No. 888,041. PATENTED MAY 19, 1908.

J. B. SALO.

SCULPTOR'S REPRODUCING MACHINE.

APPLICATION FILED SEPT. 16, 1902.

2 SHEETS—SHEET 1.

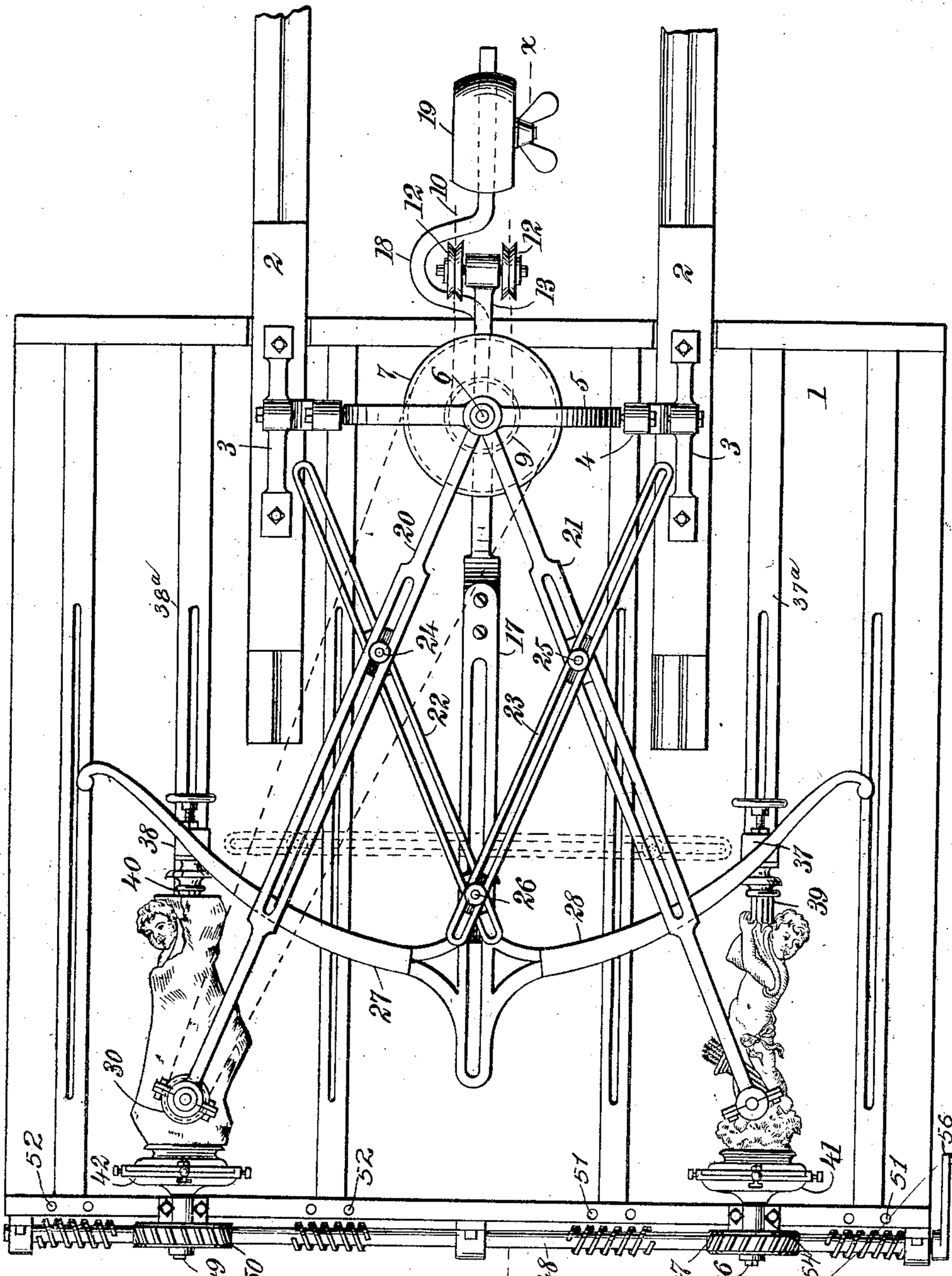

Fig. 1

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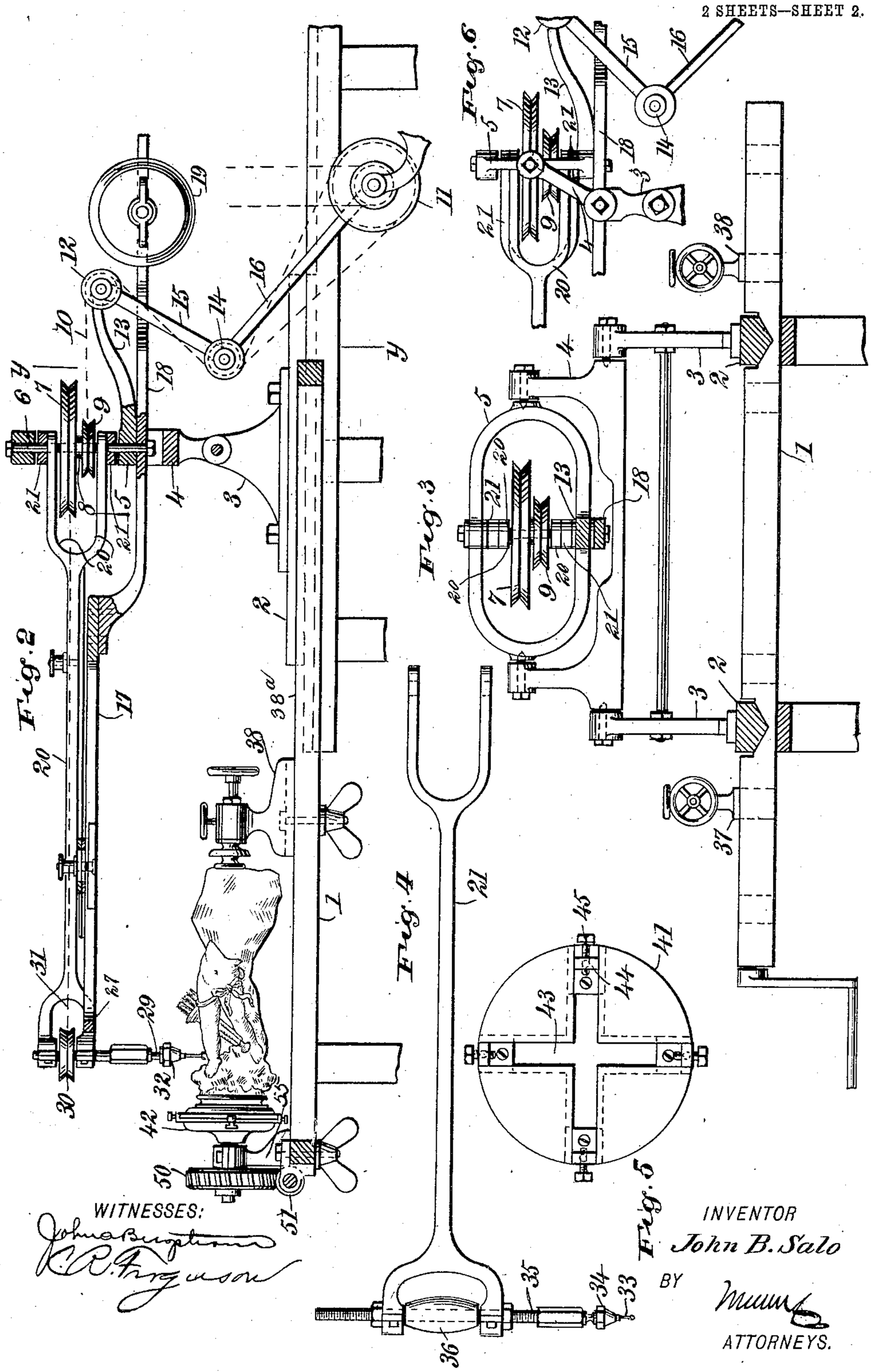

UNITED STATES PATENT OFFICE.

JOHN B. SALO, OF NEW YORK, N. Y.

SCULPTOR'S REPRODUCING-MACHINE.

No. 888,041. Specification of Letters Patent. Patented May 19, 1908.

Application filed September 16, 1902. Serial No. 123,585.

To all whom it may concern:

Be it known that I, JOHN B. SALO, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented new and useful Improvements in Sculptors' Reproducing-Machines, of which the following is a full, clear, and exact description.

This invention relates to a machine designed for use by sculptors and others in reproducing relief work, such as a model or the like, on any kinds of material, of either a hard or soft nature.

The improved machine of the present invention is designed to relieve the sculptor of the tedious and uninteresting labor of securing one or more accurate and faithful reproductions of the original model, which may be either a figure, panel, bracket or other object. In this invention, provision is made for copying the original either on the same scale, or on an enlarged or a reduced scale, as may be desired; and the working parts of the machine are so nicely adjusted and balanced that, without appreciable effort, the artisan is able to control the movement of the cutter at any and all stages of the work, in order to accurately follow the intricate and delicate delineations of the original. So thoroughly is the machine under control that the operator, if he is an expert in the art of carving, is able to produce the object directly on the material desired without the aid of any original model, and to create the forms and patterns as the work progresses, the same as he is able to do when carving by hand.

According to one embodiment of this invention, the machine employs a pantographic frame, one of the arms of which carries a tracer, while another arm is provided with a bearing for a high-speed rotary cutter, whereby the arms of said frame may be confined in movable relation to each other or in a fixed relation to each other, for the purpose of compelling the cutter to move in a path corresponding to the path of the tracer, thereby reproducing in the work the configuration of the model or pattern. The pantographic frame is supported in such manner that it remains normally in a substantially or approximately horizontal position, but this frame may be moved up and down, and it may also be swung on a vertical axis while remaining in such substantially horizontal position, whereby the tracer may readily follow the configuration of the pattern or model. The mount or supporting means for the pantographic frame is also movable freely on horizontal axes so as to shift the frame back and forth, and in addition to the described adjustments of the frame and its mount, said parts are capable of a bodily sliding movement in a horizontal plane by the provision of a carriage which is slidable in a predetermined horizontal path, in order that the entire frame and mount therefor may be moved to allow it to be used to the best advantage on work of different sizes.

