(No Model.) 2 Sheets—Sheet 1.

A. M. ENGLISH.

ENGRAVING MACHINE.

No. 510,905. Patented Dec. 19, 1893.

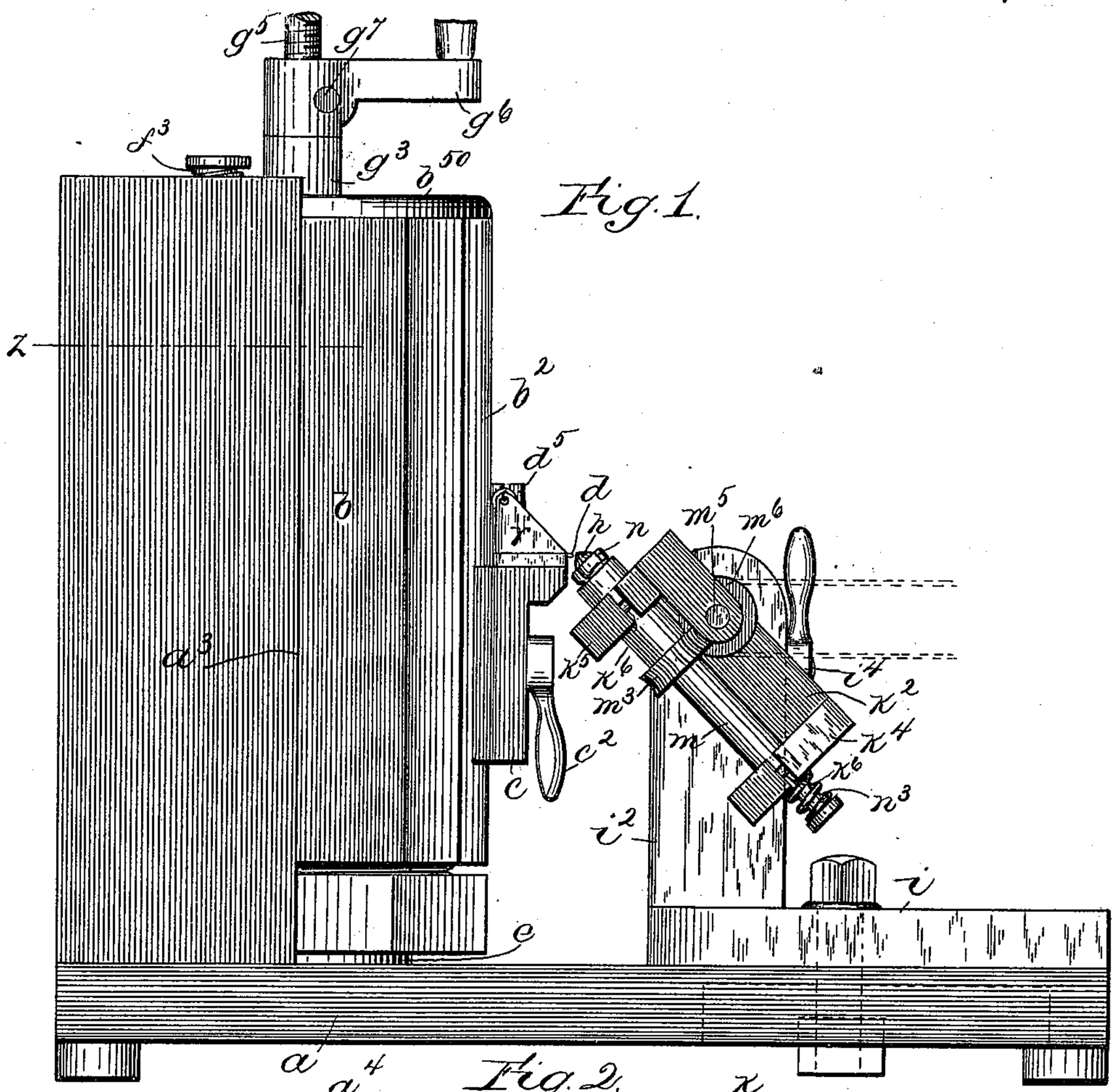

Fig. 1.

