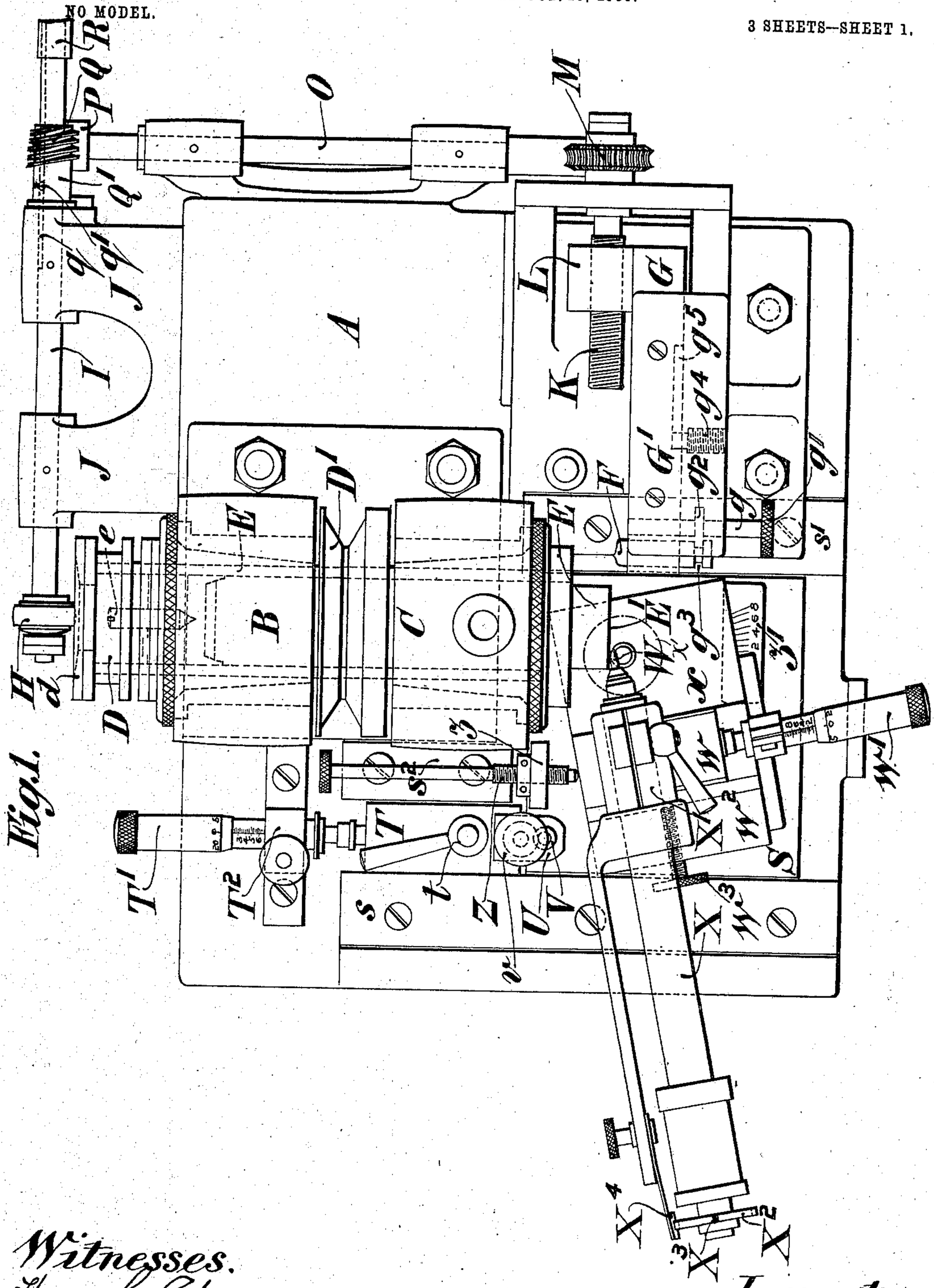
No. 736,193. PATENTED AUG. 11, 1903.

M. BARR.

MACHINE FOR GRINDING TRACERS AND TOOLS FOR ENGRAVING MACHINES.

