April 24, 1956 C. R. COMPTON 2,742,823

VERTICAL LIFT THREE DIMENSIONAL PANTOGRAPHIC REPRODUCING MACHINE

Filed Sept. 16, 1952

Fig. 1

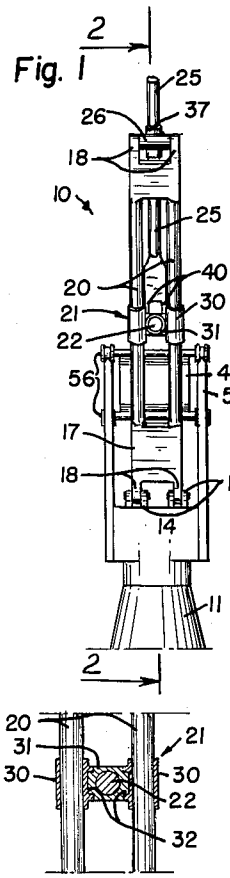


Fig. 2

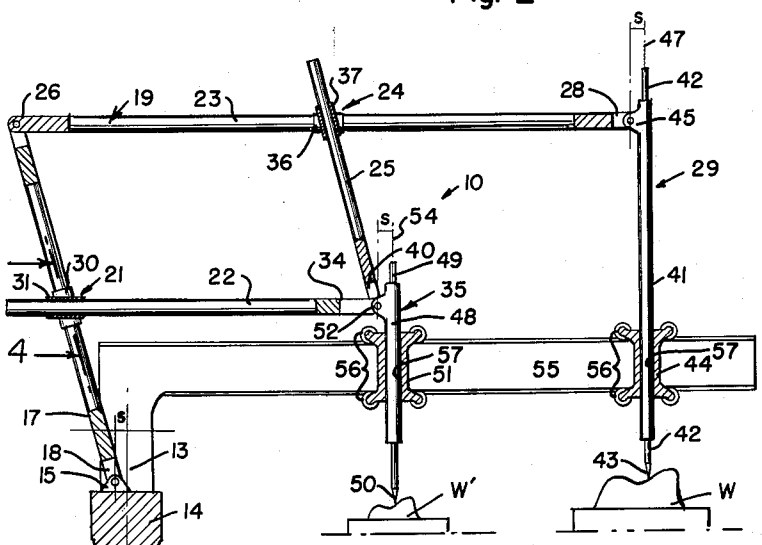


Fig. 3

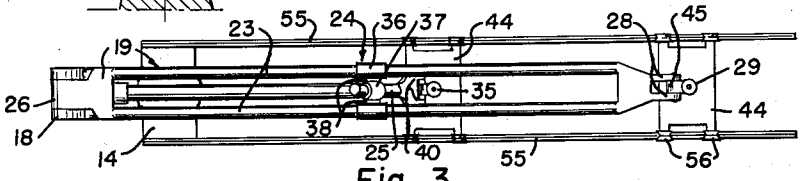


Fig. 4

Fig. 5

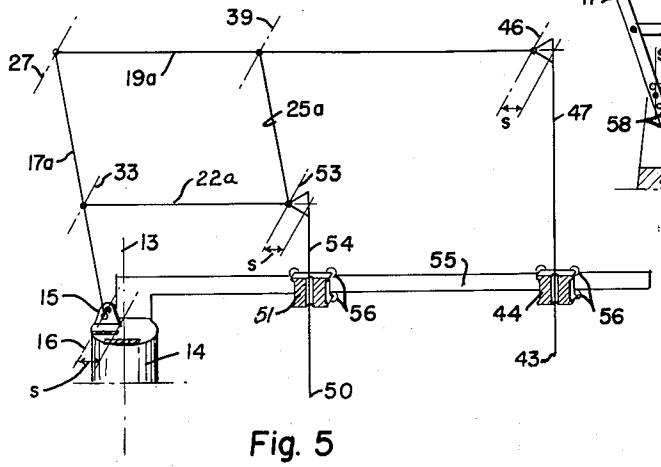
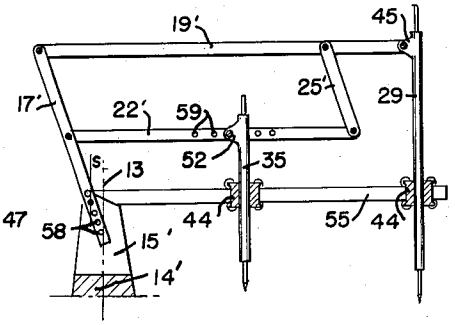