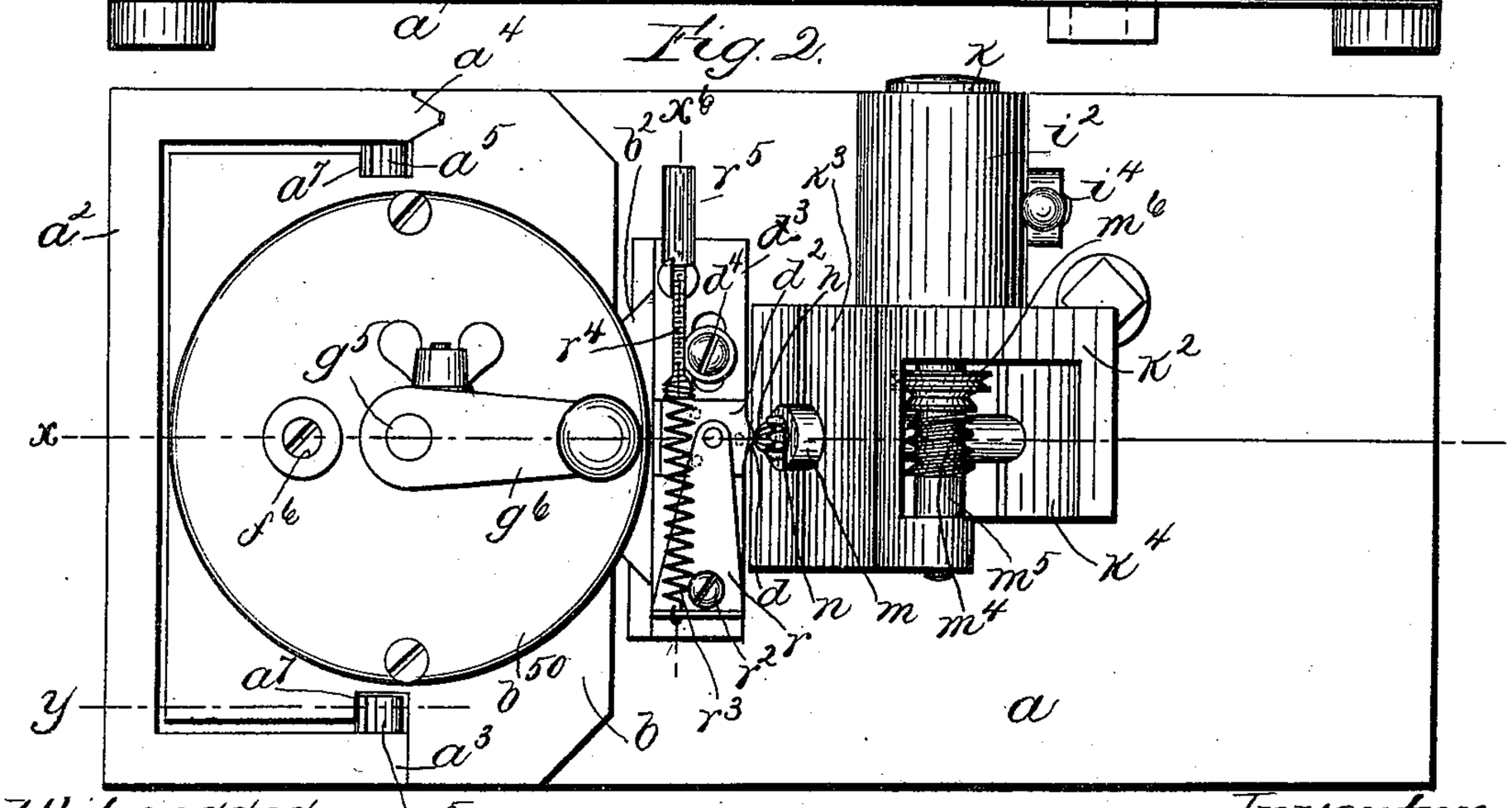

Fig. 2.

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(No Model.)

2 Sheets—Sheet 2.

A. M. ENGLISH.

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Fig. 3.

