

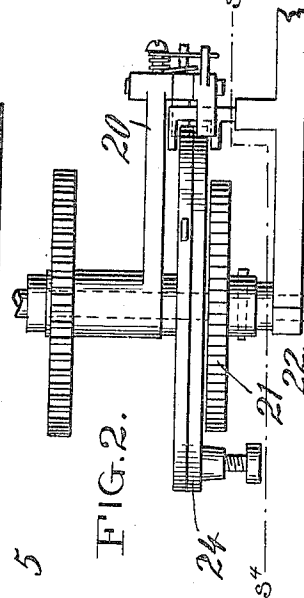
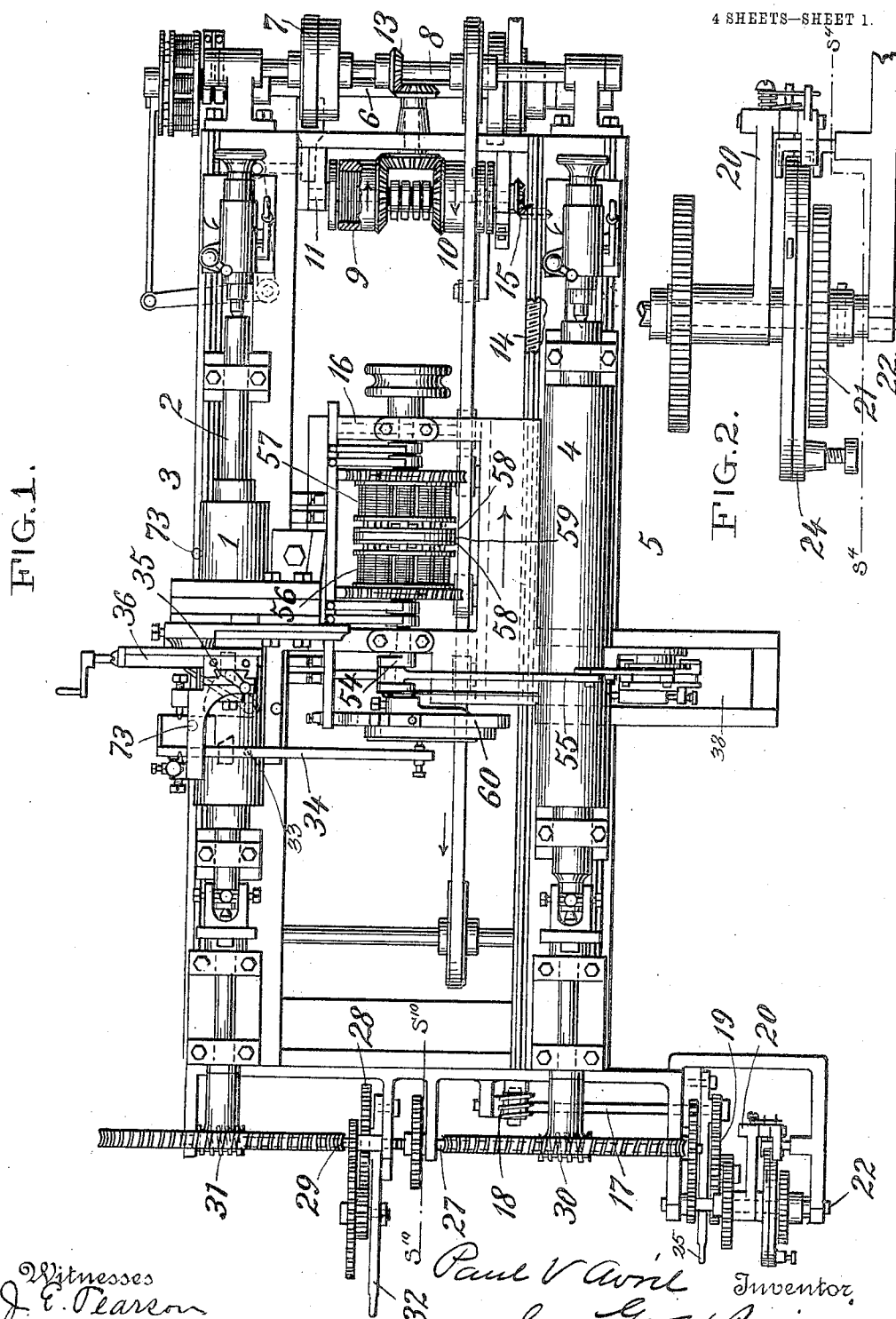
No. 818,139.

