2 Sheets—Sheet 1.

F. L. BAILEY.

Engraving-Machine.

No. 215,259. Patented May 13, 1879.

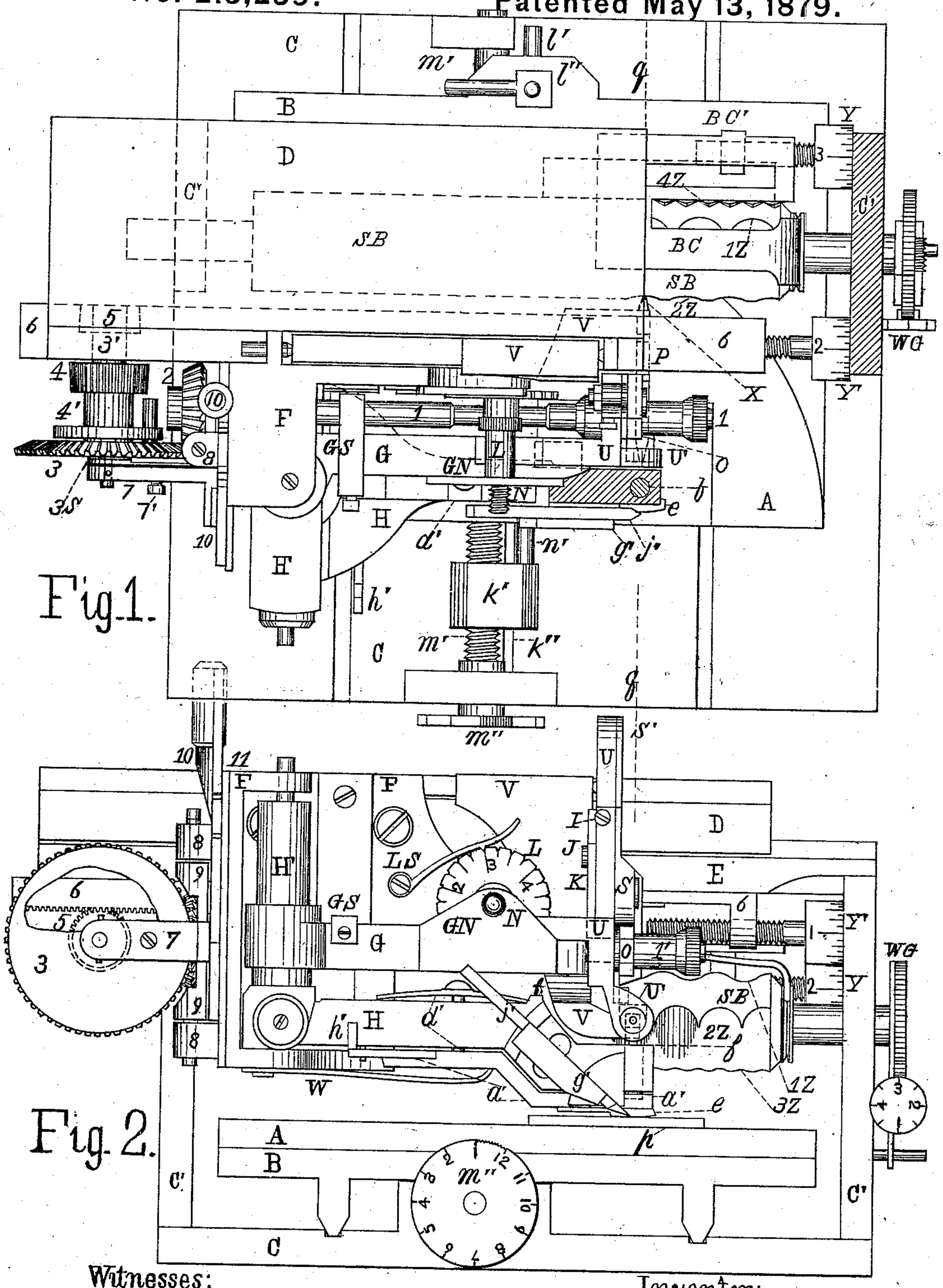


Fig. 1.

