

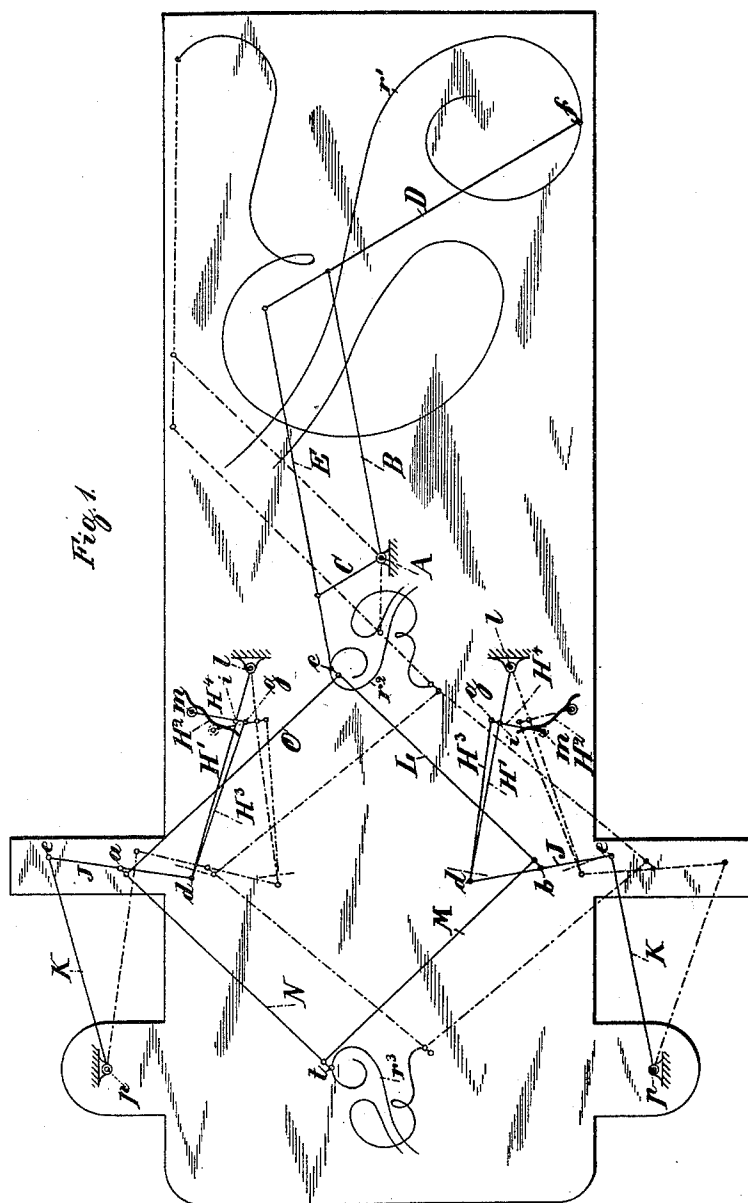
(No Model.)

2 Sheets—Sheet 1.

F. W. SABEL.
ENGRAVING MACHINE.

No. 460,762.

Patented Oct. 6, 1891.



Witnesses.
W. Harvey Muzzy
J. M. Copenhaver

Inventor
Friedrich Wilhelm Sabel
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Attorney.