PATENTED APR. 17, 1906.

P. V. AVRIL.
ENGRAVING MACHINE.

APPLICATION FILED OCT. 7, 1904.

4 SHEETS—SHEET 1.



Witnesses
J. E. Pearson
Frank Connor

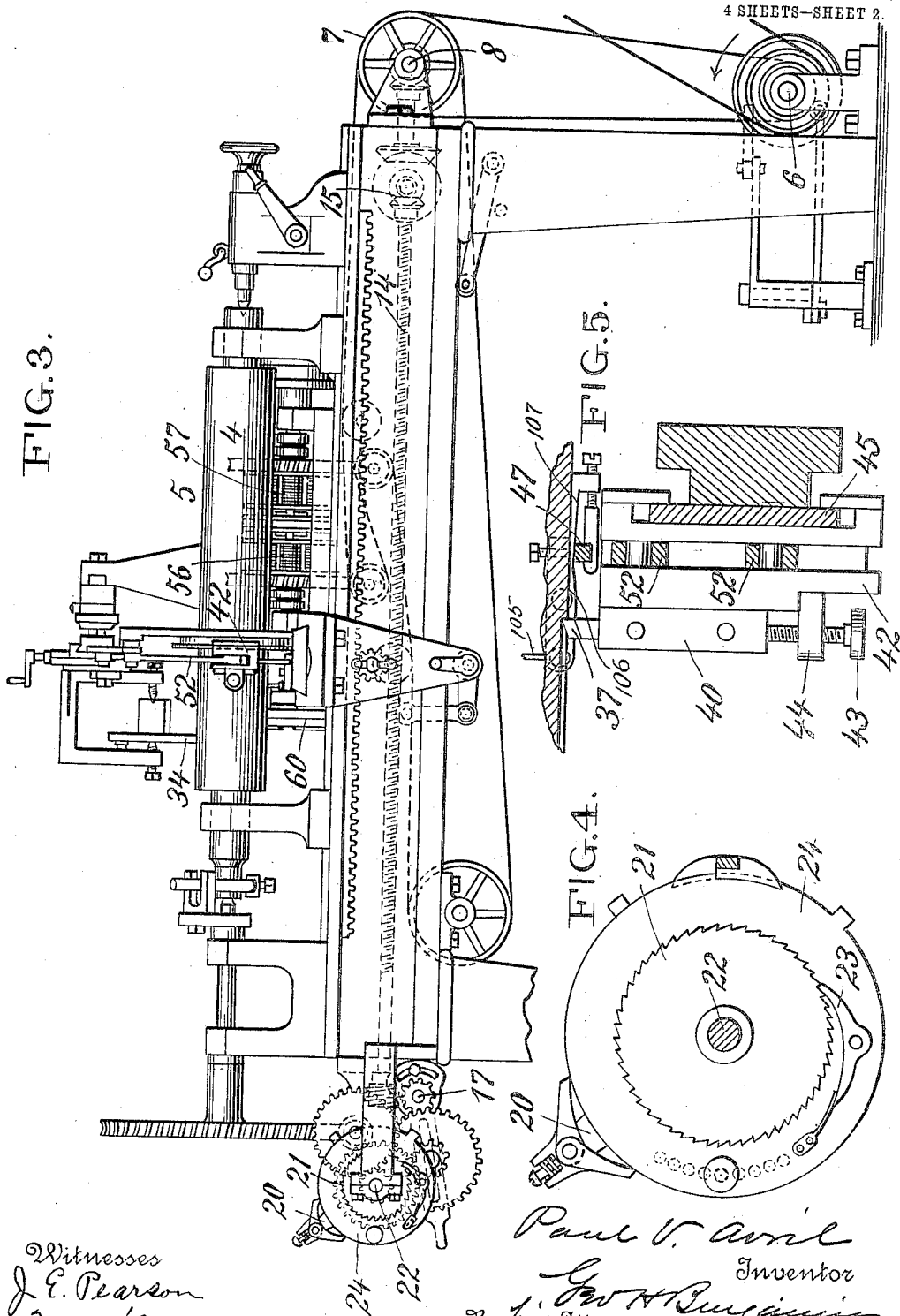
Paul V. Avril Inventor.
By his Attorney Geo. W. Benjamin

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FIG. 3.



