No. 741,442. PATENTED OCT. 13, 1903.

M. BARR.

PANTOGRAPH ENGRAVING MACHINE.

APPLICATION FILED MAR. 3, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

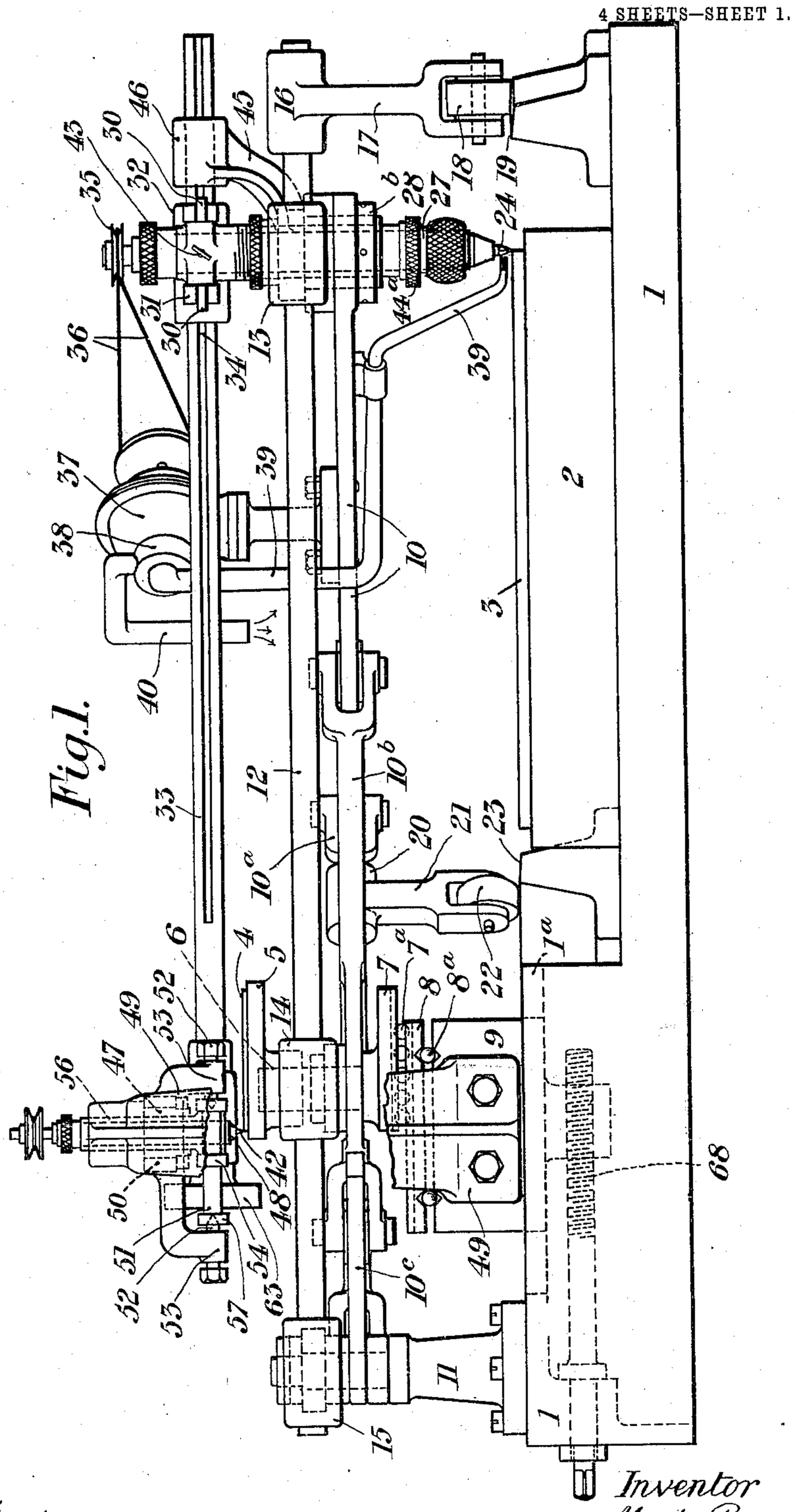

Fig. 1.