Provision is made for holding the work and the model independently of each other in the machine, each holding means being adjustable in two directions for carrying objects which may vary in size (lengthwise and in width). The holding devices for the work and for the model are adjustable simultaneously for the purpose of bringing different sides of the work and the model into position for access by the cutter and the tracer, respectively, so that a change in the position of the model will correspondingly change the position of the work.

In connection with the pantographic frame and the rotary cutter carried thereby, I employ a cutter driving mechanism which is effective in propelling the cutter irrespective of any change in the horizontal or the vertical positions of the frame and the tool.

Further objects and advantages of the invention will appear in the course of the subjoined description, and the actual scope thereof will be defined by the annexed claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, wherein like characters of reference are used to indicate corresponding parts in all the figures.

Figure 1 is a plan view of a sculptor's reproducing machine constructed in accordance with my invention and illustrating the process of reproducing a relief figure from an original model. Fig. 2 is a vertical longitudinal sectional view, the plane of the section being indicated by the dotted line x—x of Fig. 1. Fig. 3 is a vertical transverse section in the plane of the dotted line y—y of Fig. 2. Fig. 4 is a detail view in side elevation of that arm of the pantographic frame which carries the tracer and the means for adjusting the tracer so as to vary the eleva-

tion of the pantographic frame. Fig. 5 is an enlarged detail view, in front elevation of a revoluble part adapted to clamp either a model or the block of work. Fig. 6 is a detail side view showing the positions of a part of the pantographic frame, the mount therefor, and the cutter driving mechanism on the inward movement of the parts when the tracer is pushed away from the operator.

In carrying my invention into practice, I provide a suitable base on which is mounted a slidable normally stationary carriage that carries the mount for the pantographic frame. As shown by the drawings, the base 1 is in the form of a skeletonized frame comprising suitable longitudinal and cross bars united one to the other to produce a rigid firm structure. The bars of this frame, at the middle and rear portions thereof, are provided with suitable slide-ways, grooves or channels, shown more clearly by Figs. 1 and 3, for the accommodation of a slidable carriage, herein shown as consisting of rails, 2, that are confined in the slideways for endwise movement freely therein. From the parts of the slidable carriage 2, rise the posts or brackets, 3, which are made fast with the carriage so as to travel therewith, but normally the carriage and the brackets are at rest on the base 1, owing to the weight of the parts, although under certain conditions the carriage and the parts mounted thereon may be moved longitudinally of the base. The brackets on the slidable carriage carry the mount for the frame, said mount consisting of two members which are connected pivotally one to the other and one of said members being pivoted on the brackets, the axes of the two members being parallel and each of said members being free to move independently of the other so as to maintain the pantographic frame in the desired horizontal position while allowing it to move freely up and down with the parts comprising the mount. One member, 4, of the mount is in the form of a yoke which has pivotal connection with the brackets, 3, and said yoke-shaped member has upstanding arms in which is pivoted the loop-shaped member 5 of the mount, the pivots of said member, 5, being located above and parallel to the pivots of the yoke 4, as shown in Fig. 3. The looped member 5, is free to turn on its pivots within the yoke member 4, but under certain conditions, said member 5 will swing with the member 4, in the practical operation of the apparatus. The member 5 of the mount affords a support for a spindle that serves as the axis of movement for the pantographic frame and as the center of rotation for the driving pulley for the revoluble cutter, said spindle being shown in Figs. 2 and 3 of the drawings in the form of a bolt, 6, that is attached to the upper and lower bars of the looped member 5. On this bolt or spindle is loosely mounted a compound pulley, herein shown as consisting of a large pulley 7 and a smaller pulley 9, the two being made fast one with the other in a suitable way, as for example by the employment of a sleeve, 8, that is fitted loosely on the spindle.

Extending rearwardly from the lower part of the loop member 5 of the mount is an arm, 13, which at its rear end carries a pair of idle direction pulleys, 12, 12, see Figs. 1 and 2, and around the small member 9 of the compound loose pulley on the shaft or spindle, 6, runs the bight of an endless driving belt, 10, the latter running over the direction pulleys, 12, and driven by a main pulley 11, that is suitably mounted to be driven by a belt from an overhead line-shaft (not shown), or by any other suitable means.

