No. 818,137. PATENTED APR. 17, 1906.

P. V. AVRIL.

ENGRAVING MACHINE.

APPLICATION FILED AUG. 24, 1904.

3 SHEETS—SHEET 1.

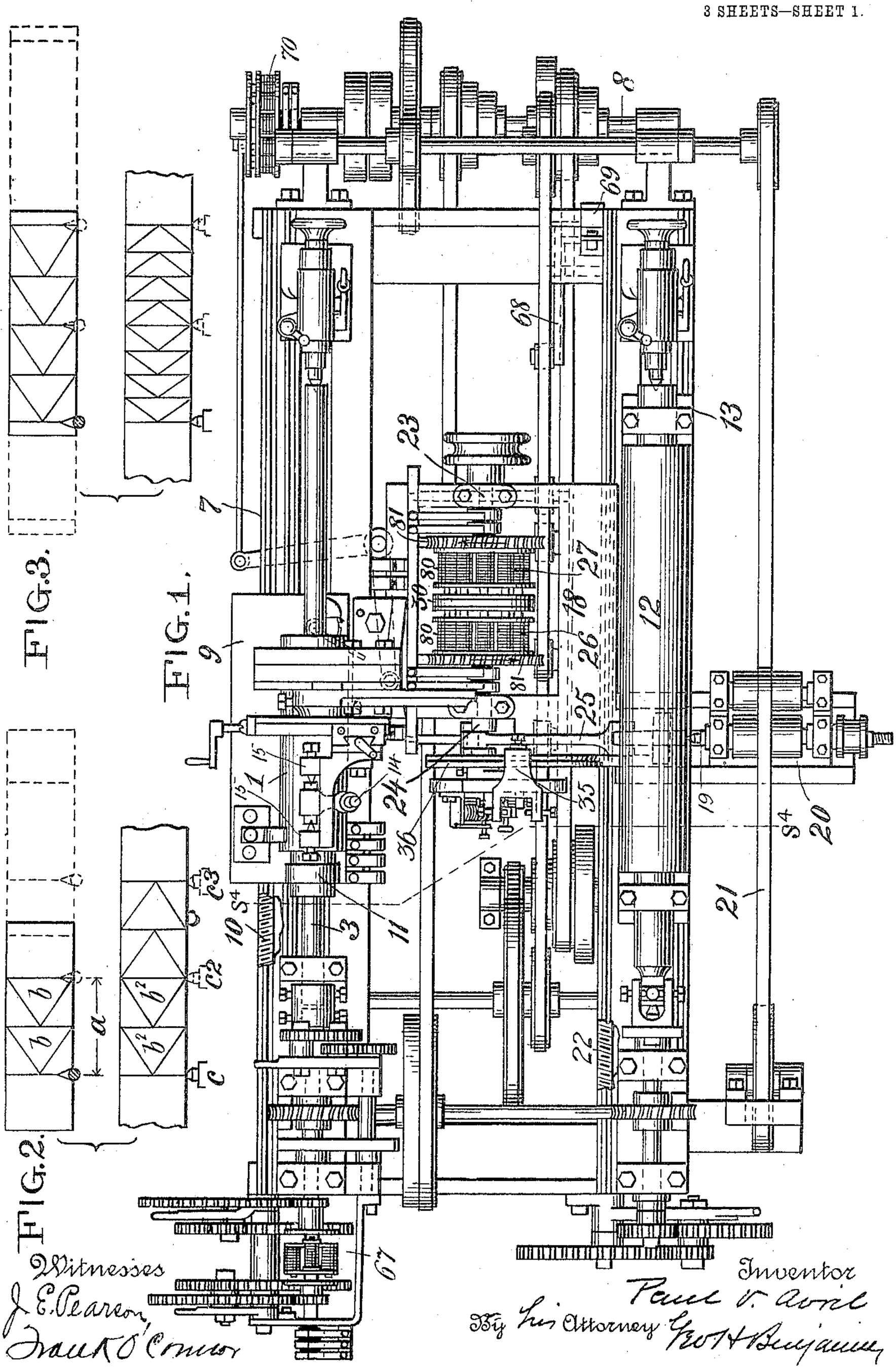

FIG. 1.

