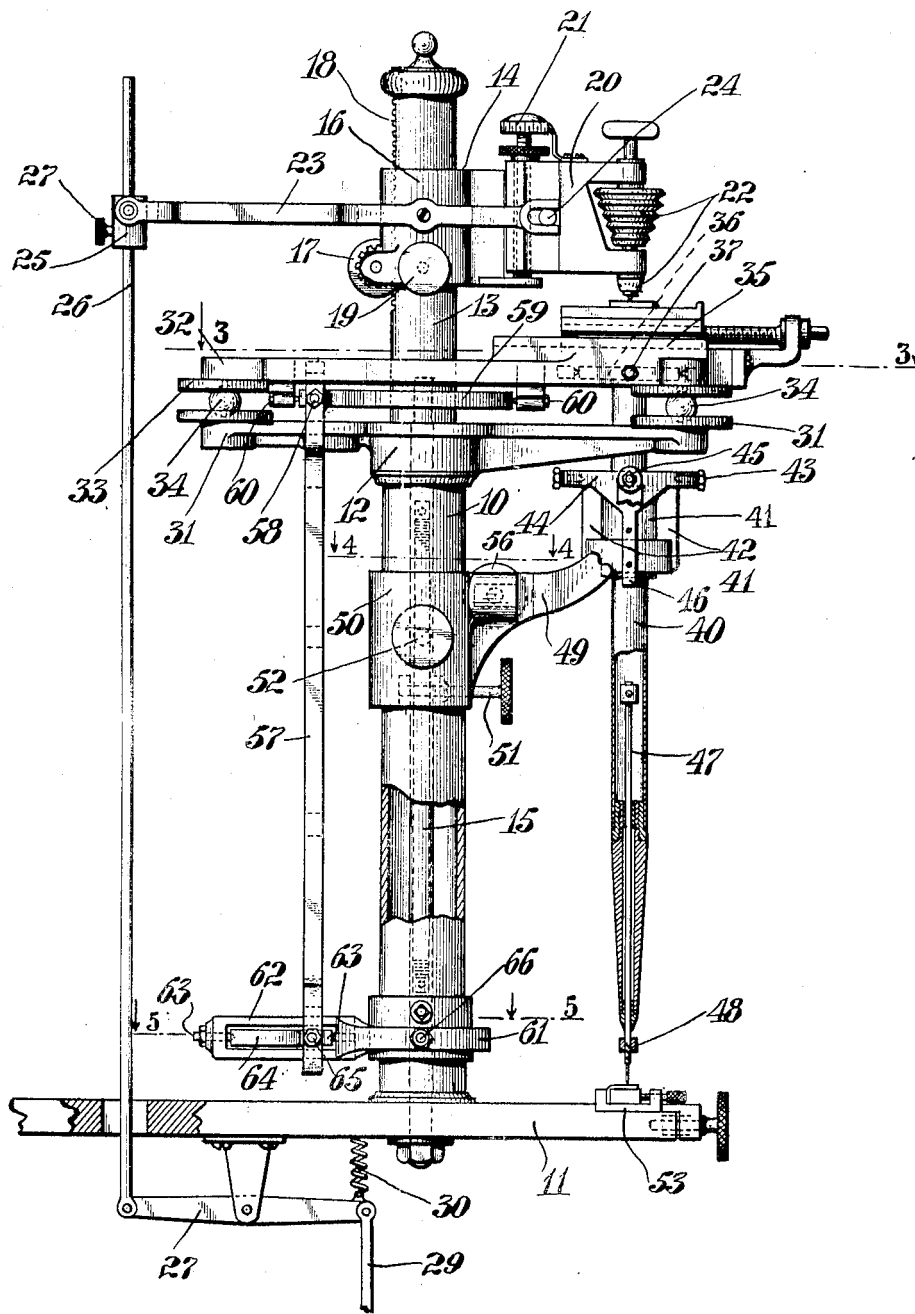
W. S. EATON.
 ENGRAVING AND SIMILAR MACHINE.
 APPLICATION FILED JUNE 2, 1911.