Witnesses.
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Horace. Grellier.

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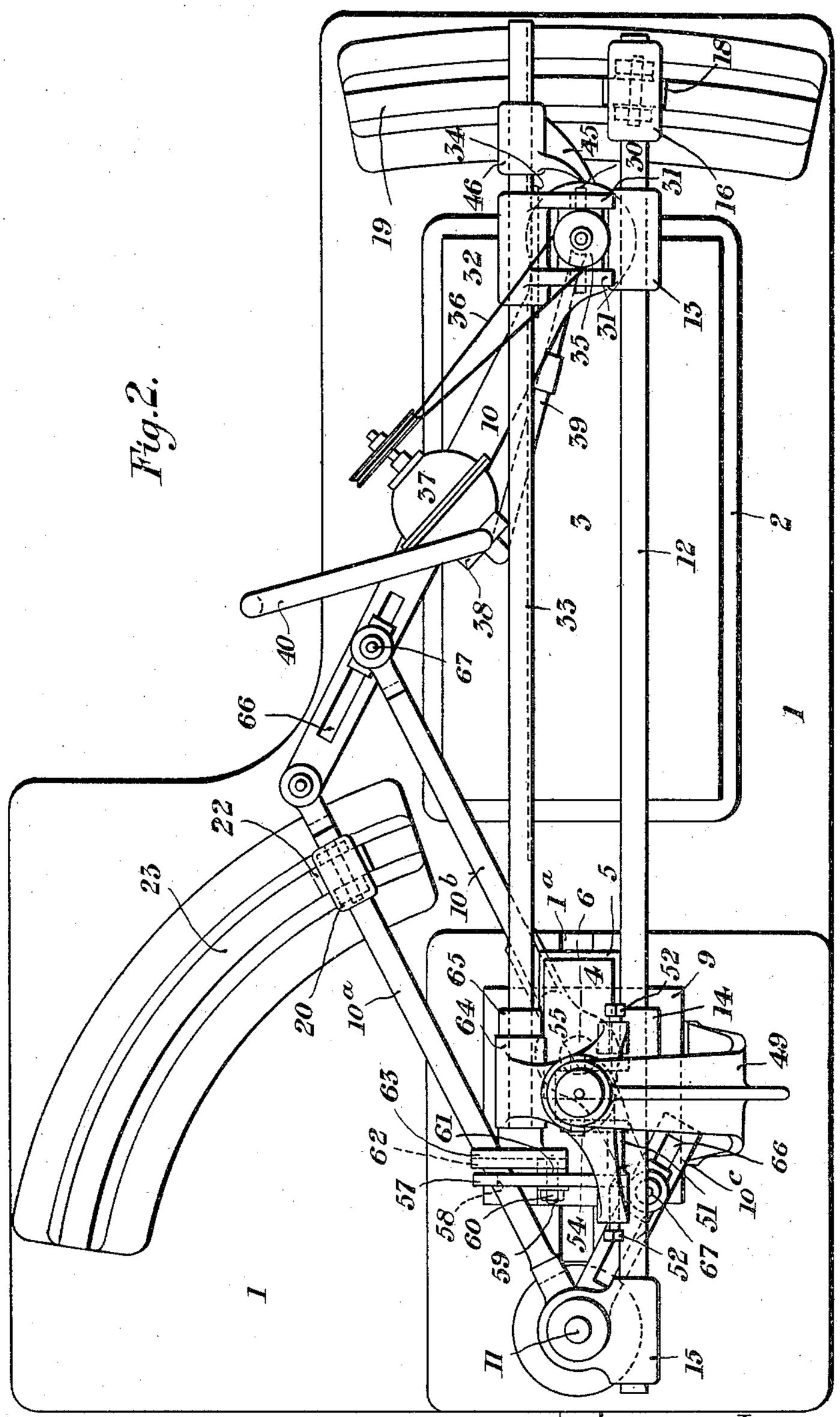
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.