APPLICATION FILED OCT. 13, 1900.

NO MODEL. 3 SHEETS—SHEET 1.



Witnesses.
Harry L. Bott
Horace Gellier

Inventor.
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per Chas. L. Woodruffe
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NO MODEL. 3 SHEETS—SHEET 2.

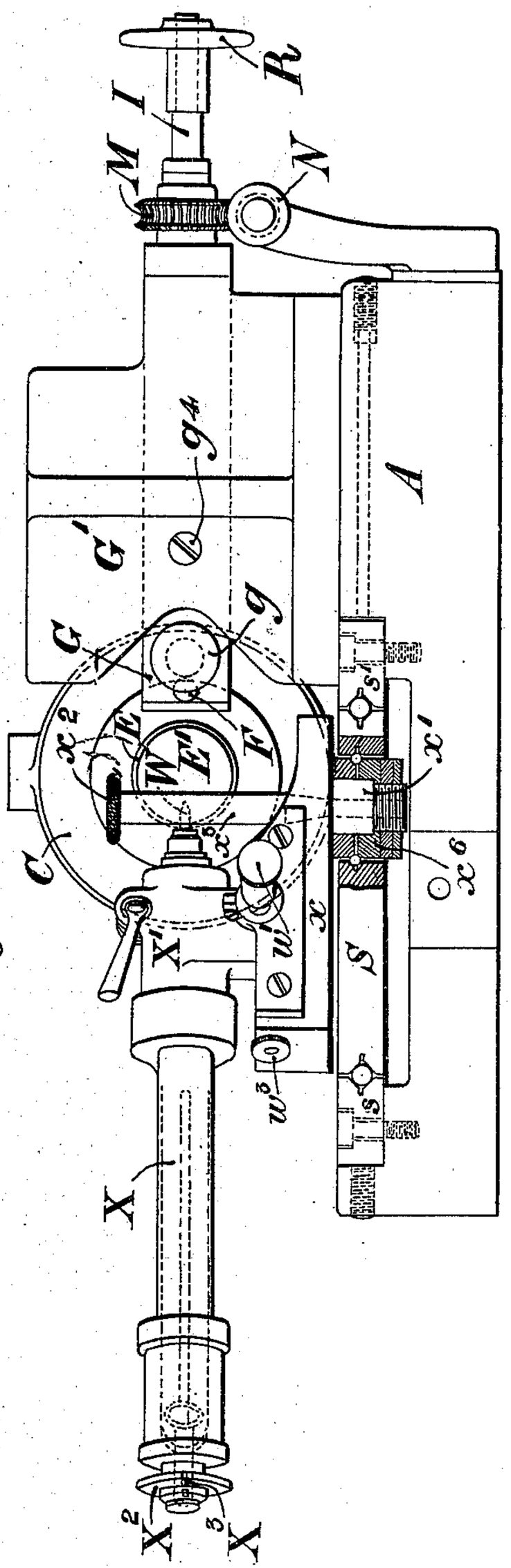

Fig. 2.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

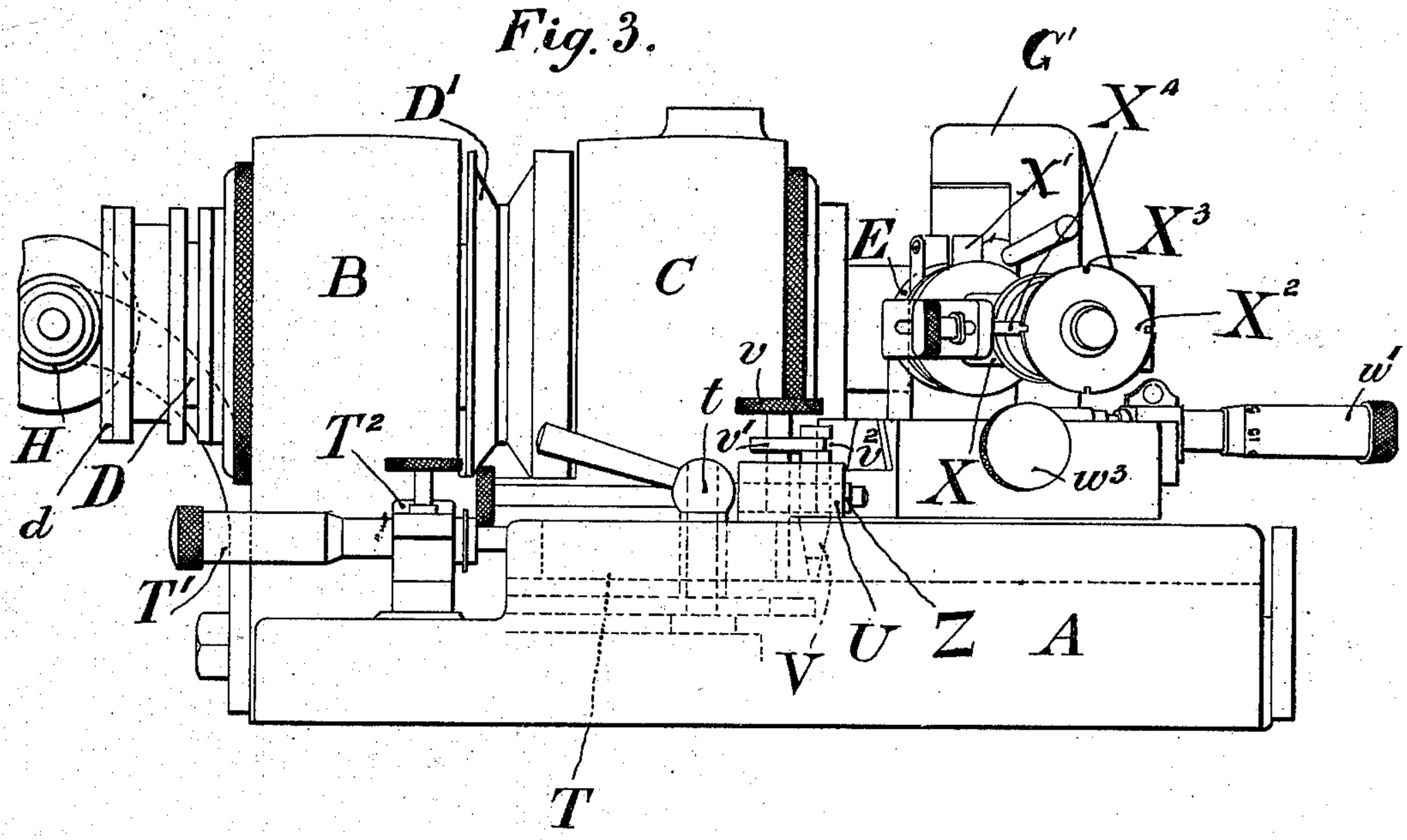
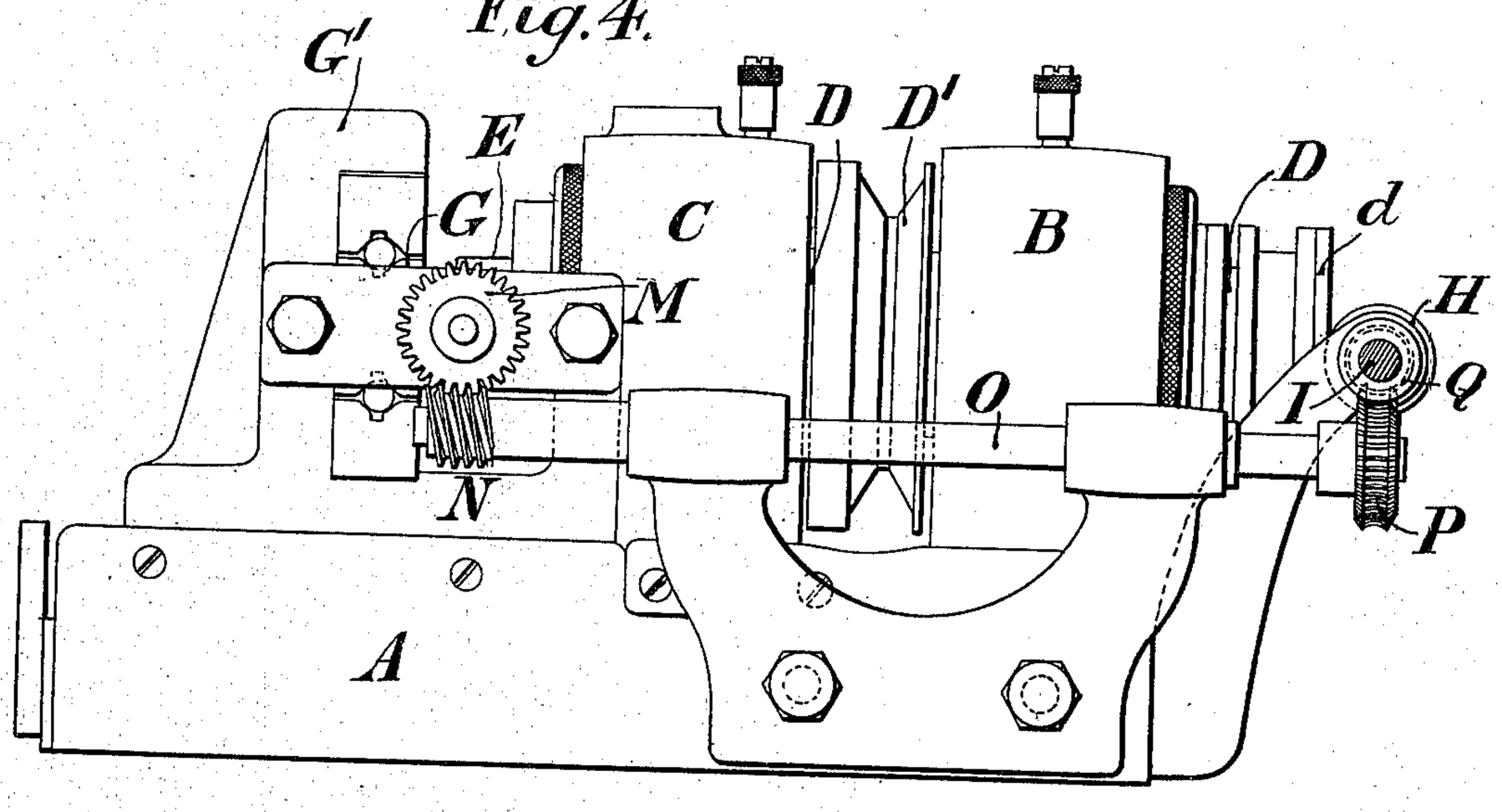