Fig. 2.

Witnesses;
Lemuel Albee
W. E. Benjamin

Inventor;
Franklin L. Bailey

2 Sheets—Sheet 2.

F. L. BAILEY.
Engraving-Machine.

No. 215,259. **Patented May 13, 1879.**

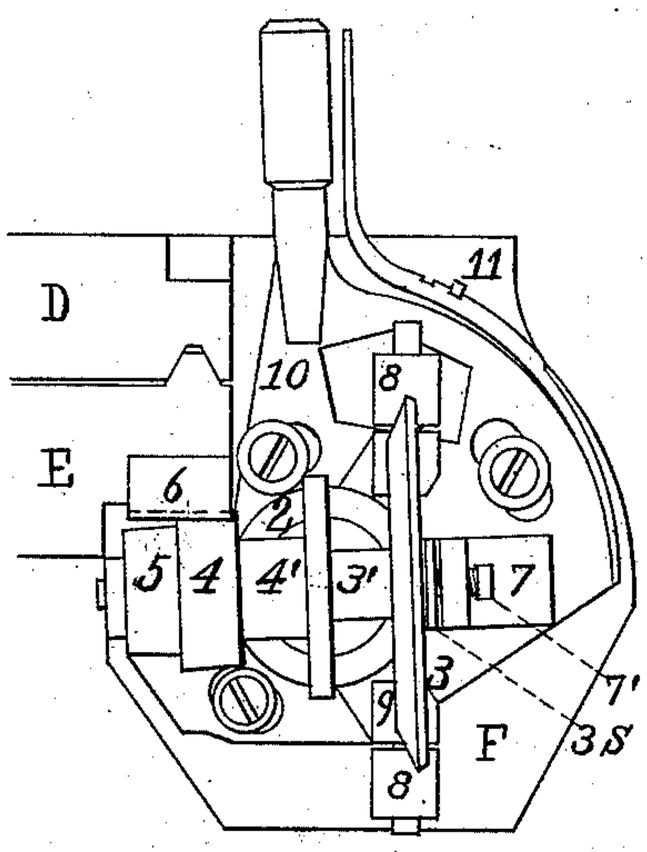


Fig. 3.

