

[54] APPARATUS FOR THE MANUFACTURE OF
THREE-DIMENSIONAL REPRODUCTION
OF AN OBJECT

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[56] References Cited

UNITED STATES PATENTS			
1,594,607	8/1926	Engelmann	90/13.1
671,174	4/1901	Albee.....	90/13.2
3,062,996	11/1962	Ertell et al.....	90/13.1
495,233	4/1893	Snow	90/13.2
1,546,636	7/1925	Engelmann	90/13.1

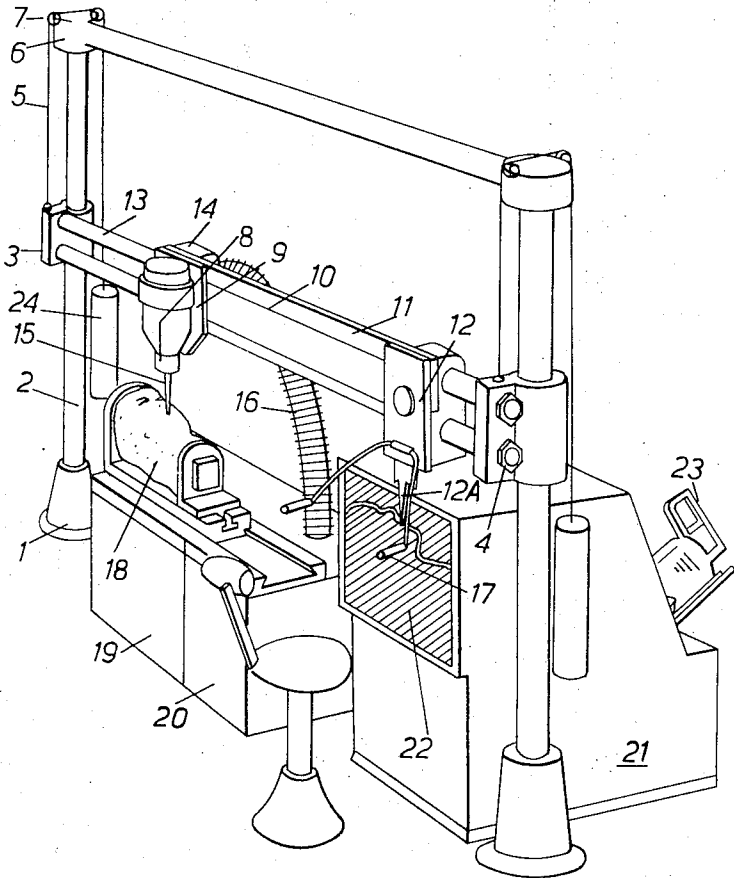
2,177,347	10/1939	Sedelmeyer et al.	90/13.1
3,085,923	4/1963	Agnew.....	90/13.1
3,246,570	4/1966	Nogradi et al.....	90/13.1
3,466,974	9/1969	Stuart et al.....	90/13.1
1,382,978	6/1921	Hopkins.....	90/13.1

