No. 864,655. PATENTED AUG. 27, 1907.

C. KUEHNER.

PANTOGRAPHIC ENGRAVING MACHINE.

APPLICATION FILED MAY 6, 1904.

4 SHEETS—SHEET 1.

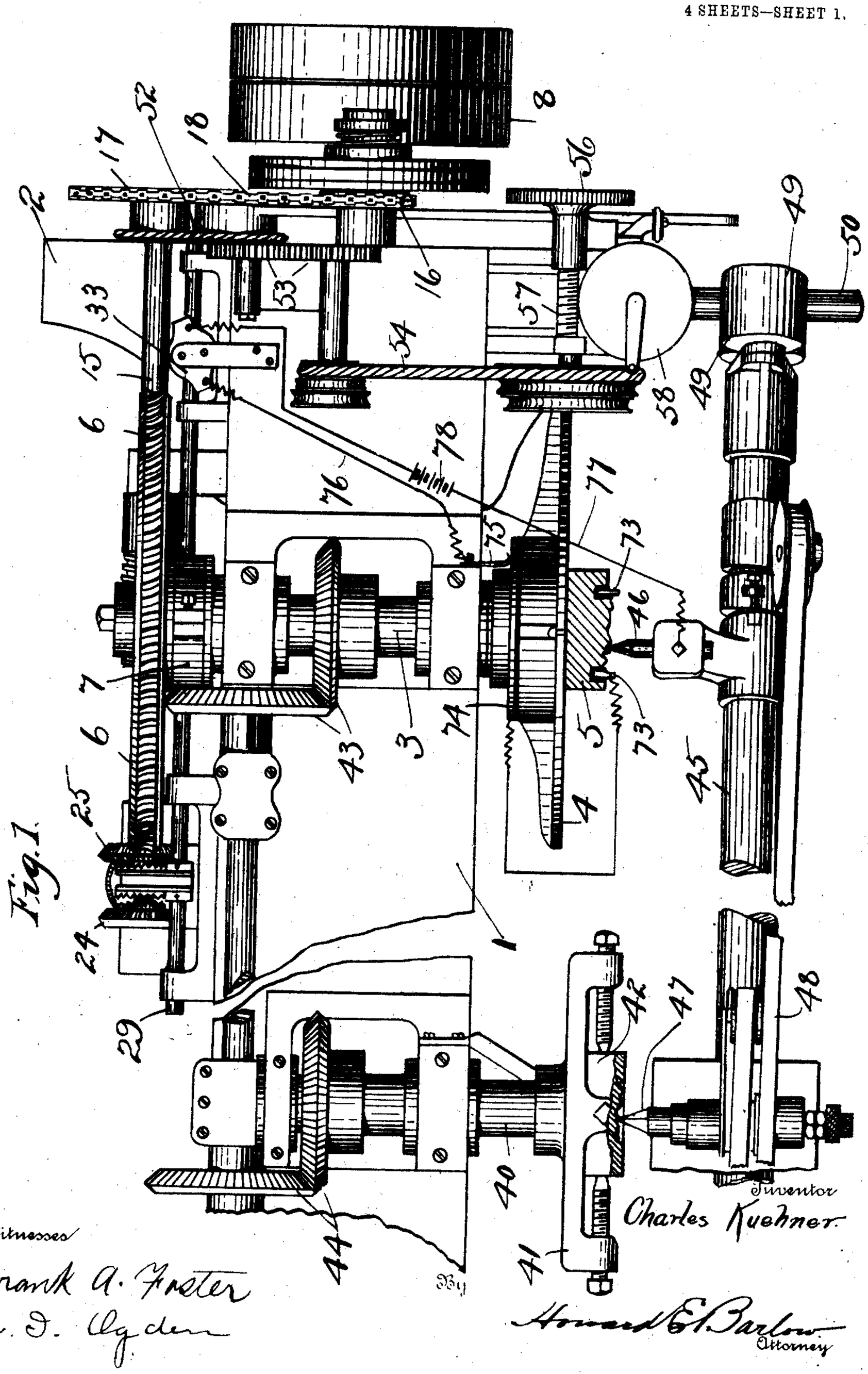


Fig. 1.

