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ENGRAVING AND REPRODUCING APPARATUS

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3 Sheets--Sheet 1



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March 27, 1956

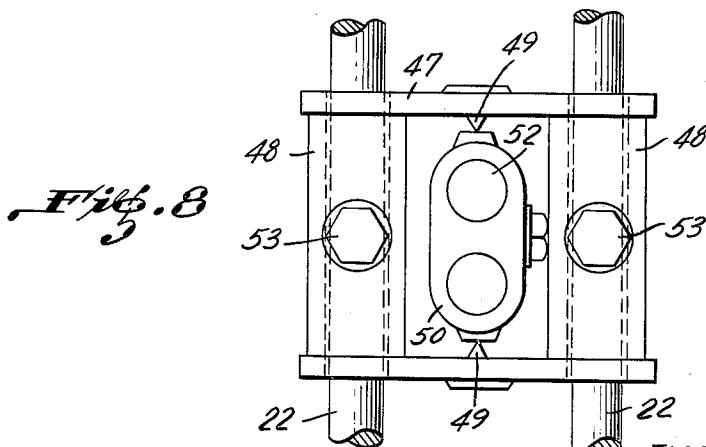
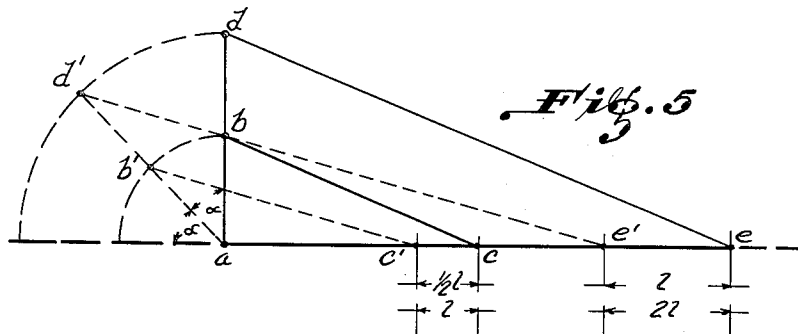
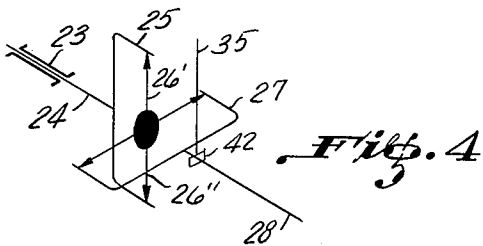
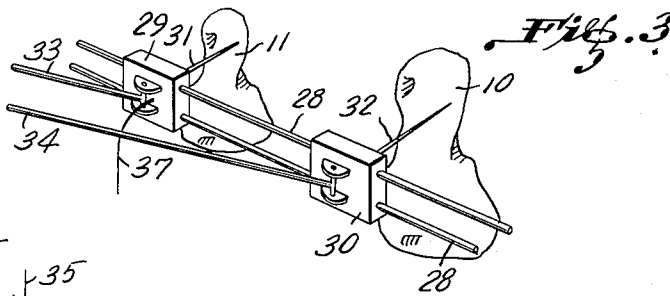
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3 Sheets-Sheet 2