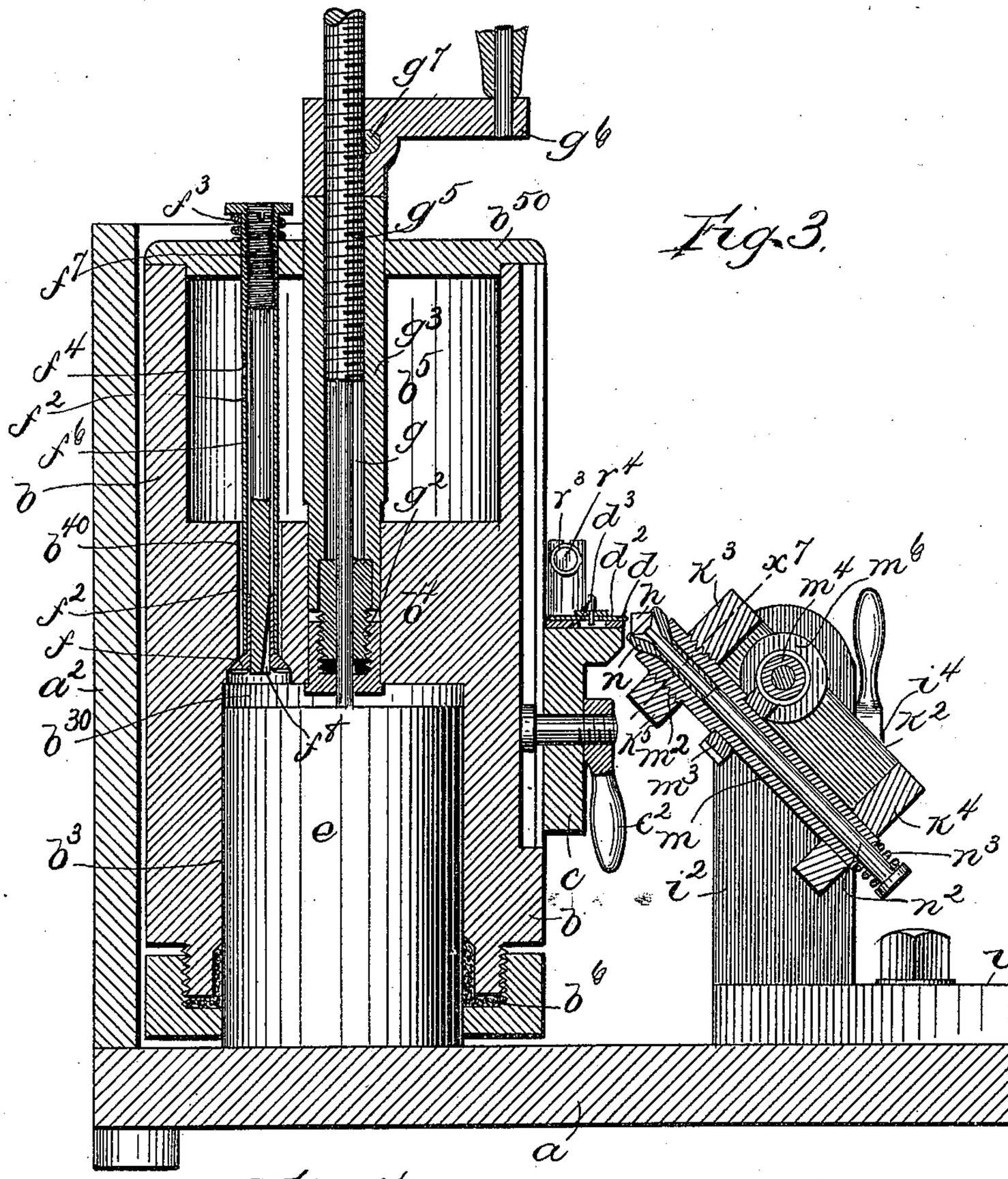


Fig. 4.

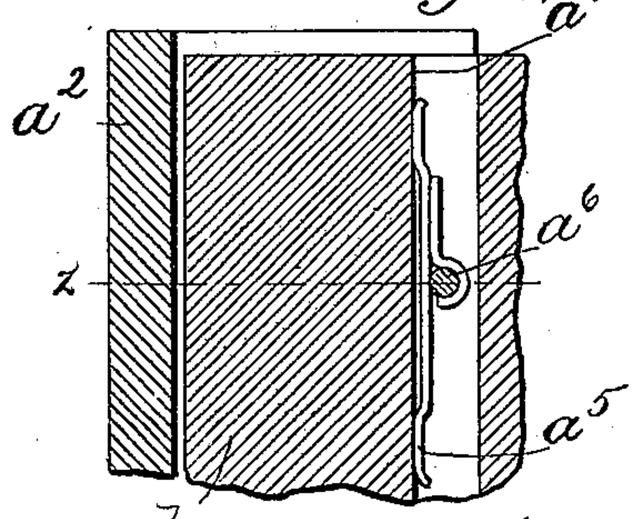


Fig. 5.