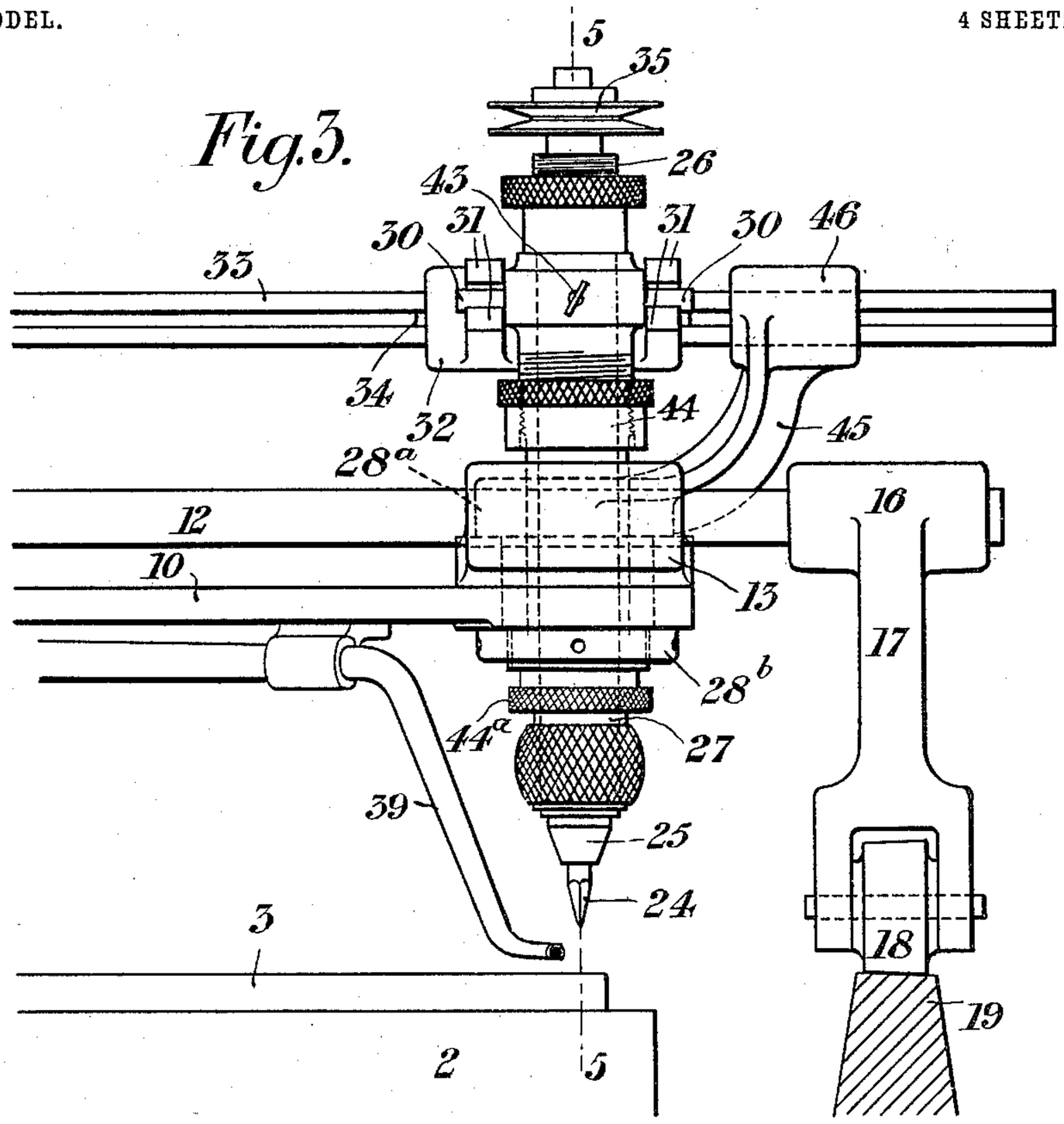
