No. 805,698. PATENTED NOV. 28, 1905.

P. V. AVRIL.

ENGRAVING MACHINE.

APPLICATION FILED OCT. 7, 1904.

3 SHEETS—SHEET 1.

FIG. 1.

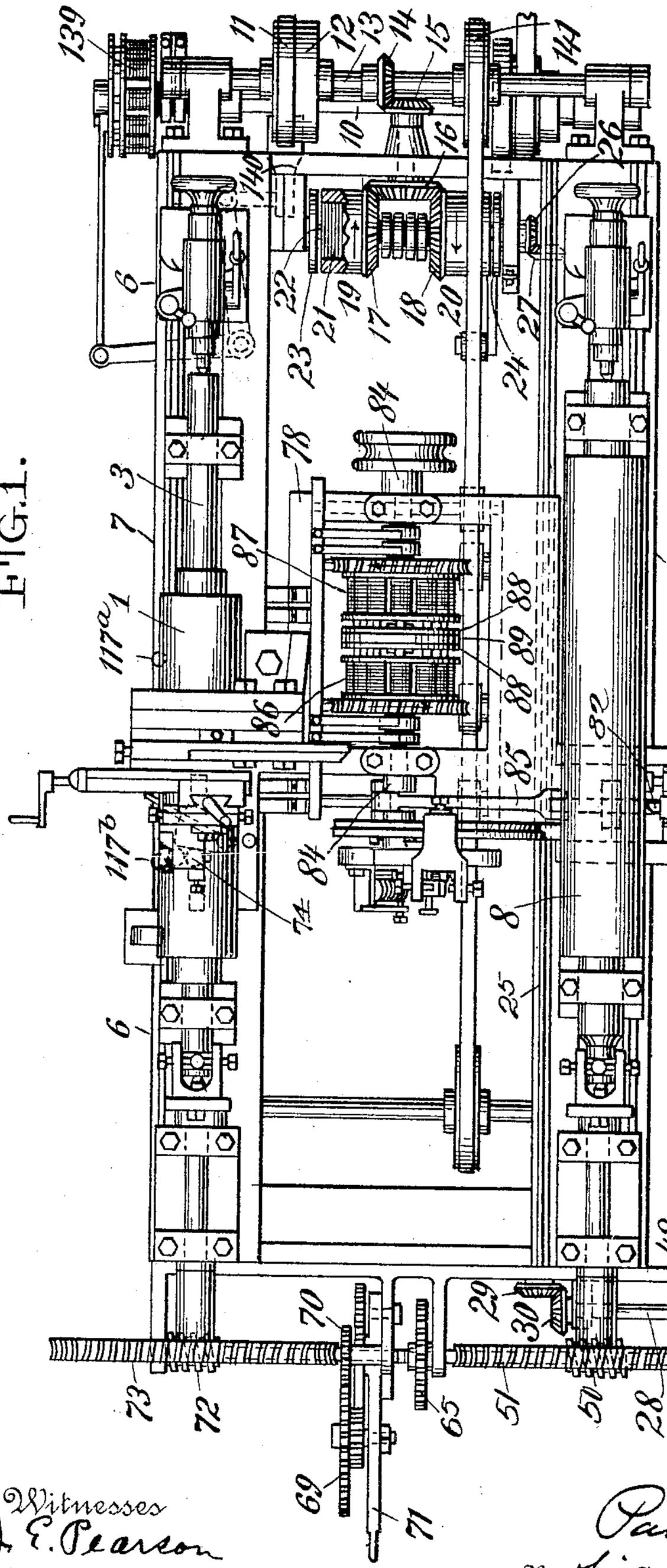


FIG. 3.

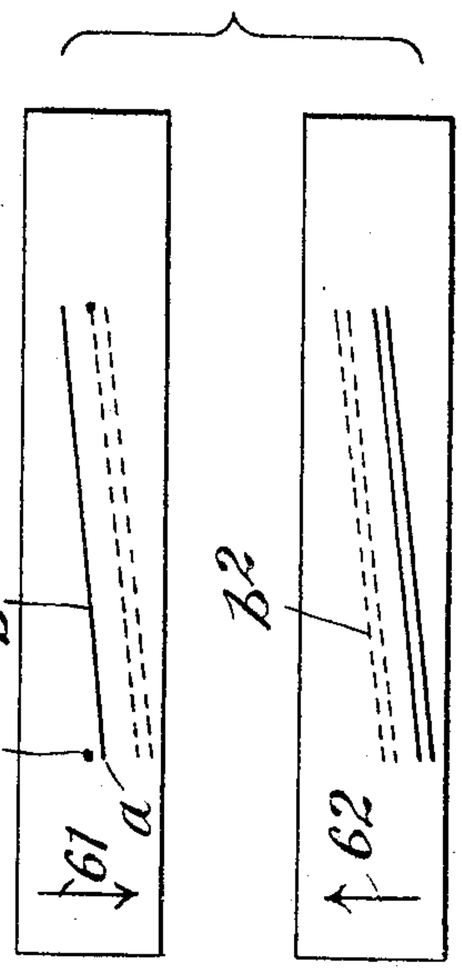
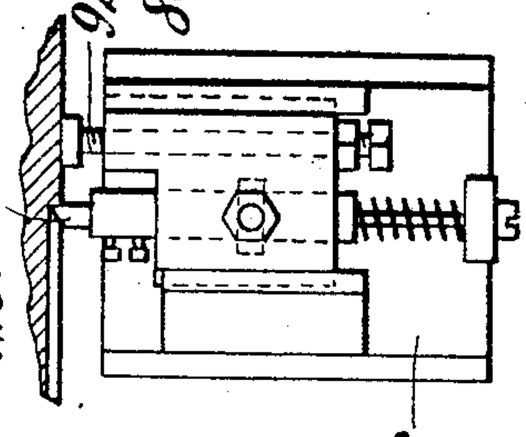


FIG. 2.



