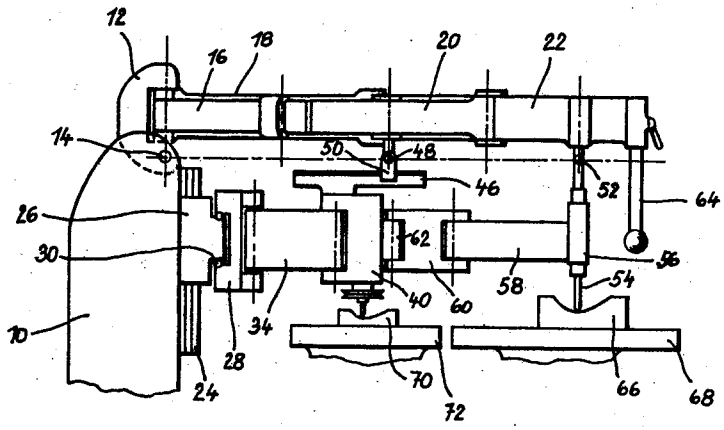
March 31, 1964 K. ZWICK 3,126,792

ENGRAVING AND COPYING MACHINE

Filed Sept. 5, 1961 2 Sheets-Sheet 1

Fig. 1



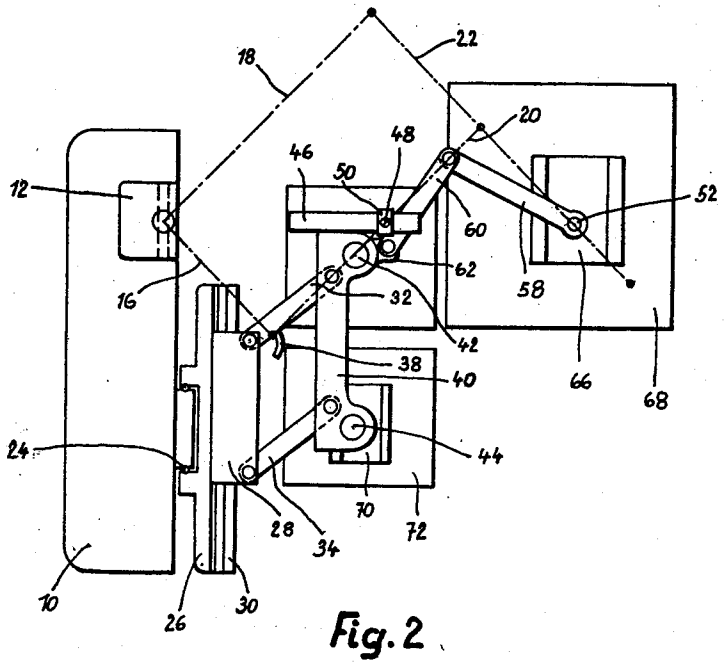


Fig. 2

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Fig. 3

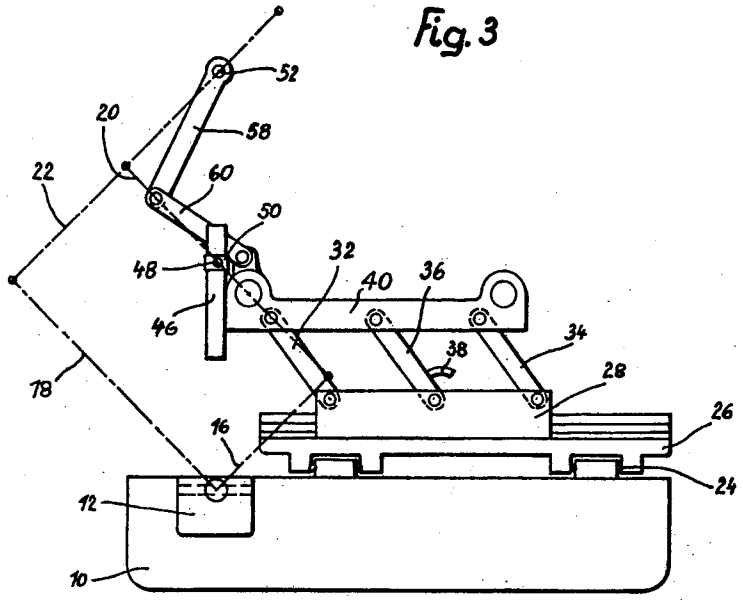
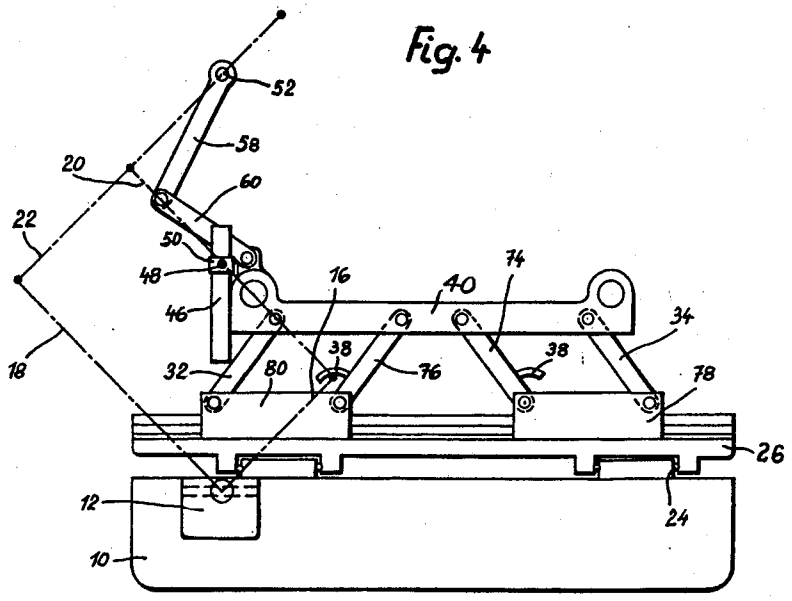


Fig. 4



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3,126,792

ENGRAVING AND COPYING MACHINE

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1 Claim. (Cl. 90—13.1)

The invention relates to an engraving and copying machine with a movable beam, fitted with holders for tools and tracing stylus, which is guided in parallel to itself.

In engraving and copying machines in the prior art, such as represented by U.S. Patent 2,176,193, granted to Kurt Zwick, on October 17, 1939, the parallel guidance of the tool and stylus carrying beam was formerly attained by constructing it either as a cross slide or by guiding it with several control arms or levers disposed in double parallelogram form. In the former case, the slide which is movable diagonally to the beam projects into the machine stand and thus it requires more expensive guidance mechanism. In the latter case, the stable guidance required of the machine for a large shaving removal can only be obtained by use of special high-grade and thus expensive control levers or arms, since many levers are necessary in the parallelogram linkage type machine.