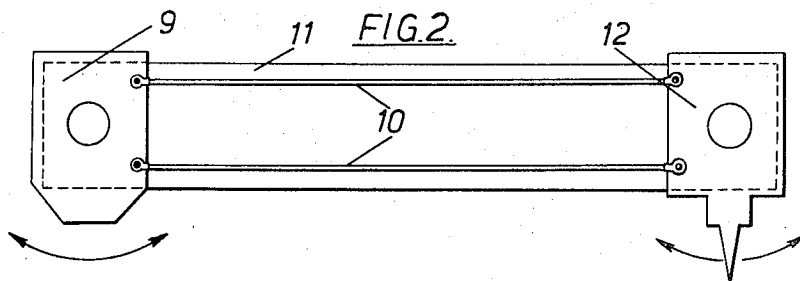
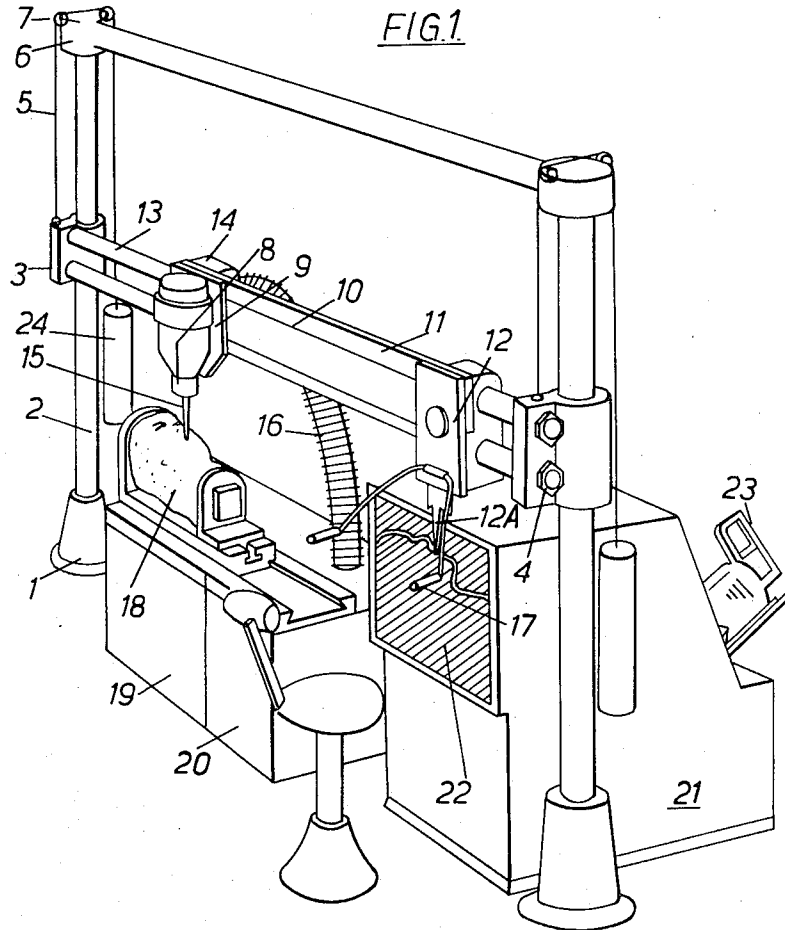
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[57] ABSTRACT

Apparatus for the manufacture of three dimensional reproductions of an object from a series of photographic records thereof taken at predetermined angular and longitudinal intervals. It has means for projecting the series of photographed outlines of the object one by one onto a screen, means for scanning the outlines, means for transmitting the scanning movements onto a cutting tool, and a table carrying a block of material into which the cutting tool cuts or carves the scanning tool.

8 Claims, 2 Drawing Figures





APPARATUS FOR THE MANUFACTURE OF THREE-DIMENSIONAL REPRODUCTION OF AN OBJECT

The invention relates to an apparatus and a method for the manufacture of three-dimensional reproductions of an object, such as an article, person or a part thereof, from a photographic record or series of photographic records of the object taken at regular angular and/or longitudinal intervals. The apparatus has application in various fields, including for example, the manufacture of portrait sculptures artificial limbs or machine parts.

A suitable method and apparatus for producing three-dimensional articles of for example, a human head from a series of shadows or photographs or an original to be copied, is described, e.g., in British Patent Nos. 939,261 and 939,262. The present invention aims to provide an apparatus for the same general purpose which is of simple construction and which is more convenient to use.

A method and apparatus for taking a series of photographs suitable for the above mentioned apparatus and method are described in copending U.S. Pat. application Nos. 48,214, filed June 22, 1970 and 48,215, filed June 22, 1970.