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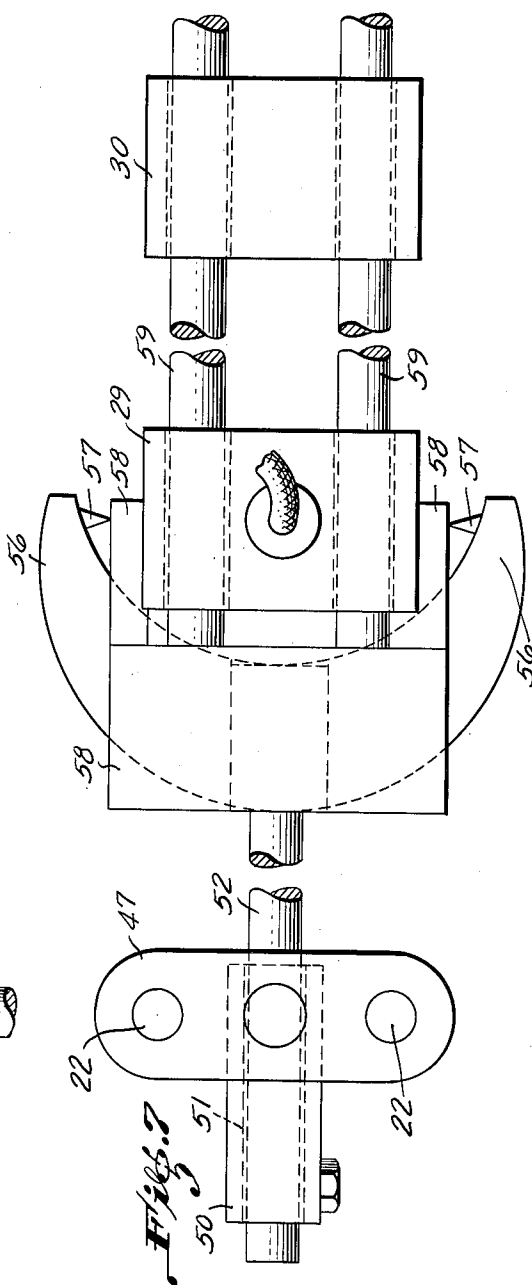
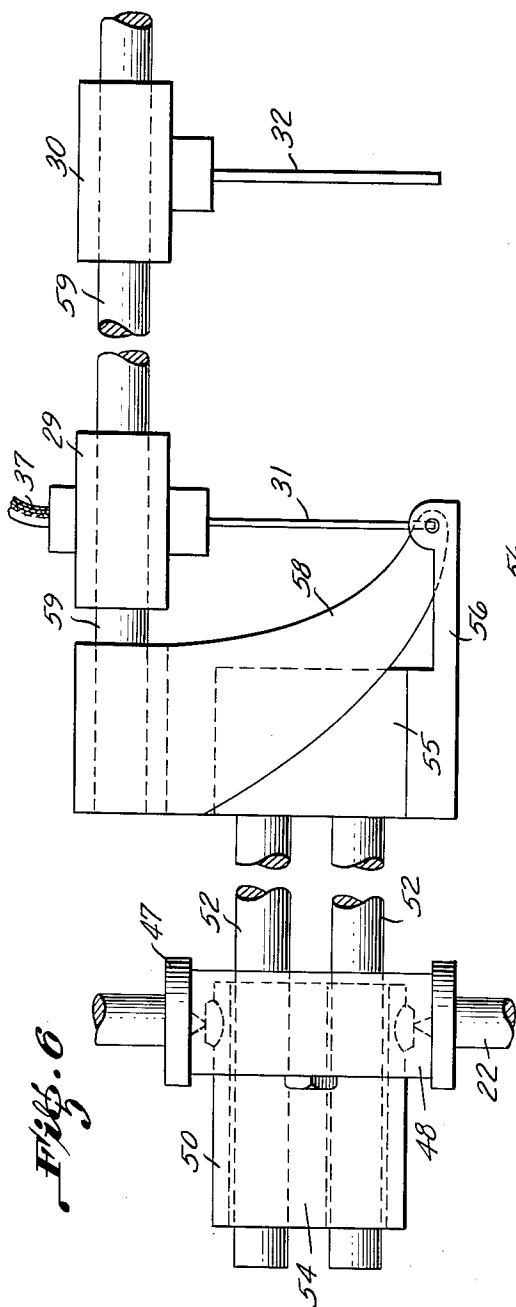
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3 Sheets-Sheet 3



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ENGRAVING AND REPRODUCING APPARATUS

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8 Claims. (Cl. 90—13.1)

My present invention relates to an engraving and reproducing apparatus for sculptural work.

It is an object of my invention to provide an apparatus for the reproduction of sculptures of whatsoever form and dimension to desired scale.

It is a further object of my present invention to provide for the reproduction of reliefs and the transformation of the latter into medium or low reliefs.

It is another object of my invention to provide for an apparatus which combines means for accomplishing these two objects.

A more particular object of my invention is to permit the reproduction of solid bodies or relief objects and the change of the original scale without the necessity of specific measurements of individual parts.

With the above objects in view my present invention mainly consists in an engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support, elongated generally horizontal first carrier means disposed on said stationary support, two work tables, one for the model object and the other for the work, means for moving the said work tables along said first carrier means, substantially vertical support means, elongated second carrier means pivoted at one end to said vertical support means so as to be tiltable towards said first carrier means, a pair of spaced elements movable on said second carrier means, a guide tool carried by one of said elements, a working tool carried by the other element, and means for simultaneously adjusting the position of said two elements relatively to said work tables.