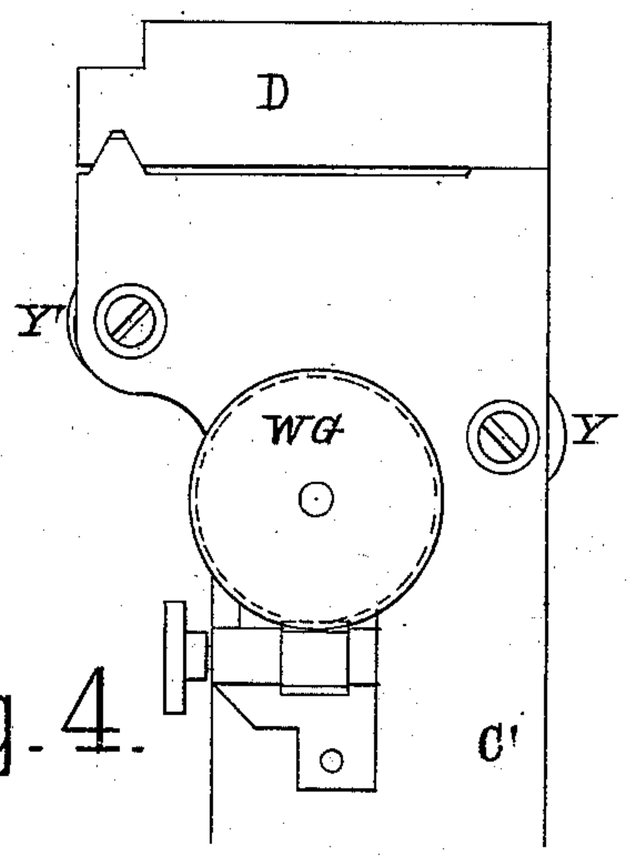
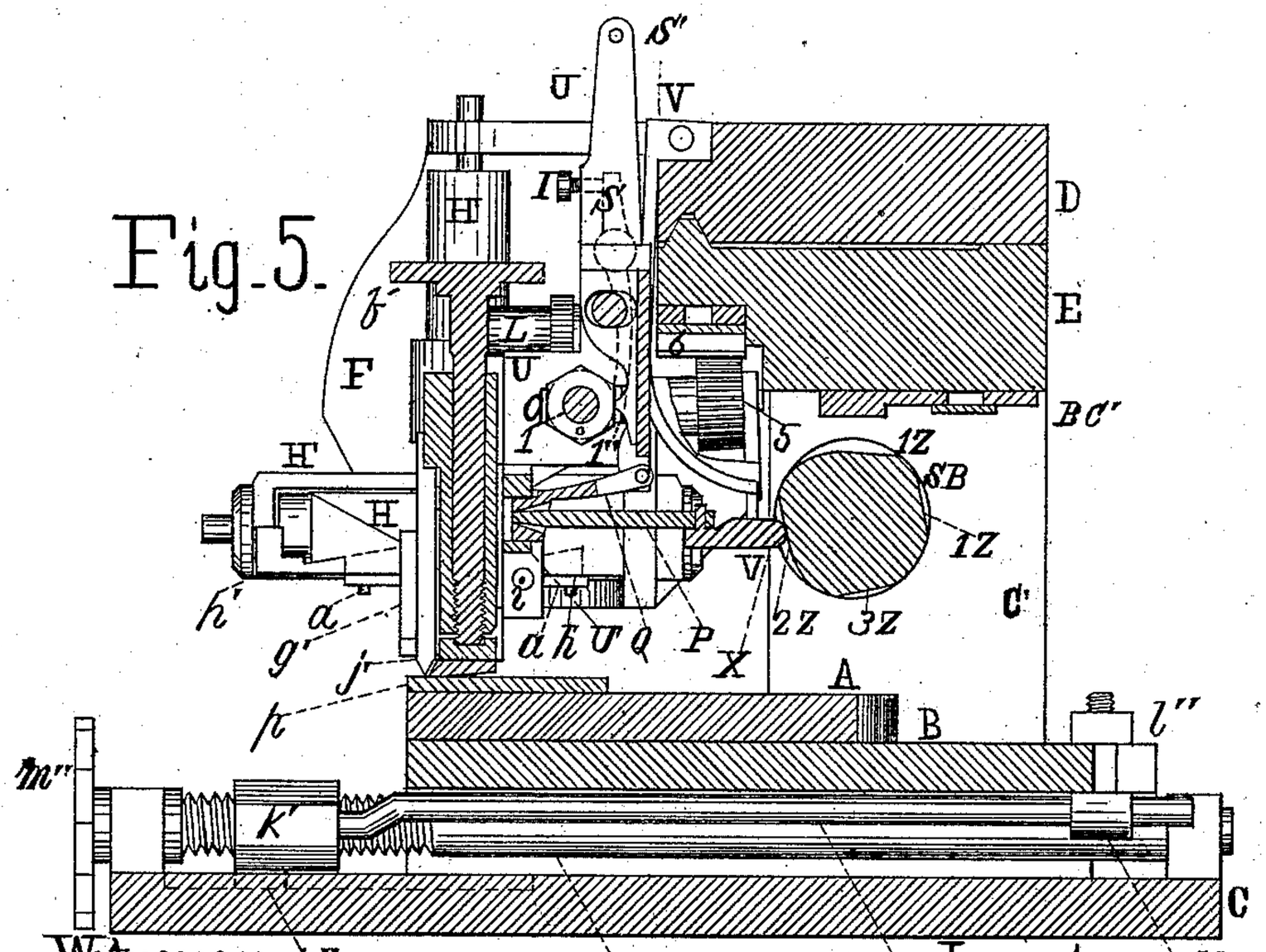


Fig. 4.

