

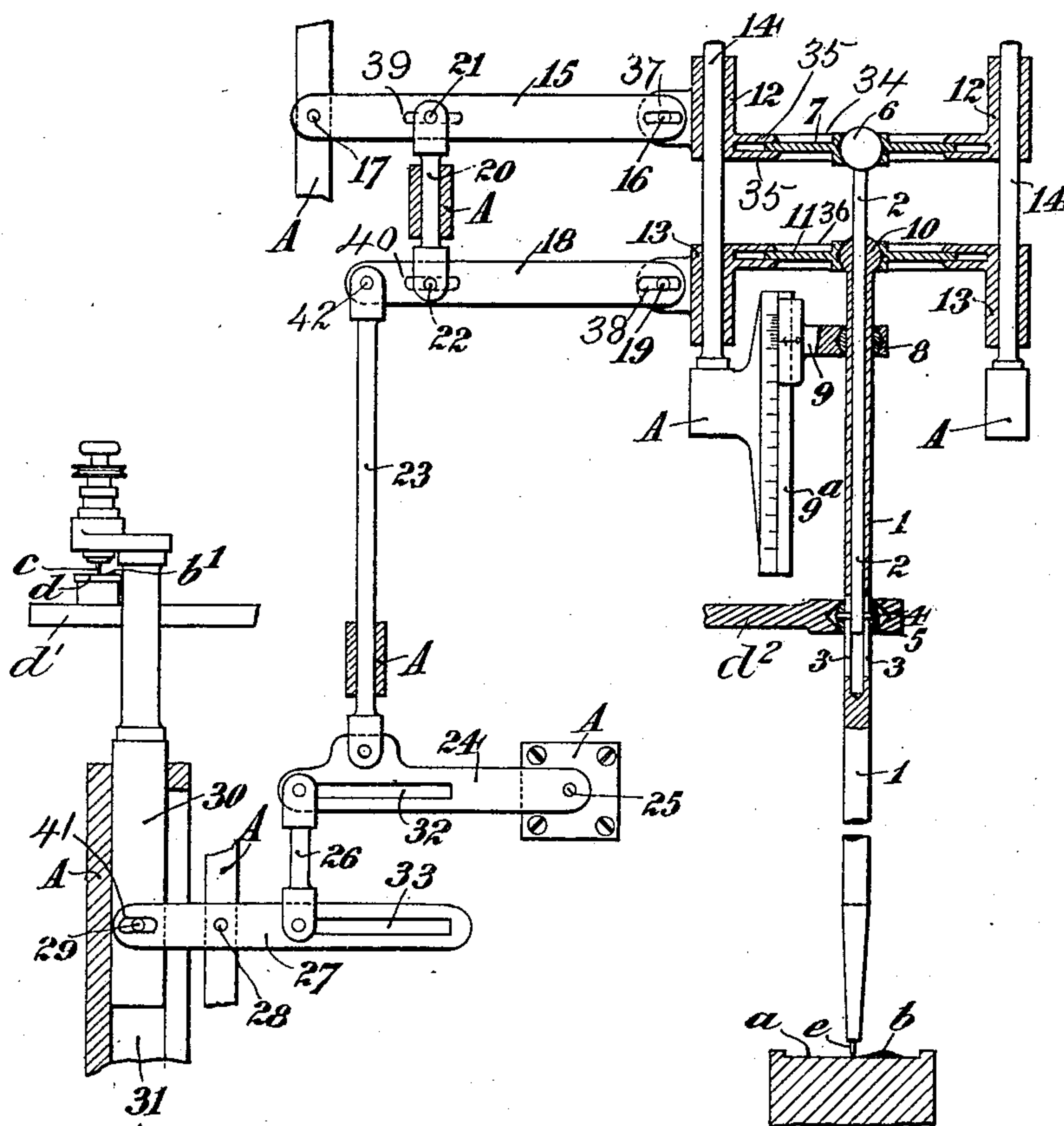
**No. 706,007.**

**Patented Aug. 5, 1902.**

**M. BARR.**  
**PANTOGRAPH ENGRAVING MACHINE.**

(Application filed Jan. 4, 1900.)

(No Model.)



*Witnesses.*

Robert E. McLaren

Harry L. Coit

*Inventor*

Mark Barr,

per Jas. S. Woodroffe,  
Attorney.

# UNITED STATES PATENT OFFICE.

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

## PANTOGRAPH ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 706,007, dated August 5, 1902.

Application filed January 4, 1900. Serial No. 344. (No model.)

*To all whom it may concern:*

Be it known that I, MARK BARR, of Broadheath, in the county of Chester, England, have invented certain new and useful Improvements in Pantograph 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 present invention relates to improvements in pantograph engraving-machines capable of dealing with three dimensions—length, width, and depth—by a swinging and vertically-moving tracer-rod and horizontally-moving work-table and vertically-moving tool.