Witnesses

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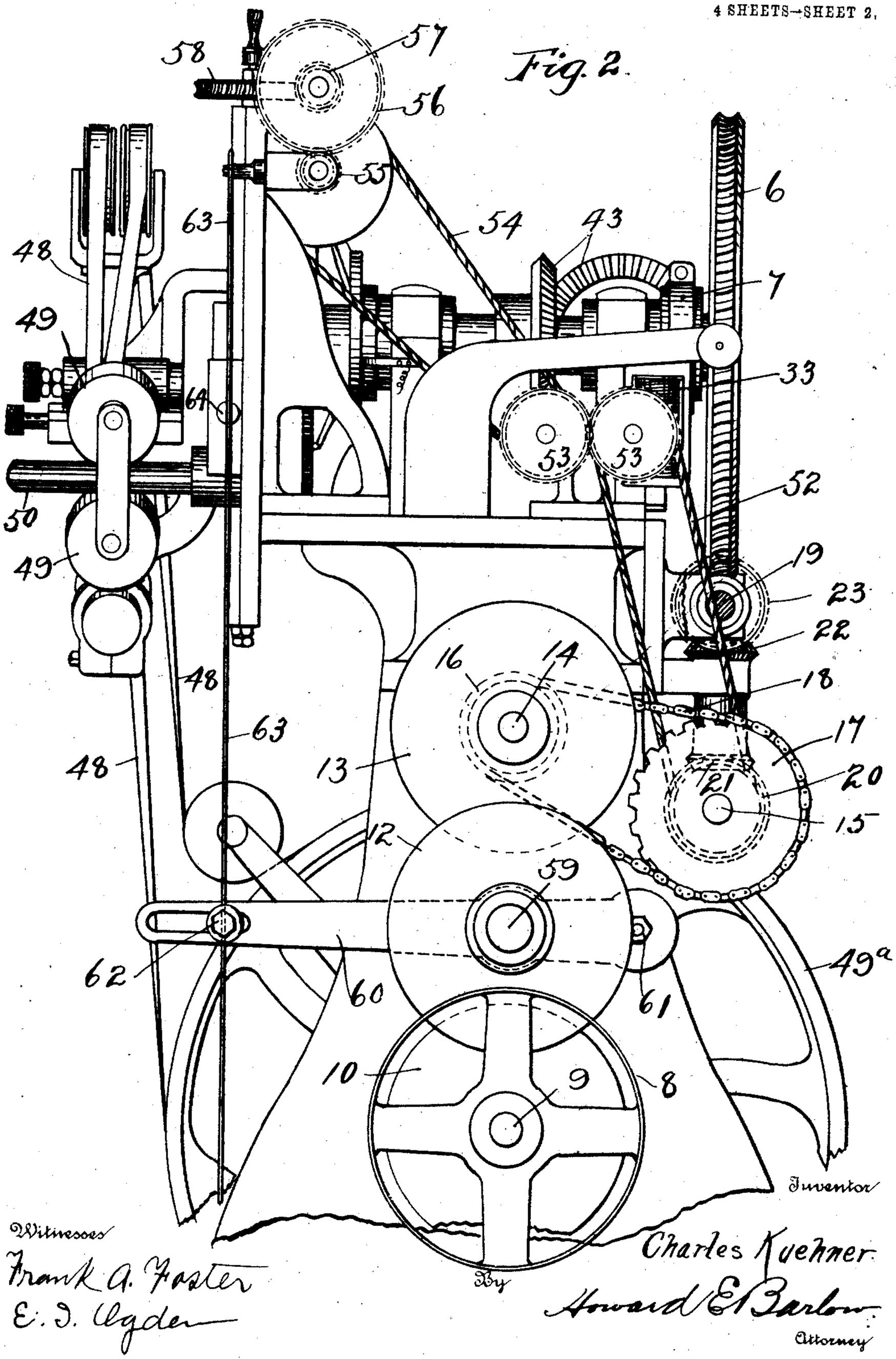
4 SHEETS—SHEET 2.

Fig. 2.