Fig. 5.



Witnesses; Summer Albee, W. C. Benjamin.

Inventor; Franklin L. Bailey

UNITED STATES PATENT OFFICE.

FRANKLIN L. BAILEY, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN ENGRAVING-MACHINES.

Specification forming part of Letters Patent No. **215,259**, dated May 13, 1879; application filed July 29, 1878.

To all whom it may concern:

Be it known that I, FRANKLIN L. BAILEY, of Boston, in the county of Suffolk and State of Massachusetts, have made certain new and useful Improvements in Engraving-Machines; and that the following is a full, clear, and exact description of the same.

My invention relates to that class of machines used in engraving designs for printing, in which the designs engraved are formed of lines, and the ornamentation by the shape and relative positions of these lines with reference to each other, these shapes and positions being given by forms more or less fixed.

The machines in common use have the means of feeding the plates along in a direction at right angles to the lines, differing distances in a regular or varying ratio for each succeeding line or space, in that way modifying the appearance of the design. In these machines the forms are also generally series of figures or scallops cut on the surface of the cylinder in lines parallel with the general course of the lines to be cut, these figures being traced by a follower reaching the tool-holder, which is kept against the cylinder by a spring-pressure. These figures are of limited width, and fade out on the curved surface of the cylinder. So, by a slight movement of the cylinder on its axis for each line cut, it has a different form, resulting in a series of lines curved in a less and less degree until they become straight, but the curvatures being all parallel with each other, because heretofore these cylinders have had no movement except this one on its axis, and for that reason are quite limited in capacity. So far I have described the old machines.

One of the improvements of my engraving-machine is that of making the figured cylinder, spoken of above, which I also use, adjustable longitudinally in addition to the common adjustment on its axis, thereby subjecting the curves and angles of the lines to a displacement in some defined order of crowding, overlapping, or superposition, accompanied by corresponding open spaces repeated so that figures or waves appear, or there appear designs caused by bisecting or otherwise dividing any line or series of lines by lines of the same kind, by setting the cylinder along one-half the length of the figure or designs from weaving together of curves of large or small figures.

A part of my invention consists in interposing, so to speak, between the movable cutter and the figured cylinder the means of producing another system of figures for modifying the course of the cutter, consisting of a revolving roller or rollers of small diameter having their peripheries flattened or scalloped, or otherwise cut in differing numbers of facets revolving on a shaft, substantially as described, on the same carriage with and vibrating the cutter, according to their own shapes alone, and a straight surface of the cylinder is used, or combining their own with those of the figured cylinder; and also it is of this invention to subject this system to the same longitudinal displacement or transposition as that of the figured cylinder, this being done as well as motion being given to the figured roller by an adjustable rack and suitable intermediate gearing.

Another part of my invention consists in giving the design formed by the above means another character or quality of ornamentation, resulting from intercepting in its inward movement or vibration the cutter as regards the depths of the figures on the cylinder or the revolving figured roller. This interference being effected by a graduated disked nut, in a regular or any ratio of increase or decrease of movement, impresses its character on the lines and designs in the form of straight smooth parts of lines, accompanied with an offset of that portion of the figure which is still within reach, usually curved or angular.

By reference to the drawings, it will be seen that the lateral motion of the frame G and all the parts it carries is that of a vibration on the common center H′, and that about midway between that point and the plane which includes the point of the cutter the follower X of the scalloped cylinder and the follower 1″ of the revolving roller, is the graduated disked nut L, so placed on a stationary screw on F that this movement of the framework carrying the shaft and figured roller and the cutter toward the cylinder under the constant pressure of the spring G S may be wholly or in any degree interrupted. If this inter-

cepting-nut be wholly withdrawn the bottoms of the deepest figures will be reached, and corresponding designs will result. If the nut be moved, and this movement be interrupted a small part, a new form of figures will appear by reason of straight lines appearing at the crests of the figures. If this nut be moved outwardly still more, this new character will be broader, but not so deep. If the nut is cut so the offset is very slight this figure may appear as shallow paneled work. If a plain straight surface of the cylinder be used, and the shaft 1 and its figured roller be revolved and the nut withdrawn, the figures of the roller wholly and alone appear. This quality may be carried through these figures, also their curves and angles may be changed into straight lines, the depths of the offsets lessening until the whole may disappear.