The novel features which I consider as characteristic for my invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation of the apparatus according to my invention;

Fig. 2 is a plan view showing the apparatus in working position for the reproduction of solid objects;

Fig. 3 is a detail view of Fig. 2 illustrating particularly the guide and working tools;

Fig. 4 is a diagrammatic view of the universal joint employed in the apparatus;

Fig. 5 is a diagram illustrating the underlying mathematical concept;

Fig. 6 illustrates another embodiment for use in the reproduction of relief objects, the view shown being a partial side elevation;

Fig. 7 shows the same parts as Fig. 6 in plan view; and

Fig. 8 is a partial front elevation of the embodiment illustrated in Figs. 6 and 7.

Referring to the drawings and in particular to Figs. 1 to 3 it will be seen that the apparatus comprises two horizontal bars generally indicated as 1. These bars

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constitute the first carrier means of the apparatus. The bars are supported at their ends by stationary legs 2. Interposed between the bars and legs are cooperating disc members 3 and 4 which permit a relative angular displacement so as to provide for an inclination of the bars about the axes of discs 3 and 4. A pair of clamping nuts 4a and 4b hold the discs 3 and 4 in adjusted position.

Movable on the bars are two slides 5 which are provided with movable working tables 6 and 6'. The lengthwise movement of the slides is accomplished by handles 7 which actuate pinions 8 for cooperation with the rack portion 9 which is provided at the bottom of the bars 1.

A revolving mechanism consisting of extensible bars 12; worms 13 and worm wheels 14 provides for revolution of the work tables about their axes. The actuating mechanism for this purpose comprises cooperating bevel gears 15 and 16 which are driven by a shaft 17. Shafts 12 being extensible, the gearing mechanism associated therewith is kept in operative position relative thereto during relative movement between slides 5. The shaft carries at its outer end an actuating disc 18 and a handle 20 and is supported in a slide 19 which is movable on one of the bars 1.

Substantially at one end of the bars 1 a support block 21 is provided from which vertical standards 22 rise. A bearing box 23 is carried by these supports so as to be vertically slidable thereon. A shaft 24 extends into the bearing box 23 and is freely revolvable therein. The shaft 24 carries at its free end a universal joint. The joint comprises a fork 25 which is fixed to the end of the shaft 24, a cross member 26 and a second fork 27. With specific reference to Fig. 4 it will be seen that the two arms 26' and 26'' of the cross member are pivoted to the fork 25 while the other two arms 26''' and 26'''' are pivoted to the fork 27. Secured to the fork 27 are rods 28. These rods extend normally parallel to the bars 1 and constitute the second carrier means of the apparatus. Movable on these bars 28 are two slides 29 and 30. The first of these slides carries the working tool which may be a stylus, graver, chisel or any similar implement. The second tool carries a guide tool 32. Pivoted adjacent the place of junction 42 between the fork 27 and the rods 28, is a lever bar 35 which at its free end is provided with a ball shaped handle 36. This lever bar 35 is connected with the slides 29 and 30 by parallel bars 33 and 34 of distinct length. The bar 33 is pivoted to the lever bar 35 at 43 and to the slide 29 at 45, the bar 34 is pivoted to the lever bar 35 at 44 and to the corresponding slide 30 at 46. The bar 33 may be made adjustable as to length, or a number of bars of predetermined different lengths may be used.

One of the rods 28 is provided with a handle 41 which is secured thereto in any well known suitable manner. A rod 40 carried by a slide 39 on one of the bars 1 extends vertically upward and provides a guide for the rods 28, by providing a rigid member against which one of the rods 28 may be brought to bear.

A motor 38 furnishes driving power to the working tool 31 through flexible shaft 37.

The apparatus described operates as follows:

The model object is placed on the work table 6 and the block 11 to be shaped is put on the work table 6'. In order to perform work on solid bodies the lever bar 35 as a rule is swung sidewise from the position shown in Fig. 1 to the position shown in Fig. 2. The tools are then guided by means of the handle 41 in a vertical direction (that is the direction shown by the arrow adjacent the handle 41 in Fig. 1), until the stylus 31 makes contact with the piece 11. Owing to the rapid motion imposed upon the stylus by the electric motor 38, the tool will rapidly cut the block down to a definite point. Then the guide tool 32 will trace the contour of the pattern, its motion being followed by the tool 31 in the proportion determined by