Witnesses
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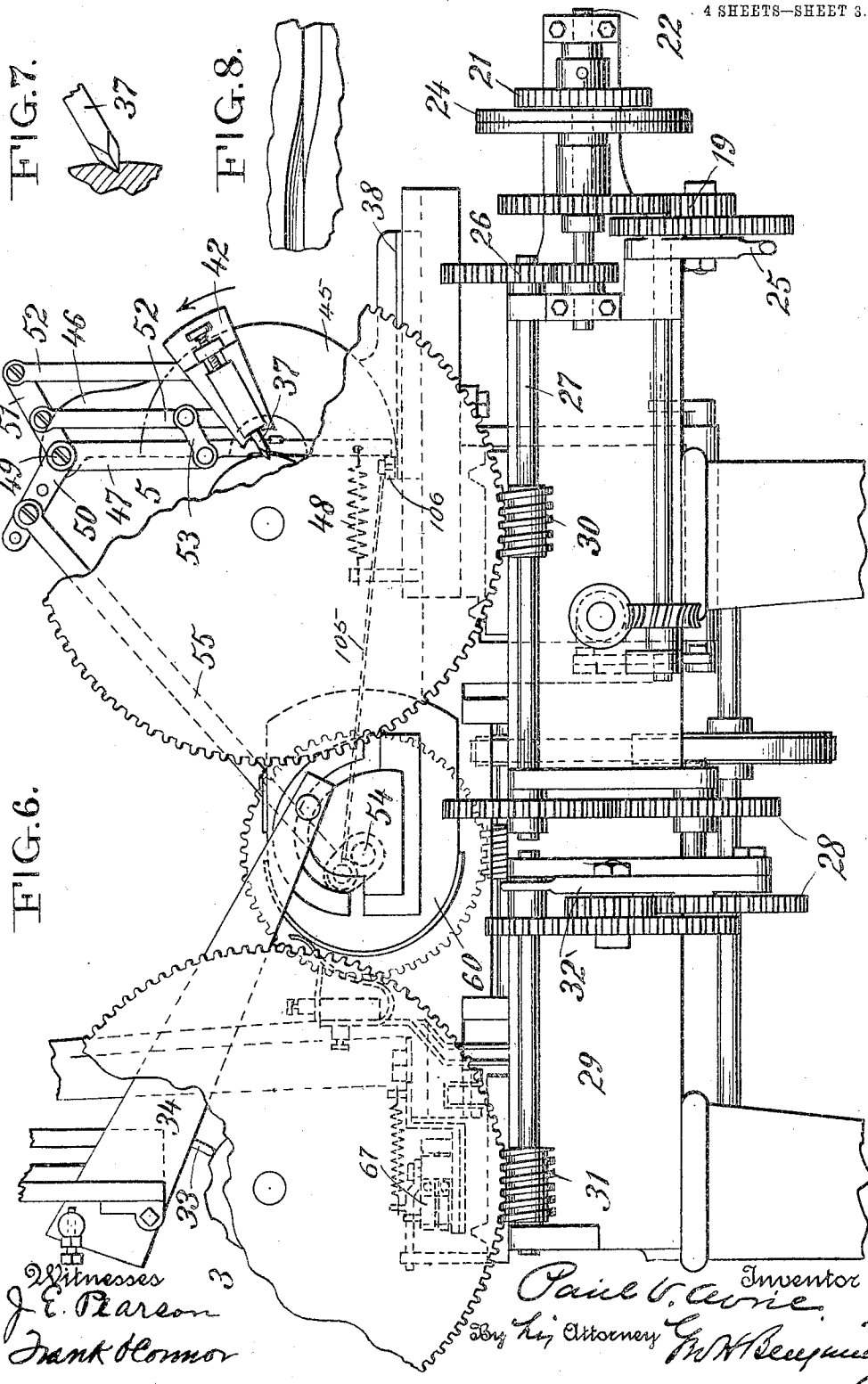
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