1,039,714.

Patented Oct. 1, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



Attest:
E. W. Mitchell
 Eugene W. Mitchell

28 William S. Eaton
 Inventor:
 by Frank T. Wentworth
 his Atty.

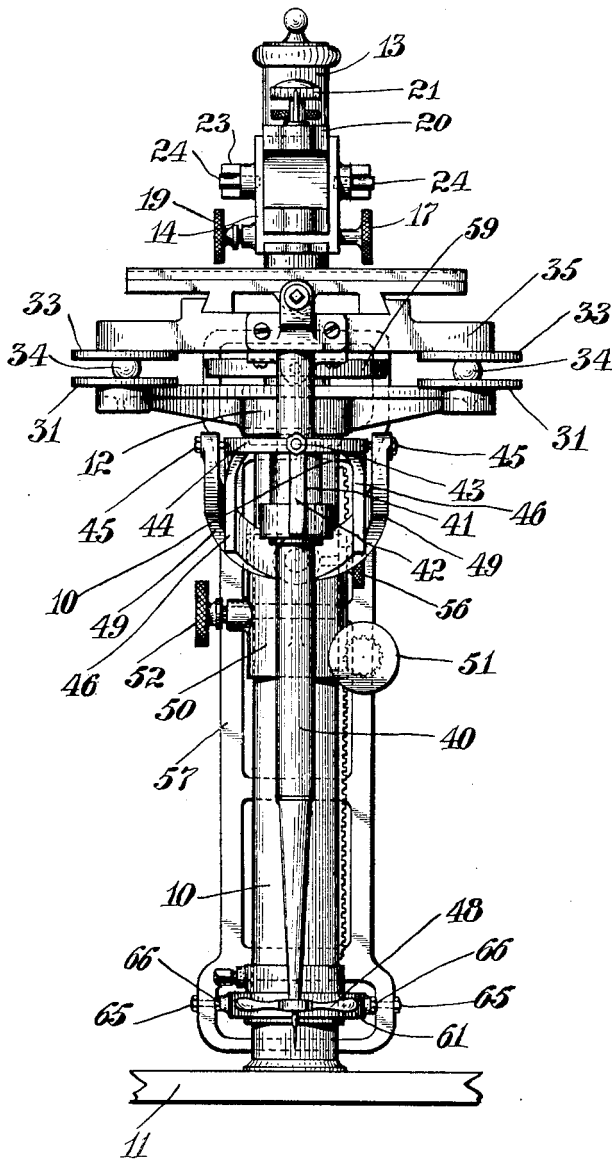
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

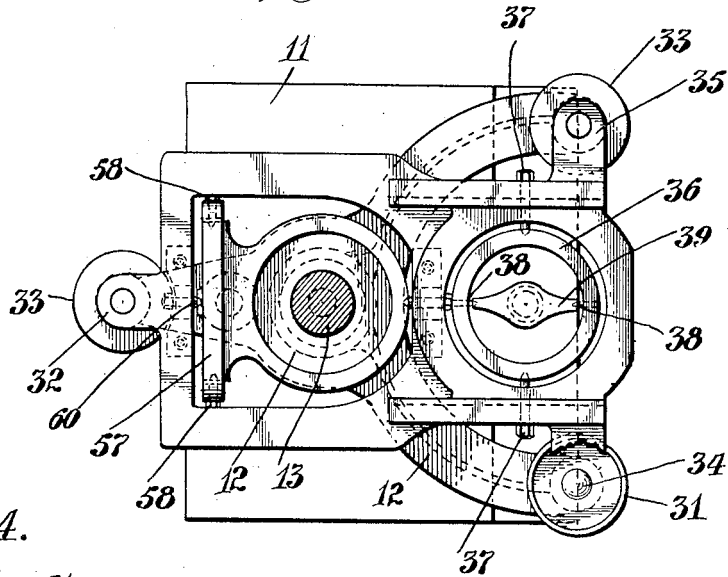


Fig. 4.