The accompanying figure is a diagrammatic side elevation, partly in section. It does not include the means by which the swinging motions of the tracer-rod are converted into horizontal motions of the work-table, for the reason that these means do not form any part of the present invention. Any of the well-known horizontally-acting pantographic linkages may be applied to the mechanism illustrated to effect such conversion.

The dimensions of length and width above mentioned are included hereinafter in the expression "lateral movements or motions," and the dimension of depth is referred to as "vertical movement or motion." Many of the movements of the tracer-point are neither truly lateral nor truly vertical, but compounds of both. The lateral components of such movements are transmitted by the horizontally-acting pantographic linkage above mentioned and the vertical components by the mechanism of the present invention. The latter therefore consists in improved means for transmitting the vertical movements or the vertical components of the movements of the tracer-point to the tool and of means for preventing the lateral movements or the lateral components of the movements of the tracer-point producing vertical movements in the tool. For convenience sake I will describe the latter part first.

A A are portions of the main frame of the machine.

*a* is the pattern having a projection *b* on

its surface. This projection is introduced into the figure to show how the invention deals with it by the vertical movement of tracer-point, so as to make the tool *c* reproduce it at *b'* in the work *d*, which is carried by the work-table *d'*. The tracer-rod is in two portions, which are connected together telescopically. The bottom portion 1 of it is outside the top portion 2 and slides over it. The connection between the two portions consists of two vertical slots 3 3 in the outer or bottom portion 1 and opposite to each other, a horizontal pin 4, passed through the bottom end of the inner portion 2 and engaging in the respective slots 3 3, and a ball 5, surrounding the bottom portion 1. The ball 5 is made fast to the above-mentioned pantographic linkage, and for that reason it can move only in one and the same horizontal plane. The adjacent portion of this linkage is shown at *d'*. The bottom portion 1 is therefore capable of sliding freely through the said ball, while the top portion 2 is held to it by the engagement in it of the prolonged ends of the pin 4. The length of the pair of slots 3 3 is not less than the maximum vertical movement or vertical component thereof, which is required of the tracer-point *e*. The top of the inner portion 2 swings by a ball-and-socket joint 6 in a horizontal plate 7, capable of sliding in any horizontal direction in a guide 34, consisting of two parallel rings 35 35, standing at right angles with two vertical guides 12 12, one on each side of the guide 34. These rings 35 are at such a distance apart from each other that the plate 7 can move horizontally only between them. The guides 12 enjoy a vertical sliding motion upon a pair of fixed standards 14 14 on the frame A. The top of the bottom portion 1 is likewise connected by a second ball-and-socket joint 10 to a second horizontal plate 11, capable of sliding in any horizontal direction in a guide 36 of the same construction as the guide 34, already described, and which is made fast to the vertical guide 13 13 in the same way as the guide 34 to the guides 12 12. These guides 13 13 are likewise capable of a vertical sliding motion on the said standards 14 14.

The tracer-rod 1 2 swings as a whole in a ball-and-socket joint 8, and through which it



is capable of sliding vertically. This latter is the fulcrum of the tracer-rod and is carried bracketwise by a block 9, adapted to slide upon a fixed vertical guide 9<sup>a</sup>, formed on the frame A, for the purpose of adjusting the ratio of lateral dimension between the pattern and the work. The said guide 9<sup>a</sup> and block 9 are provided with the usual scale and vernier, respectively.

15 is a lever having one end pivoted to the adjacent guide 12 at 16 and its opposite end pivoted on a fulcrum 17, fixed to the frame A, the pivot 16 being fast to the said guide and engaging in a horizontal slot 37 in the lever 15.

18 is a second lever having one end pivoted to the adjacent guide 13 at 19, this pivot 19 being fast to the said guide and engaging in a horizontal slot 38 in the lever 18.

The levers 15 and 18 are connected by a link 20, which has a vertical motion in a suitable part of the frame A, as in a guide, as shown. The said link is pivoted to the lever 15 at 21 and to the lever 18 at 22. The pivots 21 and 22 are fast to the link 20, and engage, respectively, in horizontal slots 39 and 40 in the levers 15 and 18. This point 22 is also the fulcrum of the lever 18, and upon this fulcrum it rocks only when there is vertical motion of the tracer-rod up or down a projection *b* on the pattern to be communicated to the tool *c*. The said lever 18 is connected to the tool *c* by the following means: 23 is a link from the said lever, to which it is pivoted at 42, to the lever 24, which has its fulcrum 25 in a fixed point on the said frame. The link 23 slides in a guide in the frame A, as shown.

26 is a link from the end of the lever 24 opposite to its fulcrum to one end of a lever 27, having its fulcrum at 28 in the frame A and its opposite end pivoted at 29 to a rod 30, which carries the tool *c* and is capable of a reciprocating motion only in a guide 31 in the said frame A. The pivot 29 is fast to the rod 30 and engages in a horizontal slot 41 in the lever 27. The link 26 is adjustable horizontally along slots 32 33 in the levers 24 and 27, respectively, for ratio of vertical reduction between a projection *b* and its reproduction *b'* in the work *d*.