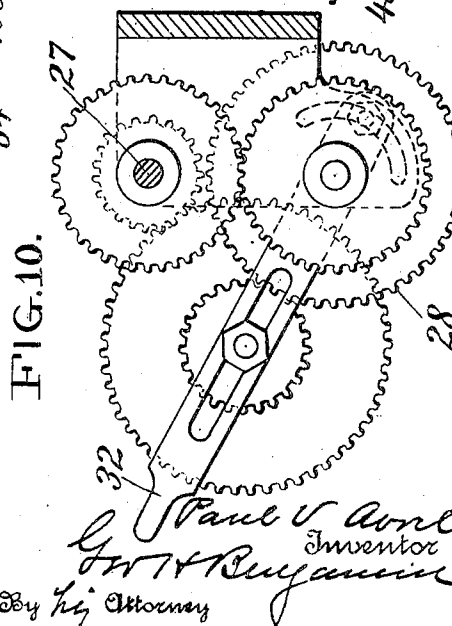
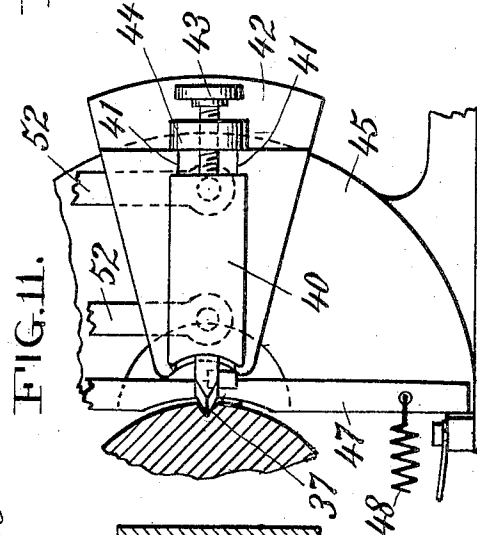
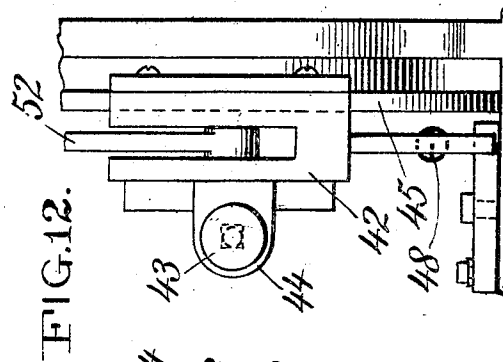
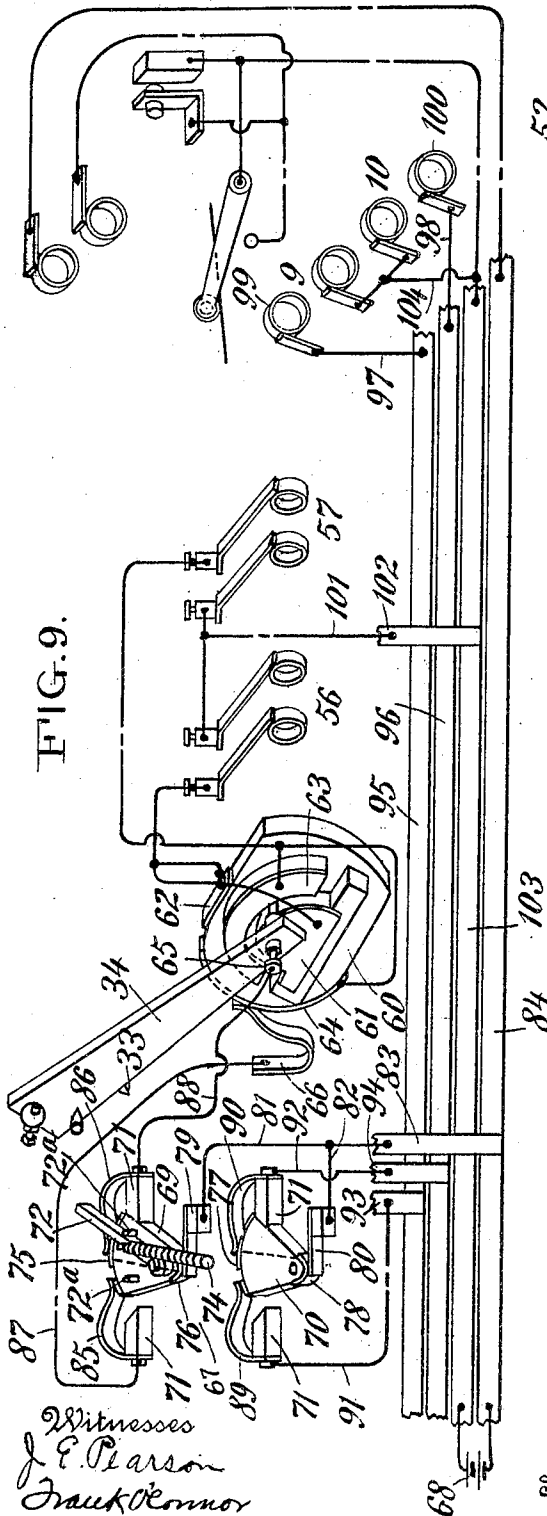


