No. 736,475. PATENTED AUG. 18, 1903.

M. BARR.

THREE DIMENSION ENGRAVING MACHINE.

APPLICATION FILED JAN. 25, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

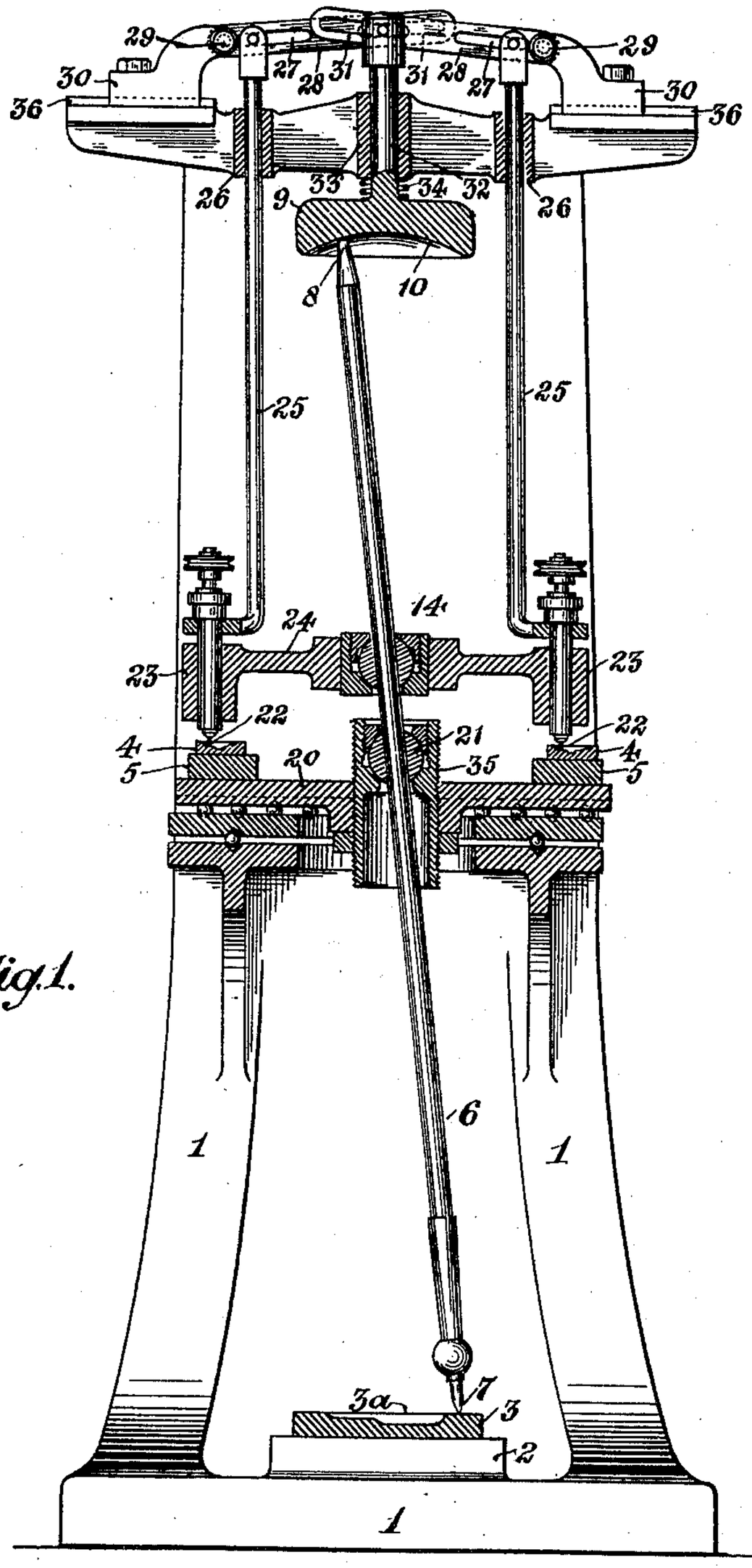

Fig. 1.

Witnesses.
Horace. Grellier.
Rodolphe J. Cleary.

Inventor
Mark Barr
per Chas. S. Woodroffe
Attorney.

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NO MODEL. 3 SHEETS—SHEET 2.