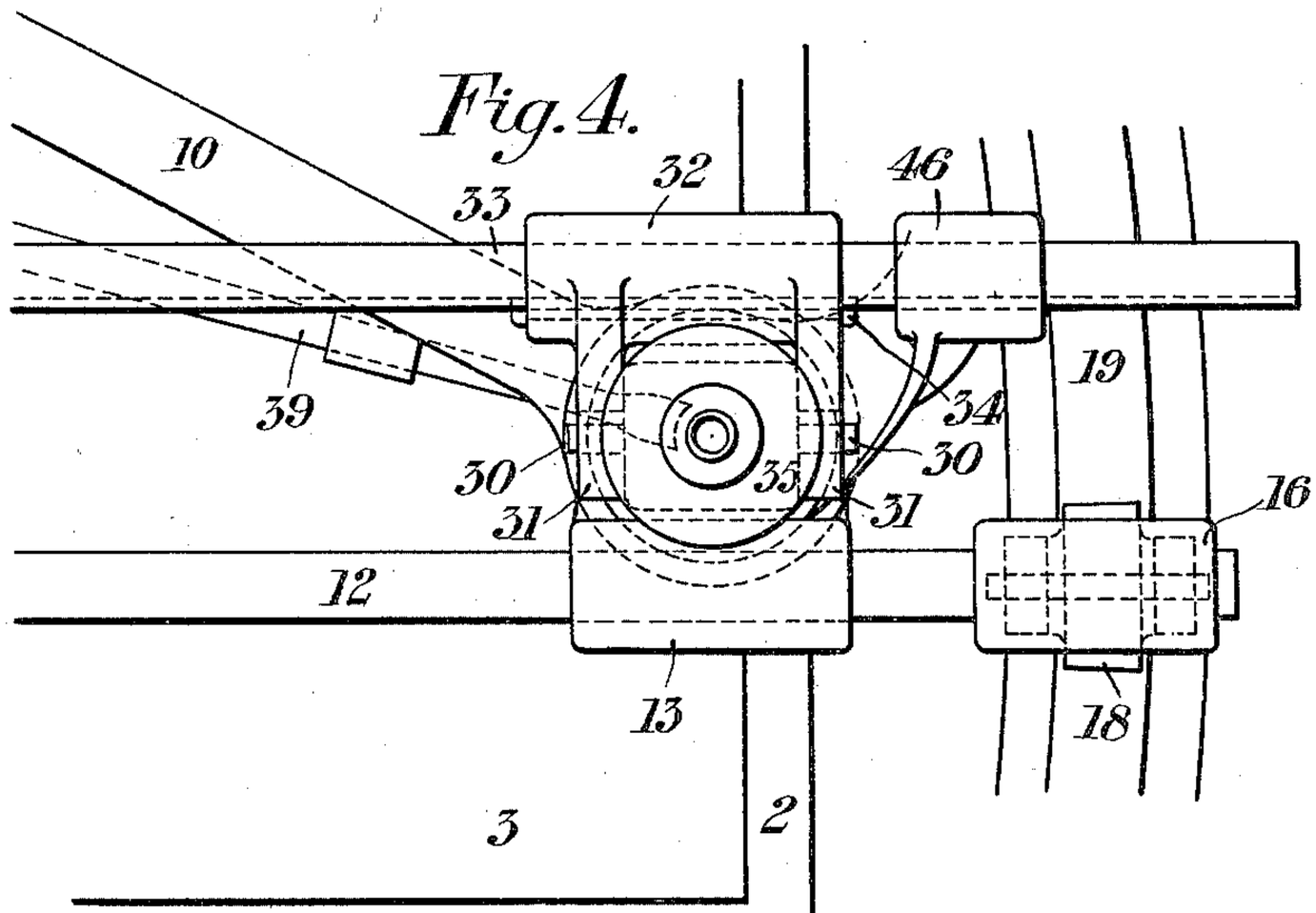