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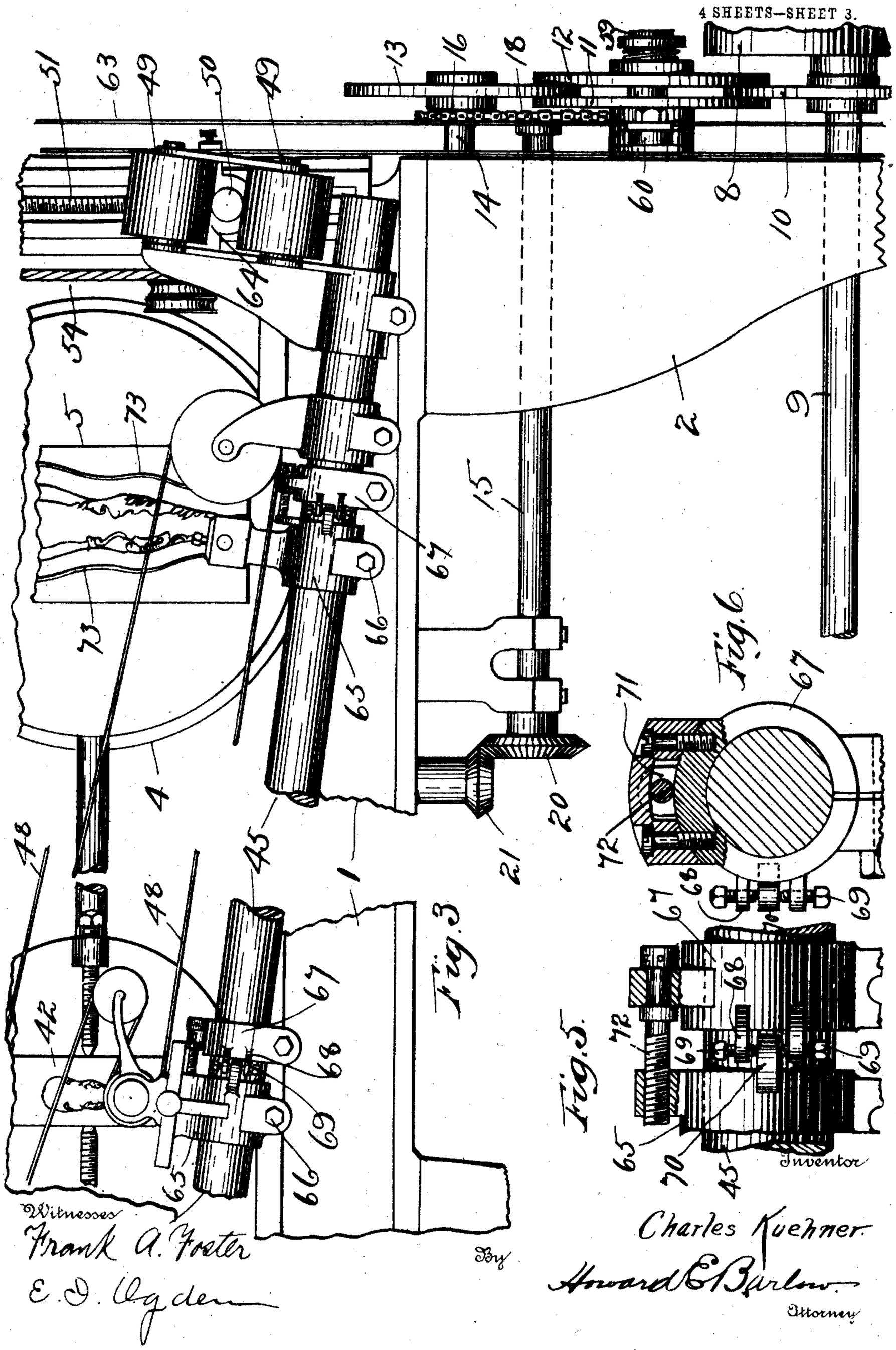


Fig. 3.




Fig. 5.