The distance between the pulleys 9 and 11 may be changed in wide limits by the movement of the mount and the pantographic frame under the manipulation of the tracer in following the outlines of the pattern or model, and to avoid slack in the drawing belt, 10, I employ a toggle device consisting of the members 15, 16 and the direction pulleys, 14. The link, 16, of the toggle device is free to turn on an axis coincident with that of the main pulley, 11, while the link, 15, turns on the spindle or arbor that supports the direction pulleys, 12. The links, 15, 16, are connected pivotally one to the other by a bolt that supports the direction sheaves, 14, the latter being located below and in the vertical plane of the pulleys, 12, thus affording a proper means for directing the belt, 10, and for taking up slack therein on the forward or backward movement of the pantographic frame in a horizontal plane or in a vertical plane. By reference to Fig. 2 it will be seen that the links of the toggle lie at an angle one to the other when the pantographic frame is in a certain position, as when the cutter is operating at an end portion of the work; but when the cutter is moved rearward by the frame and by the tracer following a different part of the work, the two-part mount and the arm 13 are moved in a corresponding direction, thereby moving the pulleys, 12, 14, and the toggles in a corresponding direction, the links 16 swinging on the shaft of the pulley 11. As the frame is raised or lowered, the links move toward or from one another, but under all changes in the position of the frame, the pulleys 14 keep the belt 10 in a taut condition.

The pantographic frame consists of the arms 20, 21, and the links 22, 23, the parts being connected pivotally one to the other to make them work in a well known way for controlling the position of the high-speed rotary cutter, said cutter being shiftable in unison with the adjustment of a tracer that is adapted to follow the lines of the original model or pattern. Each arm 20, 21, of the frame is provided with the forked or bifur-

cated end portions or yokes of the character shown more clearly in Figs. 2 and 4 of the drawings, and the forks at the inner ends of the two arms 20, 21, are fitted loosely on the spindle or bolt 6 in a way to straddle the double pulley thereon, as clearly shown in Figs. 2 and 3 of the drawings. The arms of said frame are thus mounted on an axis coincident with that of the double pulley, and said frame is thus capable of a swinging movement in a horizontal plane without causing slack in a belt 31 which serves to transmit the motion of the double pulley from the member 7 thereof to the cutter-driving pulley, 30. The arm 20 of the frame is united to the link, 22, by a pivotal block connection 24 which is adjustable in longitudinal slots that are provided in said arm and the link, as shown in Fig. 1, the parts being disposed in crossing relation, as shown. The arm, 21, and the link, 23, are also provided with longitudinal slots and disposed in crossing relation, and these parts are united by a pivotal block connection, 25, whereby the several members of the frame are connected operatively one to the other.

It will be observed that the arms, 20, 21, of the frame are connected pivotally at a fixed point to the member, 5, of the two part mount, and to sustain the weight of the frame I employ a supporting bar, 17, which is made fast with the member 5 and which projects forwardly or outwardly therefrom. This bar is provided with a longitudinal slot, as shown by Fig. 1, and with the laterally extending members, 27, 28, said bar and the members thereof lying below the parts of the frame so that they may rest on and be supported by the bar and its parts. The links, 22, 23, are inclined oppositely and cross at their outer ends over the slotted part of the bar, 17, and said links and the bar are connected pivotally by a block connection 26, which is free to ride or play in the slot of the supporting bar, 17, although this pivot block connection may be removed from engagement with the slotted bar, 17. The arms, 20, 21, extend across the members, 27, 28, of the supporting bar for a considerable distance, and at its free end, the arm 20, is equipped with bearings for the cutter-shaft, 29, while the arm 21 carries the tracer, 33. The supporting bar, 17, and the weight of the pantographic frame is balanced by the employment of a counterpoise, 19, which is clamped adjustably to an arm 18, that extends rearwardly from the member 5, of the mount. It will be noted that the supporting bar, 17, and the pantographic frame are disposed on one side of the pivots of the mount, while the counterpoise is on the other side of the pivots, whereby the counterpoise is adapted to balance the weight of the frame and to insure easy motion to the frame in its manipulation by the hand of the operator.

The tracer, 33, is held in a suitable form of chuck, 34, that is attached to the lower part of a threaded spindle, 35, the latter passing through alined openings in the forked end of the arm, 21. This spindle has nuts screwed thereon for engagement with the branches of the forked end, as shown by Fig. 4, and on this threaded spindle is screwed a revoluble adjusting sleeve, 36, the latter being confined within the branches of the forked end of the arm, 21. The nuts or collars and the handle-sleeve are so arranged on the threaded spindle that the latter may be raised or lowered by rotating the sleeve, 36, which also affords a means whereby the operator is able to conveniently grasp that part of the machine which is to be manipulated by the hand. It will be seen that the sleeve may be turned in one direction to lower the spindle and the tracer which effects a corresponding elevation of the pantographic frame and the cutting tool, but by turning the sleeve in the other direction, the spindle and the tracer are raised for correspondingly lowering the frame and the cutter. A very slight adjustment of the handle sleeve is all that is necessary, as a rule, for changing the elevation of the frame and the cutter, but in all raised or lowered positions of the frame, and in any back or forth horizontal movement which may be given thereto by the operator when holding the sleeve, the cutter is rotated at the required speed through the belts and the pulleys, without causing slack in the belts.