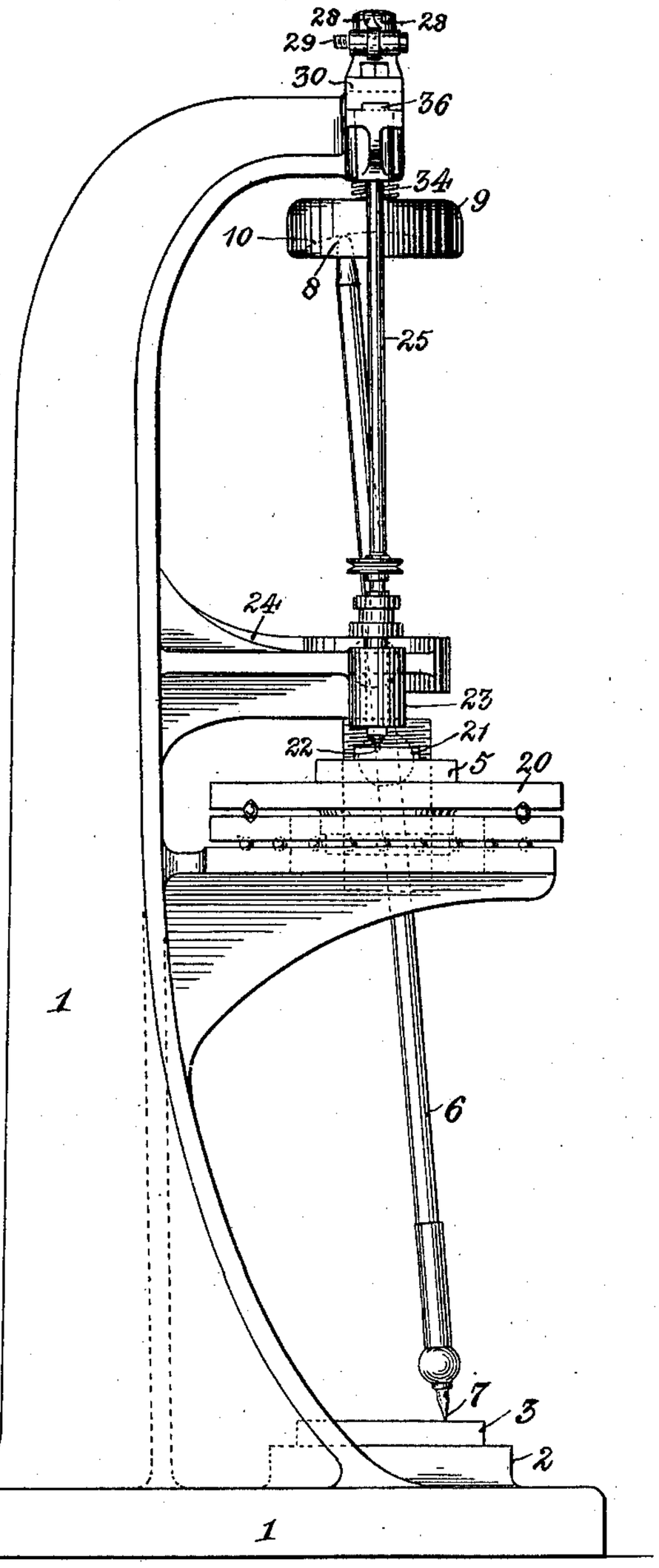

Fig. 2.

Witnesses.
Horace Grellier,
Rodolphe J. Cleary.

Inventor
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Attorney.

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THREE DIMENSION ENGRAVING MACHINE.