Witnesses
J. E. Pearson
Frank O'Connor

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

No. 805,698. PATENTED NOV. 28, 1905.

P. V. AVRIL.

ENGRAVING MACHINE.

APPLICATION FILED OCT. 7, 1904.

3 SHEETS—SHEET 2.

FIG. 5.

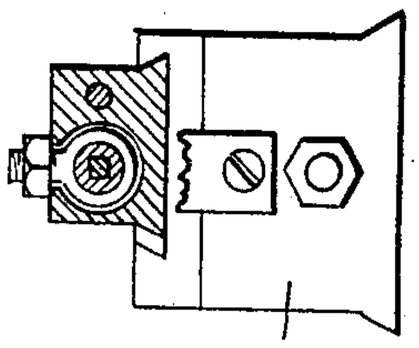
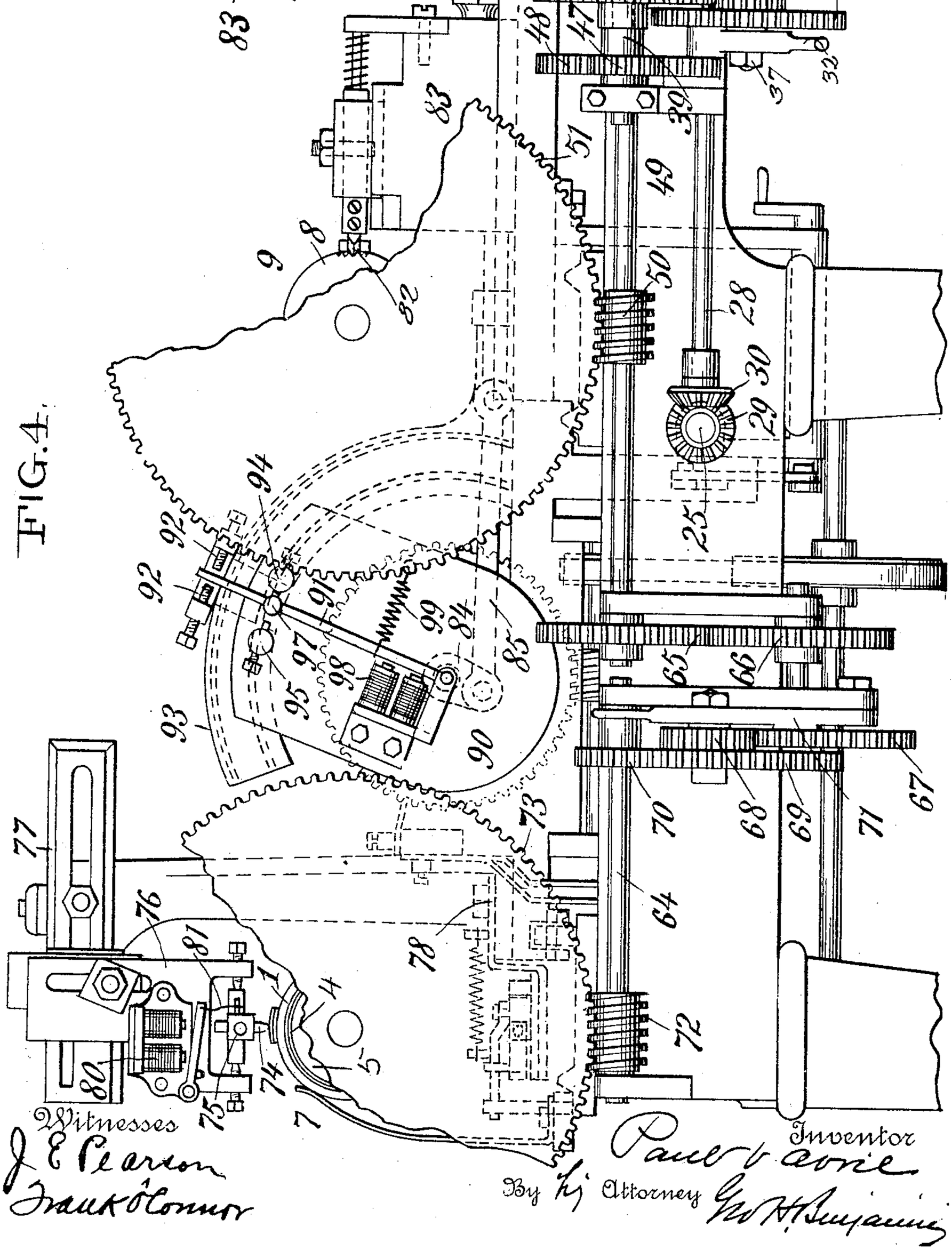


FIG. 4.