It will be noted that the transmission gear herein disclosed as one embodiment of this invention contemplates the employment of pulleys which vary in size and are arranged to very greatly increase the speed of the cutter-driving pulley, 30, as compared with the speed of the main pulley, 11.

The cutter-shaft, 29, is journaled for free rotation in appropriate bearings provided in the outer forked end of the arm, 20, and this shaft is provided at its lower end with a chuck, 32, in which is held a suitable form of cutter tool, as shown in Fig. 2. It is evident that a cutter-tool of one character may be removed and another kind of tool secured in the chuck, thus making provision of interchanging the tools to suit different materials and kinds of work.

My machine is equipped with two sets of holding devices, one of which is designed to receive the model or pattern that is adapted to be traversed by the tracer, 33, while the other holding device receives the block of material in which is to be cut the counterpart of the model by the operation of the cutter head in the chuck, 32, of the cutter-shaft 29. Each work-holding device is adapted to be adjusted lengthwise and crosswise of the base, to accommodate the device to models or blocks of work which may vary in size within the capacity of the machine,

and the two holding devices are connected operatively with one another to insure simultaneous and uniform adjustment to the model and the work.

At one end of the base, 1, are provided the sets of bolt-holes, 51, 52, and on the base are provided the longitudinal slots or guide-ways 37^a, 38^a, the latter being in alinement longitudinally with the respective sets of bolt holes, 51, 52, as shown in Fig. 1. In either of the guide ways, 37^a, is fitted the slidable base, 37, of a head stock having a center screw, 39, adapted for engagement with one end of the model, as shown in Fig. 1. With this head stock coöperates a chuck, 41, see Figs. 1 and 5, the same being provided with a plurality of radial grooves, 43, in which are fitted the slidable jaws 44, that are held in adjusted positions by the set screws 45. The chuck, 41, is made fast with a short shaft, 46, journaled in a bearing of a bracket or base, 54, that is bolted to the base, 1, by bolts which may pass through either of the openings 51. It is evident that the bracket, 54, may be shifted to positions over either of the other sets of openings, 51, of the base and be fastened in different positions thereon. Similarly, the head stock may be adjusted to fit either of the guide-ways, 37^a, so as to aline with the chuck, whereby the holding device for the model may be adjusted on the base to suit the different sizes of models. For holding the block of material in which the model is to be reproduced, I provide the head stock, 38, and the chuck, 42, the same being disposed in alined coöperative relation on the base, 1, so as to be traversed by the cutter of the shaft, 29. The base of the head-stock for the work holding device may be secured adjustably to either of the guideways, 38^a, on the base by means of the clamping screw shown by Fig. 2. The chuck, 42, for said work-holding device is similar in construction to the chuck shown in Fig. 5, and it is attached to a short shaft, 49, that is journaled in a bearing, the latter being provided at the upper part of the bracket or base, 55, which may be fastened by bolts adapted to pass through either set of bolt-holes, 52, provided on the base 1, of the machine. The members comprising the holding device for the block of material to be cut may be fastened to the base 1 to suit the different sizes of the blocks of material, and it will be noted that the chucks can be adjusted crosswise of the bed 1, while the head stocks may be adjusted both crosswise and lengthwise of the base.

The shafts, 46, 49 of the two chucks, 41, 42, are equipped with worm gears, 47, 50, respectively, and these gears are arranged to mesh with right and left hand worms on a horizontal adjusting shaft, 48, the latter being journaled crosswise of the base, 1, at one end of the machine. The shaft is provided with three right hand worms with which the worm gear of one chuck is adapted to engage in either of the adjusted positions of the chuck, and similarly the shaft, 48, is equipped with three left hand worms, with which the worm gear of the other chuck may engage when the latter occupies one of its adjusted positions on the base 1. This worm-shaft is provided with a hand crank, 56, or its equivalent, for the convenient manipulation of the shaft, and by giving a quarter turn to the shaft, the gears of the chucks impart a quarter turn simultaneously and equally to the two chucks which coöperate with the head stocks in holding the model and the block of material.

The operation of the machine may be described as follows:—The chucks and the head stocks having been set in proper positions on the base, 1, the model and the block of material are fitted between the chucks and the head stocks of the holding devices for the model and the work, respectively. In placing either the model or the block of material in position, the operator sets the base thereof against the face of the proper chuck as centrally as possible with respect thereto, the jaws are moved inwardly to engage with the model or the work, they are fastened by the screws, 45, and the screw of the head stock is centered on the model or the work, whereby the parts are held in the machine below the tracer and the cutter which are carried by the pantographic frame. The operator stands at the front end of the machine, and with his right hand he grasps the handle-sleeve, 36, of the tracer, and with the left hand the forked end of the arm, 20, in which is journaled the cutter-shaft, 29. Motion is now communicated to the cutter shaft through the driving belts, 10, 31, and before proceeding to execute the work, the operator determines whether the cutter is in proper relation to the tracer so as to make the tool cut into the work when the tracer touches the lines of the model. If it is found that the cutter does not properly correspond to the tracer so as to cut into the material when the tracer touches the work, the operator turns the sleeve, 36, to the left causing the tracer 33 to rise and consequently lower the pantographic frame and the cutter, but if it is found that the cutter extends too far below the tracer, the sleeve is turned in an opposite direction for elevating the frame and the cutter. After having adjusted the parts, the operator proceeds with the work of carving the reproduction of the model in the block of material, and in doing this, the tracer is made to follow the outlines of the model and is given a gyratory motion by the right hand of the operator. This motion of the tracer is communicated to the frame and through the latter to the cutter, which in turn operates on the block of material so as to cut the latter in imitation of