FIG. 2.

FIG. 3.

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3 SHEETS—SHEET 2.

FIG. 5.

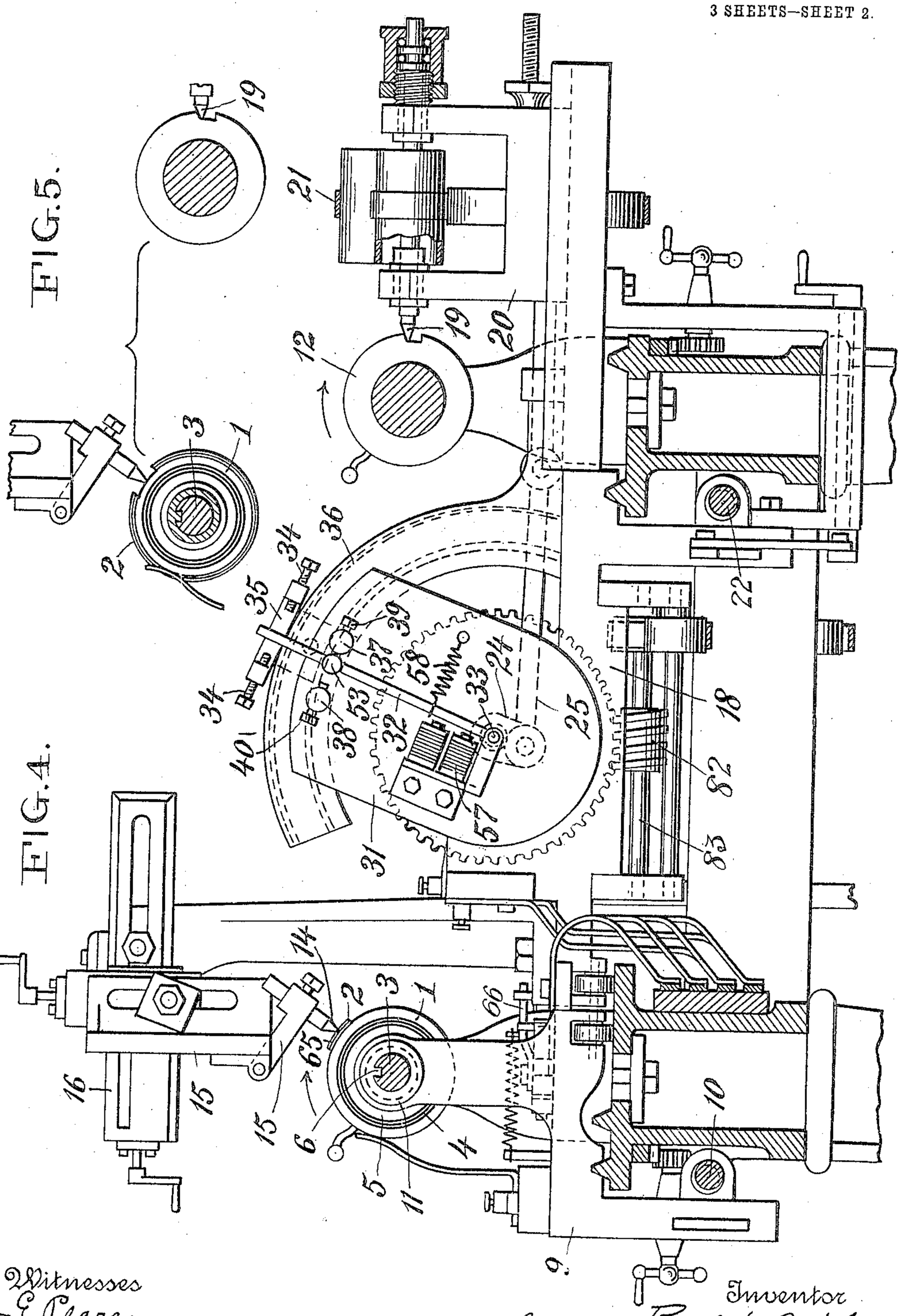

FIG. 4.