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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

PAUL VICTOR AVRIL, OF PARIS, FRANCE.

ENGRAVING-MACHINE.

No. 818,139.

Specification of Letters Patent.

Patented April 17, 1906.

Application filed October 7, 1904. Serial No. 227,574.

To all whom it may concern:

Be it known that I, PAUL VICTOR AVRIL, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Engraving-Machines, of which the following is a specification.

My invention relates generally to automatic engraving-machines, and as herein embodied is adapted for reproducing designs, design elements, or other figures, &c., in moire effects.

Heretofore two separate and distinct operations have been necessary in reproducing upon plates or cylinders designs in moire effects. In the first operation the ordinary groove-cutting machine is employed to cut a series of equispaced grooves of uniform cross-section throughout the surface area of the plate or cylinder, forming a ground upon which the design is subsequently produced. The second operation is then performed either manually or by means of the automatic engraving-machine; and it consists in varying the cross-sectional form of such grooves by cutting away the wall thereof as required at points throughout their length to produce light and shade effects necessary for bringing out the figures or elements of the design.

The present invention is designed to reduce the time, labor, and expense involved in the production of such cylinders or plates by cutting the ground and design with a single tool in the same operation. This is readily accomplished by adjusting the tool manually or automatically while cutting the ground grooves to vary the cross-sectional form thereof as above described.

For convenience in completing an operative illustration of my invention as applied I have shown it in the accompanying drawings in connection with a machine substantially similar to that described in my pending application, serially numbered 227,572, filed October 7, 1904, and I will therefore in this application give but a general description of such mechanism, referring to the application mentioned for details of construction. I wish it understood that I do not limit myself to either the exact construction or arrangement of parts shown, as it will be obvious that various other mechanisms may be employed operating in substantially the same manner to produce practically the same result.

In the drawings, Figure 1 is a plan view of the machine. Fig. 2 is an enlarged detail view of a ratchet device by which the design-cylinder and cylindrical blank are given a step-by-step rotary feed. Fig. 3 is a front view of the machine. Fig. 4 is a detail sectional view of the ratchet-feed device, taken on the line S⁴ S⁴ of Fig. 2. Fig. 5 is an enlarged detail view of the engraving-tool and the slide, &c., upon which it is mounted, the tool being shown in connection with a portion of the blank upon which the design is reproduced. Fig. 6 is an end view of the machine with portions broken away to show the relative arrangement of the tools and the cylinders with which they coöperate. Fig. 7 is an enlarged detail view showing the point of the engraving-tool in connection with a portion of the blank. Fig. 8 is an enlarged detail view of a portion of the blank, showing the cut or groove made by the engraving-tool. Fig. 9 is a view in diagram of the various circuits. Fig. 10 is a detail sectional view taken on the line S¹⁰ S¹⁰ of Fig. 1. Fig. 11 is a detail side view of the engraving-tool, &c., shown in Fig. 5, and Fig. 12 is a front view thereof.

Referring now to the drawings, 1 represents a cylinder, having upon its surface the model or design to be reproduced, which may be cut, molded, or otherwise formed thereon either in intaglio or relief. The cylinder may be solid or hollow, and when hollow it is mounted in any suitable manner upon a mandrel 2, secured to rotate in a lathe 3. A blank, in the form of a cylinder 4 of metal or other suitable material, upon the surface of which the design is to be reproduced, is mounted in a second lathe 5.

The lathes 3 and 5 are driven from a shaft 6, mounted in bearings upon the frame of the machine and belted, as indicated at 7, to a shaft 8. Electrically-operated clutches 9 and 10 upon a shaft 11 are driven continuously in opposite directions from shaft 8, through bevel-gearing 13, as shown. The lead-screw 14 of the lathe 5 is geared to the clutch-shaft 11, as indicated at 15, and through the action of the clutches 9 and 10, controlled in a manner to be later on described, the rotation of the lead-screw is periodically reversed. A carriage 16, connected in the usual manner to be thrown in or out of gear with the lead-screw, is fed back and forth lengthwise of the design and blank cylinders 1 and 4 as the ro-

tation of the lead-screw is reversed through the action of the clutches, as above described. A shaft 17, driven by worm-gearing 18 from the lead-screw, is connected by a series of
 5 spur-gears 19, to impart an oscillating movement to an arm 20 of a ratchet-feed device, (shown in detail in Figs. 2 and 4), by which the design and blank cylinders are given a step-by-step rotary feed.