Witnesses

J. E. Pearson

Frank O'Connor

Inventor

Paul V. Avril

By his Attorney Geo. H. Benjamin

No. 805,698. PATENTED NOV. 28, 1905.

P. V. AVRIL.

ENGRAVING MACHINE.

APPLICATION FILED OCT. 7, 1904.

3 SHEETS—SHEET 3.

FIG. 9.

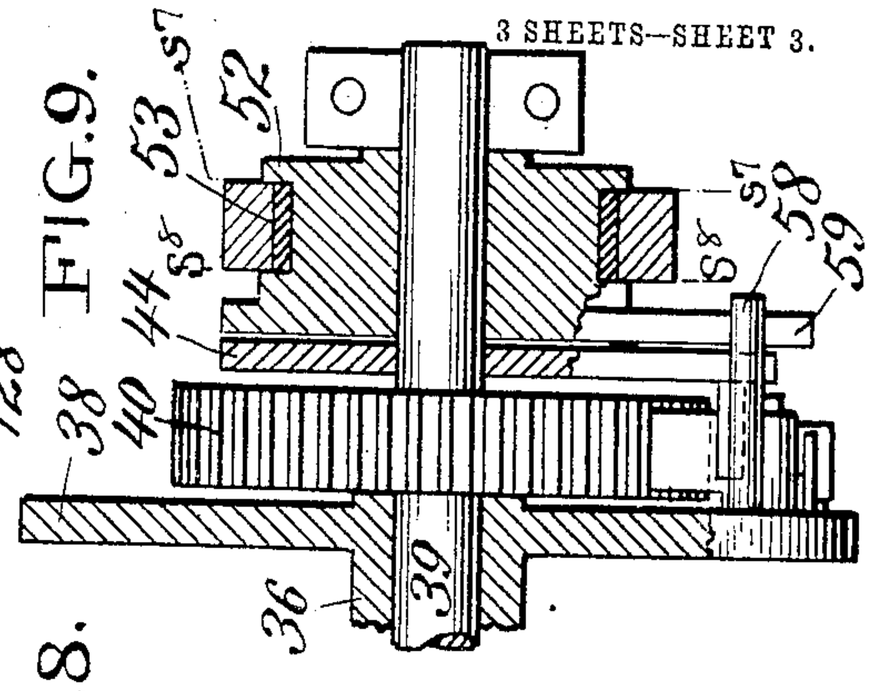


FIG. 6.

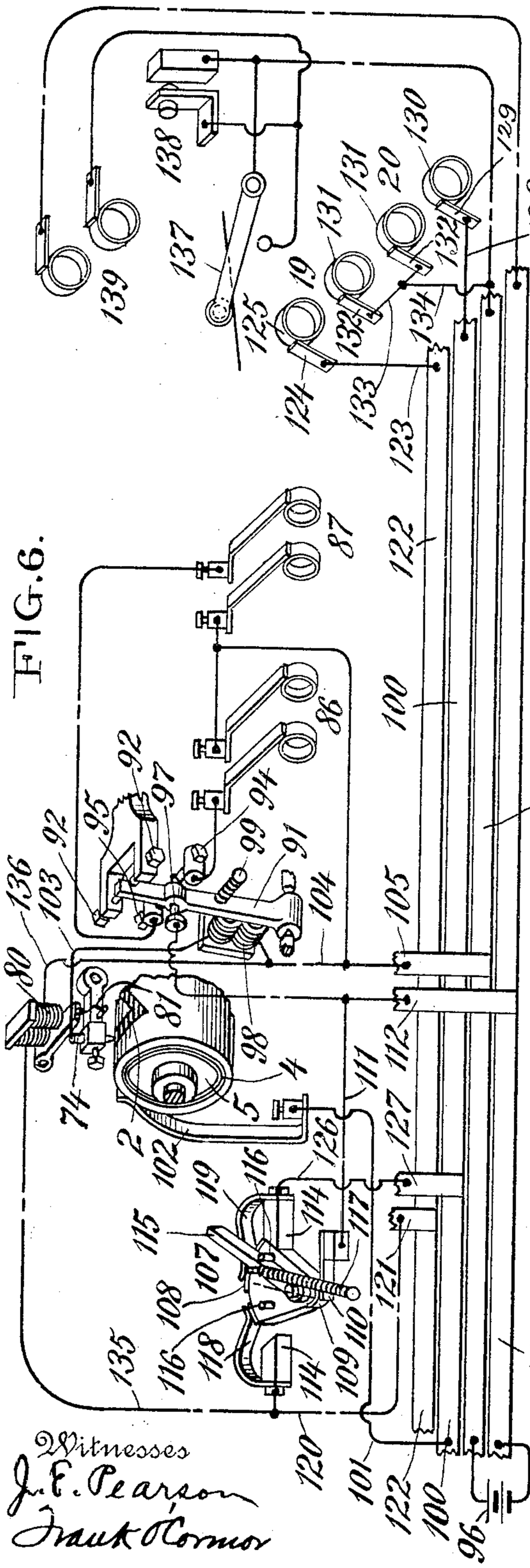


FIG. 8.