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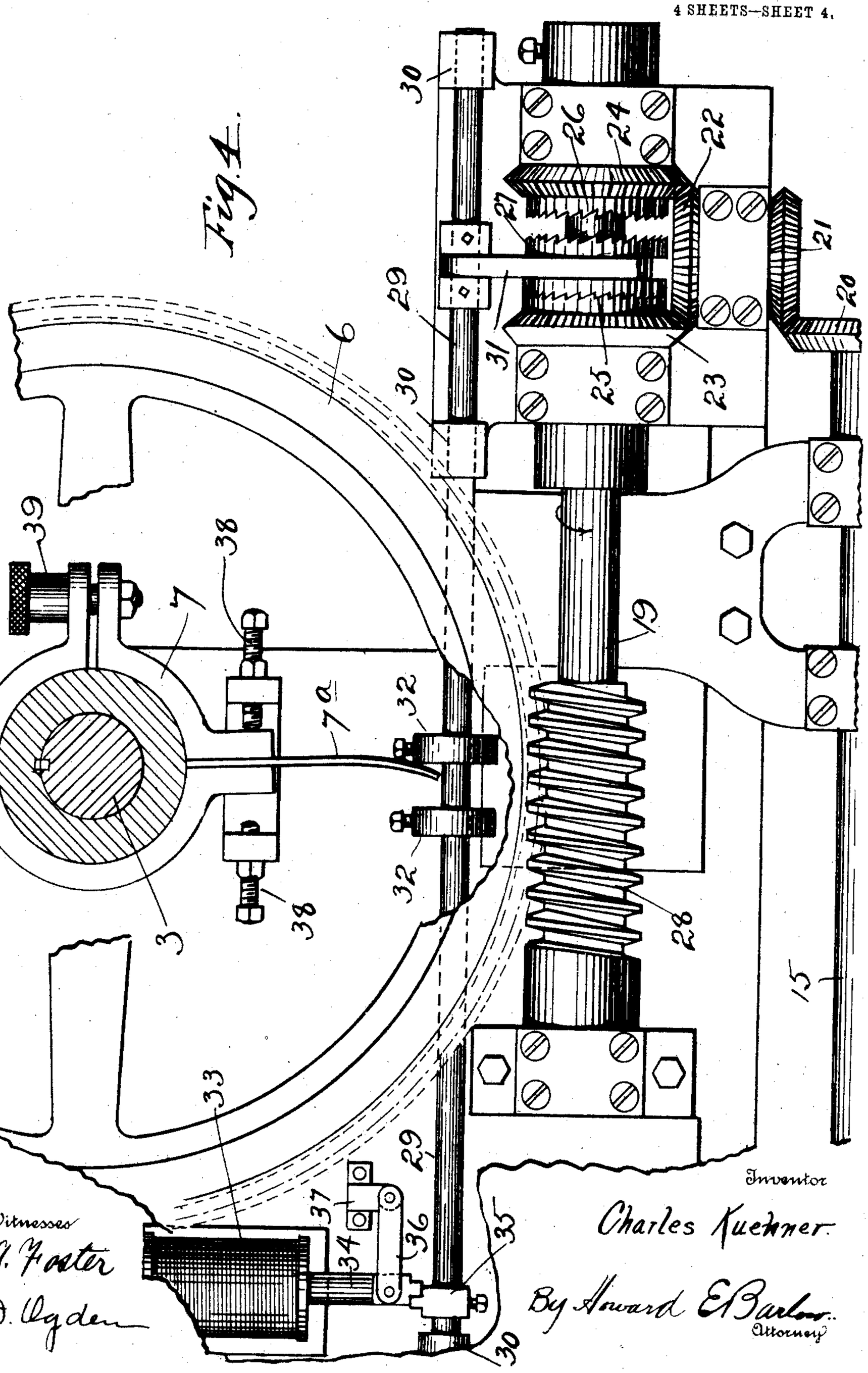
4 SHEETS—SHEET 4.

Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## PANTOGRAPHIC ENGRAVING-MACHINE.

No. 864,655. Specification of Letters Patent. Patented Aug. 27, 1907.

Application filed May 6, 1904. Serial No. 206,721.

*To all whom it may concern:*

Be it known that I, CHARLES KUEHNER, a resident of the town of Cranston, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Pantograph Engraving-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to an improvement in pantograph engraving machines.

The object of my invention is to provide a machine of this character in which the pointer or tracer will be constantly retained in contact with the figured surface only of the model, the cutting tool being relatively mounted therewith, whereby its cutting operations will conform exactly to the movements of the pointer, thus saving that time which has heretofore been lost in machines of this character by reason of the tool traversing surfaces beyond the limits of the work. I have therefore constructed and arranged electrical means to operate on the reversing mechanism so that the model or pattern and also the material under operation are at times given but a partial rotation, causing the pointer or tracer to travel over the figured surface of the model from one side or boundary thereof to the other, whereupon the direction of travel or rotation of said model will be automatically changed, the movement thereof in either direction being sufficient to cause the tracer to travel across the figured surface only.