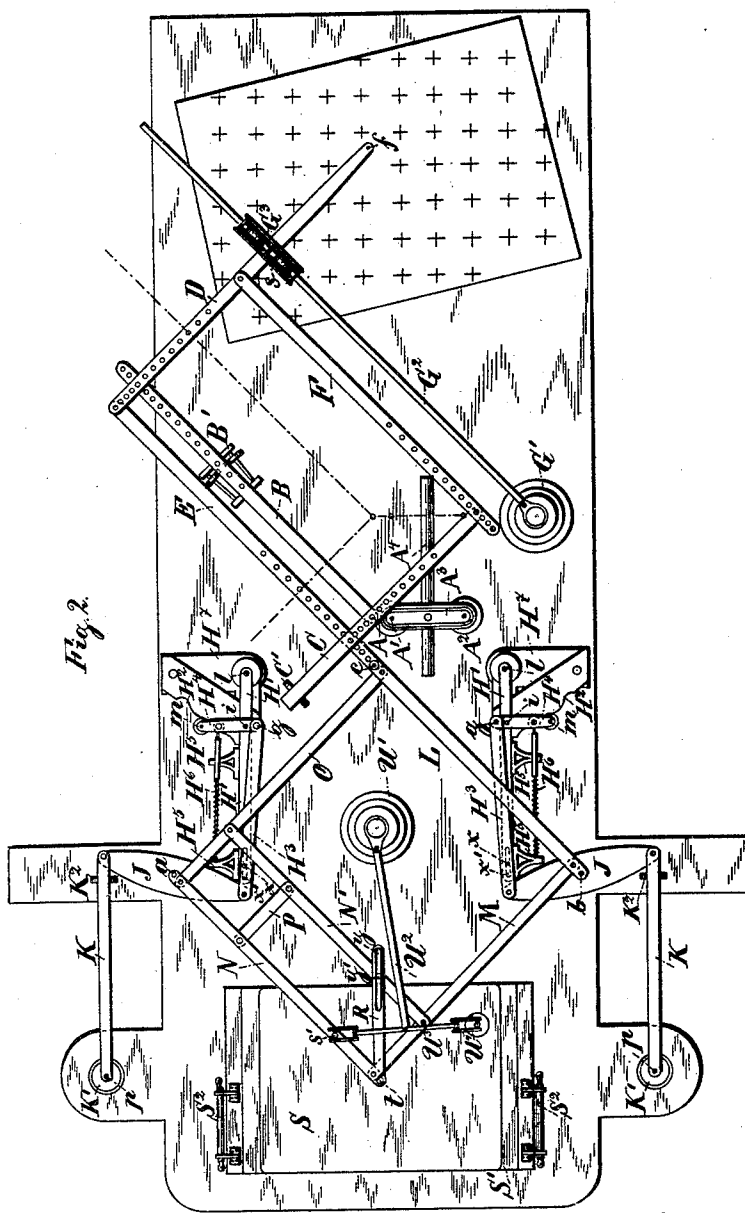
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W. H. Muzzy.
E. K. Sturtevant.

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UNITED STATES PATENT OFFICE.

FRIEDRICH WILHELM SABEL, OF COBLENTZ, GERMANY.

ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 460,762, dated October 6, 1891.

Application filed March 16, 1891. Serial No. 385,313. (No model.) Patented in Germany July 16, 1889, No. 51,309; in France September 5, 1889, No. 200,580; in England March 5, 1890, No. 3,549, and in Austria-Hungary October 7, 1890, No. 24,685 and No. 46,668.

To all whom it may concern:

Be it known that I, FRIEDRICH WILHELM SABEL, a citizen of the German Empire, and a resident of the city of Coblenz, Prussia, Germany, have invented certain new and useful Improvements in 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.

This invention has been patented in the following countries: in Germany, No. 51,309, dated July 16, 1889; in England, No. 3,549, dated March 5, 1890; in France, No. 200,580, dated September 5, 1889, and in Austria-Hungary, No. 24,685 and No. 46,668, dated October 7, 1890.

My invention relates to improvements in engraving-machines for copying maps or drawings or the like in a reversed position and at the same time reducing the size of the copy.

The chief object of my invention consists in the application of a pantograph as a moving lever, which designs the reduced reversed drawing by means of a parallelogram frame.

In the accompanying drawings, Figure 1 represents a diagram of the devices embodying my invention, and Fig. 2 represents a top view of the said devices.

E, C, B, and D are the arms of a pantograph, having its fulcrum in A, the guide-point in *f*, and the writing or drawing point in *c*. The latter, giving the non-reversed drawing in reduced size, is connected to a parallelogram frame, the four sides L M N O of which are equal in length. If the two opposite ends *a* and *b* are moved in a straight line passing through both, the point *t* will evidently design a figure, being the reversed picture of the one described by the point *c*, both pictures being of the same size. When, therefore, the traveling point *f* is made to follow the lines of a drawing *r'*, the point *c* will give, according to the proportional reduction of the instrument, a right picture *r''* of this drawing, more or less reduced in size, while an engraving-point (diamond or steel) inserted at *t* will engrave the reversed figure—i. e., the reflected picture *r''*—in a stone or other

printing-plate, so that the impression from it gives the right (positive) picture of the reduction.

According to my invention the points *a* *b* are guided in a straight line placed through them, not in a slide or in slots, being the easiest and nearest, as this kind of guide leads to very serious faults, as I have found, but in a suitable link-motion guide, which I have endeavored to find out as applicable to the purpose. But all link-motion guides are working only approximately in a correct straight line, and I had to make use of a supplementary correction-guide to produce motion in an exact straight line. I have shown the well-known Lemniscoid guide as the most appropriate to the purpose.