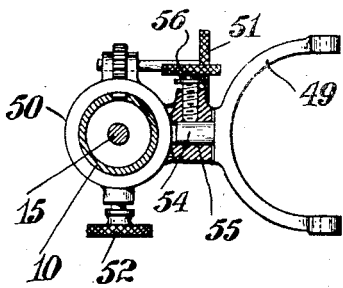
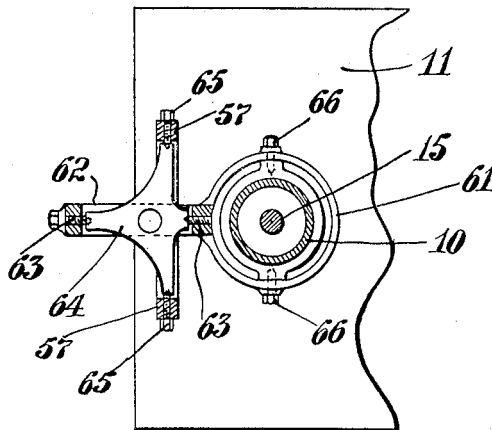


Fig. 5.



Attest:
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UNITED STATES PATENT OFFICE.

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

ENGRAVING AND SIMILAR MACHINE.

1,039,714.

Specification of Letters Patent.

Patented Oct. 1, 1912.

Application filed June 2, 1911. Serial No. 630,853.

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 and Similar 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 and similar machines, and more particularly to machines of this character of the pantograph type. Machines of this character are of two broad types, those in which the work bed is movable relative to the tool, and those in which the tool is movable relative to the work bed, the movable member in both types of machine comprising therein a carriage universally movable upon a single plane, which carriage is actuated by a transmitter having a universal connection therewith and carrying a stylus. Heretofore, the general practice has been to use a plurality of superposed carriages, movable upon tracks perpendicular to each other, a construction requiring fine workmanship to secure accuracy and avoid lost motion. In some instances, the carriage has been mounted upon bearing balls in lieu of such perpendicular tracks. Machines of this type are ordinarily employed to reproduce a pattern upon a very much reduced scale, thus requiring minute adjustment and great precision in the movement of the carriage. The slightest deviation of the carriage from the movement desired, results therefore, in imperfect work, and I have found that in most machines which I have made, there is a decided tendency on the part of the carriage to slightly twist or wobble about a vertical axis with a resultant undesirable characteristic and inaccuracy in the reproduction of the pattern. This condition I have found to be much worse in machines wherein the carriage is supported upon bearing balls, although from a practical standpoint, such form of support is more desirable than a construction embodying therein tracks and rollers. I have also found that the use of a triangular support for the carriage, with bearing balls at the apices of the triangle, results in a machine wherein the carriage has much freer movement, thus resulting in an easier running machine. When a triangular support of this kind is used,

however, the tendency to twist or wobble appears to be greater. While a machine possessing the characteristics above referred to is, nevertheless, commercially operative, it is not capable of producing uniformly accurate work.

The main object of my invention is to provide a machine of the character above described, wherein the movable carriage will be so controlled during its movement as to prevent any twisting or wobbling thereof or any departure from, or deviation in, its movement from that determined by the master plate or pattern through a stylus and transmitter mechanism.

A further object is to provide controlling means for the carriage which, while preventing the twisting or wobbling above referred to, will not interfere with the universal movement of the carriage upon a single plane and will have no tendency to raise the carriage from its support and thus accidentally vary the depth of cut, or the character of the reproduction.

A still further object is to provide controlling means of the character above referred to embodying therein an oscillatory member which will automatically adjust itself to compensate for the arc described by said oscillatory member in following the movement of the carriage.

A still further object is to provide a machine of the character described, embodying therein controlling means of the character above referred to, wherein the scale of reproduction or the character of the reproduced pattern may be varied without interfering with the operative effect of said controlling means. And a still further object is to provide a machine of this character employing a plurality of bearing balls, which bearing balls will be arranged at the apices of a triangle, without likelihood of a loss in the accuracy of, or unintentional distortion in, the reproduction.