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the triangle formed by the bars 33, 34, 28 and 35. Tool 31 and guide tool 32 will trace a semi-circular path with the universal joint 25, 26, 27, as its center; the stylus will follow the configuration of the pattern. This semi-circular path about a center may be termed a meridian line. Having cut one meridian of the contour, the hand wheel 18 and with it the tables 6 are actuated, thus imparting a slight rotation to the tables, and the new meridian is then traced. The object is thus reproduced by sectors. None of the recessed parts of the pattern can remain untreated, since the operator is able to follow all curves and convolutions by virtue of the universal joint, which permits him to work in any direction. The horizontal travel of the stylus and guide tool is effected by operation of the lever bar 35, which displaces the slides 29 and 30 and the tools 31 and 32 in accordance with the proportions of the distances previously established by means of the bar 33, the length of which determines the scale of reproduction.

For tracing the outline, the position of stylus and guide tool will be horizontal with respect to the operator; for following the recesses of the figure, these members may be placed at an angle or operated vertically.

Even the smallest details of the pattern may be reproduced, since the speed of the stylus may be arranged to take only a fine cut at each stroke or revolution and the stylus 32 may be made pointed and sharp to permit the former to accomplish a complete shaping and the latter to enter even the smallest depressions.

To facilitate the work of the operator, as well as to diminish the weight of the stylus upon the work, the bars 1 may be placed in an inclined plane with respect to the vertical by simply loosening and tightening nuts 4a and 4b on their screws provided to this end in the disks 3 and 4 so that the bars may assume the proper position.

The principle underlying the scale reproduction is easily understood by reference to Fig. 5.

Line $a-d$ corresponds to lever bar 35; line $a-e$ corresponds to rods 28; line $b-c$ corresponds to bar 33; and line $d-e$ corresponds to bar 34. As will be seen lines $d-e$ and $b-c$ (bars 34 and 33) constitute the hypotenuse of two similar triangles $a-d-e$ and $a-b-c$. The angular displacement of line $a-d$ (lever bar 35) will result in a change of relative position of points c and e . On the apparatus, this means that blocks 29 and 30 will slide on the rods 28. For instance, when lever arm 35 (line $a-d$) has reached position corresponding to line $a-d'$, after angular displacement α , the distance from $e-e'$ will be twice the distance from $c-c'$. Accordingly, the enlargement or reduction will be in the proportion of two to one, or one to two. Any desired ratio may be obtained by choosing an arm 33, of a certain predetermined length; alternatively arm 33 may be formed to be adjustable along its length. It will be seen that the apparatus does not operate on the usual pantograph principle; rather the motion of one tracer point is transmitted to a lever bar pivoted about an axis disposed at the end of the sliding rods 28; and this lever bar in turn has a connection with the working tool sliding on rods 28, so that this tool will move in unison with the tracer point.

For work on relief objects the apparatus just described can be used and should then be in the initial position illustrated in Fig. 1. However, for the reduction of relief objects to medium and low reliefs preferably another embodiment of the apparatus is used which is illustrated in Figs. 6 to 8.

The arrangement of the stationary support and the lower or first carrier means as well as the arrangement of the working tables and vertical supports and standards will be the same in this apparatus as that shown in Figs. 1 to 3. The differences lie in the means to accomplish the necessary movements of the working and guide tool.

To this end a slide member is provided on the vertical supports 22. This slide member has tubular guides 48 by which it can move on the standards 22. Provided in the

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slide member 47 are pivots 49 for a first bearing block 50 in which superimposed intermediate carrier means, bars 52 are movable through tubular channels 51. Screws 53 and 54 are provided for locking of the bars 52 in vertical and horizontal direction. At the extreme end of the bars 52 a second bearing block 55 is provided, which, as appears from Fig. 7, has a crescent shape so as to form projecting end pieces 56 which carry pivots 57 for an end block 58. In this end block 58 the ends of superimposed bars 59 are fixed. The latter bars constitute the second carrier means of this embodiment and therefore correspond to the bars 28 of the previously discussed form of the invention.

The operation of this second embodiment is as follows:

The slides 29 and 30 which carry the guiding tool and working tool can be adjusted on bars 59. The horizontal position in a lengthwise direction can furthermore be adjusted by sliding of the intermediate bars 52 in the bearing block 50. In addition, the swivel joints 49 permit rotation of the tools in a generally horizontal plane. The vertical inclination of the tools is accomplished by tilting of the end block 58 about the pivots 57. It will be appreciated that the horizontal dimension thus provided will be in proportion to the distance of the tools from the pivots 49 and the vertical dimension or relief depth will be in accordance with the tips of the tools from the pivots 57.