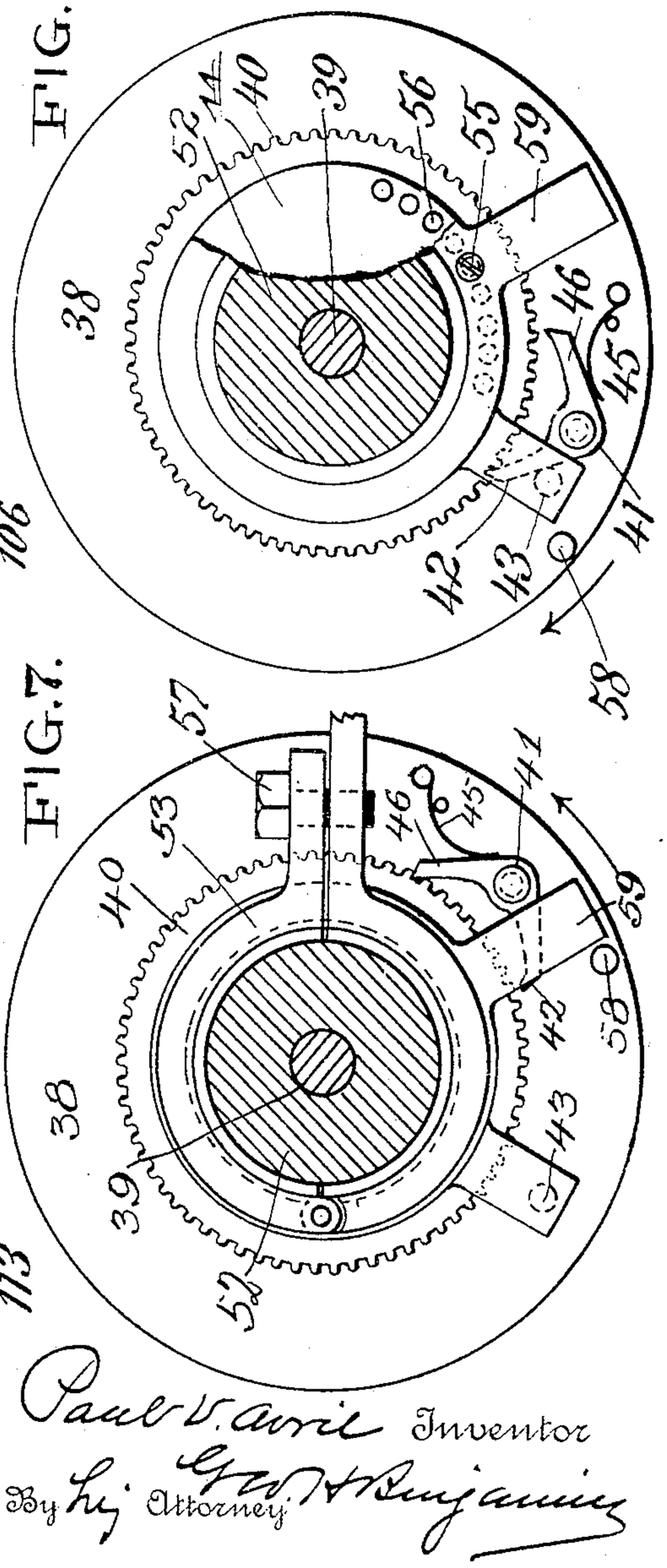


FIG. 7.

Witnesses
J. E. Pearson
Frank O'Connor

Paul V. Avril Inventor
By his Attorneys G. W. & A. Benjamin

UNITED STATES PATENT OFFICE.

PAUL VICTOR AVRIL, OF PARIS, FRANCE, ASSIGNOR TO MARINIER, NAVOIT AND JEANSON, OF PARIS, FRANCE, A COPARTNERSHIP.

ENGRAVING-MACHINE.

No. 805,698. Specification of Letters Patent. Patented Nov. 28, 1905.

Application filed October 7, 1904. Serial No. 227,572.

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 to automatic engraving-machines of a type adapted for reproducing upon a cylinder or plate designs, design elements, or other figures or illustrations from drawings or engravings thereof.

The machine as herein embodied employs certain features which I have fully described in several prior applications—to wit, Serial No. 222,188, filed August 25, 1904, and Serial No. 221,985, filed August 24, 1904. I will therefore in this application give but a general description of such features, referring to the applications above-mentioned for details of construction. In the machines of the applications referred to the cylindrical blank upon which the design is reproduced rotates in one direction only, as in an ordinary lathe, and the tool movable at right angles to the axis of the cylinder produces a cut extending transversely thereof. In the present instance, however, the cylinder is given an oscillating movement and the engraving-tool a reciprocating movement lengthwise thereof, the resultant of these motions being a spiral line extending longitudinally of the cylinder.

The accompanying drawings will serve to illustrate a machine such as may be employed to carry my invention into effect. I wish it understood, however, 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 the engraving-tool, shown in connection with the compound slide upon which it is mounted and a portion of the cylindrical blank with which it coacts. Fig. 3 illustrates in diagram the cut produced by the tool and the step-by-step rotary feed of the cylindrical blank. Fig. 4 is an end view of the machine with portions broken away to show the relative arrangement of the tracer and engraving-tool to their respective cylinders. Fig. 5 is a detail view, partly in section, of the compound slide upon which the engraving-tool is mounted. Fig. 6 is a view in diagram of the various circuits. Fig. 7 is an enlarged detail sectional view taken on the line $s^7 s^7$ of Fig. 1, showing a ratchet device for oscillating the cylindrical blank while giving the same a step-by-step rotary feed. Fig. 8 is a similar view on the line $s^8 s^8$ of Fig. 9 with the parts adjusted to rotate in a direction opposite to that indicated in Fig. 7; and Fig. 9 is a side view, partly in section, of the ratchet-feed device.