The invention consists primarily in such 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, a portion thereof being broken away to disclose the interior construction of some of the parts; Fig. 2 is a front elevation thereof; Fig. 3 is a section on the line 3—3

of Fig. 1; Fig. 4 is a detail of the adjusting mechanism of the transmitter mechanism; and Fig. 5 is a detailed view of the lower support for the carriage controlling link.

5 Like letters refer to like parts throughout the several views.

In the embodiment of my invention shown in the drawings, 10 indicates a pedestal column carried by the top plate 11 of the machine and supporting, in a fixed position thereon, a frame 12 adapted to support the movable carriage of the machine. Surmounting the column 10 is a column 13 carrying the guide block 14 for the cutter head. The columns 10 and 13, to secure absolute rigidity, are tied together and to the top plate 11 by means of the tie rod 15, it being absolutely necessary to secure this rigidity in said column inas-
 20 much as all of the operative parts of the machine are supported therefrom and a loss of position thereof would result in a loss of the proper relative position of the various mechanisms. The guide block 14 is adjust-
 25 ably mounted upon the column 13 by means of a sleeve 16 having mounted therein a pinion 17 in mesh with the rack 18 upon said column, said block being secured in any adjusted position by means of the set screw 19. The forward face of the block 14 is provided with vertical ways in which is
 30 mounted a vertically reciprocatory cutter head 20, provided with a micrometer adjustment stop 21, of any desired or approved type, for determining with exactitude the
 35 limit of feeding movement of the cutting tool. Mounted in said head is an ordinary cone pulley-driven tool spindle 22. Pivotal-
 40 ly mounted upon the sleeve 16 is a bifurcated lever 23, one end of which straddles the cutter head 20 and is connected thereto by means of the pivots 24 moving in slots in said ends, and the other end of which straddles and is pivotally connected to a
 45 collar 25 adjustably mounted upon the link 26 by means of a set screw 27, which construction permits the adjustment of the cutter head simultaneously with the adjustment of the sleeve 16, or independently thereof
 50 through the sleeve 25 upon the link 26. The link 26 is connected with one end of the oscillatory lever 27, the other end of which lever is connected to a treadle 28 by the link 29. The treadle 28 is normally raised by
 55 means of the spring, or other equivalent means, 30, so as to normally hold the cutter head in a raised position.

The supporting frame 12 is provided with a plurality of circular ball cups 31 trian-
 60 gularly arranged, with the base of the triangle presented toward the front of the machine. Mounted upon said frame is a carriage 32 having a plurality of ball cups 33, similar, and oppositely disposed, to the cups
 65 31, bearing balls 34 of a diameter consider-

ably less than that of said cups being mounted between said cups in a manner to permit the carriage to have universal movement upon a single plane. Carried by the forward part of the carriage 32 is a work
 70 bed 35 of any desired construction. Mounted in the carriage 32 is a ring 36 which ring is adapted to oscillate about the oppositely dis-
 posed pivots 37, and mounted in said ring by means of the pivots 38, which pivots extend
 75 perpendicularly to the pivots 37, is a cross head 39 rigidly connected with the transmitter 40. This means of suspension of the transmitter from the carriage constitutes a universal connection permitting a free
 80 movement of the transmitter in any direction with a resultant transmission of a similar movement to the carriage 32.