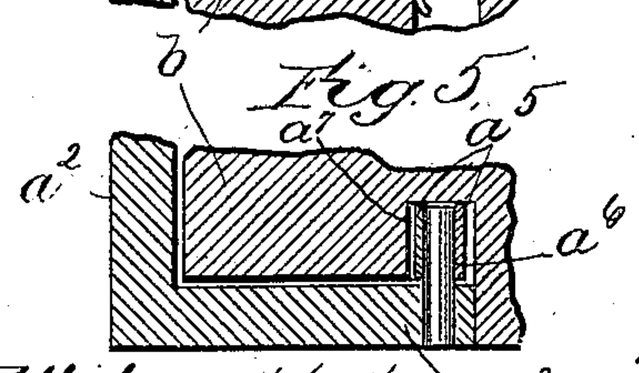


Fig. 6.

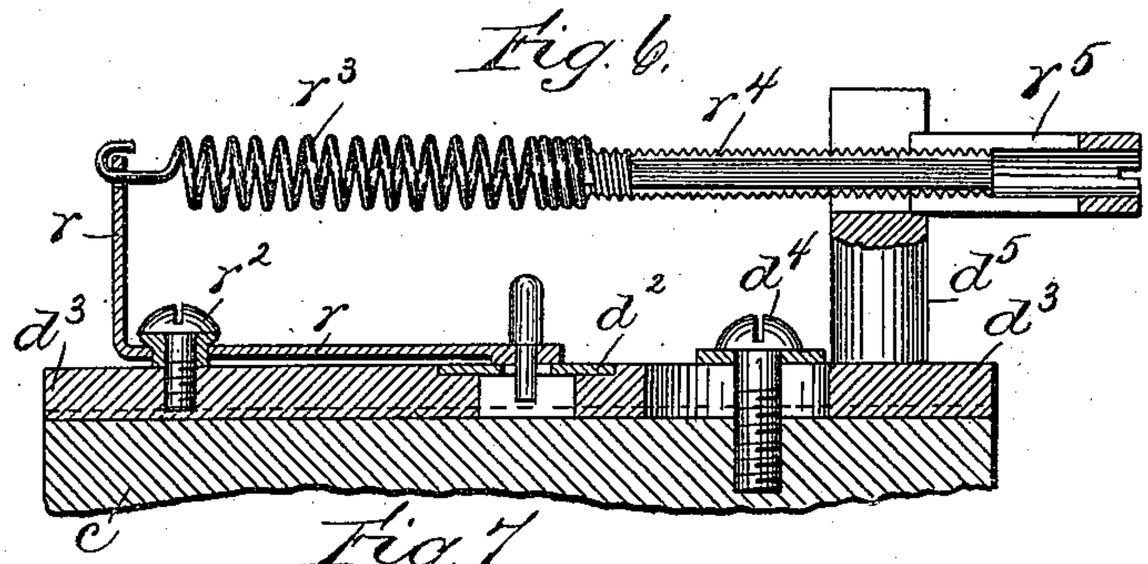
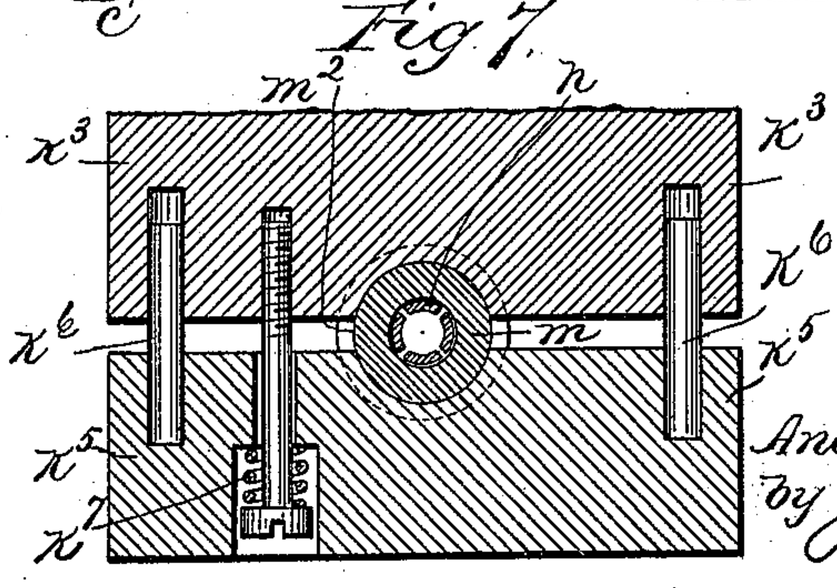


Fig. 7.