Fig. 4.



Witnesses.
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No. 736,193. Patented August 11, 1903.

UNITED STATES PATENT OFFICE.

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

MACHINE FOR GRINDING TRACERS AND TOOLS FOR ENGRAVING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 736,193, dated August 11, 1903.

Application filed October 13, 1900. Serial No. 32,999. (No model.)

To all whom it may concern:

Be it known that I, MARK BARR, of the Linotype Works, Broadheath, in the county of Chester, England, have invented certain new and useful Improvements in Machines for Grinding Tracers and Tools for 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 consists, first, in improvements in the relationship between the tracer ends and the cutting-tools of engraving-machines, and, secondly, in grinding-machines for grinding such tools. It enables the form of the tracer end to control the form of the cutting-tool which it is to guide in the engraving-machine of which each is an organ, such control being exercised by means of the improved grinding-machine.

In an engraving-machine—such, for instance, as the well-known Benton Waldo or the Ballou engraving-machine—for producing objects which, like dies, have three dimensions—length, width, and depth of design—it is essential that the cutting edges of the tool shall have the same form as the tracer end, the dimensions of those edges being at the same time modified according to the desired ratio between pattern and object. In all such engraving-machines it is the motion of the axis of the tracer end which is transmitted to and reproduced proportionally and with more or less accuracy in the axis of the tool; but as the tracer end has necessarily a finite thickness the pattern will be touched, as the said end is moved over it, by points in the surface of the tracer end which are radially on one side of the axis of that end. Consequently, it is the motions of those points as distinguished from the motions of points situated in the said axis and in the same horizontal plane that are reproduced in homologous points in the surface of the tool.