On the other hand, a more economical parallel beam guidance has been obtained as taught by U.S. Patent 2,371,941, granted to Kurt Zwick, on March 20, 1945, wherein two or more control levers or arms, arranged in only one parallelogram mechanism, carry a slide conveyor whereon the tool and stylus holder carrying beam slides shiftably alongside. However, this arrangement appears disadvantageous because the control levers or parallelogram arms must carry the comparatively great weight presented by the slide conveyor and the tool carrying beam. In addition, the distance between the tool and the points of the slide conveyor supported by the control levers or arms changes currently during the operation of the machine by the displacement of the beam on the slide conveyor, and this produces variable torsion moments in the control levers and affects the stability of the mechanism. Further, the slide conveyor reciprocating in an arc in the space above the workpiece and the pattern must have such a length that it should enable the beam guided thereon to operate within a shifting range of a length of approximately the distance between the tool and tracing stylus. This construction thus affects the observation of the tool and the pattern.

One of the objects of the invention, therefore, is to provide a construction of mechanism for supporting a parallel-motion beam in an engraving and copying machine in which less weight is supported by said mechanism to provide more stable movement thereof.

Another object of the invention is to provide a construction of parallel-motion beam support mechanism for engraving and copying machines in which no torsion moments are imparted to the mechanism during manipulation of the same, so as to render the translatory movements thereof more precise and the mechanism more freely movable in three-dimensional space.