Fig. 4.



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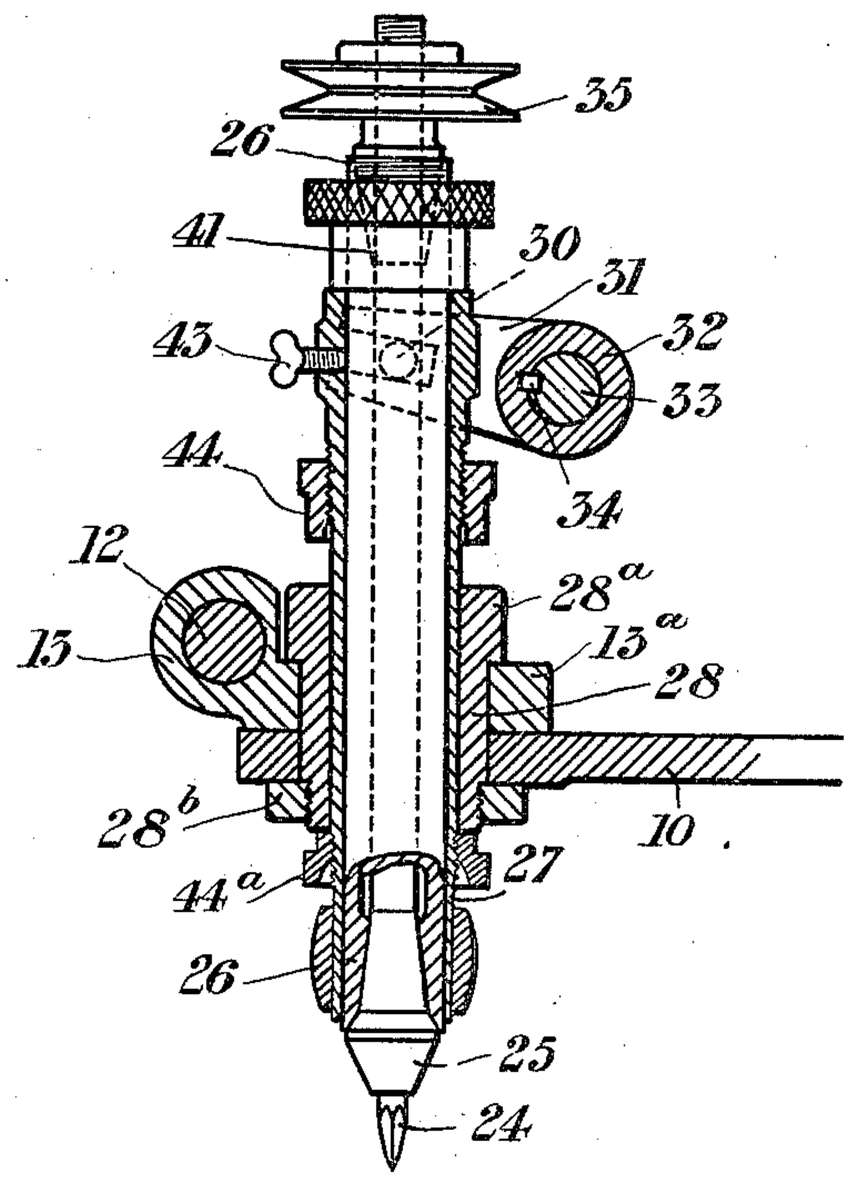
NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5



Witnesses:
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No. 741,442. Patented October 13, 1903.

UNITED STATES PATENT OFFICE.

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

PANTOGRAPH ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 741,442, dated October 13, 1903.

Application filed March 3, 1902. Serial No. 96,509. (No model.)

To all whom it may concern:

Be it known that I, MARK BARR, residing at No. 25 Kensington Court Gardens, Kensington, in the county of Middlesex, England, have invented certain new and useful Improvements in Pantograph Engraving-Machines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in pantograph engraving-machines, and has for its principal object to construct such a machine so as to enable an operator to produce a line-engraving with lines of gradually-varying depth and thickness without necessitating the employment therefor of a specially-cut pattern, such as has generally been used for the purpose, and the quality of which engraving shall be equal or superior to the best hand-cut work. The cutting of the above-named pattern has hitherto necessitated the employment of highly-skilled labor and has therefore proved to be a very expensive operation. By the employment of a machine constructed according to the present invention the necessity for this expense is entirely overcome, and although, if such be desired, the resultant engraving may be identical with the original the operator has means at his command whereby he can vary the treatment of the subject engraved according to requirements.