A part of my invention is in the arrangement of the system of gearing that revolves the shaft 1 to meet its variable positions and movements of the parts; and it consists in the application of a spring-pressure to keep the bevel-gears together and revolve the shaft 1 regularly against the irregularities of the roller O, under the pressure of the spring G S, and in the application of a spring-bearing on one side of the roller-shaft, while the opposite side bears at two points opposite the follower 1″, that the shaft at this point may not be irregular in its movement in its bearing and cause irregularities in the figures of O.

My invention is seen, also, in the combination and arrangement of two spur-gears of different sizes entering at will the rack 6. The shaft 1 they turn by bevel-gearing, by which the revolution of the roller O may be made to correspond with the different lengths of scallops on the figured cylinder making them register and produce evenly-balanced figures, or, if desired, figures of more marked character if this is disregarded.

One of my improvements consists in adjusting the angle of the bearing of the foot-bearer *e* to the differing heights of blocks to be cut, so that the under surface of the foot may be as nearly straight as possible, so as not to ride up onto the chips in engraving, and that a small part of it may bear just opposite the point of the cutter, that the cut line may be of even depth and width.

Another improvement of my invention is making a flexible connection between the screw *m′* and its nut *k′* and the bed E, that any irregularities in the screw and its setting may not lift the bed, causing irregularities in the spaces between the lines of the engraving, the bed being pulled along by the tensile strength of the rod *n′*, at the same time allowing the bed to be set quickly at different positions along the length of the rod, and as quickly disconnected, that it may be moved into positions favorable for the reception of the work.

In the drawings, of which there are two sheets, Figure 1 is a plan entire, except the beam E and the carriage-slide D are removed in front to the dotted line *q q*, and a longitudinal section of the tool-holder H on line *f f*. Fig. 2 is a longitudinal elevation of the left side of the machine, showing the beam and carriage-slide entire, but the top of the tool-carrier removed, on line *f f*. Fig. 5 is a transverse section taken vertically through the entire machine on dotted line *q q*. Fig. 4 is the extreme front end. (Omitted in Fig. 5.) Fig. 3 is an end view, showing, in blank lines, the positions of the rack and gearing and its shifting apparatus.

C C is the base of the machine, having at its opposite sides the posts C′ C′, which support the beam E, extending horizontally across the machine. This beam carries upon its upper surface the sliding plate D, which carries the tool-holder and all the moving parts affecting its motion.

The posts C′ C′ support the figured cylinder S B, which is suspended under and parallel with the beam E on its two long bearings, on which it turns on its axis, and slides longitudinally back and forth, being moved in the last direction by an indexed screw, Y, nut B C′, and slide and clutch B C, (seen in Fig. 1,) which are attached, by proper screws and slots, to the under side of bed E, the revolution of this cylinder being produced by a worm and gear, W G.

Upon the under side of the front edge of the beam E, in a recess parallel with the slide above, is an adjustable rack, 6. This longitudinal adjustment of the rack parallel with that of the figured cylinder is effected by a similar graduated screw, Y′, entering the bent end of rack 6.

The base C C carries upon its upper surface a bed, B, which travels back and forth lengthwise of the machine upon suitable shoes fitting into grooves in C C. This bed supports upon its upper surface the circular table A, but which is represented in these drawings in only one-half its diameter, that the means for moving the bed and table and the engraved plate *p*, resting on the top of A, may be more clearly seen, these means being the screw *m′*, turning in fixed bearings on blocks on C C at each end of the machine, the nut *k′* fitting the screw, and the rod *n′* fastened at its left end to *k′*, and extending alongside of the screw between the bed and base of the machine to the right side of the bed, where it is clamped to the under side by the loop *l′* and its screw *l″*.