A further object of the invention is to provide a construction of engraving and copying machine having a parallel-motion beam mechanism in which the observation of the workpiece and pattern is facilitated.

Other and further objects of the invention reside in the arrangement of the members comprising the beam supporting mechanism in the several forms of the invention shown as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which;

FIG. 1 is a fragmentary side elevation view of an engraving and copying machine showing the parallel-motion beam supporting mechanism of the invention;

FIG. 2 is a top plan view of the machine of FIG. 1, with the control pantograph linkage indicated diagrammatically by dot-dash lines for purposes of clarity;

FIG. 3 is a top plan view similar to FIG. 2, but showing a modified form of the invention; and

FIG. 4 is a top plan view showing another modified form the invention.

The present invention is applicable to engraving and copying machines of various types and for purposes of illustration it is here shown as applied to machines of the general type disclosed in U.S. Patents 2,176,193 and 2,371,941, and, insofar as details of the construction and operation of the present machine are not disclosed in the present application, such details may be the same as those disclosed in said patents.

Throughout the several views similar reference numerals refer to similar machine elements. At the top of a machine stand or frame 10 a support 12 is swingably mounted to pivot around a horizontal axis 4. A pantograph linkage of the lazytongs type, formed of members 16, 18, 20 and 22, pivoted to each other in the familiar manner with the ends of the member 20 being adjustable lengthwise along the adjacent members 16 and 22 in known manner, is pivotally mounted on the support 12 on an approximately vertical pivot carried thereby. The pantograph linkage, for purposes of illustration, is represented only schematically in FIGS. 2, 3 and 4.

A vertical guideway 24 is secured to the machine frame 10 and a slide member 26 is connected to slide on guideway 24 in the vertical plane. A horizontally disposed guideway 30 is carried on the front face of slide member 26 and a horizontal slide member 28 is connected to slide longitudinally along guideway 30 in the horizontal plane.

A pair of arms 32 and 34 arranged parallel to each other are each pivoted on one end on vertical pivots carried by the forward face of horizontal slide member 28, and the opposite ends of arms 32 and 34 are connected to vertical pivots carried by a shiftable beam 40. With this arrangement the members 28, 32, 34 and 40 together form what may be termed a single parallelogram linkage arranged so that the beam 40 may swing in an arc when the arms 32 and 34 swing about their pivots on horizontal slide 28 and beam 40, while the beam remains disposed parallel at all times to horizontal slide 28 and all of the possible selected positions the beam itself may assume throughout its arcuate movement. In order to avoid a dead position of the beam 40, a dog 38 is connected on one of the hinged arms and is disposed to abut the forward face of the horizontal slide member at a selected point in the arc of movement of the beam 40.

The shiftable beam 40 may carry any desired number of holders or sockets for receiving a cutting tool, and at least one holder or socket in which a tracing stylus may be placed. Some, or all of these sockets, or holders, may be constructed to receive interchangeably either a cutting tool or a tracing stylus. For purposes of illustration, in the drawings, I have shown the beam 40 carrying holder 44 at one end of the beam adapted to receive the power driven rotary spindle of a cutting tool, and carrying a second holder 42 at the other end of the beam adapted to receive interchangeably either a tracing stylus or a second cutting tool.

A horizontal bar 46, providing a guideway, is connected to the upper surface of shiftable beam 40 so that it is disposed at all times substantially normal to the horizontal axis 14. A slide block 50 is disposed to engage the guideway of horizontal bar 46 so that the block is shiftably adjustable to various positions thereon,

and the slide block 50 is pivotally connected to the recording point of the pantograph bar 20 at 48.

When the machine is used for making reduced scale reproductions, a tracing stylus 54 is pivotally mounted at 52 to the bar member 22 of the pantograph linkage and the tracing sytlus is held for sliding movement up and down in the vertical plane by means of a guide sleeve 56, through which the stylus extends, supported on one end of a horizontally swingable arm 58. The opposite end of arm 58 is hinged on a vertical pivot to a horizontally swingable linkage 60, which, in turn, is hinged on a vertical pivot carried by the shiftable beam 40.