The above-mentioned lever 18 may rock upon the fulcrum 22 without producing any vertical motion in the rod 23, and this will often occur during purely lateral movements of the tracing-point. The movement is as follows: If the pivot 19 rises, it tends to push the rod 23 down; but if the moving fulcrum 22 is raised proportionally as the pivot 19 rises then there is no downward motion imparted to the rod 23.

The invention, constructed as above described acts as follows: When the point *e* of the tracer-rod 1 2 is moved horizontally over the pattern *a*, the tracer-rod itself swings on its fulcrum 8. Let it be supposed that the motion of the point *e* is a lateral one from the

center of the pattern toward one edge of it. The bottom portion 1 of the tracer-rod will slide down over the inner portion 2, because the ball 5 always moves in a fixed horizontal plane, and move the guides 13 of the plate 11 down the standards 14. This motion of the guides 13, on which the lever 18 is pivoted, would beget a vertical motion in the tool *c*, for which there is no cause in the pattern; but such motion is neutralized by the vertical component of the arcual motion of the ball of the joint 6, which ball is the top end of the compound tracer-rod 1 2. The guide 12 communicates this vertical motion of the plate 7 to the pivot 16, thereby dropping the pivot 21 a certain amount. This drop, which is of a certain length, is communicated to the pivot 22 by the link 20. The proportions of the several levers are such that the said drop given, as described, to the pivot 22 is just enough to prevent the lever 18 moving the link 23 under the influence of the above-described downward motion of the guides 13. Expressed numerically they are preferably as follows:

From <i>a</i> to center of 10.....	20	
From center of 5 to center of 6.....	12	
From pivot 19 to pivot 22.....	6	95
From pivot 22 to pivot 42.....	2	
From pivot 16 to pivot 21.....	6	
From pivot 21 to pivot 17.....	30	
	<hr/>	
	7	100

Other proportions are practicable; but the above may be regarded as typical as well as preferable.

Having described above how the present invention prevents the lateral movements or the lateral components of the movement of the tracer-point *e* over the pattern *a*, producing any vertical motion in the tool *c*, I will proceed to describe how the vertical movements or the vertical components of the movements of the said point *e* are communicated to the said tool. The motion of the point *e* up the side of a projection *b* has a vertical component. This vertical component is transmitted by the bottom portion 1 of the compound tracer-rod 1 2, sliding upward through the ball of the joint 8 to the guide 13, to which the lever 18 is pivoted, thereby rocking the said lever on its fulcrum 22, and thereby transmitting a proportional motion to the tool *c* through the link 23, lever 24, link 26, lever 27, and rod 30. The fulcrum 22 remains stationary, because the upward motion of the guides 13 is not communicated to the guides 12 and lever 15, and the reason why it is not communicated is that the bottom portion 1 of the tracer-rod slides freely over the portion 2, and this latter is held by the pin 4 and ball 5 to the pantograph linkage already mentioned. So when the tracer-point *e* descends the projection *b* on the other side of it the downward motion of the portion 1 takes the guide 13 down with it, sliding over the stationary portion 2



in so doing and rocking the lever 18, but without having disturbed the guides 12.

I claim—

1. The combination of swinging compound  
5 tracer-rod consisting of two portions telescop-  
ically connected together; two horizontal  
plates, one jointed to each portion of the said  
rod and capable of a reciprocating vertical  
10 horizontal plate of that portion of the tracer-  
rod that carries the tracer-point, to the tool,  
adapted to transmit to the latter, the vertical  
movements or vertical components of the  
movements of the tracer-point; and a connec-  
15 tion between the two horizontal plates to pre-  
vent a lateral movement or a lateral compo-  
nent of a movement of the tracer-rod, pro-  
ducing a corresponding vertical movement  
in the tool.  
20 2. The hereinbefore-described combination  
of swinging compound tracer-rod having a  
bottom and outer portion adapted to slide  
over the top and inner portion; a connection  
fast to the said inner portion for limiting its  
25 motions to one and the same horizontal plane;

a horizontal plate jointed to the top end of the  
said top and inner portion and capable of a  
reciprocating vertical motion; a horizontal  
plate jointed to the top end of the said bottom  
and outer portion and capable of a reciprocating vertical motion; a lever having a fixed  
30 fulcrum at one end and its opposite end con-  
nected to the horizontal plate of the said top  
and inner portion; a lever connected to the  
horizontal plate of the said bottom and outer  
35 portion of the tracer-rod; a link connecting  
the two levers and a link-and-lever mechan-  
ism establishing a connection between the  
last-mentioned lever and the tool to trans-  
mit the vertical movements or vertical com-  
40 ponents of the movements of the said bottom  
and outer portion of the tracer-rod to the tool.

In testimony that I claim the foregoing as  
my invention I have signed my name in pres-  
ence of two subscribing witnesses.

MARK BARR.

Witnesses:

THOMAS TAYLOR,  
HAROLD ISHERWOOD.