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3 SHEETS—SHEET 3.

FIG. 6.

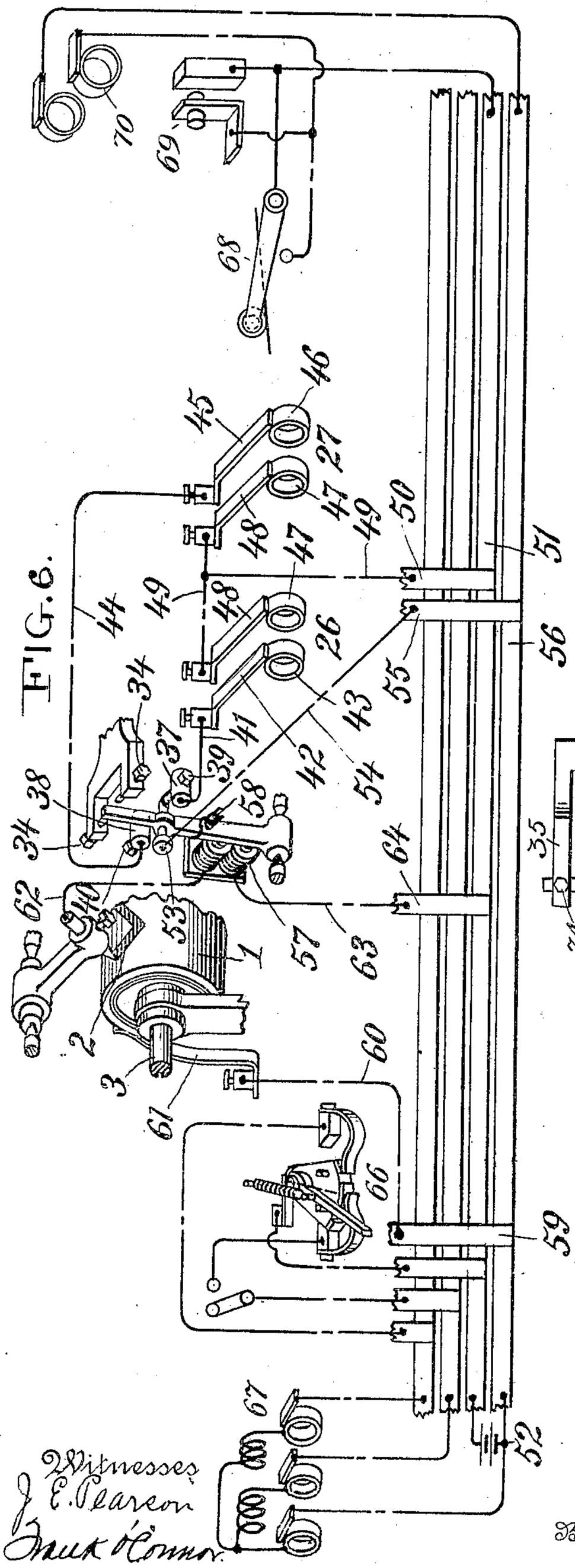
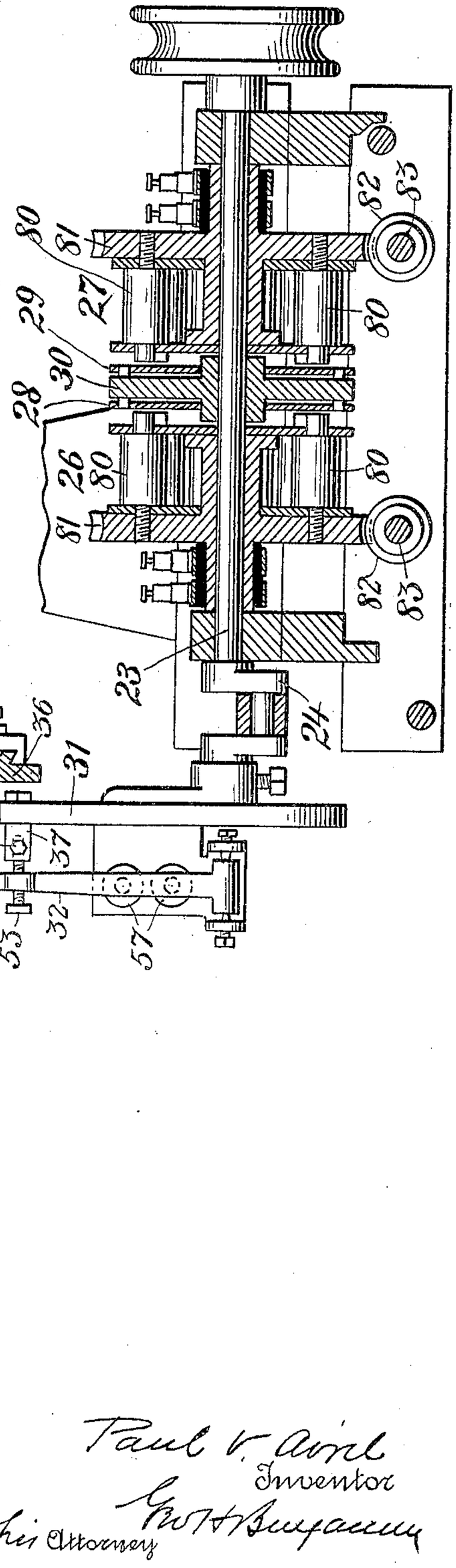