the work, but owing to the action of the pantographic frame on the cutter, the latter cuts the copy or reproduction in the block of material the reverse of the model, that is to say, if the model is "right" the cutter produces a "left" copy in the work. The tracer is manipulated by the right hand to follow the model, while the frame and the tool are steadied by the left hand of the operator grasping the frame at the forked end of the arm 20, thereof. The frame is free to have practically universal movement owing to the employment of the peculiar form of the mount having two members which are movable independently and on horizontal axes, which mount permits the counterpoised frame to be raised or lowered and to be moved horizontally back and forth, while at the same time, the frame is free to swing in a horizontal plane, on a vertical axis afforded by the spindle, 6.

It will be noted that the frame and the cutter may be adjusted to a limited extent and in a vertical direction by the manipulation of the sleeve, 36, while the entire frame and the mount may be moved horizontally toward or from the operator simply by pushing or pulling on the frame in an obvious manner. A slight backward or forward movement of the frame and its parts, shifts the looped member, 5, on its pivot without disturbing the member 4, while a further movement of the frame moves the two members, 4, 5 substantially as shown in Fig. 6; but a slight or extended movement of the frame in a back or forth direction has no effect on the driving belts for the operation of the cutter owing to the provision of the links, 15, 16, and the pulleys, while the swinging adjustment of the frame on the pivot, 6, allows the belt, 31, to be driven at all times by the pulleys, 7, 9.

The described method of adjusting the frame, allows the tracer and the cutter to travel over one quarter or one third of the surfaces of the model and the work, but when the limit has been reached, the operator can push backward on the frame so as to give a sliding movement to the shiftable carriage, 2 and the posts, 3, thus bringing the tracer over another part of the model and allowing the cutter to traverse another part of the block of material. In adjusting the frame and the carriage lengthwise of the base, the operator can push on the supporting bar 17 which acts against the mount, 4, 5, and the latter in turn pushes on the carriage so as to slide it on the base, thereby bodily adjusting the operating parts of the machine over the model and the work. The operations of following the model and cutting the block may now be resumed until one side of the work is finished, after which the operator should turn the crank and the shaft, 48, which causes the two worms to turn the chucks, 41, 42, equally and simultaneously, thereby bringing other sections of the model into view and other parts of the work into position below the cutter. The operations of following the model and cutting the work may now be proceeded with as before, and finally the crank-shaft is again turned to bring the unfinished work and the hitherto inaccessible parts of the model into view, whereby the work of cutting the block may be performed accurately and expeditiously.

As thus far described, the pantographic frame controls the movement of the cutter by the shifting travel of the tracer in a way to carve the reproduction of the model in the reverse of said model, but should the operator desire to enlarge or reduce the reproduction as compared with the model, the pantographic frame must be adjusted to secure this end, although such adjustment may result in a slight distortion of the reproduction. The pivot block connections 24, 25, must be unscrewed and adjusted lengthwise in the slots of the arms and the links so as to unequally fulcrum the several members of the frame with relation one to the other, that is to say, the pivotal connection 24 may be moved towards the cutter-spindle, while the set screw, 25, is shifted toward the pivotal spindle, 6, or vice versa as the case may be, for which purpose the slotted members of the pantographic frame may be provided with graduations to indicate the extent of adjustment of the pivotal connections. While the pivotal connections, 24, 25, may be adjusted to change the leverage of the frame, the connection, 26, between the frame and the slotted bar, 17, should not be disturbed, thus allowing the connection, 26, to slide freely in the groove or said bar in the usual way. Should it be desired to carve the work in the block of the same size and position as the model, and in every respect like the model, the pantographic frame should be adjusted to maintain the arms, 20, 21, in fixed relation. To accomplish this end, the pivotal connections, 24, 25, and 26 should be removed from the pantographic frame, the links, 22, and 23, lifted off, and one of the links should be placed across the slotted arms 20, 21, as indicated by dotted lines in Fig. 1, after which the arms and the cross link should be fastened firmly one to the other, as by the screw bolts, thereby uniting the parts firmly and arresting the operation of the frame as a pantograph.

It will be understood that any suitable kind of chuck may be supplied to the tracer and the cutter-shaft, and this is advantageous in connection with the chuck 32 of the shaft because the shank of any kind of tool may be gripped firmly in the chuck. By changing the cutters, and by using cutters of different kinds, the machine may be made to operate in hard materials such as wood, ivory, stone, marble, and metal; but the use

of other kinds of cutters allows the machine to carve or cut such materials as plaster, meerschaum, and soft materials, thus enabling the machine to be used to good advantage by sculptors, wood carvers, routers, engravers, die sinkers, modelers, pattern makers, marble cutters, and in many other lines of industry.