The invention consists of other novel features and parts and combinations of the same as will be fully described hereinafter and then pointed out in the appended claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1—is a top plan view illustrating the operating mechanism and the wiring for the electrical reversing mechanism. Fig. 2—is an end view of the machine illustrating the automatic speed controlling device. Fig. 3—is a front view of the machine, a portion of which is broken away, illustrating the model and the material operated on, also the longitudinal work bar on which is mounted both the pointer or tracer and the cutting-tool. Fig. 4—is an enlarged view illustrating the reversing mechanism. Fig. 5—is an enlarged side view, partly broken away, showing the universal screw adjustment for setting the pointer and the cutting tool. Fig. 6—is an end view of the same, also partly broken away, showing the elongated hole to allow for a slight circular adjustment.

Referring to the drawings, at 1 is the bed of the machine which is supported from the floor or other convenient place on the legs 2. On this bed is mounted the shaft or spindle 3, on one end of which is the face plate 4 to which is secured the pattern block 5 (see Fig. 1.) On the opposite end of this spindle 3 is mounted its driving worm gear 6 and reversing friction collar 7 and spring arm 7ª. The power to drive this spindle 3 and the attending mechanism is transmitted by a belt (not shown) through the pulley 8, main shaft 9 and automatic speed regulating disks 10—11—12 and 13 to shaft 14, the operation of which will be hereinafter more fully described.

Power is transmitted from shaft 14 to shaft 15 through the sprocket wheels 16 and 17 and the chain 18, and from shaft 15 to shaft 19 through the gears 20—21—22—23 and 24. The gears 23 and 24 are loosely mounted on said shaft 19 and are both constantly in mesh with gear 22 by which gear they are driven each in opposite directions. These gears 23 and 24 each have a notched face 25 and 26 respectively which faces serve to engage the clutch 27. This clutch is arranged to slide on a fixed key in said shaft 19 to engage either of the two notched faces 25 and 26 and through this clutch the shaft 19 is turned. The direction of rotation of said shaft is reversed by throwing the said clutch from one gear over to engage the notched face of the other gear. At 28 is a worm fixed to said shaft 19 by which spindle 3 is driven through the worm wheel 6. At 29 is the shifting bar which is held to slide longitudinally in suitable bearings 30—30. On this bar is the depending yoke 31 which engages and actuates the sliding clutch 27. At 32—32 are collars that are fixed to said bar 29 and which are engaged by the spring arm 7ª. At 33 is a solenoid electro-magnet the lower end of its core 34 being adapted to engage the dog 35 on the bar 29 and hold it against an endwise movement. The strain of holding this bar instead of coming directly on the end of the core 34 is taken up by the link 36 which link is pivoted at one end to a bracket 37 fixed to the frame of the machine, and allowing the core a sufficient vertical movement to release the dog 35. At 38—38 are set screws to regulate the throw of the friction collar 7 the amount of friction of said collar being regulated by the adjusting screw 39. At 40 is the spindle to the outer end of which is secured chuck 41 which holds the die 42 to be cut. This spindle is driven from the model spindle 3 through the two pair of miter gears 43 and 44.

Opposite the pattern 5, and die or the piece of material to be operated upon 42, and extending longitudi-

nally along the machine, is placed a bar or arm 45. On this bar is secured the pointer or tracer 46 the end of which is kept in constant contact with the model 5 as it revolves or reciprocates. At 47 is the rapidly revolving cutting tool which comes opposite to and operates on the face of said die 42. This cutting tool is revolved by the belt 48 which receives its motion from the revolving speed pulley 49ª (see Fig. 2) mounted on the shaft 9 said belt being led by suitable pulleys to engage the spindle on which said cutter is mounted to revolve the same very rapidly. One end of said bar 45 is held in a universal joint (not shown) while the other end is supported by the rolls 49—49 on the spindle 50, which spindle is moved vertically by the screw 51, thereby controlling the vertical movement of the bar 45. Said screw 51 receives its motion from the shaft 15 through the belt 52, gears 53, belt 54, pinion 55, gear 56, worm 57 and worm wheel 58.