FIG. 7.



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PAUL VICTOR AVRIL, OF PARIS, FRANCE.

ENGRAVING-MACHINE.

No. 818,137. Specification of Letters Patent. Patented April 17, 1906.

Application filed August 24, 1904. Serial No. 221,985.

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 an engraving-machine of a type adapted for automatically reproducing from drawings either intaglio or relief copies of complete designs, design elements, or the like.

My invention as herein embodied employs mechanism substantially similar, excepting certain features to be hereinafter pointed out, to the mechanism which I have fully described in an application filed August 25, 1904, and serially numbered 222,188. I will therefore in this application give but a general description of the same, referring to my other application for details of construction.

The accompanying drawings will serve to illustrate a machine such as may be employed for carrying 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 a view in diagram illustrating the operation of reproducing design elements, first as in the original, then in the reverse order. Fig. 3 is a similar view illustrating the same operation, modified by varying one dimension of the design as reproduced. Fig. 4 is a cross-sectional view of the machine, taken on the line S^4 S^4 of Fig. 1. Fig. 5 is a detail view showing the design-cylinder, model-cylinder, and the tools which cooperate therewith. Fig. 6 is a view in diagram of the various circuits, and Fig. 7 is a detail sectional view of the clutch mechanism interposed between the tracing-style and the cutting-tool.

Referring now to the drawings, 1 represents a 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 which it covers. The 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. In a keyway, formed in the mandrel, a pin or lug 6 of one of the sleeves 5 projects, and through this connection the cylinder is caused to rotate with the mandrel, being free at the same time to move lengthwise thereof. The mandrel is held between the centers of the head and tail stocks of a lathe 7, motion to which is transmitted from a shaft 8 through suitable gearing, as shown, and which is fully described in my application above referred to. The carriage 9 of the lathe, controlled in the usual manner by a lead-screw 10, is provided with a bearing 11 to receive the projecting end of one of the sleeves 5, and thus connected the carriage and cylinder move together in either direction lengthwise of the lathe-bed.

A blank in the form of a cylinder 12, of metal or other suitable material, upon the surface of which the design is to be reproduced, is mounted in a second lathe 13, motion to which is transmitted from shaft 8 through suitable gearing, the detail construction of which is described in the application to which I have previously referred.