That the nut may not turn when the screw is turned there is provided an arm entering from *k′* into a groove, *k″*, in the base. *m″* is a graduated disk on screw *m′*, for effecting its movements, usually provided with fine teeth, and handle-lever, pawl, &c., (not here represented,) so that the screw can be minutely turned regularly or in distances, according to the coarseness or fineness or character of the designs.

The slide D, which slides lengthwise upon the upper surface of the cross-beam E, has

the screw m' and plate being engraved in some regular or variable ratio for the spaces between each and every line must be understood.

In a design proposed the cutter may first cut straight lines, the follower X bearing against a straight side of the cylinder; next, this may be added to by successive turnings of the cylinder on its axis with or without a horizontal movement until X may follow the coarsest figures; next, the interference-nut L may produce straight lines over the deepest part of the figures, widening next by regular or variable ratios until only the crests of the figures are seen in curves, alternating with straight portions of lines. If, now, a roller on shaft 1 having five facets be revolved by the spur-gear of forty teeth it can be made by the adjustable rack 6 to agree with the curves on these crests; next may be added the more frequent not harmonizing figures produced by the smaller spur-gear of thirty-two teeth; next, these may be made to vanish into straight lines by nut L. With this as a center-line the whole series may be operated in a reverse order, producing the two sides of an evenly-balanced design, but the two halves being in obverse and reverse order; but, if at the center-line the plate be turned about with its circular table one hundred and eighty degrees then the two halves will both be in obverse or reverse order.

Again, suppose a groundwork design is desired, a hexagonal roller with rounded corners is revolved by the gear of forty teeth, X, following a shallow portion of the coarsest figures on the cylinder. Rack 6 moved longitudinally evenly in one direction produces a diagonal wave, in alternate directions a series of lines or zigzag figures; next, the interference-nut will produce groundwork with rays, and, finally, straight lines.

I do not wish to be confined to this precise form of mechanism for producing the effects or partial designs, made separately or combined.

That my invention may be more fully understood, I will describe what I believe to be mechanical equivalents of some portions of this machine that would come within my invention.

The system of figures made by the revolving figured roller alone could be produced as well if the shaft which carries the rollers did not partake of the lateral motion of the cutter and the vibrating arm G, but revolved in a stationary bearing, and the follower 1″ of the roller O were put on the vibrating arm G, the intercepting-nut remaining where it is, and acting the same then as now. In that case no bearing-surface on S B would be required; but then the two systems could not be united. So, also, in the place of the revolving shaft and its figured roller, a reciprocating shaft or sliding rod with cam or wedge-shaped and figured edges, motion being given by intermediate gearing by an adjustable rack as now, would produce similar effects and would come within my invention.

I claim as my invention—

1. The revolving figured roller O and cutter j' upon the same carriage and traveling together, in combination with mechanism, substantially as described, by which it is adapted to modify alone or in combination with the figures of the scalloped cylinder S B the course of the cutter while traveling over the plates in cutting the lines.

2. The adjustable interfering disked nut L, placed upon the same carriage and traveling with the cutter, and the figured revolving roller O, in combination with the vibrating arm G, substantially as described, and serving to modify the action of the figures of the revolving roller or the figures of the scalloped cylinder upon the movements of the cutter j.

3. The combination of a revolving shaft carrying a figured roller, and placed upon the same carriage with the cutter, with a vibrating arm, G, and a follower, 1″, said roller serving to impart motion to arm G and shaft H′, the tool-holder H, and cutter j', substantially as described.

4. The combination of the shaft 1, bearing a figured roller or disk, provided with means of revolution, the follower 1″, the vibrator S, the thimble Q, stem P, and the follower X on supporter V with the cylinder, substantially as described.

5. The combination of the spring G S, the vibrating arm G, the revolving figured roller and shaft, the follower 1″, the thimble Q, stem P, and follower X with the cylinder S B, substantially as described.