An Apparatus according to the invention comprises a pointer-tool assembly which comprises a head for driving a rotary cutting tool and scanning pointer means interconnected and mounted for simultaneous displacement so that each displacement of the pointer is exactly copied by the tool, and further comprising a projection and screen unit for showing the said series of photographic records and a work table adapted to carry adjustably and displaceably a block of material from which the reproduction is to be made, the scanning pointer carriage including means for displacing the pointer so that it scans the profile of the photographic record projected onto said screen.

The pointer-tool assembly can either be mounted on a common horizontally extending and vertically slidable member or on separate vertical slidable members.

The invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of a cutting machine according to the invention, and

FIG. 2 shows details of the pointer-tool assembly.

The apparatus according to the invention comprises a projector unit 21, having a screen 22 onto which is projected a profile from one of a series of photographic records from a film contained in a projector 23 provided at the rear of the projector unit 21. The projector unit comprises a mirror onto which the photographic record is projected and which reflects it onto the screen. The angle of inclination of the mirror corresponds to the angle between the camera and the slit projector described in the said copending patent applications. The angular position of the projector 23 and its focus can be adjusted, so that a sharp picture of a required size can be projected at a required part of the screen.

The apparatus also comprises a work table 19 provided with a slide mechanism (FIG. 1) supporting a carrier mechanism for clamping and turning the work piece 18, which in the described example is a block of

plaster or of Ciba Araldite (Registered Trade Mark). Of course any other material suitable for shaping by a rotary tool, such as metal, can be used. A dust extractor 20 is connected to the work table 19.

The block can be adapted, clamped and turned substantially as described in British Pat. No. 939,262.

The apparatus further comprises two columns 2 interconnected by a cross beam 6. Each column 2 is supported by a base 1 anchored in the shop floor. The columns 2 serve as vertical guides for a horizontal guiding means at each end of which is provided a block 3. The two blocks 3 are interconnected by a pair of parallel horizontal guiding rods 13, arranged one above the other. End cups 4 are provided at the ends of the guiding rods 13 carried by the blocks 3. Each block 3 contains a fixed ball bearing housing assembly by means of which it is easily slidable up and down along its particular column 2. The guiding rods 13 carry a cross slide comprising two riding blocks 14 (FIG. 1) interconnected by a base plate 11. Each block 14 comprises two ball bearing housing assemblies so that the cross slide is easily displaceable horizontally along the guiding rods 13.

The base plate 11 carries at one end a swivel plate 9 and at the other end a swivel plate 12. Swivel plates 9 and 12 are interconnected by two parallel link rods 10, thus a parallelogram connection being formed whereby the swivel plate 9 is angularly displaced simultaneously with the angular displacement of the swivel plate 12.

The swivel plate 9 carries a rotatable cutter head 8 including clamping means for a cutting tool 15 and driven by an electro-motor. The electro-motor can either be attached to the swivel plate 9 or it can be carried for instance by the cross beam 6 and drive the cutter head 8 by means of a flexible shaft (not illustrated). The tool 15 is preferably a rod-shaped tool with a sharply pointed tip. The swivel plate 12 is provided with control handles 17 and a copy pointer 12A.

The weight of the horizontal guiding means and of the pointer tool assembly is counterbalanced by counterbalance weights 24, connected by means of nylon ropes 5, guided by pulleys 7 provided at the ends of the cross beam 6, to the blocks 3.

The apparatus may be so arranged that the horizontal rods 13 carry vertical slide means for the pointer-tool assembly so that the pointer-tool assembly can be vertically displaced on its own without the rods 13 and their blocks 3. For this variant the rods 13 are either fixed to the columns vertically non displaceably, or so that their vertical displacement can be blocked.

It will be appreciated that the tool 15 can be displaced both vertically and horizontally and also be swivelled while its axis remains in one vertical plane. The axis of rotation of the block 18 is contained in the same plane.

A locking means, releasable from the control handles 17, prevents unintentional swivelling of the said plates, from their normal vertical position.