A particular advantage of this form is the possibility of an adjustment to such degree that the tip of the working tool 31 virtually coincides with the axis formed by the pivots 57. Thus disproportion between reduction in horizontal direction and reduction in relief can be diminished.

Preferably the working tables 6 and 6' in this embodiment should be machine driven which can be accomplished by an additional connection between the revolving shaft 17 and the motor 38.

While I have illustrated and described the invention as embodied in an engraving and reproducing apparatus I do not intend to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of my invention.

Without further analysis, the foregoing will so fully reveal the gist of my invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What I claim as new and desire to secure by Letters Patent is:

1. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means disposed on said stationary support; two work tables movably mounted on said first carrier means, one for the model object and the other for the work; means operatively associated with said work table for moving the same along said first carrier means; substantially vertical support means rising from said first carrier means; elongated second carrier means; means slidable on said vertical support means for connecting said second carrier means at one end to said vertical support means; universal joint means forming part of said connecting means so as to permit swinging of said second carrier means in planes parallel and normal to said first carrier means; a generally vertical guide bar for said second carrier means secured to said first carrier means; handle means disposed at the free end of said second carrier means; a lever bar pivoted to said connecting means so as to be movable with said second carrier means and so as to be swingable in a plane passing through the axis

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of said second carrier means; a pair of spaced slides movably mounted on said second carrier means; a guide tool carried by one of said slides; a working tool carried by the other slide; and a pair of parallel bars of different lengths, each bar pivoted at one end to one of said slides and at the other end to said lever bar, whereby upon swinging of said lever bar the positions of said guide tool and working tool on said second carrier means may be varied in a definite relationship.

2. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means disposed on said stationary support; two work tables movably mounted on said first carrier means, one for the model object and the other for the work; means operatively associated with said work tables for moving the same along said first carrier means; substantially vertical support means rising from said first carrier means; elongated second carrier means; a bearing box lengthwise slidable on said vertical support means; a generally horizontal shaft revoluble in said bearing box; a universal joint device securing said second carrier means at one end to said horizontal shaft; a lever bar pivoted at one end to the junction of said universal joint device and said second carrier means; a pair of spaced slides movably mounted on said second carrier means; a guide tool carried by one of said slides; a working tool carried by the other slide; and a pair of parallel bars of different lengths, each bar pivoted at one end to one of said slides and at the other end to said lever bar whereby upon swinging of said lever bar the positions of said guide tool and working tool on said second carrier means may simultaneously be varied in a definite relationship.

3. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means disposed on said stationary support; two work tables movably mounted on said first carrier means, one for the model object and the other for the work; means operatively associated with said work tables for moving the same along said first carrier means; substantially vertical support means rising from said first carrier means; intermediate carrier means; a slide member lengthwise movable on said vertical support means; a first bearing block mounted in said slide member for rotary movement in a plane normal to the plane of said vertical support means, the said first bearing block providing slide bearings for said intermediate carrier means; means for locking said intermediate carrier means in adjusted positions relative to said first bearing block and slide member; a second bearing block attached to the one end of said intermediate carrier means so as to project beyond the said end; elongated second carrier means; pivot means for one end of said second carrier means disposed at the free end of said bearing block so as to permit tilting of said second carrier means towards said first carrier means; a pair of spaced elements movable on said second carrier means; a guide tool carried by one of said elements; and a working tool carried by the other element and having its tip disposed in one of the extreme positions of said second carrier means so as to be in close proximity to said pivot means.

4. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means; cooperating holding members disposed at the ends of said first carrier means and on said stationary support, the said holding members being adjustable in selected angular positions; two work tables movably mounted on said first carrier means, one for the model object and the other for the work; means operatively associated with said work tables for moving the same along said first carrier means; substantially vertical sup-

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port means rising from said first carrier means; elongated second carrier means; means slidable on said vertical support means for connecting said second carrier means at one end to said vertical support means; universal joint means forming part of said connecting means so as to permit swinging of said second carrier means in planes parallel and normal to said first carrier means; a lever bar pivoted to said connecting means so as to be movable with said second carrier means and so as to be swingable a plane passing through the axis of said second carrier means; a pair of spaced slides movably mounted on said second carrier means; a guide tool carried by one of said slides; a working tool carried by the other slide; and a pair of parallel bars of different lengths, each bar pivoted at one end to one of said slides and at the other end to said lever bar, whereby upon swinging of said lever bar the positions of said guide tool and working tool on said second carrier means may be varied in a definite relationship.

5. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means; cooperating holding members disposed at the ends of said first carrier means and on said stationary support, the said holding members being adjustable in selected angular positions; two work tables movably mounted on said first carrier means, one for the model object and the other for the work; means operatively associated with said work tables for moving the same along said first carrier means; substantially vertical support means rising from said first carrier means; elongated second carrier means; means slidable on said vertical support means for connecting said second carrier means at one end to said vertical support means; universal joint means forming part of said connecting means so as to permit swinging of said second carrier means in planes parallel and normal to said first carrier means; a generally vertical guide bar for said second carrier means secured to said first carrier means; handle means disposed at the free end of said second carrier means; a lever bar pivoted to said connecting means so as to be movable with said second carrier means and so as to be swingable in a plane passing through the axis of said second carrier means; a pair of spaced slides movably mounted on said second carrier means; a guide tool carried by one of said slides; a working tool carried by the other slide; and a pair of parallel bars of different lengths, each bar pivoted at one end to one of said slides and at the other end to said lever bar, and one of said parallel bars being lengthwise adjustable whereby upon swinging of said lever bar the positions of said guide tool and working tool on said second carrier means may be varied in a definite relationship.

6. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means disposed on said stationary support; two work tables movably mounted on said first carrier means, one for the model object and the other for the work; means operatively associated with said work tables for moving the same along said first carrier means; substantially vertical support means rising from said first carrier means; elongated second carrier means; a bearing box lengthwise slidable on said vertical support means; a generally horizontal shaft revoluble in said bearing box; a universal joint device securing said second carrier means at one end to said horizontal shaft; a lever bar pivoted at one end to the junction of said universal joint device and said second carrier means; a pair of spaced slides movably mounted on said second carrier means; a guide tool carried by one of said slides; a working tool carried by the other slide; and a pair of parallel bars of different lengths, each bar pivoted at one end to one of said slides and at the other end to said lever bar where-

by upon swinging of said lever bar the positions of said guide tool and working tool on said second carrier means may simultaneously be varied in a definite relationship.

7. An engraving and reproducing apparatus for sculptural work, comprising in combination, a stationary support; elongated generally horizontal first carrier means disposed on said stationary support; two work tables movably mounted on said first carrier means, one for the model object and the other for the work, the said two work tables being revoluble about their axes; means operatively associated with said work tables for moving the same along said first carrier means; an actuator slidably disposed on said first carrier means; gear means connecting said actuator and said work tables so as to permit revolving of the latter; substantially vertical support means; intermediate carrier means; a slide member lengthwise movable on said vertical support means; a first bearing block mounted in said slide member for rotary movement in a plane normal to the plane of said vertical support means, the said first bearing block providing slide bearings for said intermediate carrier means; means for locking said intermediate carrier means in adjusted positions relative to said first bearing block and slide member; a second bearing block attached to the one end of said intermediate carrier means so as to project beyond the said end; elongated second carrier means; pivot means for one end of said second carrier means disposed at the free end of said bearing block so as to permit tilting of said second carrier means towards said first carrier means; a pair of spaced elements movably mounted on said second carrier means; a guide tool carried by one of said elements; and a working tool carried by the other element and having its tip disposed in one of the extreme positions of said second carrier means so as to be in close proximity to said pivot means.

8. An engraving and reproducing apparatus for sculptural work comprising, in combination, a stationary support; elongated generally horizontal first carrier means disposed on said stationary support; two work tables, one

for the model object and the other for the work movably mounted on said carrier means; means operatively associated with said work tables for moving the same along said first carrier means; substantially vertical support means mounted on said first carrier means and rising therefrom; elongated second carrier means having a predetermined axis; connecting means mounted on said vertical support means for connecting said second carrier means at one end thereof to said vertical support, said connecting means including a universal joint so as to permit swinging of said second carrier means in planes parallel and perpendicular to said first carrier means; a lever bar pivoted to said connecting means and mounted thereon for swinging movement in a plane passing through the axis of said second carrier means; a pair of spaced slides slidably mounted on said second carrier means; a guide tool carried by one of said slides; a working tool carried by the other slide; and a pair of parallel bars of different lengths, each bar being pivoted at one end to said slides and at the other end to said lever bar.

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