Now I am convinced that the principles laid down in the preceding paragraph have not been appreciated hitherto at their true value or have not been carried into effect.

An engraving-machine is called upon to produce objects in many ratios that has hitherto necessitated an indefinitely large number of tools, so as to be ready for an object in any ratio to the pattern. Further, as it is impracticable to grind a tool held in any head-stock other than the one in which it is to be used, a corresponding number of head-stocks, each holding the respective tool, is a second necessity, and, furthermore, when a tool is wanted to work to a given ratio it must be ground to the necessary form at a moment's notice.

One result of the present invention is that the tracer-rod is equipped with only a comparatively small number of tracer ends. The forms of these ends are such as will be convenient generally—say blunt, curved, ball-pointed, and sharp. These ends are for tracing over any pattern which may be brought to the engraving-machine to be worked from, and for each ratio between pattern and object corresponding tools are ground, that grinding being effected in the improved grinding-machine described farther on.

The present invention requires that the form (using this word as including all the geometric elements) of each of the tracer ends mentioned in the preceding paragraph shall be one that is easily expressed by one or more simple elements or coördinates, and, further, that the movements of the tool-blank—that is, the unground tool—in front of the abrading member of the grinding-machine shall be controlled by adjustable devices the adjusted positions of which correspond with the geometric elements of the tracer end. The result is that as these geometric elements will be known to the operator the mere adjustment of the said devices leads forthwith to the generation of a tool having corresponding form or geometric elements.

The above-mentioned simple elements or coördinates appear first in the tracer end, to be afterward reproduced in the tool. The easiest process for giving the desired form to a tracer end is well-known to users of engraving-machines to be of one grinding, the unground end being held up to the grinder at right angles with its surface and rocked about a center of oscillation situated somewhere along the axis of the tracer end or to one side thereof. Now the radius (R) of the curva-

ture of the ground end and the distance (D) of the center of oscillation from the axis of the tracer end are the two simple elements or coordinates above mentioned, and their respective dimensions settle the form of the tracer end. Both range from zero upward. If R be infinite and D be zero, there will not be any curvature at all. If R equal the radius of the cross-section of the unformed tracer end and D be zero, the form of that end will be hemispherical, and it will acquire acuteness in proportion as D is made longer. All the tracer ends are, according to the present invention, bodies of revolution—*i. e.*, any section at right angles with the axis is exactly circular—and each one is, for the purpose of the invention, marked with the respective values of R and D. Several sizes of each form of tracer end are provided.

The machine for grinding a tool is of the same construction exactly as the one for grinding the tracer end and with which it is homologous, but correspondingly smaller. The relationship between the tracer end and its homologous tool can be realized with a tracer end formed by any convenient means; but seeing that the R and D of the tracer end must be known before it can be formed the desired form can be obtained more quickly by the improved machine than by any means hitherto used.

The following description of the figures treats them as if the machine illustrated is a small one—that is, one for grinding a tool.

Referring to the accompanying drawings, which are to be taken as part of this specification and read therewith, Figure 1 is a plan of the improved grinding-machine; Fig. 2, a front elevation, partly in section and corresponding therewith; Fig. 3, a side elevation of Fig. 1 from the left hand, and Fig. 4 a side elevation of Fig. 1 from the right hand.

A suitable base A carries a pair of bearings B C, in which turns a tube D, containing a cylindrical abrader E. The flat end E′ of the latter, projecting beyond the front end of the said tube D, is the abrading member already referred to.

D′ is the driving-pulley for the tube D. A diamond dresser F to dress up the surface E′ is mounted on a suitable traverser G, adapted to work in a traverser-block G′, fast on the base A. The traversing is effected by a leather friction-wheel H, adapted to be moved diametrically across the rear end of the tube D and which end has a leather facing *d* to prevent the wheel H slipping. The friction-wheel H is mounted upon the end of a shaft I, turning in bearings J J.