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UNITED STATES PATENT OFFICE.

ANALDO M. ENGLISH, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO JOHN JACOBSON, OF SAME PLACE.

ENGRAVING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 510,905, dated December 19, 1893.

Application filed February 13, 1893. Serial No. 462,128. (No model.)

To all whom it may concern:

Be it known that I, ANALDO M. ENGLISH, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Ruling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention is embodied in a machine especially intended for ruling or engraving fine lines upon a conical or cylindrical or approximately conical or cylindrical object, the invention relating especially to the feed mechanism for advancing the tool between the consecutive rulings or lines and being applicable to other uses, requiring a minute and uniform feed.

The apparatus is shown as employed for engraving or ruling a line in successive convolutions about a conical or pyramidal object such for example as a gem, the object being to produce lines or striations that are very close together and uniformly spaced so that the striated surface will decompose the light falling upon it, giving an iridescence to the said surface, or to the light reflected therefrom, and thus enhancing the brilliancy if the object is a gem.

The rulings when applied to a cone or cylinder are in the form of a continuous spiral line around the axis thereof but the successive convolutions of the spiral are so close together as to give substantially the effect of parallel rulings in planes at right angles to the axis of the article ruled. The said article is rotated at uniform speed with its surface presented to the tool or graver and it is necessary to give the graver a very slow and uniform movement lengthwise of the slant height of the object, if it be a cone or pyramid, or parallel with its axis if it be a cylinder. In order to effect this result, either the article being engraved and the means for rotating it, or the tool is mounted upon a carriage adapted to have the required feed movement, and as shown in this instance the tool is fed with relation to the object which has only the rotary motion required to carry the marking of the tool around its surface. The feed movement is produced by the force of gravity and is controlled by the flow of a fluid which gives an extremely uniform feed capable of easy regulation. The tool post is supported upon the side of a heavy vertical cylinder or carriage having a cylindrical bore containing a stationary plunger between which and a transverse wall or head of the cylinder is confined the controlling fluid, and there is an adjustable vent to permit the gradual uniform escape of the fluid under the pressure due to the weight of the cylinder which thus descends slowly and with great uniformity. Means are also provided for raising the cylinder between the different feed operations and for guiding the same in its movement and for controlling the position of the article being engraved, all of said parts being constructed to attain extreme accuracy of relative movement of the tool to the surface acted upon by it, and to prevent any displacement or inaccuracy in said relative movement from lost motion of the parts.

Figure 1 is a side elevation of a ruling machine embodying this invention; Fig. 2 a plan view thereof; Fig. 3 a longitudinal vertical section on line x, Fig. 2; Fig. 4 a longitudinal sectional detail on line y, Fig. 2, of a portion of the guiding mechanism for the feed cylinder; Fig. 5 a transverse sectional detail on line z, Figs. 1 and 4, of said guide mechanism; Fig. 6 a vertical sectional detail on line x^6, Fig. 2, of the tool support, and Fig. 7 a sectional detail on line x^7, Fig. 3, of the arbor for carrying the article to be ruled and the bearing therefor. Figs. 6 and 7 are on a larger scale than the other figures.