The invention may be said to consist, essentially, in substituting for the usual tracer a rotating conical cutting-tracer generally homologous with the engraving-tool and in employing a pattern depicted upon the surface of a plate, block, or other body of a friable material, such as gypsum or plaster-of-paris, which can be readily cut away by the said cutting-tracer without presenting undue or excessive resistance to its manipulation by the operator.

The pantograph engraving-machine employed is of the three-dimension type, and as a convenient example it is herein described as substantially of the construction set forth in the specification of Letters Patent No. 684,973.

Referring to the accompanying drawings, which are to be taken as part of this specification and read therewith, Figure 1 is a side elevation, and Fig. 2 a plan, of the engraving-machine; Fig. 3, a side elevation of part of the machine, showing the cutting-tracer in a position different from that in which it is shown in Fig. 1; Fig. 4, a plan of Fig. 3, and Fig. 5 a vertical section on line 5 5 of Fig. 3 looking toward the left of that figure and with the quill-holder shown partly in elevation. Figs. 3, 4, and 5 are drawn to a scale larger than that to which Figs. 1 and 2 are drawn.

1 is the base of the machine, on which the pattern-table 2 is rigidly secured, and 3 is the pattern, affixed to the pattern-table by any convenient means.

4 is the work, secured in any convenient manner to the work-table 5, mounted on the upper end of a column 6, which extends upward from the upper one 7 of a pair of plates 7 8, which are fitted to work freely at right angles with each other, the plate 7 upon ball-races 7^a, between it and the plate 8, and the plate 8 upon ball-races 8^a, between it and the table 9, adjustable on the base 1.

10, 10^a, 10^b, and 10^c are the four links of a pantograph which has its center upon a vertical post 11, fast to the base 1, and the link 10^b of which is pivotally connected to the column 6 in order that the motion imparted to the pantograph may be communicated to the work 4.

12 is a straight rigid bar connected to the pantograph by being passed through three sockets 13, 14, and 15 in pivotal connection with the said pantograph, the bar being rigidly fixed in the socket 15, but free to slide through the sockets 13 and 14 as the linkage shortens and lengthens. The end of the bar 12 adjacent to the pattern-table 2 projects beyond that table for a short distance and is secured in a socket 16 on the upper end of a pillar 17, whose lower end is provided with a roller 18, adapted to travel to and fro along a fixed arcual track 19 as the pantograph is rocked on its center 11.

The link 10^a near that end at which it is pivoted to the link 10 is rigidly secured in a socket 20, on the upper end of a pillar 21, whose lower end is provided with a roller 22, adapted to travel to and fro along a fixed

arcual track 23 as the pantograph is rocked on its center. The two arcual tracks 19 and 23 are rigidly secured to the machine-base 1.

The cutting-tracer 24, as shown most clearly in Fig. 5, is carried in a quill 25, rotatably mounted in a quill-holder 26, axially adjustable in a constantly-vertical tube or bush 27. This tube or bush is adapted to slide axially through a sleeve 28, fixed in the link 10 of the pantograph adjacent to the before-mentioned socket 13. The sleeve 28, as shown in Fig. 5, may most conveniently be formed as a hollow bolt, the head 28^a of which is situated above a flange 13^a, integral with the socket 13, and which bolt, conjointly with a screw-threaded nut 28^b on its lower end, serves to firmly secure the said socket to the link 10. The top of the tube or bush 27 carries two pins 30 30, constituting a cross-head, which engage with slotted arms 31 31, projecting forward from a boss 32, slidable along a longitudinally-grooved rod 33, the said boss being connected to the rod 33 by a feather-and-groove connection 34, which prevents any independent rotary motion of these two parts.