APPLICATION FILED JAN. 25, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

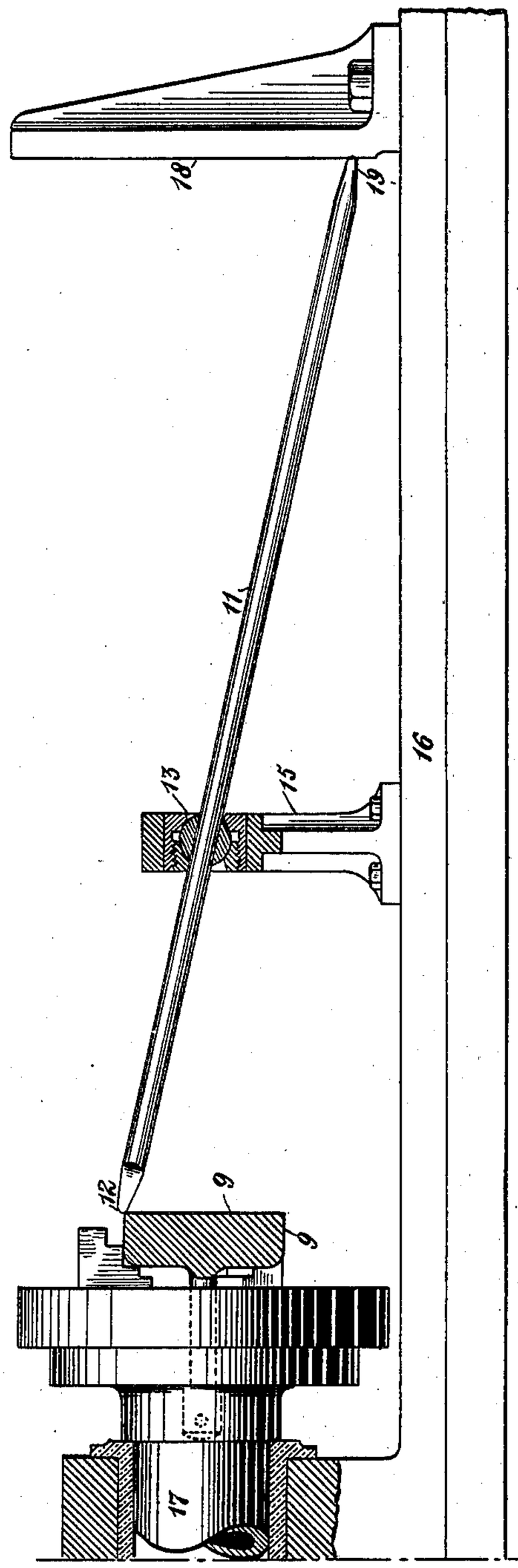

Fig. 3.

Witnesses.
Horace Grellier,
Rudolphe J. Cleary.

Inventor
Mark Barr
per Chas. Woodroffe,
Attorney.

No. 736,475. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

MARK BARR, OF LONDON, ENGLAND, ASSIGNOR TO THE LINOTYPE COMPANY, LIMITED, OF LONDON, ENGLAND.

THREE-DIMENSION ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 736,475, dated August 18, 1903.

Original application filed July 26, 1900, Serial No. 24,920. Divided and this application filed January 25, 1902. Serial No. 91,235. (No model.)

To all whom it may concern:

Be it known that I, MARK BARR, of 25 Kensington Court Gardens, Kensington, London, England, have invented certain new and useful Improvements in Three-Dimension Engraving-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, the subject-matter of this application being a division from that described in a pending application filed July 26, 1900, Serial No. 24,920.

The present invention relates to improvements in three-dimension engraving-machines of the type wherein is employed a swinging tracer-rod.

An engraving-machine that can deal only with a plane surface in both pattern and work has a two-dimension capacity—that is, it can deal with length and breadth only—but an engraving-machine whose tracer-rod and tool have each a capacity for vertical motion or for motion that has a vertical component, such as would be required in engraving the intaglio or the cameo contours of a medal, has a third-dimension capacity; hence the term "three-dimension" engraving-machines.

The improvement herein described and claimed relates more particularly to those engraving-machines in which the device for adjusting the ratio between pattern and work is beneath the fulcrum of the tracer-rod.

Referring to the accompanying figures, which are to be taken as part of this specification and read therewith, Figure 1 is a sectional front elevation; Fig. 2, a side elevation of an engraving-machine made according to the present invention, and Fig. 3 a front sectional elevation illustrating the formation of the improved contact-surface for the top of the tracer-rod.

1 is the frame of the machine; 2, the pattern-table; 3, the pattern fixed thereon; 3^a, the mean surface of the said pattern, and 4 4 two pieces of work fixed on the respective work-tables 5 5.

6 is the tracer-rod. When the latter swings from a given point it must slide through a spherical fulcrum-joint whose center is coincident with that point to enable the tracer-point 7 to move over the pattern 3 in any of the horizontal directions, lateral, diagonal, or backward and forward. The end 8 of the rod above the fulcrum-joint would describe arcs of different circles having a common center were it not that the tracer-point 7 must keep down upon the pattern 3, and thereby "depress," so to speak, the two ends of each such arc. The said end 8 will therefore move in a path approximating in shape to part of a sphere, but at no section of which along any meridian thereof would be presented a contour having a circular arc.

The formation of the contact-surface with which the end 8 can be constantly in contact for the purpose of making the tool or tools partake with precision of the vertical motions of the tracer-point 7 forms the subject-matter of the before-mentioned pending application, Serial No. 24,920; but the process of that formation and the means employed are both included in this specification for the purpose of making the scope and application of the present invention quite clear. 10 is this contact-surface. The said object is effected as follows, (see Fig. 3): The block 9, in which the surface 10, Fig. 1, is to be formed, having been duly machined with the exception of that surface is chucked in a lathe in the ordinary way with the face 9^a, in which that surface is to be cut, outward. A rod 11, carrying a suitable cutter 12 at one end and being then of the same length as the tracer-rod 6 from tracer-point 7 to top end 8, inclusive, is mounted on a lathe by having an equivalent 13 of the fulcrum-joint 14 mounted in a standard 15, which is clamped to the lathe-bed 16 at the same distance from the block 9 as the fulcrum-joint 14 is from the finished block 9 in Figs. 1 and 2, the center of the said equivalent 13 being alined with the axis of the lathe-mandrel 17. A vertical plate 18 is clamped to the lathe-bed 16 in the proper relative position to stand for the top plane 3^a of the pattern 3. As the above-mentioned outer face 9^a of the block 9 is still uncut, the cutter-rod 11 is now standing obliquely between it and the vertical plate 18, the cutter 12 being next to an edge of the said outer face on one side of the axis of the lathe