A control handle 64 is adjustably attached to the end of pantograph bar 22 to depend therefrom, in a position adjacent to the tracing stylus 54, and is grasped by the operator for controlling and guiding the movements of the pantograph, tracing stylus, supporting arms, the shiftable beam carrying the cutting tool and the remainder of the parallelogram mechanism including the horizontal slide and vertical slide members. The weight of the vertical slide member 26 and the horizontal slide member 28, as well as the remainder of the parallelogram mechanism members, etc., supported therefrom, are counterbalanced by suitable spring or weight means as taught in U.S. Patents 2,176,193 and 2,371,941, so that only slight weight is supported by the pantograph linkage at points 48 and 52, thus making the entire assembly easy to manipulate by means of control handle 64.

When the machine is used for producing reproductions on a reduced scale, the pattern 66 is clamped on the model table 68 beneath the stylus 54 and the workpiece 70 is clamped on a work bench 72 beneath the cutting tool held by holder 44 on beam 40. By means of handle 64 the operator moves the stylus 54 over the contour of the pattern 66 and through the linkage arm, beam and slide member arrangement, the cutting tool traces the exact same movement and reproduces these movements on the workpiece 70. When the machine is to be used for enlarged scale reproductions, rather than reduced scale, then the positions of the pattern 66 and workpiece 70 are reversed and a cutting tool spindle is substituted in place of the tracing stylus 54 in guide slide 56 and a stylus is substituted for the cutting tool in holder 44. Whenever the pantograph member 20 is shifted along the members 16 and 22 to vary the ratio of reduction or enlargement, the position of the connection 48 at the recorded point is also shifted along the member 20 so that the recording point always lies on a line between the stylus connection at 52 and the vertical pivot point of the pantograph members 16 and 18 on support 12.

When operating the machine to produce reproductions of equal scale, the pattern is clamped on a table beneath the holder 42, alongside the table 72, and a tracing stylus is inserted in holder 42. As before, the workpiece is clamped on table 72 beneath a cutting tool held in tool holder 44. The pantograph members 16, 18, 20 and 22 need not be used for equal scale reproductions and may be temporarily removed from the machine, if desired, although it is sometimes convenient to leave these members in place and to use them for linkage effect in transmitting the hand movements, of the operator, to the stylus and cutting tool.

The shiftable beam 40, carrying the holders 42 and 44, may thus move in all directions in three-dimensional space with a pure movement of translation by means of control levers or arms 32 and 34, horizontal slide 28 and vertical slide 26, and is held at all times against any movement of rotation in the vertical plane and is disposed in the horizontal plane so that all positions of the beam are parallel to each other. Movements having a vertical component are accompanied by movements of vertical slide 26 on guideway 24 and movements of the beam 40, having a horizontal component, are accomplished by swinging the beam in a horizontal arc on the pivoted arms 32 and 34 or by moving the entire parallelogram mechanism 40, 32, 34 and 28 by sliding horizontal slide 28 horizontally along its guideway 30 supported by vertical guide 26. However, in most cases, horizontal movement of beam 40 is usually accomplished by a combination of these two movements.

In copying machines, as shown in FIG. 3, for handling comparatively large workpieces, the beam 40 must be appropriately longer in length and in order to impart a stable support to the beam it may be connected with a correspondingly longer horizontal slide member 28 by means of a third parallelogram linkage arm 36 hingedly connected between beam 40 and slide 28 in a manner similar to arms 32 and 34. The vertical slide member 26 and its guideway for horizontal slide 28, of necessity, will also have to be constructed longer in length as shown, and in order to provide stable vertical movement to the vertical slide 26 the beam may be supported to the machine frame 10 by means of a pair of vertical guideways 24, as shown in FIGS. 3 and 4, rather than a single guideway as shown in the preferred form of the invention in FIGS. 1 and 2.