The machine is provided with a horizontal bed a having rigidly fixed thereto, at one end, a vertical guide way a^2 having the guides a^3, a^4, upon which the vertical feed carriage runs, one of said guide ways as a^3 being shown as flat or plane and the other a^4 as V-shaped, and the corresponding surfaces of the feed cylinder or carriage b being pressed against the said guide surfaces by springs a^5, see Figs. 4 and 5, abutting against pins or studs a^6 in the vertical guide way and pressing against longitudinal shoulders a^7 on the carriage b. The said carriage b is itself provided with a longitudinal guide way b^2 upon which may be fastened at any desired height the tool post or support c, upon which is fastened the tool

or graver d in any suitable manner, the specific means for supporting the tool being hereinafter described. The said tool post c is securely clamped in adjustable position upon the guide b^2 by any suitable or usual means, such for example as the bolt and clamping handle c^2 shown in Figs. 1 and 3. The said cylinder is provided with a longitudinal bore b^3 in its lower position and a transverse partition b^4, see Fig. 3, forming an end wall or head for said bore, and a chamber or reservoir b^5 above the said partition. The said cylinder bore b^3 at the lower portion of the cylinder receives within it, the plunger e which rests upon but is not fastened to the base a and is thus not liable to bind in the bore of the cylinder which is provided at its lower end with packing b^6 to make a fluid tight joint around the plunger e.

In the space b^{30}, of the cylindrical bore b^3 between the plunger e and partition b^4 a fluid is confined which should be of such character as to be as little variable as possible in density and fluidity, glycerine being well adapted for this purpose, and the said plunger and liquid will sustain the weight of the cylinder which can descend under the force of gravity only as said fluid is permitted to escape from the space b^{30}, so that the uniformity of outflow of the fluid will insure uniformity in rate of descent of the cylinder which may thus be fed with a slow uniform movement and with far greater uniformity than can be obtained by ordinary mechanical feed mechanism, such for example as produced by a screw or gearing. In order to provide for and regulate the escape of the fluid under the space b^{30}, the part b^4 is provided with a passage b^{40}, terminating at its lower end in a valve seat within which is seated a valve f connected with a tubular valve stem f^2 extended up through the cap b^{50}, closing the upper end of the reservoir b^5 in the cylinder, and being there acted upon by a spring f^3 which tends to press the tubular valve stem upward and thus draw the valve f tightly to its seat in the lower end of the passage b^{40}. The said valve stem is provided with a lateral port or opening f^4 communicating with the interior of the reservoir b^5.

The valve f itself is tubular and has its bore substantially filled by the lower end of a rod f^6 the upper end of which is screw-threaded as shown at f^7 and works in an internal thread in the tube f^2 the upper end of said rod being preferably depressed below the end of the tube so as not to be accidentally disturbed, but being easily accessible by a screw-driver or equivalent device when it is desired to turn the said rod to screw it up or down the tube.

The lower end of the rod g^6 is provided with a tapering groove f^8 which is contained within the bore of the valve f and thus forms a vent passage from the chamber b^{30} which is adjustable by moving the said rod f^6 up or down so as to bring a shallower or deeper portion of the said groove at the end of the bore in the valve f thus making a larger or smaller orifice for the escape of the liquid. Thus the speed of the descent of the cylinder b under the action of gravity may be varied and adjusted by adjusting the rod f^6 and thus varying the effective size of the orifice through which the liquid escapes from the chamber b^{30}, while uniformity of the said movement at any determined speed depends upon the uniformity of flow of the fluid itself which under these conditions is extremely uniform. The liquid after passing through the orifice at the end of the groove f^8 passes up through the tubular valve stem f^2 and flows out through the lateral opening f^4 thereof into the reservoir b^5 in the upper part of the feed carriage.

When the carriage is raised after a downward feed movement has been completed and preparatory for another feed operation, the liquid will flow back from the reservoir b^5 through the passage b^{40}, into the chamber b^{30}, by unseating the valve f and if it is necessary at any time to give the cylinder a quick downward movement independent of its feed movement this can be done by depressing the valve stem and unseating the valve and thus permitting a rapid outflow of the liquid from the chamber b^{30}, through the passage b^{40}, around the valve. It is not essential that the vent passage should be contained in the valve. An adjustable vent passage such as shown might be made at another point in the partition b^4 from that containing the valve controlled return passage b^{40}, but by the arrangement shown it is necessary to make only one passage through the said partition. A convenient means for raising the cylinder is shown as comprising a rod g passing through a suitable stuffing box g^2 at the lower end of a tube g^3 extending from the partition b^4 up through the cap b^{50}, and screw-threaded at its upper end to co-operate with a screw threaded rod g^5 upon which is mounted a crank g^6 which may be fastened to said screw threaded rod at any desired height by a key or clamp g^7. When it is desired to raise the cylinder the crank g^6 is fastened to the rod at some distance above the upper end of the tube g^3 and the said rod is then turned by the said crank in such direction as to screw it down into the tube g^3 when it comes to a bearing on the end of the rod g^5 and the latter comes to a bearing on the plunger e, so that the cylinder travels up along the rod g^5 as the latter is rotated until it is brought to the desired height, and when the apparatus is ready for the next feed movement the screw g^5 is merely run up a distance equal to or greater than the complete feed movement desired thus leaving the cylinder free to descend, under control of the escaping liquid.