Referring now to the drawings, 1 represents a pattern-cylinder upon the surface of which the design elements or the like to be reproduced are drawn, stamped, or otherwise formed in outline, solid color, or in any other suitable manner, as indicated at 2, with an ink or paint possessing non-conducting qualities and which when applied to the cylinder forms an insulating-coating over that portion of the surface it covers. The pattern-cylinder 1 may be solid, hollow, or a mere shell, as may be found most convenient. As shown, a hollow cylinder is employed and mounted upon a mandrel 3, being insulated from the same, as indicated at 4, and centered relatively thereto by interposed sleeves or plugs 5 5. The mandrel is held between centers of the head and tail stocks 6 6 of a lathe 7. A blank in the form of a cylinder 8, of metal or other suitable material, upon the surface of which the design is to be reproduced, is mounted in a second lathe 9. The lathes 7 and 9 are driven by means of gearing, which I will now describe.

A counter-shaft 10, mounted upon the frame of the machine, is connected by means of a belt 11, passing around a pulley 12 upon a shaft 13, to drive the same, and motion from shaft 13 is transmitted through bevel-gears 14, 15, and 16 to gears 17 and 18 of two electromagnetic clutches 19 and 20, which, as indicated by arrows in Fig. 1, rotate in opposite directions. The clutches 19 and 20 consist, respectively, of one or more electromagnets 21, secured upon each of the gears 17 and 18, above referred to, which are mounted loosely upon a shaft 22, carrying disk-armatures 23 24, secured to rotate therewith. Motion from the clutch-shaft 22 is transmit-

ted to the lead-screw 25 of lathe 9 by bevel-gears 26 27 and from the lead-screw 25 to shaft 28 by similar gears 29 and 30. Fast upon the shaft 28 a pinion 31 is mounted, and adjoining the pinion and turning loosely upon the shaft there is an arm 32, carrying a gear 33 and pinion 34. The gear 33 meshes with the pinion 31 on shaft 38, and the pinion 34 may be shifted in or out of mesh with a gear 35, fast upon a sleeve 36, by adjusting the arm 32 and securing the same by means of a bolt 37. The gear 35 and sleeve 36 form part of a ratchet-feed device (shown in detail in Figs. 7 to 9), by which the cylinders 1 and 8 are rotated in unison, first in one direction and then in the other, through a definite number of degrees and this motion varied as required to at the same time produce a step-by-step rotary feed of the cylinders. This device consists of a driving member in the form of a disk 38, which is fast upon the sleeve 36. The sleeve turns loosely upon a shaft 39, mounted in an extension of the main frame of the machine. Fast upon the shaft 39 there is a toothed wheel or driven member 40, to which motion is imparted by a double pawl 41, pivoted upon the driving member 38. Through the action of the clutches 19 and 20, controlled in a manner to be later on described, the direction of rotation of the driving member 38 is periodically reversed. When the driving member rotates toward the right, the end 42 of the pawl rides under a pin or projection 43 upon a disk 44, and by it is cammed into engagement with the toothed wheel or driven member 40, causing these members 38 and 40 to rotate together, as indicated in Fig. 8. Rotation of the driving member in the opposite direction, as indicated in Fig. 7, carries the pawl from under the pin 43, and by means of the spring 45 the pawl is rocked about its pivot until the end 46 thereof interlocks with the driven member, which thereupon rotates with the driving member toward the left.

Through an intermeshing pinion 47 and gear 48 a driving connection is provided between the shaft 39, carrying the member 40, and a shaft 49, connected by a worm 50 and worm-wheel 51 with the spindle of the lathe 9. When therefore the member 40 is rotated, as above described, first toward the right then toward the left, such motion transmitted to the cylindrical blank in the lathe 9 through the gearing described causes the blank to oscillate in time with the reciprocating tool. In order now to give the cylindrical blank a step-by-step rotary feed as it is oscillated, the end 46 of the pawl is caused to interlock with the teeth of the driven member 40 throughout substantially the entire movement of the driving member in one direction and when moving in the opposite direction the end 42 of the pawl runs idly over the teeth of the driven member for a definite distance without imparting motion thereto. By reason of this lost motion the member 40 in oscillating has greater movement in one direction than in the other, and the cylindrical blank driven therefrom through the gearing described is thus given a slight advance during each oscillation—as represented, for example, from point a to point a^2 in Fig. 3. Assuming now that after the ratchet-feed device has made the required number of turns toward the left the direction of rotation of the driving member is reversed, it will be seen that as the pawl moves from the position shown in Fig. 7 to that shown in Fig. 8 the engaging end 46 thereof, acted upon by the spring 45, will ride over the teeth of the member 40 and motion will not be imparted to this member until the opposite end 42 of the pawl is forced into engagement therewith by the pin 43. The driving member 38 is thus given a lead relatively to the driven member 40 when rotating in one direction, and by increasing or decreasing such lead in a manner to be later on described the feed of the blank will be correspondingly varied. It will be observed that the position of the pin 43 determines the lead given the driving member 38, and in order to maintain these parts in proper relation, so that the pin will occupy the same position relatively to the pawl at any time the motion of the driving member is changed from left to right, I provide for giving the pin a follow-up movement by means of a device now to be described.