Slidably mounted upon the transmitter 40 is a sleeve 41, which carries vertical sections
 8. 42 having bearings therein adapted to cooperate with pivot screws 43 carried by an oscillatory ring 44. The ring 44 is supported by pivot screws 45, the axes of which
 9 are perpendicular to those of the pivot screws 43 the said pivot screws 43 and 45 constituting a compound axis or fulcrum
 arranged intermediate the ends of the transmitter 40 about which said transmitter may have universal movement. The ring 44 has
 9 oppositely disposed extensions 46, having a series of bearings therein adapted to cooperate with the pivot screws 45 and permit the vertical adjustment of said ring to contract
 or expand the reproduction. The sleeve 41
 1 being slidably mounted upon the transmitter permits that movement of the transmitter within said sleeve essential to avoid the upper
 end of said transmitter describing an arc when actuating the carriage. The transmitter has slidably mounted in the lower end
 thereof a telescoping section 47 which has the twofold function of permitting the operator to follow the pattern irrespective of any
 1 arc described by the lower end of the transmitter, and automatically varying the leverage of both ends of the transmitter to compensate for the movement of the transmitter in the sleeve 41, and maintain the
 scale of reproduction irrespective of a variance in the length of the upper end of the transmitter.

The section 47 is provided with a pivoted cross head 48 which assists the operator in following the pattern and at the same time prevents the interposition of the hand in a manner to obscure the pattern while operating the machine. The ring 44 is supported by a bracket 49 carried by a sleeve 50, which sleeve is in turn adjustably mounted by means of a rack and pinion mechanism 51
 upon the column 10, a set screw 52 being used to lock said collar or sleeve in any ad-
 justed position, said sleeve being made ad-
 justable so as to vary the fulcrum point of

the transmitter 40 with a resultant variance in the scale of reproduction.

Mounted upon the top plate 11 of the machine is a pattern holder 53 of any desired or approved construction, said pattern holder being positioned below the carriage supporting frame 12 and below the front portion of said frame, being in substantial alinement with the axis of the tool spindle.

To permit that adjustment of the machine requisite to impart obliquity to the reproduction, I mount the yoke or bracket 49, by means of a pivot 54 rotatably seated in a hollow boss 55 upon the sleeve 50, a set screw 56 being used to lock the yoke or bracket in any adjusted position. The axis of the pivot 54 in the machine shown in the accompanying drawings is below and parallel with the axes of the pivot screws 43. By this construction, the arms of the bracket or yoke may be tilted from the horizontal in either direction with a resultant lateral pitch of the axis of the pivots 45, thus imparting a lateral coefficient of motion to the transmitter arm when it is oscillated upon said pivots 45, the restriction of movement placed upon the stylus resulting in a lateral deflection of the carriage in an oblique line, the angle of which deflection may be governed by the angle or pitch of the pivots 45. When it is desired to pitch the letter or other pattern to the right in the reproduction, the bracket or yoke should be tilted to the right, and to pitch the reproduced letter to the left, said yoke should be tilted to the left. This adjustment can be accomplished without materially varying the scale of reproduction.

The transmitter 40 being suspended from a point toward the front of the carriage 32, there is a slight tendency on the part of the said carriage to twist and wobble about a vertical center with the movement of the transmitter at any point of its movement, which tendency results from the universal suspension of the transmitter and sometimes causes a loss of exactitude in the reproduction. To obviate this difficulty, I provide a stability device or carriage controlling means which will prevent any possibility of movement of the carriage except in perpendicular lines, thus positively preventing any twisting of the carriage and limiting its movement to that defined by the transmitter. This device comprises a link 57, the upper end of which is mounted by means of pivots 58 extending transversely of the machine, to the frame 59, which is pivotally mounted on the carriage 32 by means of the pivots 60 extending longitudinally of the machine, or perpendicularly to the pivots 58, the said pivots 60 being arranged a sufficient distance apart to afford a wide bearing for the frame 59. It will be observed that by this connection, any movement of the car-

riage except on perpendicular lines cannot occur except through the twisting of the link 57, the lower end of which is so mounted as to preclude any possibility of such twisting. Secured to the collar 10 adjacent to the bottom thereof, is a frame 61 parallel with the frame 59, and carried thereby is a housing 62 carrying pivots 63 extending longitudinally of the machine. Mounted in these pivots is a head 64 to which is pivoted by means of the pivot screws 65 the lower end of the link 57. The pivots 65 extend laterally of the machine. It will thus be seen that by reason of the universal pivotal connections at both ends of the link 57, said link and consequently the carriage 32 is permitted to move freely in perpendicular lines, but is held against any twisting or wobbling.