In FIG. 4, I have shown a machine for handling larger type workpieces than could be conveniently handled by the machine shown in FIGS. 1 and 2, or the machine shown in FIG. 3. In this third form of the invention it will be noted that the vertical slide member and shiftable beam carrying the tool holder are of greater length than shown in the previous forms of the invention and the vertical slide is connected to the machine frame by a pair of guideways 24 in similar manner as shown in FIG. 3. In this form of the invention, the beam 40 is connected to the vertical slide member by means of two separate parallelogram linkages supported on the slide 26 by means of two horizontal slide members 78 and 80. The arms of the two parallelogram linkages are normally disposed in opposed relation to each other but at a point during their course of movement may become mutually parallel one with the other. The first parallelogram linkage is comprised of beam 40, horizontal slide 78, and control levers or arms 34 and 74, hingedly connected on vertical pivots intermediate the aforesaid members. The second parallelogram linkage is comprised of beam 40, horizontal slide 80 and control levers or arms 32 and 76, hingedly connected on vertical pivots therebetween. With this mechanism, beam 40 is free to move longitudinally in a horizontal plane with respect to the guideway of vertical guide 26 and the same may move toward or away from slide 26, while always remaining parallel thereto, and to all positions of the beam itself. For instance, for the beam 40 to move inwardly toward slide 26, horizontal slide 78 and 80 would move respectively away from each other to increase the acuteness of the inner angles between the slide 26 and the arms of the parallelogram mechanisms. As the beam 40 moves away from slide 26 to increase the horizontal distance therebetween, horizontal slide members 78 and 80 respectively move inwardly toward each other, until the maximum travel of beam 40 is attained, when parallelogram arms 32, 76, 74 and 34 are mutually parallel to each other and the dogs 38, carried thereby, are disposed in abutment with their respective horizontal slide members.

Thus, in the mechanism of the present invention, the majority of the weight of the parallelogram linkage is disposed immediately adjacent the machine frame on the vertical slide member to remove excess weight from the arms of the parallelogram linkage so that they only have to support the weight of the beam 40 carrying the tool holders. By thus reducing the weight supported by the parallelogram arms or levers the movement of translation of the mechanism is greatly stabilized and ease of operation is increased. The distance of the tool and stylus holders 42 and 44 to the points at which the control levers or arms are pivoted to the beam 40 remains constant at all times and thus no variable torsion moments

are imparted to the parallelogram arms during manipulation of the mechanism. The overall length of the beam which moves in an arc in the space above the workpiece and the pattern and which is carried by the control levers or arms is substantially confined to the distance between the tool holder 44 and the tracing stylus holder 42, thereby greatly facilitating the observation of the workpiece and pattern respectively positioned beneath the mentioned holders.

While I have described my invention in certain of its preferred embodiments I realize that modifications may be made, and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claim.

What I claim as new and desire to secure by Letters Patent of the United States, is as follows:

An engraving and copying machine comprising, a machine frame, a substantially vertical guideway on said frame, a first slide member connected for upward and downward movement along said vertical guideway, a substantially horizontal guideway on said first slide member longer than the working range of the copying machine in the direction parallel to said horizontal guideway, a second slide member movable along said horizontal guideway and provided with pivot connectors at each of its ends such that a line passing through the axes of the pivot connectors is disposed substantially parallel to said horizontal guideway, a pair of rigid lever arms, one end of each lever arm pivotally connected to opposite ends of said second slide member by said pivot connectors, a holder beam provided with pivot connectors adjacent each of its ends, the opposite ends of said rigid lever arms pivotally connected to said holder beam by said pivot connectors, said rigid lever arms forming a parallelogram with said second slide member and said holder beam, a rotary cutting tool connected to one end of said holder beam outwardly of the pivot connector, a pantograph pivotally mounted on said frame and carrying a recording point connected to said holder beam outwardly of one of its pivot connectors, and a tracing stylus connected to one end of said holder beam intermediate the recording point connection and the adjacent pivot connector for guidance by said pantograph whereby the working range of the rotary cutting tool in the direction parallel to said horizontal guideway is shorter than the length of said horizontal guideway, and the masses of said first and second slide members are disposed in close proximity to said machine frame.

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2,371,941	Zwick	Mar. 20, 1945
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