The disk 44 above referred to is provided with a projecting lug upon which the pin 43 is secured, and is mounted free to turn upon the shaft 39; but its rotation is opposed by a friction device, (shown in Fig. 9,) which in acting upon the disk serves to yieldingly hold the pin for a definite interval of time in any position to which it may be adjusted as the motion of the driving member 38 is reversed. This device consists of a pulley 52, loose upon the shaft 39 and rotating within a friction-band 53, secured to the frame of the machine, as indicated at 54 in Fig. 1. The disk and pulley are secured to rotate together by means of a screw 55 engaging any one of a series of threaded openings 56, formed in the disk. By removing the screw and adjusting the pin 43 relatively to the pawl the lead of the driving member 38 may be increased or decreased to vary the feed of the cylindrical blank as desired. A clamp screw or bolt 57 is provided for tightening the friction-band about the pulley to increase the friction as required. The pin 43, thus controlled by the friction device, is advanced in one direction by being directly engaged by the pawl 41, as previously described and shown in Fig. 8, and is given a follow-up motion relatively to the pawl in the opposite direction by a stud 58 upon the driving member 38, which is ar-

netic clutches 19 20 and the magnet 80. The switch is carried by the lathe-carriage and consists of a pivoted sector of insulating material upon the curved face of which a contact-plate 108 is secured and connected with the source of current-supply 96 through the plate 109, brush 110, wire 111, brush 112, and bar 113. The plate 109 is secured upon the rounded end of the sector adjacent to its pivot and the brush 112 upon the lathe-carriage, so as to move back and forth with the same in contact with the bar 113, which extends lengthwise of the lathe-bed. The switch has a limited movement between stops 114 114 and is operated by means of a lever 115, pivoted thereon and arranged to coöperate with two pins or projections 116 116 thereof. A spring 117, acting through the lever 115 and pins 116 116, serves to give the switch a quick motion and also holds it as thrown in contact with one or the other of the stops 114. The movement or adjustment of the lever is controlled by spaced pins or trips 117^a 117^b upon the lathe-bed, which are arranged to engage the projecting end of the lever and throw the switch when the carriage reaches a predetermined point in its travel in either direction. Coöperating with the contact-plate 108 upon the curved face of the switch there are two brushes 118 119. The brush 118 is connected with the magnets of the clutch 19 through the wire 120, brush 121, bar 122, wire 123, brush 124, and contact-ring 125, a similar set of connections 126 127 100 128 129 130 being provided from the brush 119 to the magnets of clutch 20. The return-circuit from these clutch-magnets is by way of contact-rings 131 131, brushes 132 132, wires 133 134, and bar 106 to the source of current-supply. The brushes 121 and 127 are secured to and movable with the carriage of the lathe and contact, respectively, with bars 122 and 100 arranged parallel with the bars 106 and 113. The rings 125 130 131 131, suitably insulated, are mounted upon the clutch-shaft 22. The magnet 80 is connected in circuit with the switch 107 by wires 135 136, one of which leads from the brush 118 of the switch to the magnet, the other being connected to the return circuit-wire 104 from the magnet 98. When the switch is adjusted as shown in Fig. 6, the magnets of clutch 20 are energized, and through the gearing described the carriage is fed toward the right, as viewed in Fig. 1, and the style and engraving-tool mounted thereon are given movement lengthwise of their respective cylinders, while the latter rotate in the direction indicated by the arrow 61 in Fig. 3. Assuming, for example, that both the style and engraving-tool are so relatively adjusted as to engage their cylinders at a point such as *a*, Fig. 3, if now the carriage is fed to the right and the cylinders rotated in the direction indicated by the arrow 61 the travel of the style and engraving-tool in contact with the cylinders would be represented by the line *b*, which extends lengthwise at a slight angle to the axes thereof. The style and engraving-tool having reached the end of their travel, the switch 107 upon the carriage strikes the trip 117^a, which throws it over, and thereby cuts out the clutch 20 and completes the circuit through the clutch 19 and the magnet 80. This results in reversing the feed of the carriage, lifts the style clear of the pattern-cylinder, and causes the cylindrical blank to rotate in the opposite direction. (Indicated by the arrow 62, Fig. 3.) The travel of the carriage toward the left continues until the switch 107 strikes the second trip 117^b and is shifted back to the position shown in Fig. 6, cutting out the clutch 19 and magnet 80 and again closing the circuit through the clutch 20. Controlled by the ratchet feed device in the manner above described the cylinders during each oscillation are fed forward or advanced a definite distance, so that on the next movement toward the right the style and engraving-tool start from a point a^2, Fig. 3, and move in contact with the cylinders along a line b^2 parallel with line *b*. Any change in the speed of rotation of the cylinders relatively to the longitudinal movement of the style and engraving-tool will produce a corresponding variation in the angle of the engraved line to the axis of the cylinder, and the distance separating the engraved lines or the rotary feed-step of the cylinders may be varied by a relative adjustment of the pin 43 and lug 59 of the ratchet feed device, as above described.