Coöperating with the design-cylinder there is a tracing point or style 14, carried by a pivoted arm 15, which is adjustable by means of vertical and cross feeds 16 17, upon the carriage 18 of lathe 13. Coöperating with the blank-cylinder there is a cutting-tool 19, rotatably mounted in a cross-slide 20 of the carriage 18 and driven by means of a belt 21, passing around pulleys arranged in a manner to permit the tool to move transversely and longitudinally of the lathe while being driven. As both the style and cutting-tool are carried by the carriage 18 of the lathe 13, movement of the same longitudinally of their respective cylinders is imparted by the lead-screw 22 through the usual connection with the carriage,

Movement of the cutting-tool transversely of the lathe is controlled by the style through interposed mechanism now to be described. Motion from a rock-shaft 23, mounted upon the carriage 18, is imparted to the cross-slide 20 by means of a crank 24 and connecting-rod 25. The rock-shaft is oscillated through the action of two clutches 26 and 27, one of

which rotates continuously toward the right and the other continuously toward the left. Each clutch consists of a series of electro-magnets 80, carried by a worm-gear 81, free to turn upon the rock-shaft and in mesh with and driven by a worm 82 on a shaft 83. Motion from the shaft 8 is transmitted to the worm-shaft by a series of suitably-arranged pulleys. The clutches are arranged one on each side of a disk 30, of brass or other non-magnetic metal, which is made fast to the shaft 23 and serves to support flat-ring armatures 28 and 29, which are mounted thereon to rotate with the disk and have a limited movement toward the magnets. Current to the clutches is controlled by the style through an automatic switch, carried by an arm or sector 31, fast upon the rock-shaft. As shown in Fig. 4, the switch-lever 32 is pivoted at 33 and has a limited movement between screw-stops 34 34, carried by a bracket 35, adjustably secured upon a curved arm 36 of the carriage 18.

Posts 37 38, provided with adjustable contact pins or screws 39 40, are secured upon the sector 31, one on each side of the switch-lever 32. The post 37 is connected by wire 41, brush 42, and contact-ring 43 with the magnets of clutch 26, and a similar set of connections 44 45 46 are provided from post 38 to the magnets of the other clutch 27. The return-circuit from these magnets is through rings 47 47, brushes 48 48, wires 49 49, brush 50, and bar 51 to a source of current-supply 52.

Coöperating with the contact-screws of posts 37 38 there is a pin 53, carried by the switch-lever 32, which is so arranged as to engage one or the other of the screws 39 40 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 53 being connected with the source of current-supply, as shown in Fig. 6, by a wire 54, brush 55, and bar 56.

Movement of the switch-lever toward the left, Fig. 4, is effected by means of an electro-magnet 57, mounted upon the sector 31, and toward the right by means of a spring 58. It will therefore be seen that in the operation of the machine when the spring 58 is acting the pin 53 of the switch-lever contacts with screw 39 and closes the circuit through the clutch 26, controlling rotation of the rock-shaft toward the right, Fig. 4, and the resulting motion imparted to the cross-slide through the crank 24 and connecting-rod 25 will be such as to move the tool 19 toward the cylinder. When the magnet 57 is energized, the switch-lever swings toward the left, causing the pin 53 to contact with the screw 40 and close the circuit through the clutch 27, which, as viewed in Fig. 4 and indicated in Fig. 1, rotates toward the left, and the rock-shaft under its influence moving in the same direction acts through the crank 24, connecting-rod 25, and cross-slide 20 to move the tool away from the cylinder.