Fig. 6



INVENTOR.

Clarence R. Compton

BY WHITEHEAD & VOGL

PER Earle Whitehead

ATTORNEYS

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VERTICAL LIFT THREE DIMENSIONAL PANTOGRAPHIC REPRODUCING MACHINE

Clarence R. Compton, Littleton, Colo.

Application September 16, 1952, Serial No. 309,891

3 Claims. (Cl. 90—13.1)

This invention relates to machines for reproducing in selectively varied proportions, a large variety of articles, including among many others, such articles as dies, molds, engravings and the like, and especially to machines of that class which operate in three dimensions using pantographic action.

This is a continuation-in-part, as to common subject matter, of applicant's prior application, Serial No. 47,387, filed September 2, 1948 which matured into Patent No. 2,610,404 issued September 16, 1952.

An object of the invention is to provide a device of the class described which shall be adapted by pivotal mounting for swinging horizontally throughout a circle and which shall be hingedly mounted upon said pivotal mounting in such a manner as to provide a raising and lowering of the tools attached to the pantograph in varied proportional heights and depths.

Another object of this invention is to provide a device of the type above described which is adapted to carry the pantograph in a vertical plane intersecting the axis of the pivotal mounting and to raise and lower the tools attached to the pantograph in said plane.

Another object of this invention is to provide, in a machine of the class described, a pantograph having its supporting element mounted, by a horizontally axised hinge, to the vertical axised pivot.

Yet another object of this invention is to provide, in such a pantograph, a coordinated system of offset pivotal connections whereby to facilitate the construction of the elements constituting the machine.

Another object of this invention is to provide, in such a pantograph, a coordinated system of offset pivotal connections combined with a system of parallel guides adapted to permit the setting of tools on the pantograph without the necessity of securing perfect alignment of the tools with respect to a base axis, and to require a minimum of adjustments of the work carrying tables.

With the foregoing and other objects in view, all of which shall more fully hereinafter appear, the invention comprises certain novel constructions, arrangements and combinations of parts as shall now be described and defined in the appended claims and illustrated, in preferred embodiment, in the accompanying drawing, in which:

Figure 1 is an end elevation of my vertical lift, three-dimensional pantographic machine, which was shown as Fig. XV in the parent application.

Figure 2 is a sectional side elevation of the pantographic machine as viewed from the indicated line 2—2 at Fig. 1 and which was shown as Fig. XIV in the parent application.

Figure 3 is a plan view of the pantographic machine.

Figure 4 is a fragmentary sectional detail as viewed from the indicated line 4—4 at Fig. 2, but on an enlarged scale.

Figure 5 is a diagram of the elements constituting my improved pantograph to better illustrate the principles of operation.

Figure 6 is a sectional side elevation of a pantographic

machine similar to the showing at Fig. 2, but on a reduced scale and showing an alternate construction of a pantograph embodying the principles of my invention.

The pantographic reproduction machine **10** is essentially a two-dimensional pantograph carried upright in a vertical plane upon a standard or base member **11** and upon a pivot **12** rotatably mounted in the standard about a vertical axis **13**, that portion of the pivot surmounting the standard **11** forming a hub **14**. A horizontal pivot member comprising pair of mutually aligned bearings **15** upstand, as sets of ears, from the top of the hub **14** and are eccentrically positioned on top of the hub, their axis **16**, Fig. 5, being horizontal and spaced from the pivot axis **13** to provide a selected offset "*s*" for purposes hereinafter described.