In order to automatically regulate the speed of the rotating or reciprocating cutting surface of the die block and attending mechanism to correspond to the increased cutting surface as the cutter is drawn down from the center, I have arranged to drive the friction disk 13 by the disk 10 through the pair of spring actuated friction plates 11 and 12, which plates are hung on a pin 59 from the lever 60. This lever is pivoted at one end 61 and to its opposite end 62 is connected the continuous flexible cord 63, which cord is led over suitable pulleys above and below said arm. This flexible cord is also connected to and actuated by the movement of the screw nut 64, which nut also regulates the vertical movement of the pin 50 and bar 45, and by this means the speed of all the different parts are simultaneously regulated to conform to the ever changing position of the cutter and pointer controller bar 45.

When a new piece of work is started in this machine it is found in practice to be necessary, in order to produce the best results, that both the cutting tool 47 and the pointer 46 should be set exactly on the center and to get this fine adjustment I have constructed the mechanism best illustrated in Figs. 5 and 6 in which 65 is the collar that holds the cutting tool or the pointer, which collar may be bound to said bar 45 to be firmly held in place, after it is set by the binding screw 66. 67 is a collar fixed to the bar 45. Through ears 68 projecting out from the side of this collar are the set screws 69 which screws engage the end 70 of the said tool supporting collar 65. On the upper side of this collar 67 is shown an elongated hole 71 in which the longitudinal adjusting screw 72 is held to turn and adjust the said tool holding collar longitudinally on the bar 45. By elongating the slot 71 the necessary motion is allowed for the circular adjustment.

My method of reversing the direction of rotation of the spindles and attending mechanism is extremely simple and practical and is accomplished by electrical means as follows: Around the edge or outline of the pattern or model, see Fig. 3, is bent a thin strip of brass 73 or other conducting material supported in any convenient manner, either on posts of insulation, or set into a groove and secured by an insulating cement, as shown in Fig. 1. This brass strip is connected through the revolving face plate 4 to the insulated ring 74 on its back side, against which ring rests the conducting finger 75 and by the wire 76 is connected to the magnet 33. The second wire 77 connects from the pointer 46 through the battery 78 to the opposite pole of said magnet. By the above construction each time the pointer or tracer travels from one side or edge of the figured surface of the model to the opposite side of edge thereof and comes in contact with the conducting material 73 surrounding said figured surface, the electric circuit is completed, the magnet 33 energized, the core 34 raised and the dog 35 released to allow the shifting bar, which is under tension of the spring arm 7ª, to at once throw the clutch 27 out of engagement with one side and into engagement with the other, thereby reversing the direction of rotation of the spindles and attending mechanism. Then the pointer 46 travels back across the face of the figured surface to the opposite side thereof and engages the conducting material on that side when the circuit is again completed and the direction of rotation is again reversed as before, which operation is continued throughout the cutting of the die.

By my improved electric mechanism a quick, positive and automatic reverse is obtained. Both the model and the material under operation may thus be given but a portion of a revolution when desired, the tracer and cutter thereby being caused to travel over the figured surface only.

The operation of my device is further explained as follows: The pattern or model and the die or work to be cut or engraved are mounted on separate parallel spindles 3 and 40 respectively and geared together to rotate in time with each other. Opposite the pattern 5 and piece of material 42 to be operated upon is placed a bar or arm 45 extending longitudinally along the machine, one end of which is furnished with a universal joint (not shown) in order that said bar or arm may be freely moved in vertical and horizontal planes. On this bar or arm is secured the pointer or tracer 46 the end of which is kept in constant contact with the surface of the model 5 as it revolves or reciprocates slowly in front of it, and mounted on the same bar is a rapidly revolving cutting tool 47 which comes opposite the die or material to be operated upon, so that as the pointer or tracer follows the uneven surface of the pattern the cutting tool acts correspondingly upon the material under operation, the result being that the die is cut to form an exact facsimile of the pattern, the only difference being its reduced size, every part of the figured surface being in exact proportion to that of the pattern as the movement of the cutter is controlled by the movement of the pointer through the said arm 45 on which both said pointer and cutter are mounted.