10 As this device is fully described in Letters Patent of the United States No. 711,273, granted to me October 14, 1902, a detail description of the same is not herein deemed necessary. It suffices to say that it comprises a ratchet-wheel 21, fast upon shaft 22,
 15 from which motion is transmitted through suitable gearing to the spindle of each of the lathes, and cooperating with the ratchet-wheel 21 there is a pawl 23, spring-held in
 20 engagement therewith and carried by a member 24, which is given motion by the oscillating arm 20, above referred to. The arrangement is such that on movement of the arm 20 in one direction the pawl 23 engages and
 25 rotates the ratchet-wheel 21, and through interposed gearing such motion imparted to the design and blank cylinders serves to advance the same step by step, as required. Movement of the arm 20 in the opposite di-
 30 rection causes the pawl to ride idly over the teeth of the ratchet-wheel without imparting motion thereto. Provision is made for adjusting the device to vary the feed and by means of a lever 25, carrying one or more of
 35 the gears 19, the feed may be thrown in or out of action at will.

The shaft 22, upon which the ratchet-feed device is mounted, is connected by spur-gears 26 to drive a shaft 27, and this shaft 27 is in
 40 turn connected by a train of gears 28 to drive a shaft 29. Motion from shaft 27 is transmitted to the spindle of lathe 5, through worm-gearing 30, and in a similar manner from shaft 29 to the spindle of lathe 3, through
 45 worm-gearing 31. By means of a lever 32, carrying one or more of the gears of train 28, the lathe 3 may be thrown in or out of action.

Coöperating with the design-cylinder there is a traversing style 33, carried by a pivoted
 50 arm 34, which is adjustable by means of vertical and cross slides 35 36 upon the lathe-carriage 16, and coöperating with the cylindrical blank there is an engraving-tool 37, mounted upon a cross-slide 38 of the carriage 16. As
 55 both the traversing style and engraving-tool are mounted upon the lathe-carriage, it will be seen that the reversal of the feed periodically, as above described, will give the style and tool motion lengthwise of their respec-
 60 tive cylinders. Normally the tool 37 is radially disposed to the cylindrical blank and lies in the horizontal plane of the axis thereof, as shown in Fig. 11. The tool is secured to a block or slide 40, movable in guides 41 of a

sector 42, and is adjustable relatively to the
 65 cylindrical blank to vary the depth of cut, by means of a screw 43, which is threaded through a lug 44 of the sector.

Secured upon the cross-slide 38 there is a curved guide-plate 45, shaped to conform ap-
 70 proximately to concentric arcs struck from the point of the tool as a center. The sector 42, carrying the engraving-tool, is mounted upon this guide so as to have a limited movement toward and from the cylinder, as shown
 75 in Fig. 5, in order that the tool may clear the same on the back stroke thereof.

The point of the tool is preferably V-shaped and if given motion lengthwise of the
 80 blank when radially disposed thereto, as in Fig. 11, will cut a groove therein of symmetrical cross-section—that is to say, a groove having its sides oppositely inclined at the
 85 same angle to the plane of the axis of the blank. This being the normal position of the tool, any number of such grooves may be cut in the blank and equispaced through the action of the ratchet device above described as controlling the step-by-step rotary feed
 90 thereof.

When producing moire effects, the above-described grooves form the ground surround-
 95 ing the figures of the design, and it will therefore be seen that the tool must assume its normal position shown in Fig. 11 during the time the style is traversing the plain surface of the design-cylinder.

The effect of the style traversing a portion of the design is to cause the tool to assume
 100 positions at different angles to the horizontal plane of the axis of the cylindrical blank, and in being thus adjusted the tool moves about its point as a center. Referring again to
 105 Fig. 11, it will be at once apparent that the slightest adjustment of the tool from the position shown will change the cross-sectional form of the groove cut in the blank. This is clearly shown in Figs. 6 and 7, in which the
 110 position of the tool is such as to cut a groove one side or wall of which is practically horizontal, while the other is inclined to an angle of about sixty degrees.