The four rods K K and H' H', having their fulcrums on the table in *p p* and *l l*, are connected with their ends *e e* and *d d* to the two links J. The two points *a* and *b* will make a nearly rectilinear motion when the system is going to and fro and will approximately follow a straight line placed through *a* and *b*. I change this defective motion into a correct straight-lined one by the following device: The two links J are not attached with their ends *d* to the rods H' H', but are hinged to H³, a supplementary bar, which is connected to the levers H⁴ in *g*. These levers H⁴ turn on pins *i*, secured on the bars H', while their longer arms carry the two rollers *m*, intended to glide along the special curves or rules H². The rods H' serve only to carry the two rods H³, which glide upon one another, by means of a stud and a slot, and which thus transfer the motion of the levers H⁴ upon the ends *d* of the links J. The two curves or rules H² have been found in practice to guide the two points *a* and *b* along an accurately-dressed ruler, while two pencils placed in the axles of the rollers *m* traced the curve from which the correct curve has been derived by the deduction of the radius of the rollers *m*. It is evident that the fulcrums *p l* must remain in an unaltered position, respectively, to each other.

The fulcrum A is fixed upon the end of a rail A³, supported by two studs A' A². The whole can be displaced upon an iron rod A⁴, secured to the table, and can be fastened in

any position by means of a set-screw, so that the fulcrum A becomes unremovable. The bar B has one end fixed to this fulcrum and is supported by a pair of rollers B'. Besides the bar C is attached to this fulcrum and is provided with the carrying-roller C'. The rods B and C are connected to the strong rods E and D, the latter of which carries the traveling point *f*. The movable rod F prevents a lateral giving way. A revolving arm G² turns upon a post G' and carries a sliding block G³, to which the arm D is suspended by means of a pin *s*. Thus the weight of the arms D and F is taken up and cannot change the traveling point. The rods B C E D F are provided with holes for adjusting the apparatus in the desired proportion of reduction. The parallelogram frame L M N O is hooked to the point *c*, giving the reduction. This parallelogram frame should not be disconnected in its corners whenever the instrument is changed for another proportion. The fulcrums *p* of rods K, carried by rollers K², rest upon parts K', which are securely attached to the table. The rods K are hinged to the links J, which carry the ends *a* and *b* of the parallelogram frame in their middle, and at their free ends the counter-guide J is hinged to the rod H³, which carries a pin *x*, projecting into a slot *x'* of the lever H', having its fulcrum in *l*, as also the slot may be in H³ and the pin on H'. A lever H⁴, turning upon a stud *i* on the rod H', is connected at *g* with one end to the rod H³, while its other end receives the roller *m*, which is guided along the curve of the ruler H². A rod provided with a spiral spring H⁶, being supported by brackets H⁵, presses the roller *m* always against the curve H². The latter and the fulcrum *l* are disposed upon a part H¹, securely fixed to the table.

In order to maintain the engraving-point *t* in its exact position, it is attached to a bar R, being slotted at *y* to have a pin *y'* play therein, which projects from the rod N', hinged to M and O. A cross-rail P is provided to maintain N' always in parallel position to N. The weight of the whole parallelogram frame and its connections is carried by an arm U², turning on a pivot U'. The free end of U² is provided with a cross-bar U³, which is movable thereon. The arm N is hooked to one end of U³ by means of a wire

s', while the other end carries a tin can U⁴, which is to be filled with so much small shot that the point *t* just touches the stone plate S or rests upon it with exactly the pressure which is necessary for engraving. The stone S rests upon a slide S', which is moved by the two handles S².

Having thus fully described my invention, I claim—

1. In an engraving-machine, the combination of the pantograph B C E D with the parallelogram frame L O N M, the guide-rules H², rollers *m*, and an intermediate series of levers connecting said parallelogram and rollers, substantially as and for the purpose set forth.

2. In an engraving-machine, the combination of the pantograph B C E D with the parallelogram frame L O N M, fulcrum A, its supporting-studs A', rod A³, adjustably mounted, rod G², supporting said pantograph, rod U², supporting the parallelogram frame, guide-rollers *m*, rules H², and an intermediate series of levers making connection between said rollers and said parallelogram frame, substantially as and for the purpose set forth.

3. In an engraving-machine, the combination of the pantograph B C E D with the parallelogram frame L O N M, bars K, H', H³, and H⁴, connecting-link J, rules H², rollers *m*, spring H⁶, pivoted rod U², its cross-bar U³, receptacle U⁴, and support G², all substantially as and for the purpose set forth.

4. In an engraving-machine, the combination of the pantograph B C E D with bar F, revolving arm G², carrying said pantograph, supporting-rollers B', fulcrum A, parallelogram frame L O N M, bars P N', and slotted bar R, attached to said parallelogram, revolving arm U², carrying said parallelogram frame, and a correction-guide consisting of bars K, H', H³, and H⁴, connecting-link J, rules H², rollers *m*, and spring H⁶, all substantially as and for the purpose set forth.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FRIEDRICH WILHELM SABEL. [L. s.]

Witnesses:

ALVESTO S. HOGUE,
JEAN GRUND.