6. The combination of the spring G S, the cutter-holder H, and cutter j', vibrating with the arm G, with a revolving figured roller and its shaft, arranged substantially as described.

7. The combination of the movable arm G, carrying a cutter or a cutter-holder, the changing nut L, a retracting-spring, G S, all placed on the same traveling carriage, with the stationary but adjustable figured cylinder S B, substantially as described.

8. The combination of the screw m', adapted to move a plate-table, A, and capable of a variable feed, and a scalloped cylinder, S B, capable of a longitudinal adjustment for each succeeding line, with the cutter j', arranged to vibrate in accordance with the figured surface of the cylinder in its various positions as it passes over the plates in cutting the lines, substantially as described.

9. The combination of the screw m', having a graduated disk, m'', and capable of a variable feed, the cylinder S B, adjustable both longitudinally and on its axis, and a revolving figured roller, O, with the cutter j', which vibrates in accordance with the surface of the scalloped cylinder combined with that of the figured roller, substantially as set forth.

10. The combination of the screw m', capable of a variable feed, the scalloped cylinder S B, the adjustable rack 6, the revolving shaft 1, bearing the figured roller O, receiving motion by gearing from the rack, and the inter-

screwed to its edge at its left the bracket F. In the upper and lower sides of F, on its front side, is pivoted an upright shaft, H′, having arms at its lower end, at right angles to it, which inclose and are pivoted to the two arms of the tool-holder H. This tool-holder, extending forward from its hinge, allows the cutting-tool *j*, which is held firmly in an inclined position on H by its clamp *g′* and nut *i*, to touch the plate P and enter and engrave it to any desired depth, the upward and downward movement of the tool-holder being for that purpose, the depth of the line cut being regulated by the foot-bearer *e*, close beside the point of the cutter, which bears and slides upon the upper surface of the plate. This bearer is fastened to the under side of the forward end of the bent lever *a′*, which, extending back on the under surface of the tool-carrier H to near its pivots, spreads out into a wide lateral bearing, to prevent its twisting out of position at the point of the cutter. This wide end of *a′* fitting loosely on two studs from H is kept in position laterally, while its front end receives into its upper surface the lower end of the regulating-screw *b*. (Seen in Fig. 5.)

Placed on the top surface of H is the strong spring *d′*, which, with a screw passing through H into *a′*, draws the latter upward against the screw *b* at its front end, and a wedge, *h′*, at its rear end. *h′*, having an incline at each end, fits into a proper groove in H, and raises and lowers in the same parallelism the two arms of *a′*. This vertical adjustment of this end of *a′* permits the bearing-surface of the bearer *e* to be made parallel with the top surface of blocks differing in heights.

The upright shaft above mentioned has firmly fixed upon it, a little above the arms that support the tool-holder, an arm, G, which reaches forward with the tool-holder to the same distance, and the two are generally parallel with the slide D and lines of the engraving. This arm and tool-holder vibrate together upon their common center H′, the parts attached to the front end of G being means for bearing against and for following the surface of the cylinder S B. This outer end of G is kept pressed toward S B by the spring G S, which is secured to bracket F and its angular clamp at its lower end, and whose pressure is regulated by a screw-point pressing against the outside of G.

The arm G has firmly fixed to its front end the upright standard U, which has also an extension, U′, downward and slightly forward into range with the point of the cutter. The standard U forms also the support and bearing of the front end of the revolving shaft 1, which lies on the back side of G, extending back, so that its rear end receives a support upon the vibratory hanger 9, hinged to two studs, 8 8, standing out from F. The bearing of this shaft in U is cut away, or low, for a space on the front side of the shaft, and on the back side in a space corresponding is the lower end of a spring, K, which is hinged to the back surface of U at J with a tension-screw, I. This shaft 1 has upon it a neck provided with the hexagonal disk or roller O, which is kept in position on the shaft by the nut 1′, in range with the front surface of U. Upon this surface, at right angles to the shaft, hinged at S′, is the vibrating lever S, kept by a proper screw and slot against the surface of U. This vibrator passing downward upon the inner side of the shaft has upon it a point or follower, 1″, standing opposite the center of the shaft, against which the periphery of the roller O (or any exchanged figured roller) bears by the pressure of the spring G S. (Seen in Fig. 5.) At a point lower down this vibrator has pivoted to it an arm-extension from the thimble Q, which enters loosely into and is supported by U′.