By the means thus far described the tool d may be fed downward with an extremely uniform rate of movement and with as slow or minute a movement as may be desired, and it is necessary only to give the article to be

acted upon by said tool such movements as are necessary in order to cause the proper action between the tool and the surface of the article in the said feed movement of the tool. As shown in this instance the article *h* to be acted upon is pyramidal in shape and the tool *d* is intended to engrave lines around the surface of the pyramid substantially parallel with one another and at right angles to the axis of the pyramid, which may be done by causing the pyramid to rotate at uniform speed while the graver *d* is presented to its surface and travels along the slant height thereof in the feed movement before described. The means for thus rotating the article *h* are supported upon a carriage *i* mounted upon the bed *a* of the machine and adapted to be set in adjusted position thereon in the usual manner, the said carriage having an upright i^2 provided at its upper end with a horizontal bore i^3 in which is contained the cylindrical stem *k* of a frame piece k^2 having brackets k^3, k^4, containing the bearings for the arbor *m* by which the article *h* is rotated. The stem *k* can be turned in the socket i^3 and clamped at any desired angular position therein by a clamping key i^4 and thus the axis of the arbor *m* may be adjusted to any desired position in a vertical plane, it being set vertically if the side of a cylinder is to be acted upon, or being set at an angle corresponding to the angle of the cone or pyramid, when as shown in this instance, an article of that kind is to be operated upon, thus bringing the slant height of the said article that is at any time presented to the graver *d* into a vertical position, or in other words, parallel with the line of feed movement of said graver *d* as is clearly shown. The said arbor *m* is shown as hollow or tubular and contains a spring chuck *n* the outer surface of the jaws of which are tapering and enter a tapering socket in the end of the arbor so that by drawing the chuck into the arbor its jaws are closed upon the article *h* as clearly shown in Fig. 3. The said chuck is connected with a rod n^2 extending through the arbor and acted upon by a spring n^3 tending to close the chuck, and it can be opened at any time by merely pressing the end of the rod against the stress of the spring. In order to prevent any end motion of the arbor it is provided in one of its bearings with a number of annular ribs m^2 entering corresponding annular grooves in the bearing bracket k^3 and the cap member k^5 of said bracket, see Fig. 7, which is connected with the fixed member of the bracket by steady pins k^6 and pressed toward the arbor by a spring k^7 so as to maintain a constant pressure between the ribs m^2 and the grooves and thus prevent any end shake of the arbor *m*. The said arbor is driven by means of a worm gear m^3, meshing with a worm m^4, on a shaft m^5, having its bearings in the frame piece k^2, and provided with a pulley m^6 to which power is applied of such character as to rotate the said shaft with as great uniformity of speed as possible.