Referring to Fig. 6, I have shown two switches 137 138, controlling an electromagnetic clutch 139 upon the shaft 10, which is arranged to operate a belt-shifter 140, coöperating with belt 11, and stop the machine in the event of the driving-belt 141 of clutches 86 87 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 application above referred to, serially numbered 221,985, a detail description is not herein deemed necessary.

As the operation will be generally understood from the foregoing description, I will describe the same briefly. Assuming that a reproduction of a design is desired in which the dimensions, order of the figures, or elements thereof, &c., are the same as in the original, a cylindrical blank is employed of the diameter of the pattern-cylinder and after being properly mounted in their respective lathes the style and engraving-tool are adjusted relatively to the cylinders and the machine is started up. The cylinders rotate in the same direction, at the same speed, and the tools, movable with the carriage, are carried back and forth lengthwise of the lathe-bed, the

ranged to coöperate with a lug or projection 59 of the friction-pulley.

The spindles of lathes 7 and 9 are ordinarily geared to rotate at the same speed and in the same direction. As shown in Fig. 4, motion is transmitted from shaft 49 to a shaft 64 through gears 65, 66, 67, 68, 69, and 70. The gears 68 and 69 are carried by an adjustable arm 71 and may be thrown in or out of mesh with the gears 67 and 70 at will, or other gears may be substituted for those carried by the arm when the pattern-cylinder is to be rotated at a higher or lower speed than that of the blank-cylinder. The spindle of lathe 7 is driven from shaft 64 by means of the worm 72 and worm-gear 73.

Coöperating with the pattern-cylinder there is a tracing-point or style 74, carried by a pivoted arm 75, which is adjustable by means of vertical and cross feeds 76 77 upon the lathe-carriage 78. A magnet 80 is secured upon the slide to which the arm 75 is pivoted, and a connection 81 between the armature thereof and the arm 75 serves when the magnet is energized to raise the style clear of the pattern-cylinder.

Coöperating with the blank-cylinder there is an engraving-tool 82, mounted on a compound cross-slide 83 of the carriage 78.

As both the style 74 and engraving-tool 82 are carried by the lathe-carriage 78, movement of the same longitudinally of their respective cylinders is imparted by the lead-screw 25 through the usual connection with the carriage. Movement of the engraving-tool transversely of the lathe is controlled by the style through interposed mechanism now to be described.

Motion from a rock-shaft 84, mounted upon the carriage 78, is imparted to the cross-slide 83 by means of a crank and connecting-rod 85. The rock-shaft is oscillated by two electromagnetic clutches 86 87, loosely mounted thereon and driven continuously through suitable gearing from the shaft 13. These clutches rotating in opposite directions, as indicated by the arrows in Fig. 1, coact with ring-armatures 88 88, carried by a disk 89, of brass or other non-magnetic metal, fast upon the rock-shaft. Current to the clutches is controlled by the style through an automatic switch carried by an arm or sector 90, fast upon the rock-shaft. As shown in Fig. 4, the switch-lever 91 has a limited movement between adjustable stops 92 92, carried by a bracket adjustably secured upon a curved arm 93 of the carriage. Posts 94 95 are secured upon the sector 90, one on each side of switch-lever 91. The post 94 is connected in circuit with the magnets of clutch 86 and the post 95 in circuit with the magnets of the other clutch 87. A return-circuit from these magnets is provided to a source of current-supply 96. Coöperating with the posts 94 95 there is a pin 97, carried by the switch-lever 91, which is so arranged as to contact with one or the other of the posts as the lever is thrown toward the right or left, as viewed in Fig. 4, and close the circuit through one of the clutches, the pin 97 being connected with the source of current-supply, as shown in Fig. 6. Movement of the switch toward the left, Fig. 4, is effected by means of an electromagnet 98, mounted upon the sector 90, and toward the right by means of a spring 99. It will therefore be seen that in the operation of the machine, when the spring 99 is acting, the pin 97 of the switch-lever engages the post 94 and closes the circuit through the clutch 86, controlling rotation of the rock-shaft toward the right, Fig. 4, and the resulting motion imparted to the cross-slide through the crank 84 and connecting-rod 85 will be such as to move the tool 82 toward the cylinder. When the magnet 98 is energized, the switch-lever swings toward the left, causing the pin 97 to contact with the post 95 and close the circuit through the clutch 87, which, as indicated in Fig. 1, rotates toward the left, and the rock-shaft under its influence, moving in the same direction, acts, through the crank, connecting-rod, and cross-slide, to move the tool away from the cylinder. The magnet 98 is connected with the source of current-supply by bar 113, brush 112, wire 111, switch 107, wire 126, brush 127, bar 100, wire 101, brush 102, pattern-cylinder 1, style 74, and wire 103, the return-circuit from the magnet being by way of wire 104, brush 105, and bar 106. The opening and closing of the circuit through the magnet 98 is effected by movement of the cylinder in contact with the point of the style. If, as shown in Fig. 6, the design is represented in solid color, the circuit through the magnet 98 will be broken when the point of the style is traversing that portion of the surface covered by the design, and at such times the switch-lever under the action of the spring 99 will be drawn over to the position shown in Fig. 4 to close the circuit through the clutch 86, which, as above described, acts to move the tool inward toward the cylinder. When the style is traversing that portion of the cylinder not covered by the design, the circuit through the magnet 98 is completed, and the switch-lever is shifted to close the circuit of clutch 87, which thereupon reverses the movement of the tool, causing it to move away from the cylinder.