The inlet of a dust extractor hose 16 is disposed in the vicinity of the cutting tool 15 and the outlet of the said hose 16 is disposed in the dust exterior 20 in a known manner.

A person, hereinafter called "operator", displaces by means of the control handles 17 the pointer 12A so that it follows the profile projected onto the screen 22, this movement being followed by the cutter 15, which copies the profile from the screen 22 onto the block 18.

3

The advantage of this manual operation is that it is very simple and cheap and that e.g., when it is used for making portrait sculptures the operator, who will be a sculptor, can make deliberate deviations from the profile to correct features of the sculpture. Naturally the profile on the screen can be scanned by any of known automatic scanning devices, so that the operator need not be a skilled person or artist.

A control panel, provided below the screen 22 and actuated by the operator, comprises switches for controlling the projector lamp and cooling fan switch, picture change and block rotation switch, cutter motor ON and OFF switch, low cutter speed switch, medium cutter speed switch, high cutter speed switch, dust extractor ON and OFF switch and main power switch.

When the picture-change and block rotation switch is operated the picture changes one position and the next following profile is projected onto the screen 22, the block being rotated simultaneously one position, substantially as described in British Pat. No. 939,262. The operator checks that the graticule on the screen 22 and film line-up and then starts to follow the new profile by means of the copy pointer 12A.

It will be appreciated that other means, for instance the means described in the two hereinbefore mentioned British Pat. No. 939,261 and 939,262, can be substituted for the projector unit 21, as long as they offer a series of profiles which can be traced, substantially as hereinbefore described.

What I claim is:

1. An apparatus for the manufacture of three-dimensional reproductions of an object, such as an article, a person, or a part thereof, from a photographic record of the object taken at regular intervals, comprising a pointer-tool assembly which comprises a head for driving a rotary cutting tool and scanning pointer means interconnected and mounted for simultaneous displacement so that each displacement of the pointer is exactly copied by the tool, said head being mounted for displacement horizontally and vertically with the axis of the tool being retained in a single vertical plane, and further comprising a projector and screen unit for showing the said photographic records and a work table adapted to carry adjustably and displaceably a block of material from which the reproduction is to be made, the scanning pointer means comprising a carriage including means for displacing the pointer so that it scans the profile of the photographic record pro-

4

jected onto said screen, said pointer tool assembly including two rigidly interconnected carrier members slidable on slide means, one of the carrier members carrying the said scanning pointer means and the other carrying the head in which the rotary cutting tool is clamped.

2. An apparatus according to claim 1, wherein the tool head is driven by an electro-motor operatively attached to the head.

3. An apparatus for the manufacture of three-dimensional reproductions of an object, such as a article, a person, or part thereof, from a photographic record of the object taken at regular intervals, comprising a pointer-tool assembly which comprises a head for driving a rotary cutting tool and scanning pointer means interconnected and mounted for simultaneous displacement so that each displacement of the pointer is exactly copied by the tool, said head being mounted for displacement horizontally and vertically with the axis of the tool being retained in a single vertical plane, and further comprising a projector and screen unit for showing the said photographic records and a work table adapted to carry adjustably and displaceable a block of material from which the reproduction is to be made, the scanning pointer means comprising a carriage including means for displacing the pointer so that it scans the profile of the photographic record projected onto said screen, said tool head being driven by an electric motor attached to the head, said pointer tool assembly being horizontally and vertically displaceable by means of slides.

4. An apparatus according to claim 3 wherein the means for displacing the pointer is a manually operated means.

5. An apparatus according to claim 3 wherein the block of material carried by the work table is displaceable by means actuated automatically as the profiles projected on the screen are changed.

6. An apparatus according to claim 1 wherein the block of material is rotatable about an axis which lies in the said single vertical plane.

7. An apparatus according to claim 1 wherein the rotary cutting tool is mounted for displacement horizontally and vertically.

8. An apparatus according to claim 1 wherein said cutting tool is mounted for angular displacement.

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