To compensate for the arc described by the link 57, the frame 61 is permitted to have a vertical component of motion preferably by being pivotally supported upon horizontal pivots 66 from the column 10, thus permitting the link to rise or fall with its movement with the carriage.

The pattern which is to be reproduced is indicated in the accompanying drawings by the numeral 67 and the work plate by the numeral 68.

The operation of the herein described machine is substantially as follows:—The pattern 67 having been secured in its holder 53 and the work plate 68 upon the work bed 35, the stylus is brought to position upon the desired portion of the pattern, which movement brings the plate 68 into the proper corresponding relation with the tool carried by the spindle 22. When it is desired to proceed with the work, the tool is brought down toward the work plate 68 by pressing the treadle 28 which, through the lever 23 and the means connecting it with said treadle, forces the entire tool head 20 downwardly, the micrometer stop 21 having first been adjusted to zero to determine a standard for regulating the subsequent feeding of the tool in making a cut of the required depth. This basis for further manipulation having once been established, the micrometer stop 21 is raised so as to permit the block or head 20 to be advanced beyond the point of initial contact and power is applied to the spindle 22. The treadle 28 is then depressed to bring the tool in contact with the plate 68 and the stylus is moved over the pattern oscillating the transmitter about the universal support intermediate its ends, thus imparting either a longitudinal or lateral reciprocation to the carriage 32 or simultaneously subjecting said carriage to movement both longitudinally and laterally to develop inclined or curved lines in the reproduction. The carriage being mounted upon bearing balls, it is free to move in any direction and the ele-

ment of friction is reduced to a minimum, thus relieving the transmitter from resistance to this movement in a degree which would tend to interfere with the operator's accurately following the pattern with the stylus. As the carriage is thus moved, the upper end of the transmitter would normally describe an arc, but being fixed to said carriage, this normal arc is compensated for by the vertical movement of the transmitter in the sleeve 41, the telescopic section 47 of said transmitter descending, as the transmitter itself is raised, in a degree which automatically varies the length of the arm below the sleeve proportionately to its elongation above, thus preserving the scale of the reproduction by a simultaneous proportionate variance in the length of the arms of the transmitter upon opposite sides of its fulcrum point. By the use of the lever 23, directly connected with the cutter head, the said head is caused to respond instantly to the pressure applied thereto through said lever by the foot or spring acting upon the treadle, thus permitting great delicacy in the control of the cutting tool. The three points of support for the carriage 32 not only reduce the friction to a minimum consistent with the desired stability of the carriage, but facilitate the leveling, and the maintenance of the level, of the carriage. With the longitudinal movement of the carriage, the link 57 will oscillate back and forth upon the pivots 58 and 65, the vertical rise and fall of the lower pivots due to the pivotal movement of the frame 61 upon its pivots 66 relieving the carriage from any vertical movement due to the normal tendency of the said link to describe an arc during this oscillatory movement. As the carriage moves laterally, the frames 59 and 64 turn upon their pivots 60 and 63 respectively, the lower universal pivotal support for the link 57 having the same rise and fall with the lateral movement, as above referred to in connection with the longitudinal movement. The pivots 58 and 63, however, prevent any twisting of the link 57 about a vertical axis, thus preventing any twisting or wobbling movement of the carriage. At the same time the pivots 58 and 65 prevent any tilting of the carriage from the horizontal or other fixed plane of movement thereof. The universal pivotal supports at opposite ends of the link 57 permit the simultaneous oscillatory movement of said link both longitudinally and laterally, thus preventing this link from interfering in any way with the free movement of the carriage upon a single plane and under the control of the transmitter, in any direction. If it be desired to vary the scale of the reproduction, the sleeve 50 may be raised or lowered by the rack and pinion mechanism 51, the set