Changes in the form, size, proportion, and the minor details may be made without departing from the spirit or sacrificing the advantages of my invention, and I therefore reserve the right to make such modifications as fairly fall within the scope of the invention defined by the annexed claims.

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

1. In a reproducing machine, a mount having a plurality of members each pivoted for movement on a horizontal axis, a pantograph having a single pivotal connection with one member of said mount, the pivot of the pantograph being at an angle to the pivot of each member of the mount, and a tracer and a cutter both supported by said pantograph.

2. In a reproducing machine, a horizontal carriage, a mount pivoted for movement on a horizontal axis, a pantograph connected by a vertical pivot to said mount, means carried by said mount and supporting said pantograph, the latter being free to move relative to said supporting means in a path parallel to the carriage, and a tracer and a cutter supported by said pantograph.

3. In a reproducing machine, a rocking mount pivoted for movement on a horizontal axis, a tracer-carrying arm supported by said mount, a tool-carrying arm also supported by the mount, means connecting said arms whereby they are adapted for movement in unison, a work holder, a pattern holder, and means whereby the aforesaid holders and the aforesaid arms are adapted for relative adjustment in a horizontal plane one to the other.

4. In a reproducing machine, a work holder, a pattern holder, a carriage slidable relative to said holders, a mount pivotally supported on said carriage for rocking movement on a horizontal axis, a frame supported by the mount, and a tracer and a cutter on said frame.

5. In a reproducing machine, a carriage, a mount consisting of two members, the first pivoted to the bed and the second pivoted to the first, the pivots of said members being parallel, a frame pivoted to the second member of the mount, means carried by the second member and supporting said frame, and a tracer and a cutter on said frame.

6. In a reproducing machine, suitable work and pattern holders, a carriage adapted for movement in a horizontal plane, a mount pivotally supported on a horizontal axis for movement relative to said carriage, tracer and cutter arms each pivoted to said mount for movement on a vertical axis, a cutter on one arm, and means for rotating said cutter, whereby a relative movement in a horizontal plane may be secured between the aforesaid holders and said arms, and the arms may be raised, lowered, and also swung in horizontal paths independently of the aforesaid horizontal movement.

7. In a reproducing machine, a rocking mount pivotally supported for movement on a horizontal axis, a tracer-arm, a tool-arm, said arms being pivoted to the mount for swinging adjustment relative thereto on a substantially vertical axis, another arm attached to said mount, and operative connections between said last mentioned arm and the two aforesaid arms whereby said tool-arm and the tracer-arm are adapted for conjoint operation.

8. In a reproducing machine, a rocking mount pivotally supported for movement on a horizontal axis, tracer and tool arms pivoted to said mount for movement on an axis substantially at right angles to said axis of the mount, an arm connected rigidly to the mount, a slide on said arm, and connections from the slide to the tracer and tool arms whereby said arms are adapted for conjoint operation.

9. In a reproducing machine, a horizontal bed, a carriage slidably mounted on the bed for movement in a horizontal plane, a mount supported pivotally on the carriage for movement on a horizontal axis, a tool-carrying arm pivoted to the mount, a tracer-carrying arm also pivoted to the mount, the pivot of said arms being at an angle to the pivot of the mount, and means connecting the two arms for insuring conjoint movement thereof.

10. In a reproducing machine, a rocking mount supported pivotally for movement on a horizontal axis, a pivoted frame carried by said mount, the pivot of said frame being at an angle to the pivot of said mount, a cutter on said frame, a tracer mounted on the frame, separate holders adapted to support work and a pattern in coöperative relation to the cutter and tracer, respectively, and hand-operated adjusting means coöperating with the tracer and the frame for raising and lowering the latter at will relative to said holders.

11. In a reproducing machine, a slidable carriage, a mount pivoted on the carriage, and a counterpoised supporting bar carried by said mount, in combination with a frame movable freely on said bar and pivoted to the mount, a tracer and a cutter carried by different members of said frame, and means for rotating said cutter.

12. In a reproducing machine, a shiftable mount, and a counterpoised supporting bar carried by said mount, said bar having laterally extending members, in combination

with a pantographic frame pivoted to the mount and engaging shiftably with said later ally extending members of the supporting bar, a cutter mechanism on the frame, and a tracer for controlling the position of the cutter through said frame.

13. In a reproducing machine, a rocking mount pivotally supported for movement on a horizontal axis, a supporting bar carried by and movable with said mount, said bar having a longitudinal slot, a pantograph having converging arms, a single pivot connecting said converging arms of the pantograph to said mount, a slidable block on said bar, means connecting the converging arms of the pantograph with said slidable block, and a cutter on said pantograph.