K is the traverser-screw, turning in a nut L and carrying a worm-wheel M on its outer end, which wheel engages with a worm N on the shaft O, the two shafts O and I being geared together by a worm-wheel P and worm Q. The engagement of the friction-wheel H with the facing *d* on the rear end of the tube D on one side of the axis of the latter moves the dresser F across the surface E′, and the engagement of it with the said facing on the other side returns the dresser F across the said surface E′ into its original position. The shaft I is slid backward and forward through the bearings J J by the disk R to move the friction-wheel H into engagement with the facing *d* on one side of the axis of the tube D to respectively traverse the dresser F across the surface E′ to dress it and to return the said dresser to its original position or to hold it out of engagement with the said facing when the dresser F is to remain out of action. This last position is the one illustrated in Fig. 1. To allow of the shaft I being so slid to and fro without disengaging the worm Q and the wheel P, the former is mounted upon a sleeve Q′, through which the shaft I is passed. The engagement of the worm Q with the wheel P and the adjacent bearing J in part prevent the said sleeve moving longitudinally with the shaft I, while the engagement of the feather *q*, fast on the sleeve Q′ in a slot *q′* in the shaft I, provides for the latter carrying the said sleeve around with it.

The abrader E is provided with any suitable means, such as a set-screw *e*, to set it up toward the front to compensate for wear. The length of the traverse of the traverser G in the block G′ is limited in both directions by the projection of a set-screw g^4, fast in the said block, into a slot g^5 in the traverser G. The diamond dresser F is capable of being set up to the face E′ of the abrader by the following means. It is adapted to slide in a suitable guide in the traverser G.

g is a setting-up screw parallel with the dresser F and engaging in the traverser G as in a nut, and *g′* is a milled head on the outer end of it. It engages with the dresser F to set it up to the face E′ or to withdraw it by a collar g^2, which fits in an annular groove g^3 in the said dresser.

S is a slide capable of a reciprocating linear motion between guides *s s′* on the base A to and from the surface E′. The limit of the motion of the slide S up to the said surface E′ is decided by a stop-block T, sliding in guides $s\,s^2$. This block T carries a bracket U, which overhangs the slide S and is fitted with a conical plug V, which can hold the slide S to the stop-block T by being forced down one side of a conical hole in the said slide S by a screw *v*. To enable it to do that, the screw *v* works in the stop-block T, as shown best in Fig. 3, and has a collar *v′* fast on it and engaging in an annular groove v^2 in the plug V.

The steel rod from which the tool end W is to be made is carried in the usual quill X and clamp X′.

X^2 is a disk fast on the outer end of the quill X and having four notches X^3 in its periphery, into each of which the spring-detent X^4 can engage to hold the face of the tool end W, then being ground, steady, as is usual in machines of this class. The clamp X′ stands up from a slide *w*, working in a table *x*, which is

pivoted in the slide S by a hollow pivot x', fast to it and turning in a bearing x^6 in the said slide, as shown best in Fig. 2. The distance of the axis of this pivot x' from the surface E′ is in all cases proportional to the geometric element R already described.

The pin x^2 is of known diameter—say, *e. g.*, two-tenths of an inch. If the radius to which the tool is to be ground is also two-tenths of an inch, the stop-block T, clamped to the base A, serves as a stop for the slide S so long as the radius just mentioned is the desired tool radius and the micrometer T′ is not called into action; but other tool radii may or will be required, and to obviate the necessity of providing a pin for each radius I equip the machine with the micrometer T′ in order that the radius of the pin x^2 may be transferred to its ram through the slide S and the stop T. When this transference has been effected it is obvious that the micrometer can be set for any other radius less or more than that of the pin x^2 and that its ram, instead of the stop T, will then be the stop for the motion of the slide S toward the surface E′. The micrometer thus obviates the necessity of equipping the machine with a pin for each tool radius.