The magnet 57 is connected with the source of current-supply by the bar 56, brush 59, wire 60, brush 61, cylinder 1, style 14, and wire 62, the return-circuit from the magnet being by way of the wire 63, brush 64, and bar 51. The opening and closing of the circuit through the magnet 57 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 57 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 58 will be drawn over to the position shown in Fig. 4 to close the circuit through the clutch 26, 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 57 is completed and the switch-lever is shifted to close the circuit of clutch 27, 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 by the screw-stops 34 34, above described as coacting with the switch-lever. It being understood that the sector is fast upon the rock-shaft and moves with the same, it will be seen that when the switch-lever is thrown over by the spring, as shown in Fig. 4, to close the circuit through the clutch 26 it will act to rotate the rock-shaft and sector thereon toward the right and move the tool inward toward the cylinder, as above described, the extent of such movement determining the depth of cut produced. As the switch-lever strikes the stop 34 its motion is suddenly checked and the continued advance of the sector separates the contact-pins 39 53 and breaks the circuit. The clutch 26 thereupon ceases to act and the tool continues to cut at the depth to which it is adjusted as the cylinder 12 is rotated until the circuit through the magnet 57 is completed by the style, which after traversing a portion of the design—represented, for example, at 65 in Fig. 4—contacts directly with the surface of the cylinder. The magnet being thus energized attracts its armature—*i. e.* the switch-lever—and causes the same to swing over until the pins 40 53 meet and close the circuit through the clutch 27. This results in rocking the shaft and sector toward the left, and such movement continues until the tool just clears the surface of the cylinder, when further movement of the switch-lever is checked by the stop 34. The continued advance of the sector separates the contact-pins 40 53 and breaks the clutch-cir-

cuit, and thereafter the tool is held clear of the cylinder until magnet-circuit is broken by another portion of the design upon the cylinder 1 passing under the point of the style, when the spring 58 again acts and throws the switch-lever over, as shown in Fig. 4, which results in repeating the cutting operation, as above described.

The bars 51 56, &c., included in the various circuits, as above described, are fixed and extend lengthwise of the bed of the lathe 7, and the brushes 50 55 64, &c., are secured to the carriage 18 and movable therewith in contact with the bars.

Referring to Fig. 6, I have shown a switch 66 arranged to control an electromagnetic clutch 67, by means of which the direction of rotation of the lead-screw 10 may be automatically reversed at predetermined points in the travel of the carriage 9 when moving in either direction. I have also shown two switches 68 69, controlling an electromagnetic clutch 70 upon the shaft 8, which is arranged to operate a belt-shifter and stop the machine in the event of the driving-belt of clutches 26 27 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, a detail description is not herein deemed necessary.

In reproducing a design of the dimensions of the original and with the figures or elements thereof arranged in the same order as in the original the operation is as follows: Assuming that the design-cylinder and the cylindrical blank are properly mounted in their respective lathes, the style and cutting-tool are then adjusted relatively to their cylinders and the lead-screw 10 is thrown out of gear, so that the carriage 9 remains at rest. As the machine is started up the design-cylinder begins to rotate, presenting first an insulated portion, then an uninsulated portion of its surface for contact with the style which results, through the connections described, in vibrating the switch-lever between the posts 37 38 and closing the circuit through first one clutch, then the other. The clutches acting alternately upon the rock-shaft oscillate the same, and such oscillations transmitted through the crank 24 and connecting-rod 25 impart a reciprocating movement to the cross-slide 20, upon which the tool 19 is mounted. The depth of cut produced by the tool may be regulated by varying the distance separating the adjustable stops 34 34, as above described, the length of cut circumferentially of the cylinder being controlled by the style in making and breaking the circuit through the magnet 57 as it traverses the surface of the design-cylinder. Under the action of the lead-screw of the lathe 13 the carriage 18 thereof, together with the style, cutting-tool, and interposed clutch mechanism mounted thereon, are advanced uniformly along the cylinders 1 and 12, continuing the operation as above described throughout that portion of the cylinder 1 containing the design and reproducing upon the cylinder 12 an exact duplicate thereof, as indicated in Fig. 2, between the arrow-points *a*. This being the usual method of operation, let it now be assumed that the design-cylinder contains only half of a symmetrical figure (represented by the elements *b b* in Fig. 2) and that it is desired to reproduce the design complete upon the blank. The elements *b b*, appearing upon the cylinder, are first duplicated, as indicated at b^2 b^2, and during this step in the operation the carriage 9 is at rest and the style and cutting-tool have the same movement longitudinally of their cylinders from point *c* to point c^2. In order now to reproduce the elements *b b* upon the blank in the reverse order, the lead-screw 10 of lathe 7 is thrown in with a train of gears, by which the carriage 9 is advanced at double the speed of carriage 18. If now the machine be started up, the style moving from c^2 to c^3 in the same direction longitudinally of the lathe as the design-cylinder, but at only half the speed, will retrace the design appearing between the arrow-points *a* from right to left, and thereby cause the elements *b b* to be reproduced upon the blank in the reverse order and combine with the duplicated elements b^2 b^2 in forming a complete figure.