14. In a reproducing machine, a rocking mount pivotally supported for movement on a horizontal axis, an arm rigidly connected to said mount, tracer and tool arms pivoted to said mount, operative connections between the first named arm and the tracer and tool arms, and means for counterbalancing the weight imposed by said arms on one side of the rocking mount.

15. In a reproducing machine, the combination of a two-part mount each member of which is pivoted to swing on a horizontal axis, a counterpoised pantographic frame having a single pivotal connection with one member of said mount to swing on a vertical axis, the members of said frame being connected adjustably together, a tracer carried by one member of the frame, and a cutter mechanism revolubly mounted on another member of the frame.

16. In a reproducing machine, a main driving shaft, a rocking mount provided with an arm, links pivoted together at their adjacent ends and having their other ends pivoted to the aforesaid arm and on the driving shaft, respectively, direction pulleys at the pivotal connections of the links to each other and of one link to said arm, a double driving pulley supported on the mount, a pulley on the main shaft, a belt fitted to the main pulley, the direction pulleys and one member of the double pulley on the mount, a frame carried by the mount, a cutter on said frame, and another belt connecting the cutter with the other member of the aforesaid double pulley.

17. In a reproducing machine, a horizontal bed, a carriage shiftable thereon, a mount consisting of first and second members, the first of which is pivoted to the carriage and the second is pivoted to the first member, both pivots having horizontal axes, a frame supported by the second member of the mount and connected pivotally thereto for movement in a horizontal plane, a cutter on said frame, and a tracer carried by the frame.

18. In a reproducing machine, a bed, a carriage, a mount pivotally supported on said carriage for movement on a horizontal axis, a carrying bar connected to said mount for movement therewith, a tracer arm pivoted to the mount and engaging with the carrying bar, a tool-arm also pivoted to the mount and engaging with the carrying bar, and means connected with the carrying bar and with both of said arms for insuring the movement of the tool-arm simultaneously with the tracer-arm.

19. In a reproducing machine, a pivoted mount, a carrying bar connected to said mount for movement therewith, a member slidable on said bar, a tracer-arm pivoted to the mount, a tool-arm pivoted to the mount, and devices connecting the slidable member and the aforesaid arms for moving the tool-arm simultaneously with the tracer-arm.

20. In a reproducing machine, a pivoted mount, a carrying bar connected to said mount for movement therewith, a tool-arm pivoted directly to said mount, a tracer arm also pivoted directly to said mount, said tool-arm and the tracer-arm being supported partly by the carrying bar, means connected to said bar and to both arms for moving the tool-arm simultaneously with the tracer-arm, and means for counterbalancing the weight of said arms and the carrying-bar on the pivoted mount.

21. In a reproducing machine, a mount pivoted for movement on a horizontal axis, a carrying bar connected to said mount and provided with a counterpoise, a member slidable on the bar, tool and tracer-arms pivoted to said mount, said arms being supported partly by said carrying bar, and means connected with the slidable member and with said arms for making said connected arms operate in unison.

22. In a reproducing machine, a mount pivoted for movement on a horizontal axis, a bar connected to said mount, a member slidable on said bar, tracer and tool arms resting on the aforesaid bar and each pivoted to said mount, the pivotal connection of the arms to the mount being at an angle to the axis of pivotal movement of the mount, and other arms connecting said slidable member to the tracer arm and the tool arm.

23. A reproducing machine having a two-part mount the members of which are pivoted for movement on horizontal axes, a spindle in one of said mount members, a supporting bar on said mount member, a frame fitted on said spindle for movement in a horizontal path and supported by said bar, a cutter on the frame, a driving member revoluble on the spindle and connected operatively to the cutter, and a tracer.

24. A reproducing machine having a two-part mount, the members of which are pivoted separately for movement on horizontal axes, a spindle on one part of the mount, a counterpoised supporting bar carried by said mount member, a pantographic frame sup-

ported by the bar and having two of its members pivoted on said spindle, a cutter on one of the members of the frame, and a tracer on another member of the frame.

25. A reproducing machine comprising a base, carriage-bars mounted to slide on said base, standards on said carriage-bars, a mount member supported to rock in the standards, another mount member pivoted to rock in the first named member, a spindle supported in the second named mount-member, a driving pulley mounted to rotate on the spindle, a tool-carrying arm mounted to swing on the spindle, a cutter-shaft carried by said arm, a band connection between the cutter-shaft and the pulley, a driving pulley, a driving belt connection between said driving pulley and the first named pulley, a take-up pulley for said driving-belt, a tracer-carrying arm, and means for adjusting said tracer-carrying arm relatively to the first-named arm.

26. A reproducing machine comprising a base, a carriage movable along the base, a two-part mount supported by the carriage to swing relatively thereto, a bar extending forward from a member of the mount, laterally extended members on said bar, a tool-carrying arm pivoted to swing relatively to the mount and supported by one of said laterally-extended members, a tracer-carrying arm pivoted to swing relatively to the mount and bearing on the other of said laterally extended members, and means for causing relative adjustments between the several arms.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN B. SALO.

Witnesses:
WILLIAM A. FREISE,
FRANCIS J. MAUBORGNE.