The depth of cut produced by the tool is regulated and rendered uniform throughout the entire design either by an adjustable gage 92^a upon the compound cross-slide 83 or through the stops 92 92, as described in my application above referred to and serially numbered 221,985.

Referring now to Fig. 6, I have shown an automatic switch 107 and connections for controlling the circuits of the electromag-

extent of such movement of the carriage being determined by the position of the trips 117^a 117^b, which operate to throw the switch 107, controlling the clutches 19 and 20, by which the lead-screw is reversed. As the style in moving toward the right traverses the surface of the pattern-cylinder it contacts successively with insulated and uninsulated portions thereof, and through the connections described causes the switch 91 to close the circuit through first one, then the other, of the clutches 86 87. The rock-shaft 84, oscillating under the action of these clutches, imparts motion, as described, to the cross-slide, and thereby adjusts the engraving-tool in and out of cutting position relatively to the cylindrical blank, the result being a broken diagonal line, which appears upon the blank, of slightly-curved or spiral form. This operation repeated throughout the circumference of the cylindrical blank produces a series of such broken lines, which extend parallel one with the other and are equispaced through the action of the ratchet-feed, as above described.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An automatic engraving-machine comprising a pattern-cylinder having a design represented thereon by an insulating material covering portions of its surface, a traversing style coöperating therewith, a source of current-supply, means for connecting the pattern-cylinder and style in circuit with the source of supply, means for supporting a cylindrical blank, an engraving-tool coöperating with the blank, means for rotating the pattern-cylinder and cylindrical blank alternately in opposite directions in unison, means for feeding the style and tool lengthwise of their respective cylinders, means for automatically reversing the feed to cause the style and tool to reciprocate between predetermined points, and means for moving the tool in and out of engagement with the blank in accordance with the action of the style in opening and closing the circuit in traversing the surface of the pattern-cylinder.

2. An automatic engraving-machine comprising a pattern-cylinder having a design represented thereon by an insulating material covering portions of its surface, a traversing style coöperating therewith, a source of current-supply, means for connecting the pattern-cylinder and style in circuit with the source of supply, means for supporting a cylindrical blank, an engraving-tool coöperating with the blank, means for rotating the pattern-cylinder and cylindrical blank alternately in opposite directions in unison, a device for imparting a step-by-step rotary feed to the cylinders, said device being adjustable to vary the feed thereof, mechanism for reciprocating the style and tool lengthwise of their respective cylinders between predetermined points, and means for moving the tool in and out of engagement with the blank in accordance with the action of the style in opening and closing the circuit in traversing the surface of the pattern-cylinder.

3. An automatic engraving-machine comprising a pattern-cylinder having a design represented thereon by an insulating material covering portions of its surface, a traversing style coöperating therewith, a source of current-supply, means for connecting the pattern-cylinder and style in circuit with the source of supply, means for supporting a cylindrical blank, an engraving-tool coöperating with the blank, oppositely-acting clutches geared to rotate the pattern-cylinder and cylindrical blank alternately in opposite directions in unison, means for automatically controlling the clutches, a device for imparting a step-by-step rotary feed to the cylinders, and means for moving the tool in or out of engagement with the blank in accordance with the action of the style in opening and closing the circuit in traversing the surface of the pattern-cylinder.

4. An automatic engraving-machine comprising a pattern-cylinder, means for supporting a cylindrical blank, a traversing style movable lengthwise of the pattern-cylinder, an engraving-tool having a like movement relatively to the blank, oppositely-acting clutches geared to rotate the pattern-cylinder and cylindrical blank alternately in opposite directions in unison, means for automatically controlling the clutches, and means for moving the tool in or out of engagement with the blank as the style in traversing the surface of the cylinder passes over portions of the design thereon.

5. An automatic engraving-machine comprising a pattern-cylinder, means for supporting a cylindrical blank, a traversing style movable lengthwise of the pattern-cylinder, an engraving-tool having a like movement relatively to the blank, electrically-operated clutches geared to rotate the pattern-cylinder and cylindrical blank alternately in opposite directions in unison, an automatic switch-controlling current to the clutches, and means for moving the tool in or out of engagement with the blank as the style in traversing the surface of the cylinder passes over portions of the design thereon.

6. An automatic engraving-machine comprising a pattern-cylinder, means for supporting a cylindrical blank, a traversing style movable lengthwise of the pattern-cylinder, an engraving-tool having a like movement relatively to the blank, electrically-operated clutches geared to rotate the pattern-cylinder and cylindrical blank alternately in opposite directions in unison, a device interposed between the clutches and cylinders to

regulate the rotation of the cylinders and give the same a step-by-step rotary feed, an automatic switch-controlling current to the clutches, and means for moving the tool in or out of engagement with the blank as the style in traversing the surface of the cylinder passes over portions of the design thereon.

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

PAUL VICTOR AVRIL.

Witnesses:
J. E. PEARSON,
FRANK O'CONNOR.