A design reproduced in the manner just described may be further modified by varying its length, as represented in Fig. 3. If, for example, the carriage 9 moves at three times the speed of carriage 18, the reproduced design will be reproduced one-half lengthwise of the cylinder. If the speeds are one to four, the resulting reduction will be one-third, and so on.

Having thus described my invention, I claim—

1. An automatic engraving-machine comprising a rotating pattern-cylinder having portions of its surface covered with an insulating material, a tracing-style coöperating therewith, means for rotatably supporting a cylindrical blank, a cutting-tool, electrically-controlled clutch mechanism operatively connected to impart movement to the tool to and from the blank, a switch in the clutch-circuit, an oscillating support for the switch, and means for shifting the switch as the style in traversing the surface of the pattern-cylinder contacts with an uninsulated portion thereof.

2. An automatic engraving-machine comprising a rotating pattern-cylinder having portions of its surface covered with an insulating material, a tracing-style coöperating therewith, means for rotatably supporting a cylindrical blank, a cutting-tool, oppositely-acting clutches electrically controlled

and operatively connected to impart movement to the tool to and from the blank, a switch controlling current to the clutches, means for shifting the switch as the style moves in or out of contact with the uninsulated portions of the pattern-cylinder, and means for automatically opening the clutch-circuit after the switch is shifted to limit the movement of the tool and render the depth of cut uniform.

3. An automatic engraving-machine comprising a rotating pattern-cylinder having portions of its surface covered with an insulating material, a tracing-style coöperating therewith, means for rotatably supporting a cylindrical blank, a cutting-tool, oppositely-acting clutches electrically controlled and operatively connected to impart movement to the tool to and from the blank, a switch controlling current to the clutches, a support for the switch mounted to have a limited movement under the influence of the clutch in circuit, a magnet arranged to throw the switch, and requisite connections through which the magnet is energized as the style moves in or out of contact with uninsulated portions of the pattern-cylinder.

4. An automatic engraving-machine comprising a rotating pattern-cylinder having portions of its surface covered with an insulating material, a tracing-style coöperating therewith, means for rotatably supporting a cylindrical blank, a cutting-tool, oppositely-acting clutches electrically controlled and operatively connected to impart movement to the tool to and from the blank, a switch, a spring for shifting the switch to close the circuit through one of the clutches, a magnet for reversing the switch to close the circuit through the other clutch, a support for the switch movable under the influence of the clutch in circuit, adjustable stops for limiting the movement of one member of the switch, and requisite connections through which the magnet is energized as the style moves in or out of contact with uninsulated portions of the pattern-cylinder.

5. An automatic engraving-machine comprising in its construction, a lathe and a carriage therefor, a pattern-cylinder mounted in the lathe and movable lengthwise with the carriage under the control of the feed thereof, said pattern-cylinder having portions of its surface covered with an insulating material, a tracing-style coöperating with the cylinder, a source of current-supply, means for connecting the cylinder and style in circuit with the source of current-supply, a second lathe providing support for a cylindrical blank, a cutting-tool movable to and from the blank, a rock-shaft mounted upon the carriage of said second lathe and operatively connected to impart movement to the tool, oppositely-acting clutches upon the shaft, said clutches being electrically operated, a switch controlling current to the clutches, a support for the switch fast upon the rock-shaft, means for shifting the switch as the style moves in or out of contact with uninsulated portions of the pattern-cylinder, and means for opening the clutch-circuit after the switch is shifted to limit the rotation of the rock-shaft to a definite number of degrees in each direction.

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

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Witnesses:

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