screw 52 being used to lock the sleeve in any adjusted position. If it be desired to vary the lateral scale of the reproduction without varying the longitudinal scale, as in condensing or expanding the reproduced letter or design, it is merely necessary to raise or lower the ring 44 relative to the yoke 49 and adjust the pivots 45 in relation to different bearings in the extensions 42. If it be desired to condense the letter or design, the ring 44 should be raised, while if it is desired to contract the reproduction, the ring should be inverted and lowered. When the ring is so raised, it will be observed, the leverage at which the transmitter acts as to the pivots 43 is increased, while when the ring is lowered this leverage is decreased. In both instances, the leverage remains the same as to the pivots 45, thus resulting in the variance of the operative moment of the transmitter upon the lateral strokes or when oscillating about the pivots 43, with a constant moment when operating upon the pivots 45. By this adjustment, the scale of reproduction may be varied simultaneously with the adjustment to accomplish the extension or condensation of the letter or design, in the same manner as when it is desired to merely vary the scale of the reproduction. When it is desired to impart obliquity to the reproduction, it is merely necessary to swivel the yoke either to the right or to the left upon its pivot. If the yoke be swiveled to the right, the reproduction will be pitched to the right, and if it be swiveled to the left, the reproduction will be pitched to the left.

While I have shown and described the stability device in connection with a machine wherein a movable carriage supports the work bed beneath a stationary tool, I do not thereby intend to limit myself to its use in connection with this specific type of machine, it being apparent that it is equally useful in connection with various types of machines embodying a movable carriage under the control of a transmitter mechanism.

I believe it to be broadly new to provide in connection with a reproducing machine of the pantographic type embodying a movable carriage, a rigid stability member connected to the carriage by a universal joint embodying therein perpendicular pivots and having its other end connected by a similar universal joint to a fixed part of the machine, and I intend to claim such broadly.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawings, it being apparent that such may be varied without departing from the spirit or scope of the invention.

Having described my invention, what I

claim as new and desire to have protected by Letters Patent, is:—

1. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

2. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis, and means permitting the vertical movement of the connecting means between the link and the carriage to compensate for the arc normally described by said link.

3. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis, said last named connection embodying therein means permitting vertical movement of the link in its entirety to compensate for the arc normally described by said link.

4. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, a frame, horizontal pivots connecting said frame with a fixed part of the machine, and

a universal joint having a compound axis, between the other end of said link and said frame whereby said link in its entirety is permitted to rise and fall to compensate for the normal arc described by the upper part thereof during its oscillatory movement, and said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

5. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a frame, pivots extending longitudinally of the carriage whereby said frame is connected to said carriage, pivots connecting said link with said frame and extending perpendicularly to said first named pivots, a second frame, horizontal pivots connecting said last named frame to a fixed part of the machine, a third frame, pivots extending longitudinally of the carriage and connecting said last named frame with said frame connected to a fixed part of the machine, and pivots connecting said link with said last named frame, said last named pivots extending laterally of the machine, whereby said link in its entirety is permitted to rise and fall to compensate for the normal arc described by the upper portion thereof during its oscillatory movement and said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

6. A machine of the character described, embodying therein a carriage, a three point support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

7. A machine of the character described, embodying therein a carriage support having three triangularly arranged cup bearings, a carriage having three similarly arranged oppositely disposed cup bearings, a bearing ball mounted in each pair of opposed cups and adapted to have lineal traverse in said cups whereby the carriage is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a uni-

versal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

8. A machine of the character described, embodying therein a carriage, a support for said carriage occupying a fixed plane, whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, means whereby the leverage of the transmitter may be varied to vary the scale of reproduction, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

9. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a work bed carried by said carriage, a reciprocatory cutter head mounted above said work bed, a guide block for said cutter head, means whereby said block may be vertically adjusted, a lever pivoted to said block having lost motion connection with said cutter head, a reciprocatory link for oscillating said lever, an adjustable connection between said link and said lever, a transmitter through which movement is imparted to said carriage, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

10. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, a universal connection between one end of said transmitter and said carriage, operating means pivotally supported from said carriage and pivotally supporting said transmitter, the pivotal supports for said means and for said transmitter extending perpendicularly to each other and longitudinally and laterally of the carriage, a universal pivotal support or fulcrum point intermediate the ends of said transmitter, means whereby said fulcrum point may be shifted longitudinally of the

transmitter to vary the scale of reproduction, and a stability device comprising a link, a universal joint, having a compound axis, between one end of said link and said carriage, and a similar joint between the other end of said link and a fixed part of the machine whereby said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

11. A machine of the character described, embodying therein a carriage, a support for said carriage whereby it is permitted to have universal movement upon a single plane, a transmitter through which movement is imparted to said carriage, a universal connection between one end of said transmitter and said carriage, operating means pivotally supported from said carriage and pivotally supporting said transmitter, the pivotal supports for said means and for said transmitter extending perpendicularly to each other and longitudinally and laterally of the carriage, a universal pivotal support or fulcrum point intermediate the ends of said transmitter, means whereby said fulcrum point may be shifted longitudinally of the transmitter to vary the scale of reproduction, and a stability device comprising a link, a frame, pivots extending longitudinally of the carriage whereby said frame is connected to said carriage, pivots connecting said link with said frame and extending perpendicularly to said first named pivots, a second frame, horizontal pivots connecting said last named frame to a fixed part of the machine, a third frame, pivots extending longitudinally of the carriage and connecting said last named frame with said frame connected to a fixed part of the machine, and pivots connecting said link with said last named frame, said last named pivots extending laterally of the machine, whereby said link in its entirety is permitted to rise and fall to compensate for the normal arc described by the upper portion thereof during its oscillatory movement and said carriage is permitted to have movement upon perpendicular horizontal lines and is prevented from twisting about a vertical axis.

12. A machine of the character described, embodying therein a carriage, means supporting same whereby said carriage is permitted to have universal movement upon a single plane, an oscillatory transmitter, pivotally supported on a compound axis consisting of perpendicular pivots extending longitudinally and laterally of the machine, and adapted to impart movement to the carriage, and a stability device comprising an oscillatory link connected to the carriage and provided at each end with a universal joint having a compound axis consisting of perpendicular pivots extending longitudinally

nally and laterally of the machine in substantial alinement with or parallel relation to the pivots supporting the transmitter, whereby said carriage is permitted to have movement along perpendicular horizontal lines but is prevented from twisting about a vertical axis.

13. A machine of the character described, embodying therein a carriage, means supporting same whereby said carriage is permitted to have universal movement upon a single plane, an oscillatory transmitter, pivotally supported on a compound axis consisting of perpendicular pivots extending longitudinally and laterally of the machine, and adapted to impart movement to the carriage, a stability device comprising an oscillatory link connected to the carriage and provided at each end with a universal joint having a compound axis consisting of perpendicular pivots extending longitudinally and laterally of the machine in substantial alinement with or parallel relation to the pivots supporting the transmitter, whereby said carriage is permitted to have movement along perpendicular horizontal lines but is prevented from twisting about a vertical axis.

14. A machine of the character described, embodying therein a carriage, a support therefor whereby said carriage is permitted to have universal movement upon a single plane, a transmitter, connecting means between said transmitter and said carriage embodying therein perpendicular pivotal supports for said transmitter whereby said transmitter is permitted to impart movement to said carriage in any direction, and a stability device, comprising a link, one end of which is connected to said carriage by a universal connection embodying therein pivots arranged similarly to the pivots supporting said transmitter, and a universal joint connecting the other end of said link to a fixed part of the machine embodying therein perpendicular pivots disposed similarly to the pivotal connection between said link and said transmitter.

In witness whereof, I have hereunto affixed my signature, in the presence of two witnesses, this first day of June, 1911.

WILLIAM S. EATON.

Witnesses:

EUGENE WEMING,
F. T. WENTWORTH.