The adjustment of the tool is controlled by the style through interposed mechanism,
 115 which I will now describe.

Pivoted upon an extension 46 of the guide
 45 there is a gage-bar 47, to the lower free end of which a spring 48 is attached, tending to yieldingly hold the bar in engagement with the cylindrical blank, the bar having a
 120 cut-away portion shaped to conform to the curved surface of the blank. The advance of the point of the tool beyond the concave edge of this bar, as shown in Figs. 5 and 11, determines the depth of cut, the tool being
 125 adjustable relatively to the same by means of the screw 43, above referred to, and movement of the bar about its pivotal center to-

ward or away from the blank serves to carry the tool into or out of engagement therewith, as will later on appear.

Free to turn about the pin 49, upon which the bar 47 is pivoted, there is a bell-crank lever 50, and depending from the arm 51 of this lever there are two links 52 52, the lower ends of which are pivotally attached to the sector 42, as shown in Figs. 11 and 12. A short link 53, extending parallel with the lever-arm 51, serves to connect one of the links 52 with the gage-bar 47. The arrangement is such as to form a parallelogram, the long sides of which are formed by the links 52 52 and the short sides by the tool 37 upon the sector and the arm 51 of the bell-crank 50. When, therefore, motion is given the bell-crank, the tool connected in parallel relation with the arm 51 thereof will be adjusted in an arc of a circle, the center of which coincides with the point of the tool. Motion is imparted to the bell-crank 50 from a crank-shaft 54 through a connecting-rod 55.

The crank-shaft is journaled in bearings upon the lathe-carriage, and loosely mounted upon this shaft there are two clutches 56 57, geared to be continuously driven in opposite directions, as indicated in Fig. 1, from shaft 8. These clutches are of the electromagnetic type and each coacts with a ring-armature 58, carried by a disk 59, of brass or other non-magnetic metal, fast upon the crank-shaft. A disk 60, of fiber or other non-conducting material secured upon the crank-shaft and rotating therewith, serves as a support for contact-plates 61, 62, 63, and 64. The plates 61 and 62 are connected in circuit with the magnets of clutch 56 and the plates 63 and 64 in circuit with the magnets of clutch 57. Coöperating with the plates 61 and 63 there is a pin or stud 65, carried by the arm 34, upon which the style 33 is mounted. As this arm is vibrated through the action of the style in traversing the undulating surface of the design-cylinder the pin or stud 65 will contact with first one and then the other of the plates 61 and 63, causing the clutches to act alternately upon the crank-shaft 54, which results in giving this shaft and the bell-crank lever 50, connected therewith, an irregular oscillating motion. As the engraving-tool is maintained in parallel relation with the arm 51 of the bell-crank through the link connection described, its adjustment relatively to the blank will obviously follow. Assuming now, for example, that the style is moving over an upwardly-inclined portion of the design upon the cylinder 1, the arm 34, carried upward by the style, will cause the pin 65 to contact with plate 63 and close the circuit through the clutch 57, which, as viewed in Fig. 6, rotates toward the left. The clutch-shaft in rotating in the same direction will impart movement to the tool through the connections de-

scribed, causing it to swing upward, as indicated by the arrow in Fig. 6, the inclination of the tool relatively to the horizontal plane of the axis of the blank varying in accordance with the rise and fall of the style in traversing the undulating surface of the design-cylinder.

Coöperating with the plates 62 and 64 there is a brush 66, connected through a switch 67 with a source of current-supply 68. The switch carries two sets of connections—one set controlling current to the clutches 56 and 57 and the other set controlling current to the clutches 9 and 10.

As shown in Fig. 9, the switch consists of two sectors 69 and 70, of fiber or other non-conducting material, arranged one above the other and connected to move together about a common pivot upon the carriage 16. These sectors have a limited movement between stops 71 71, &c., and are given motion by means of a lever 72, turning about the pin upon which the sectors are pivoted. The lever 72 is movable between two studs or projections 72^a 72^a upon the upper sector and is arranged to be thrown by means of tripping devices 73 73, adjustably secured upon the lathe-bed. A spring 74 serves to quicken the action of the lever as it is thrown and also yieldingly holds the sectors as adjusted by maintaining the lever in engagement with one or the other of the studs 72.

Upon the upper sector two contact-plates 75 76 are secured and connected, as indicated by the dotted line in Fig. 6, and the lower sector is provided with similar plates 77 and 78. These plates are connected in circuit with the source of current-supply through the brushes 79 80, wires 81 82, and a brush 83, depending from the lathe-carriage and movable therewith in contact with a bar 84, extending lengthwise of the lathe-bed.