The stop-block T moves with the slide S as one piece so long as they are held together, the object of this being to determine the position of that edge of the stop-block T against which the slide S abuts in such a manner that the said slide shall have a definite position with reference to the surface E′. The hollow pivot x' has a tapered and axial hole into which fits a circular pin x^2, having an upper parallel part x^3 of a known diameter. To determine the position of the slide S the pin x^2 is inserted in the hollow pivot x', the stop-block T and slide S made fast together by the conical plug V, and the slide S moved up toward the grinding-surface E′ until the parallel portion x^3 of the pin x' bears against it. The stop-block T is then clamped to the base A in its new position by a suitable clamp *t*. Behind the stop-block T there is a micrometer-screw T′ in a clamping-sleeve T^2, carried by the base A. This micrometer-screw T′ is set to the reading which is equal to the radius of the parallel portion x^3 of the pin x^2, and the barrel of the said micrometer is then pushed through the sleeve T^2 up to the stop-block T and clamped in that position. The stop-block T is next unclamped from the base A, disconnected from the slide S, and the pin x^2 taken out of the hollow pivot x'. The micrometer reading gives the exact distance that must separate the axis of the hollow pivot x' from the grinding-surface E′. This adjustment corresponds to the element R already mentioned.

w' is a micrometer carried by the table x and having its ram w^2 bearing against the slide w to accurately vary and measure the distance of the axis of the steel rod in the clamp X′ from the axis of the hollow pivot x'. This distance is proportional to the element D already described. w^3 is a set-screw for holding the slide w in its adjusted position.

Z is a screw-threaded stop working through a block z on the slide S to limit the arcual motion of the table x about the pivot x'.

z' is a scale by which the screw Z can be adjusted.

The tools of an engraving-machine are not round in cross-section, as are the tracer ends, for they must have faces to produce edges that will cut as they rotate. Hence the elements of the tracer end are not reproduced along the faces of the tool, but along the cutting edges of it. So in making a tool which shall be, for instance, a tenth of the tracer end, having the elements R and D, the readings of the micrometers T′ w' are not set to one-tenth R and one-tenth D, respectively, but to such values as will give the elements one-tenth R and one-tenth D to the tool edges. Now when a tool with alternate flats and edges is at work the sides of the hole or of the gutter which it cuts have a radius less than that of the faces. So, either graphically or mathematically, the corresponding radii of faces and edges are determined for each type of tracer end, and the distance of the axis of the hollow pivot x' from the axis of the tool corresponding to the radius of face curvature is found in the same way. Both these modified elements R and D are then marked on the respective tracer ends, so that the setting of the two micrometers T′ w' of the improved grinding-machine to readings proportional, according to the ratio of reduction, to those elements so marked adapts the machine to grind the end of the steel rod then in the quill X into a tool the form of whose cutting edges corresponds proportionally (and more or less approximately) to the form of the tracer end.

I claim—

1. In a grinding-machine, the combination of a slide adapted to slide to and from the abrading member, to pivot about a hollow pivot on the base of the machine and to receive a pin of a known diameter with its axis alined with that of the pivot; a slide adjustable on the base of the machine to serve as a stop for the first-mentioned slide; a supplementary slide to carry the rod to be ground and to slide in the first-mentioned slide in the direction of the latter's motion on the machine-base, and a micrometer carried by the first-mentioned slide and adapted to control the position of the supplementary slide thereupon.

2. In a grinding-machine, the combination of a slide adapted to slide to and from the abrading member and to pivot about a hollow pivot on the base of the machine; a hollow pivot in the said slide adapted to receive a pin of a known diameter; a slide adapted to serve as a stop for the first-mentioned slide and having a clamp by which it can be temporarily held to the machine-base; a clamp by which both the said slides can be temporarily held together; a supplementary slide to carry the

rod to be ground and adapted to slide in the first-mentioned slide in the direction of the latter's motion on the machine-base, and a micrometer carried by the first-mentioned slide and adapted to control the position of the supplementary slide thereupon.

3. In a grinding-machine, the combination of a slide adapted to slide to and from the abrading member and to pivot about a hollow pivot on the base of the machine; a hollow pivot in the said slide adapted to receive a pin of a known diameter; a slide adapted to serve as a stop for the first-mentioned slide and having a clamp by which it can be temporarily held to the machine-base; a clamp by which both the said slides can be temporarily held together; a micrometer working in a clamping-sleeve fast to the machine-base to serve as a stop for the said stop-slide; a supplementary slide to carry the rod to be ground and adapted to slide in the first-mentioned slide in the direction of the latter's motion on the machine-base, and a micrometer carried by the first-mentioned slide and adapted to control the position of the supplementary slide thereupon.

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

MARK BARR.

Witnesses:
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G. F. WARREN.