The base arm **17** of the upright two-dimensional pantograph is pivotally connected to the bearings **15** on the hub and is adapted to upstand from the hub and swing about the axis **16** when in use, with its longitudinal median axis, indicated by the line **17***a* at Fig. 5, moving in a vertical plane which intersects the vertical hub axis **13**. Therefore, the axis **16** is the fixed pivot axis of the two-dimensional pantograph. This base arm **17** is a symmetrical, transversely-flattened member having solid end portions which include extended bearing ears **18** for connection with the bearings **15** at the lower end and with a major work arm **19** at the upper end, and an open central portion formed by parallel guide bars **20**, which carry a slidably adjustable pivot **21** for connection with a minor work arm **22**, all as hereinafter described.

The major work arm **19** is formed as a similar transversely-flattened member having solid end portions and an open central portion formed by guide bars **23**, between which there is mounted a slidably adjustable pivot **24** which carries a coordinating arm or link **25** hereinafter described. The end of the major work arm **19**, adjacent the base arm **17**, includes an extended bearing **26** which is pivotally connected to the top bearing ears **18** of the base arm to swing about a horizontal axis **27** indicated at Fig. 5. The major work arm **19** is adapted to swing about this axis **27** and extend outwardly from the base arm **17** and beyond the hub **14**. This axis **27** lies in spaced parallelism with the bearing axis **16**, whereby the longitudinal median axis of the major work arm, indicated as **19***a* at Fig. 5, is adapted to swing in the same vertical plane defined by movement of the longitudinal median axis **17***a*. The extended end of the major work arm **19** includes a pair of bearing ears **28** between which there is attached a major working head **29** of the pantograph.

The pivot **21** includes a pair of sleeves **30** which are slidably mounted upon the guide bars **20** and any suitable means, not shown herein, are provided to secure these sleeves upon the guide bars at any selected position. These sleeves are held in spaced opposition by an orificed guide member **31** which is rotatably attached to the sleeves **30** by a hub and socket arrangement **32** on each side of the guide member. The axis **33**, of rotation of guide member **31**, shown in Fig. 5, lies in spaced parallelism with the bearing axis **16** and with axis **27**.

The minor work arm **22** includes a bar slidably carried within the guide member **31**, and any suitable means, not herein shown, may be provided to securely fasten the minor work arm within the guide member at any selected position. The minor work arm **22** extends outwardly from the base arm **17** and is rotatable about the axis **33**, shown at Fig. 5. This minor work arm is held in spaced parallelism with the major work arm by interconnection with the coordinating arm **25**, hereinafter described, and the movement of the minor work arm **22**

about the axis 33 is such that its longitudinal median axis, shown at 22*a* at Fig. 5, lies in the same vertical plane as heretofore described. The extended end of the minor work arm includes a head having a pair of bearing ears 34 to which there is attached the coordinating arm 25 and a minor working head 35, as shown at Fig. 2.

The pivot 24, on the major work arm 19, is similar to the pivot 21 and includes a pair of sleeves 36 which are slidable upon the guide bars 23 and include any suitable means, not herein shown, for securing the pivot at any selected position. The sleeves 36 are held in spaced opposition by an orificed guide member 37 which is rotatable between the sleeves by a hub and socket arrangement 38, indicated at Fig. 3, and about an axis 39, shown at Fig. 5, which lies in spaced parallelism with the bearing axis 16.

The coordinating arm 25 includes a bar portion which is slidably carried within the guide member 37 and any suitable means, not herein shown, are provided to secure it at any selected position. This coordinating arm depends from the major work arm for interconnection with the minor work arm and includes a head at the end adjacent the minor work arm having bearing ears 40 for connection with the minor work arm and minor working head. The movement of the coordinating arm 25 about the axis 39 is such that its longitudinal median axis, shown as 25*a* at Fig. 5, lies in the same plane hereinbefore described.