The thimble Q has within it a conical cavity, the bottom of which bears, by means of the spring G S, against the pointed outer end of the stem P, whose inner end is hinged to the lower end of the vibrating arm V, which is hinged to and hangs down from the slide D above, bending under and reaching nearly to the front surface of the figured cylinder S B, where it supports X, a follower of the surface of the cylinder.

Upon the outside of the arm G, and extending upward, is the plate G N, which receives, through a hole in it, loosely the outer end of the stationary screw N, fixed to bracket F. This screw has upon it the graduated disked nut L, working inwardly and outwardly, so that its hub, bearing against the inside of the plate G N, stops its inward movement, and, by means of the spring-pointer L S and its graduated disk, may be held in any position required.

The rear end of the shaft 1 has upon it the bevel-gear 2, joining with another bevel-gear, 3, and receiving motion. The gear 3, with a long hub, turns on a stationary rod supported by the standard 7 and an inner elbow of the shifting plate 10. This hub has fixed to its inner end the spur-gear 5 of thirty-two teeth, and sliding to and fro on its hub the larger gear 4 of forty teeth upon the flange 4′, by which it is locked to gear 3 by a stud on its inner surface. Either one of these spur-gears joins the rack 6 by shifting plate 10, held by the spring-clasp 11. The gear 3 is kept closely pressed against the gear 2 by a flat spring, 3 S, fixed to the inside of the standard 7, and pressing against the outside of 3 by the regulating-screw 7′.

The figured or scalloped cylinder has upon it four series of figures, one composed of hollows and rounds each five-eighths of an inch long, one of figures one-half of an inch long, one of figures one-fourth of an inch long, and one of figures (angular or lozenge form) one-fourth of an inch long. (Seen in sectional view of the cylinder, Fig. 5.)

In tracing the operation of this machine in the production of a design, the movement of

fering-nut L, with the cutter *j'*, substantially as described.

11. In combination with a scalloped or figured cylinder, the graduated screw Y, its nut B C', and clutch B C, substantially as described.

12. In combination with the figured cylinder S B, the graduated screw Y, with its connections, and the worm-gear W G, substantially as described.

13. The combination of the rack 6 with the beam E and graduated screw Y', arranged substantially as described.

14. In an engraving-machine for producing designs, the combination of the cutter *j'*, a figured cylinder or surface arranged and adapted to be moved substantially as described, having upon it any number of series of different figures, and the movable rack 6, with a revolving figured roller having any number of figures upon it, and placed upon a revolving shaft, 1, and upon the same carriage and traveling with the cutter, and with two or more gears of different sizes entering rack 6 at will, the shaft and its figured roller being adapted to assume different speeds effecting corresponding differences in or additions to the design, substantially in the manner set forth.

15. The combination of the adjustable rack 6, the spur-gear 5, bevel-gears 3 and 2, and the shaft 1, carrying figured roller O, with the plain and figured surface of the scalloped cylinder, substantially as described.

16. The combination of the movable rack 6, the spur-gear 4, bevel-gears 3 and 2, shaft 1, carrying a roller, O, with the plain and figured surface of the scalloped cylinder, adjustable both on its axis and longitudinally, substantially as described.

17. The combination of the screw *m'*, nut *k'*, grooved way and stud *k''*, the flexible rod *n'*, clamp *l'*, and screw *l''* with the bed B, substantially as described, and for the purposes set forth.

18. The combination of the tool-holder H, screw *b*, arm *a'*, and screw and spring *d'* with the wedge *h'*, substantially as described.

FRANKLIN L. BAILEY.

Witnesses:
SUMNER ALBEE,
W. E. BENJAMIN.