Coöperating with the plate 75 of the sector 69 there are two brushes 85 and 86, connected, respectively, by wires 87 and 88 with the brush 66 and pin 65, and coöperating with the plate 77 of sector 70 there are two brushes 89 and 90, connected with the magnets of clutches 9 and 10 through wires 91 92, brushes 93 94, bars 95 96, wires 97 98, and contact-rings 99 100 upon the clutch-shaft.

A return connection is provided from the clutches 56 and 57 to the source of current-supply through the wire 101 and brush 102, depending from the lathe-carriage and contacting with a bar 103. From the clutches 9 and 10 there is a return-wire 104, which is connected direct with the bar 103.

During the cutting stroke of the tool or when the carriage is moving toward the right, as viewed in Figs. 1 and 3, the switch 67 is adjusted as shown in Fig. 9, and in this position closes the circuit through the pin 65 upon the style-arm 34 and also through the clutch 10 by which the lead-screw is rotated

in a direction to advance the carriage. As the travel of the carriage is ordinarily limited to the length of the design upon the cylinder 1, the trips 73 73 are set accordingly, and as the carriage reaches the end of its travel toward the right and the switch is thrown the clutch 10 is cut out and the circuit is closed through the clutch 9 to reverse the feed. The pin 65 upon the style-arm is also cut out and the circuit of clutch 57 is closed through the brush 66 and contact-plate 64.

Under the action of the clutch 57 the crank-shaft is rotated toward the left, and this motion transmitted through the connections described serves to swing the tool upward, as indicated by the arrow in Fig. 6, at such an angle as to require a very slight movement of the sector upon which the tool is mounted to cause the point thereof to clear the blank.

The rotation of the crank-shaft continues until the clutch 57 is cut out of circuit by the brush 66 in contacting with the peripheral surface of the disk 60, a portion of which is exposed between the adjoining ends of the plates 62 and 64 thereon, and thereupon the clutch ceases to act and the tool is held as adjusted during the return of the carriage or while it is moving toward the left.

As it is desirable that the tool should clear the blank on the back stroke, there is a rod 105 and lever 106 interposed between the crank-shaft 54 and the lower free end of the gage-bar 47, the arrangement being such that as the crank-shaft nears the limit of its movement in rotating toward the left, which is determined by the position of the brush 66 upon the moving plate 64, motion will be imparted through the rod and lever, above referred to, to swing the gage-bar and tool connected therewith away from the cylinder, in which position it is maintained during the return of the carriage. In order to prevent a similar adjustment by which the tool would be carried clear of the cylinder on the cutting stroke thereof, the lever 106 and gage-bar are held normally separated by means of an adjustable wedge 107, which is interposed be-

tween the gage-bar and cylinder, as shown in Fig. 5, and by reason of this last motion there will be no engagement between the lever and bar during ordinary adjustment, such as is given the tool when controlled by the style.

Referring to Figs. 1 and 9, I have shown two switches 108 109, controlling an electromagnetic clutch 110 upon the shaft 6, which is arranged to operate a belt-shifter 111, co-operating with the belt 7, and stop the machine in the event of the driving-belt 112 of the clutches 56 57 breaking or running off its pulleys or when through inattention the carriage is permitted to feed too far toward the right. As these devices are fully described in my applications above referred to, a detailed description is not herein deemed necessary.

Having thus described my invention, I claim—

1. An automatic engraving-machine comprising means for supporting a blank, a tool coöperating therewith, a pivoted lever, connections between the tool and lever whereby they are movable in parallel relation, and means for giving the lever motion to vary the angle of the tool relatively to the blank.

2. An automatic engraving-machine comprising means for supporting a blank, a tool coöperating therewith, a pivoted lever, interposed links connecting the lever and tool in parallel relation, and means for giving the lever motion to vary the angle of the tool relatively to the blank.

3. An automatic engraving-machine comprising means for supporting a blank, a tool coöperating therewith, a gage-bar, a lever pivoted upon the bar, interposed links connecting the lever and tool in parallel relation, and means for giving the lever motion to vary the angle of the tool relatively to the blank.

In testimony whereof I affix my signature in the presence of two witnesses.

PAUL VICTOR AVRIL.

Witnesses:

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FRANK O'CONNOR.