The major working head 29 includes a tubular body 41 which carries a rotatable shaft 42 having a pointed tool or guide 43 at its lower end. When used as the tracing member or pattern follower of the pantograph, this shaft will remain stationary. However, when it becomes the cutting element of the pantograph, the shaft 42 is adapted to be rotated by any suitable powering connection, not shown. The body 41 is held vertically slidable within a guide block 44, hereinafter described. A laterally extended bearing ear 45 is provided at the upper end of body 41 for connection with the bearing ears 28 of the major work arm 19, hereinbefore described, and the axis 46 of these interconnected bearing ears, shown at Fig. 5, is in spaced parallelism with the bearing axis 16. It is to be noted that the axis 46 defines the point of major movement of the two-dimensional pantograph with the axis 16 forming the fixed pivot axis. The vertical shaft axis 47, Figs. 2 and 5, lies in the same plane as the longitudinal median axes of the pantograph elements hereinbefore described. This shaft axis 47 is spaced from the bearing axis 46 to provide an offset "*s*," the same as the offset between the pivot axis 13 and the bearing axis 16.

The minor working head 35 is formed as a tubular body or sleeve 48, having a shaft 49 therethrough carrying a tool or guide 50 which is operable for tracing purposes or for cutting purposes when suitable powering means, not herein shown, are applied to rotate the shaft 49. The body 48 is held vertically slidable within a guide block 51 hereinafter described. A laterally extended bearing ear 52 is provided at the upper end of the shaft for interconnection with the bearing ears 34, of the minor work arm, and bearing ears 40 of the coordinating arm. The axis 53 of these bearing ears, shown at Fig. 5, lies in spaced parallelism with the bearing axis 16. It is to be noted that the axis 53 defines the point of minor movement of the two-dimensional pantograph with the axis 16 forming the fixed pivot axis. The axis 54 of the shaft 49 is vertical and in the same plane as that defined by the longitudinal median axes of the pantograph elements. This shaft axis 54, Figs. 2 and 5, is spaced from the bearing axis 53 to provide an offset "*s*" the same as the offset between the pivot axis 13 and the bearing axis 16.

The guide blocks 44 and 51 are movable upon a guide track comprising a pair of horizontal guide bars 55 which are attached to and extend from the hub 14 in spaced

parallelism. The attachment of each guide block to these bars includes a set of rollers 56, above and beneath each bar 55, to permit movement of the blocks along the bars, but prevent any tilting or cocking action. The bodies 41 and 48 of the working heads are adapted to slide within a vertical orifice 57 in their respective guide blocks.

The operation of this unit, as a three-dimensional pantograph, is illustrated diagrammatically at Fig. 5. The tools or guides 43 and 50, of the major and minor working arms, are adapted to produce motions on respectively different scales depending upon the positioning of the pantograph. The horizontal movement of the tools 43 and 50 with respect to the pivot axis 13, includes radial and circumferential components of movement. The radial components of movement are effected by action of the pantograph above the hub 14 by movement of the working heads in their respective guide blocks 44 and 51 which shift toward or away from the pivot axis 13; while circumferential movements are effected by simple rotation of the entire unit about the pivot axis 13. Elevational movements and movements in the vertical plane are accomplished by the direct action of the two-dimensional pantograph in its movement about the pivot bearing axis 16. To attain true three-dimensional pantographic reproductions, it is necessary that each working head be spaced from its connecting bearing by the offset "*s*" and that the bearing axis 16 supporting the pantograph be spaced from the vertical axis 13 by the same offset "*s*." In this manner the circumferential components of movement of the working heads are geometrically fixed with respect to the vertical axis 13, while the offsets "*s*" fix proper geometric radial and elevational movements of the pantograph.

With this construction, using the offsets "*s*," a material simplification of the connections to the working heads is possible because all connective bearings may be offset from their theoretical centers. With the vertical lift pantograph construction aforedescribed, it is also possible to set the tools 43 and 50 at any position along their respective axes 47 and 54 and to bring them into working position relative to W and W' without the necessity of independent vertical alignment.