In setting the machine, the tracer is placed on the pattern at the approximate center of the shortest diameter, whereupon the cutter will start the formation of the die at the same point. As the holder rotates the arm or bar 45 moves in a direction at right angles to the axis of said pattern holder, the result being that the same causes the tracer to traverse a spiral path gradually moving from the center to the outer edge of the pattern. It will thus be noted that the pattern holder will continue to rotate uninterruptedly until the spiral movement of the tracer ends at the contact strip at which time the machine will reverse, as heretofore pointed out. From this time on the position of the tracer will be such that it will pass completely

across the pattern each time the machine reverses, whereupon the work and pattern holders are caused to oscillate until the work is completed. In other words, the work and pattern holders, in the early stage of the work are given a rotating movement, and at a later stage an oscillating movement.

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

1. A machine of the character described comprising an oscillating work holder, a movable cutter, a pattern, and means for automatically varying the arc through which the work holder moves, said means including members conforming approximately to the contour of the pattern.

2. A machine of the character described comprising an oscillating work holder, a movable cutter, a pattern, and means for automatically varying the arc through which the work holder moves with relation to the cutter, said means including an electrical governing portion having irregular contacts conforming to the contour of the pattern.

3. A machine of the character described comprising an oscillating work holder, a movable cutter, a pattern, and means for automatically varying the arc through which the work holder moves relatively to the cutter, said means including an electrical governing portion having members conforming to the contour of the pattern.

4. A machine of the character described comprising an oscillating spindle, a pattern mounted thereon, an oscillating work holder, a cutter, an electrically controlled reversing mechanism, a tracer, and contacts located adjacent the pattern, said reversing mechanism being in circuit with said contacts and tracer, whereby the arc through which the work holder moves with relation to the cutter is automatically varied.

5. A machine of the character described comprising an oscillating spindle, a pattern mounted thereon, a tracer, an oscillating spindle to carry the work, a cutter, reversing mechanism, an electro-magnet adapted to control the movement of the latter, and contacts located adjacent the pattern, said magnet being in circuit with said contacts and tracer, whereby the arc through which the work moves relatively to the cutter is automatically varied.

6. A machine of the character described comprising an oscillating spindle, a pattern mounted thereon, a tracer, an oscillating spindle to carry the work, a cutter, means for oscillating said spindles in unison, reversing mechanism, an electro-magnet adapted to control movement thereof, and contacts adjacent the pattern, said magnet being in circuit with said contacts and tracer, whereby the arc through which the work moves with relation to the cutter is automatically varied.

7. In a machine of the character described, in combination, a spindle for carrying the pattern, a spindle for carrying the work to be operated upon, means whereby said spindles are driven in unison, reversing mechanism including a shifting bar and means for automatically locking it in the desired position, and an electro-magnet for controlling the lock for said shifting bar.

8. In a machine of the character described, in combination a spindle for carrying the pattern, a spindle for carrying the work to be operated upon, means whereby said spindles are driven in time with each other, means including a friction controlled spring arm for automatically reversing the direction of rotation of said spindles and an electro magnet controlling the movement of said spring arm.

9. In a machine of the character described, in combination, a spindle for carrying the pattern or die, reversing mechanism including a clutch and a shifting bar connected to said clutch, a friction controlled spring arm carried on the spindle and acting on said shifting bar, a magnet for controlling the movement of said shifting bar and means for energizing said magnet.

10. In a machine of the character described, in combination, a spindle for carrying the pattern or die, a pointer or tracer engaging said pattern reversing mechanism including a clutch and a shifting bar connected to said clutch, a friction controlled spring arm carried on the spindle and acting on said shifting bar, a magnet for controlling the movement of said shifting bar, and means for controlling the action of said magnet by the position of said pointer or tracer.

11. A machine of the character described comprising a rotatable spindle a pattern carried thereby, said pattern being provided with oppositely arranged electrical contacts conforming to the contour thereof, a pointer or tracer adapted to engage said contacts, and reversing mechanism including an electro-magnet in circuit with said contacts, said reversing mechanism being adapted to vary the distance through which the work moves with relation to the cutter.