and the opposite end 19 of it, (and which is the equivalent of the tracer-point 7) at the opposite edge of the vertical plate 18. The lathe is then started and the cutter-rod 11 moved so as to take the end 19 diametrically across the surface of the plate 18 in a plane containing the lathe-axis. When it has completed this motion, the surface 10 will have been turned out concave to the particular curve which corresponds with the path followed by the top end 8 of the tracer-rod 6 when the point 7 is moved about and constantly in touch with the surface 3^a. When, however, the said point moves in a plane either above or below this surface 3^a, the ratio between the two portions 8 14 and 14 7 of the rod 6 is changed, thereby producing an error in the contact between the top 8 and the surface 10; but this error is so small that it is practically quite negligible.

The fulcrum-joint 14 of the tracer-rod 6 is carried by a bracket 24, made fast to and projecting from the standard of the machine-frame. The work-tables 5 5 are arranged about the rod 6 on a plate 20, capable of motion in any direction horizontally on a suitable guide in the well-known way, and this plate is connected to the tracer-rod by a ball-and-socket joint 21.

The object of the present invention is an improved means for transferring the vertical motion or the vertical components of the vertical motion of the tracer-point 7 in either direction to the tools 22. These are mounted in suitable guides 23, incorporated with the bracket already described.

25 is a rod from each tool working in a fixed vertical guide 26, carried by the machine-frame.

The top end of a rod 25 is connected by a pin-and-slot device 27 to a lever 28, having its fulcrum at 29 in a bracket 30 on the top of the machine-frame 1. The opposite end of a lever 28 is connected by a pin-and-slot device 31 to the top of a rod 32, working in a fixed vertical guide 33 and made fast by its bottom end to the top of block 9. As the rise of the tracer-point 7 moves the tracer-rod 6 upward through the fulcrum-joint 14 the top end 8 of the said rod bearing against the surface 10 pushes the rod 32 up through the guide 33 and raises the tools 22 accordingly. 34 is a spiral spring surrounding the rod 32 and resilient between the guide 33 and the block 9. As the drop of the tracer-point 7 moves the tracer-rod downward through the fulcrum-joint 14 the spring 34 pushes the block 9 after it, thereby lowering the tools 32 accordingly.

The ratio of lateral dimension between the pattern 3 and the work 4 is adjusted by moving the joint 21 nearer to or farther from the fulcrum-joint 14. It is for that purpose mounted in an externally-screw-threaded socket 35, engaging in a correspondingly-screw-threaded socket in the plate 20. The ratio of vertical motion between the tracer-point 7 and a tool 22 is adjusted by moving a bracket 30 farther away from or nearer to the rod 32. For that purpose a bracket 30 slides upon a feather 36 on the frame 1, the slots 27 in the levers 28 being horizontal or lengthwise thereof, the respective pins of the rods 25 and 32 being carried by the latter and passing through the slots.

The figures illustrate the use of a pair of work-tables 5, tools 22, and connections to the guiding-surface 10, one set on each side of the latter; but this number forms no part of the invention and may be varied as may be desired. Further, the vertical tracer-rod 6 and horizontal pattern 3 and guide-block 9 may be replaced by a respectively horizontal and vertical arrangement, the respective positions of the other organs of the machine being changed accordingly.

I claim—

1. In a three-dimension engraving-machine, the combination of pattern; tracer-rod mounted in a universal joint intermediate of its two ends and through which it can slide; and a concave contact-surface with which the end of the tracer-rod, opposite to the tracer-point, is constantly in contact when the said tracer-point is moved over the mean plane of the pattern, the said concave surface being a figure of revolution and at no section along any meridian of the concave, presenting a contour having a circular arc.

2. In a three-dimension engraving-machine, the combination of pattern; tracer-rod mounted in a universal joint intermediate of its two ends and through which it can slide; a concave contact-surface with which the end of the tracer-rod, opposite to the tracer-point, is constantly in contact when the said tracer-point is moved over the mean plane of the pattern, the said surface being a figure of revolution and at no section along any meridian of the concave, presenting a contour having a circular arc, the said contact-surface being movable and having connections to the machine-frame; work-table connected by a universal joint to the tracer-rod between its own fulcrum and its point; tool capable of variable motion in a fixed guide for depth of cut; and connections from the contact-surface to the tool by which the vertical motion in either direction of the former is transmitted to the latter.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

MARK BARR.

Witnesses:

JOSEPH LAKE,

CHAS. S. WOODROFFE.