The alternate construction at Fig. 6 shows a similar pantograph including the hub 14', the base arm 17', a major work arm 19', a minor work arm 22' and a coordinating arm 25' which are formed of flat bars hingedly interconnected. In this construction the connections of the minor work arm and coordinating arm are fixed to the base arm, and the major work arm respectively. However, it is to be noted that the fixed pivot axis and axes defining the points of major movement and minor movement of the two-dimensional pantograph are the same as aforedescribed. The adjusting means, for varying the scale of reproduction, are at the bearing axis 16 and at the point of attachment of the minor working head to the minor work arm. A series of orifices 58 is provided in the base arm to vary the points of attachment of the base arm to the bearings 15', and orifices 59 are provided in the minor work arm to vary the points of attachment of the minor working head thereto.

While I have illustrated and described many details of construction, alternatives and equivalents will occur to those skilled in the art which are within the scope and spirit of my invention; hence it is my desire that my protection be not limited to the details herein illustrated and described, but only by the proper scope of the appended claims.

I claim:

1. A three-dimensional pantographic reproduction machine comprising: a stationary base member; a rotatable hub mounted to rotate about a vertical axis on said base member; a guide track supported on and extending horizontally from said hub said track comprising two spaced horizontal bars; a first guide block movable along said track; a second guide block movable along said track;

said guide blocks being disposed between said bars and each being provided with pairs of antifriction rollers engaging the tops and bottoms of said bars to provide steady movement of said guide blocks thereon; a horizontal pivot member mounted on said hub with its axis at right angles to the length of said track; a swingable pantograph base arm mounted at its lower extremity on said horizontal pivot member; a major work arm hingedly mounted at its one extremity to the upper extremity of said base arm and extending over said track and disposed in the same vertical plane with the longitudinal axis of said track; a follower tube vertically and slidably mounted in said first guide block and extending upwardly therefrom; a first hinge means hingedly securing the other extremity of said work arm to the upper extremity of said follower tube so that said first guide block will be moved along said track in unison with the movements of the upper extremity of said base arm; a tool sleeve vertically and slidably mounted in said second guide block; a minor work arm hingedly mounted on said base arm below said major work arm and extending horizontally over said track in parallelism with said major work arm; a second hinge means hingedly securing said minor work arm to said tool sleeve so that said second guide block will be moved along said track in unison with the movements of an intermediate portion of said base arm; a link hingedly connected between said major work arm and said minor work arm, said link being parallel to said base arm and acting to support said tool sleeve from an intermediate portion of said major work arm; a pattern follower mounted in and extending downwardly from said follower tube; and an engraving tool extending downwardly from said tool sleeve.

2. A three-dimensional pantographic reproduction machine as described in claim 1 having a first adjustable means slidably mounted on said base arm and hinge means mounted on said adjustable means for hingedly securing said minor work arm at any desired height on said base arm; and a second adjustable means slidably mounted on said major work arm, and hinge means on said second adjustable means for hingedly securing said link at any desired intermediate position along said major work arm.

3. A three-dimensional pantographic reproduction machine as described in claim 2 in which the horizontal pivot member on said hub is spaced from the vertical axis of the hub, the first hinge means is spaced from the vertical axis of said follower tube, and the second hinge means is spaced from the vertical axis of said tool sleeve, all of said spacings being uniform as to direction and magnitude.

References Cited in the file of this patent

UNITED STATES PATENTS

761,349	Barr	May 31, 1904
885,428	Brierley	Apr. 21, 1908
1,351,211	Keller	Aug. 31, 1920
2,240,825	Alexander	May 6, 1941
2,626,540	Eserkaln	Jan. 27, 1953

FOREIGN PATENTS

616,908	France	Nov. 6, 1926
487,634	Great Britain	June 23, 1938