The quill 25 is provided at its upper end with a pulley 35, around which passes a driving-belt 36, driven by (most conveniently) an electric motor 37, which, as shown in Figs. 1 and 2, may be secured upon the pantograph-link 10, the said motor also being preferably provided with or adapted to operate a suction fan or exhauster 38, which, by a suction-pipe 39, terminating adjacent to the cutting-tracer 24, withdraws the powder or particles produced by the cutting of the pattern 3 to deliver them through a discharge-pipe 40 into any desired receptacle or at any desired outlet.

The quill-holder 26 has a screw-threaded nut 41 adjustable upon it near its upper end, said nut, by bearing at its under side upon the top of the tube or bush 27, serving to enable the depth to which the cutting-tracer 24 may penetrate into the pattern relatively to the depth of penetration of the engraving-tool 42, Fig. 1, into the work 4, to be adjusted preparatory to commencing the engraving operation. A clamping-screw 43, threaded through the tube or bush 27 and adapted to be screwed against the quill-holder 26, serves to hold the latter in any position to which it may be thus adjusted. A nut 44, adjustable along the tube or bush 27 and adapted to abut against the top of the sleeve 28, serves as a means of varying the maximum depth of the lines to be cut in the work 4, and a nut 44^a, similarly adjustable below the sleeve 28, may be used for limiting the upward motion of the engraving-tool or the minimum depth of the lines to be cut by it in the work.

As described in the before-mentioned specification, No. 684,973, an arm 45 extends upward from and is integral with the above-named head 28^a of the sleeve 28 and carries at its upper end a bearing 46, alined with the boss 32.

47 is a vertical bearing (shown in dotted lines in Fig. 1) for the quill 48 of the engraving-tool 42. It is supported by a strong standard 49, rigidly secured to the adjustable table 9 and overhanging the plane of the work 4 for a sufficient distance. In Fig. 1 the standard 1 is represented as partly broken away, so as to enable other parts which would otherwise be obscured by such standard to be clearly illustrated.

50 is a bearing-block carried by and capable of turning about the bearing 47, and 51 is a rod pivoted on or between screw-centers 52 52, adjustable in screw-threaded sockets 53 53, depending from the bearing-block 50.

54 54 are a pair of arms fast to the rod 51 and projecting from it at right angles, as shown in dotted lines in Fig. 2. The outer ends of the arms 54 54 are slotted to receive the respective ends of a cross-head 55, (represented in dotted lines in Fig. 2,) fast to the tube 56, within which rotates the quill 48, carrying the engraving-tool 42.

57 is a lever fast on one end of the rod 51, from which it projects, standing parallel with the arms 54 54. The lever 57 is slotted at 58, as indicated in dotted lines in Fig. 2, to receive one end of a pin 59, whose other end is screw-threaded to receive a tightening-nut 60, which is capable of pinching the said lever between itself and a collar 61 (rigid on the pin 59) on the other side of the lever to hold the pin 59 in the desired position lengthwise of the slot 58 for a purpose hereinafter described. The opposite end of the pin 59 is in sliding engagement with a diametrical slot 62 in a disk 63, fast on one end of the before-described longitudinally-grooved rod 33, turning in a bearing 64, carried by the before-described bearing-block 50, as also in the above-mentioned bearing 46. The disk 63 on the one side and a collar 65, fixed on the rod 33 at the other side of the bearing 64, prevents the said rod from moving longitudinally through the bearing 64, as the pantograph linkage 10, 10^a, 10^b, and 10^c lengthens and shortens the bearing 46 and boss 32, which are alined with the bearing 64, slide longitudinally along the rod 33, all as described in the above-named specification, No. 684,973.