12. In a machine of the character described, in combination a spindle for carrying the pattern, a spindle for carrying the work to be operated upon, means whereby said spindles are driven in time with each other, reversing mechanism to control the direction of rotation of said spindles, means including an electro-magnet for controlling said reversing mechanism, and means including friction disks for reducing the speed of said spindles as the cutter is drawn from the center of the work.

13. In a machine of the character described, in combination, a rotating spindle for carrying the pattern, a pointer or tracer to follow the face of the said pattern, conducting material on the sides of said pattern, reversing mechanism including an electro-magnet, means whereby said pointer or tracer is caused to engage said conducting material and make the connection to complete the circuit and energize said magnet whereby said reversing mechanism is released to effect a change in the direction of rotation of said spindle, and means for automatically regulating the speed of said spindle.

14. A machine of the character described comprising a rotatable spindle a pattern carried thereby, said pattern being provided with oppositely arranged electrical contacts conforming to the contour thereof, a spindle for carrying the work to be operated upon, a pointer or tracer adapted to engage said contacts, and reversing mechanism including an electro-magnet in circuit with said contacts, said reversing mechanism being adapted to vary the distance through which the work moves with relation to the cutter.

15. In a machine of the character described, in combination, a spindle for carrying the pattern, a spindle for carrying the work to be operated upon, a pointer or tracer to follow the face of said pattern, a contact strip carried on said pattern, reversing mechanism a locking mechanism therefor, an electro-magnet, and means whereby said pointer or tracer is caused to make the electrical connection with said strip to complete the circuit and energize said magnet and permit the reversing mechanism to change the direction of rotation of said spindles.

16. A machine of the character described comprising an approximately horizontal bar, spindles for carrying the work and patterns respectively, a pointer loosely mounted on said bar, a cutter also loosely mounted on said bar, collars rigidly secured to said bar adjacent said pointer and cutter respectively, and means carried by said collars for effecting a combined pivotal and lateral adjustment of said pointer and cutter upon said bar.

17. A machine of the character described comprising an approximately horizontal bar, spindles for carrying the work and pattern respectively, a pointer and a cutter loosely mounted on said bar and each provided with a lug, collars rigidly secured to said bar adjacent said pointer and cutter respectively, set screws carried by said collars and engaging said lugs, whereby a pivotal adjustment of said cutter and pointer is secured, and adjusting screws carried by said collars and engaging said cutter and pointer respectively, whereby the latter are adjusted laterally.

18. A machine of the character described comprising a pattern holder, means for rotating the same, and means for automatically changing the rotating movement of said holder to an oscillating movement.

19. A machine of the character described comprising a pattern holder, means for rotating the same, and means for automatically causing said holder to oscillate at a predetermined time.

20. A machine of the character described comprising a pattern holder, means for rotating the same, a pattern, a

contact strip conforming to the contour of the pattern, reversing mechanism in circuit with said contact strip, a tracer also in circuit with said reversing mechanism, and means for moving said tracer in a direction at right angles to the axis of said holder, whereby said tracer will engage said contact strip and cause said holder to oscillate.

21. A machine of the character described comprising a pattern holder, means for rotating the same, a pattern, a contact strip conforming to the contour of the pattern, reversing mechanism in circuit with said contact strip, a tracer also in circuit with said reversing mechanism, means for moving said tracer in a direction at right angles to the axis of said holder, whereby said tracer will engage said contact strip and cause said holder to oscillate, a work holder, and means for moving said work holder in unison with said pattern holder.

22. In a machine of the class described, the combination of a driving shaft, a reversing mechanism for said shaft, a movable pattern provided with a raised flange, a tracer, and means intermediate said reversing mechanism and tracer which are controlled by the contact of the tracer with the flange and which operate the shaft-reversing mechanism.

23. In a machine of the class described, the combination of a driving shaft, reversing mechanism therefor, a pattern having a raised surrounding flange, and a properly mounted tracer, and means intermediate said tracer and shaft reversing mechanism to operate the latter controlled by the former whenever the tracer passes into contact with the flange, in alternately opposite directions.

In testimony whereof, I have hereunto set my hand this 29th day of April A. D. 1904.

CHARLES KUEHNER.

In presence of—
HOWARD E. BARLOW,
E. I. OGDEN.