As before stated, the graving tool *d* is supported upon a block or tool post *c* which is vertically adjustable on the feed cylinder *b*. In order to provide for the free adjustment of said tool and to maintain proper pressure of the tool against the surface acted upon and to permit the tool to yield or move forward and backward to follow the surface of a pyramid, it is supported upon a slide d^2 movable toward and from the article *h* being acted upon in a transverse guide way on a plate d^3 longitudinally adjustable on the top of the tool post *c* being fixed when properly adjusted by means of a clamping screw or equivalent clamping device d^4. The said slide is pressed forward by one arm of an angular plate or elbow lever *r* pivoted at r^2 and acted upon by a spring r^3 the force of which may be readily adjusted by means of a screw r^4 and nut r^5, as clearly shown in Fig. 6. The shank of the screw *r* is flattened and drops into a notch in the upper end of the post d^5 fixed upon the plate d^3 while the nut r^5 bears against a suitable seat formed in the side of the post. The flattening of the screw prevents its rotation while the nut is being turned to adjust the strength of the spring and the spring may be readily disconnected when desired to wholly remove the tool from the article, by simply pulling the nut r^5 back from its seat in the post d^5 and then lifting the screw r^4 out from the notch in the post. The nut r^5 is split and has its ends bent together slightly so as to exert a frictional pressure on the screw to prevent accidental turning. The spring r^3 connects with the plate *r* above its pivot r^2 as shown in Fig. 6, as well as at one side on the line from the pivot r^2 to the point of engagement of the lever *r* with the tool plate d^2 and thus the tension of the spring both tends to press the arm of the lever *r* down upon the plate d^2 as will be understood from Fig. 6 and at the same time tends to press the plate d^2 forward toward the article *h* being acted upon. Thus all lost motion between the tool and its guide is avoided, and preferably the guide surface on which the tool slide d^2 rests has three high points as indicated by the small dotted circles, Fig. 2, thus giving the tool slide a tripod form of support to obviate any tendency to looseness owing to imperfect fitting of its bearing. By these means an extremely accurate relative movement of the tool to the surface operated upon is attained, and as before intimated the apparatus may be used for ruling lines about the surface of a cylinder by setting the axis of the arbor *m* vertically or parallel with the feed movement of the tool, or it can be used for ruling a spiral on the face of a disk by setting the said arbor in horizontal position, or it can rule the surface of a cone by setting the arbor at proper angle to bring the feed movements parallel with the slant height of the cone presented to the tool or

substantially so, and the yielding movement of the tool toward and from the article will accommodate slight irregularities in the surface such as may result from accidental imperfections, and will cause it to act upon the surfaces that are intentionally formed only approximate to a cone or cylinder such for example as upon a many sided pyramid or prism.

It is obvious that the details of construction can be varied without departing from the invention, it being for example immaterial whether the work or tool is carried in the feed movement, which is essentially only a relative movement of the one with relation to the other, and it is also immaterial whether the cylinder or the plunger is moved by gravity under the control of the escaping liquid, as either might be made to be the movable and the other the stationary member of these co-operating parts.

I claim—

1. The herein described feed mechanism comprising a cylinder and plunger or equivalent, one restrained from movement and the other impelled to move, under a substantially constant driving force, and a fluid confined between said parts, combined with a tool support connected with one of said parts; and a support for the material to be operated upon by the tool, connected with the other of the said parts; and a vent or escape passage for the said fluid whereby the feed, or relative movement of the tool and material operated upon by the same, is controlled substantially as described.

2. The combination of the feed cylinder and plunger and the fluid confined between the two, with an outlet passage from the space between said cylinder and plunger, the valve controlling said passage, and a vent passage through said valve for permitting a slow escape of the liquid while the valve is closed, substantially as described.

3. The combination of the feed cylinder and plunger with the valve and tubular valve stem and a regulating plug or rod provided with a tapering groove cooperating with a passage through the said valve and being adjustable with relation thereto, substantially as described.

4. The combination of the bed and vertical guide way with the plunger, supported on said bed and the cylinder cooperating with said plunger and provided with guides cooperating with the said vertical guide way, and springs for holding the guide surfaces of the cylinder and guideway in contact, substantially as described.

5. The combination of the cylinder and plunger and vent passage from the space between the two, with the cylinder lifting rod g and screw g^5, substantially as described.

6. The combination of the tool and tool carrying slide d^2 with the controlling lever r cooperating with said tool slide and the spring connected with said lever and arranged with relation to the fulcrum thereof as described, whereby the said lever is caused to press the tool slide against its guides and also press it forward to the work, substantially as described.

7. The combination of the arbor provided with annular ribs m^2, and means to rotate the said arbor with the bearing provided with grooves engaged with said ribs, to restrain the said arbor from end motion, substantially as described.

8. The combination of the feed cylinder and plunger, one provided with a tool support and the other with a support for the material to be operated upon by said tool, and fluid confined between the two, with a reservoir in said cylinder, and a passage connecting said reservoir with the space between the plunger and cylinder, and a valve controlling the said passage, substantially as described.

9. The combination of the feed cylinder and plunger and fluid confined between the two, with a reservoir in said feed cylinder, a passage connecting said reservoir with the space between the plunger and cylinder, and a plug adjustable in said passage provided with a groove constituting a vent for the escape of fluid from the space between the cylinder and plunger into the reservoir, substantially as described.

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

ANALDO M. ENGLISH.

Witnesses:
JOS. P. LIVERMORE,
M. E. HILL.