For the purpose of enabling the ratio of reduction of the first and second dimensions—*i. e.*, length and breadth—to be adjusted the two pantograph-links 10 10^c are slotted at 66 to admit of the points of connection 67 therewith of the link 10^b to be varied, and the table 9 is guided in a slot 1^a in the base 1 and is movable by a screw 68. This adjustment is effected by loosening the connections 67 and turning the screw 68 in the required direction to the desired extent. The ratio of reduction of the third dimension—*i. e.*, depth—is varied, as may be desired, by adjusting the position of the pin 59 along the slotted lever 57 and by fixing it in different positions along the slot 62, as described in the specification above referred to.

The pantograph mechanism is preferably

so arranged that there is a constant slight tendency for the cutting-tracer 24 to descend.

When it is desired to produce a line-engraving in accordance with this invention, a much enlarged photograph is taken of the plate or device to be reproduced, and this is suitably transferred or affixed to the before-mentioned gypsum or equivalent plate or body 3, or, if said plate or body 3 be provided with a suitable sensitized surface, the photograph may be taken directly onto it. This prepared plate or body 3 and the plate or body 4 to be engraved are then secured in their proper positions on the pattern-table 2 and work-table 5, respectively, and the motor appertaining to the engraving-tool 42 (which motor is not shown in the drawings) and the motor 37 for driving the cutting-tracer 24 are set in operation. The operator then follows the lines depicted on the pattern 3 with the cutting-tracer 24, which will thus be caused to cut furrows at all the parts so traversed, and according as these lines are thicker or thinner he respectively lowers or raises the cutting-tracer, so that it may penetrate more or less deeply into the pattern 3, and consequently by reason of its conicity cut a wider and deeper or narrower and shallower furrow, the immediate object of the operator being to cut away all and no more than the lines of the pattern. As the movements given by the operator to the cutting-tracer 24 are by the pantograph homologously transmitted to the engraving-tool 42 and as this latter is in itself homologous with the cutting-tracer, it follows that the resultant engraving must be an exact copy of the pattern at the predetermined ratio of reduction, which ratio can, as previously described, be varied according to requirements.

It will be obvious that when so desired the operator may vary the treatment of the subject in hand by causing the cutting-tracer 24 to penetrate into the pattern more or less deeply than is justified by the width of the lines of the pattern, and thereby correspondingly increase or decrease the width of the lines engraved. Further variation of treatment may be secured by using an engraving-tool 42 and a cutting-tracer 24 which are not homologous with each other.

If lines of only one uniform depth are to be engraved, it may be convenient to mechanically retain the before-described sleeve or bush 27 in a depressed position, and thereby hold down the cutting-tracer 24 and engraving-tool 42 in the positions necessary to secure the desired degrees of penetration into, respectively, the pattern 3 and work 4. This may be effected by tightening the nut 44ª against the under side of the sleeve 28, so as to deprive the sleeve or bush 27 of its independent motion in the third dimension and for the time being convert the three-dimension pantograph into a two-dimension one.

The before-described engraving-machine may be used for the production of stippled engravings, although not with such manifest advantages as those inherent to its application to the production of line-engravings.

I claim—

1. In a three-dimension engraving-machine the combination with a pantograph linkage and a rotating engraving-tool and rotating tracer carried thereon, of a sleeve fixed in the linkage, a bush longitudinally movable in the sleeve and in operative connection with the engraving-tool, a quill-holder longitudinally adjustable in the bush, a clamping-screw in the bush adapted to engage the quill-holder, a quill rotatable within the bush and carrying the tracer, a screw-thread on the bush, a nut adjustable on this screw-thread adapted to engage the sleeve, a screw-thread on the quill-holder and a nut adjustable on this screw-thread adapted to engage the bush substantially as set forth.

2. In a three-dimension engraving-machine the combination with a rotating engraving-tool and rotating cutting-tracer, and a pantograph linkage in operative connection with both tool and tracer to operate each homologously with each other, of a friable body bearing a pattern capable of being readily cut away by the cutting-tracer substantially as set forth.

In testimony that I claim the foregoing as my invention I have hereunto signed my name in the presence of two subscribing witnesses.

MARK BARR.

Witnesses:
CHAS. S. WOODROFFE,
WARWICK HY WILLIAMS.