

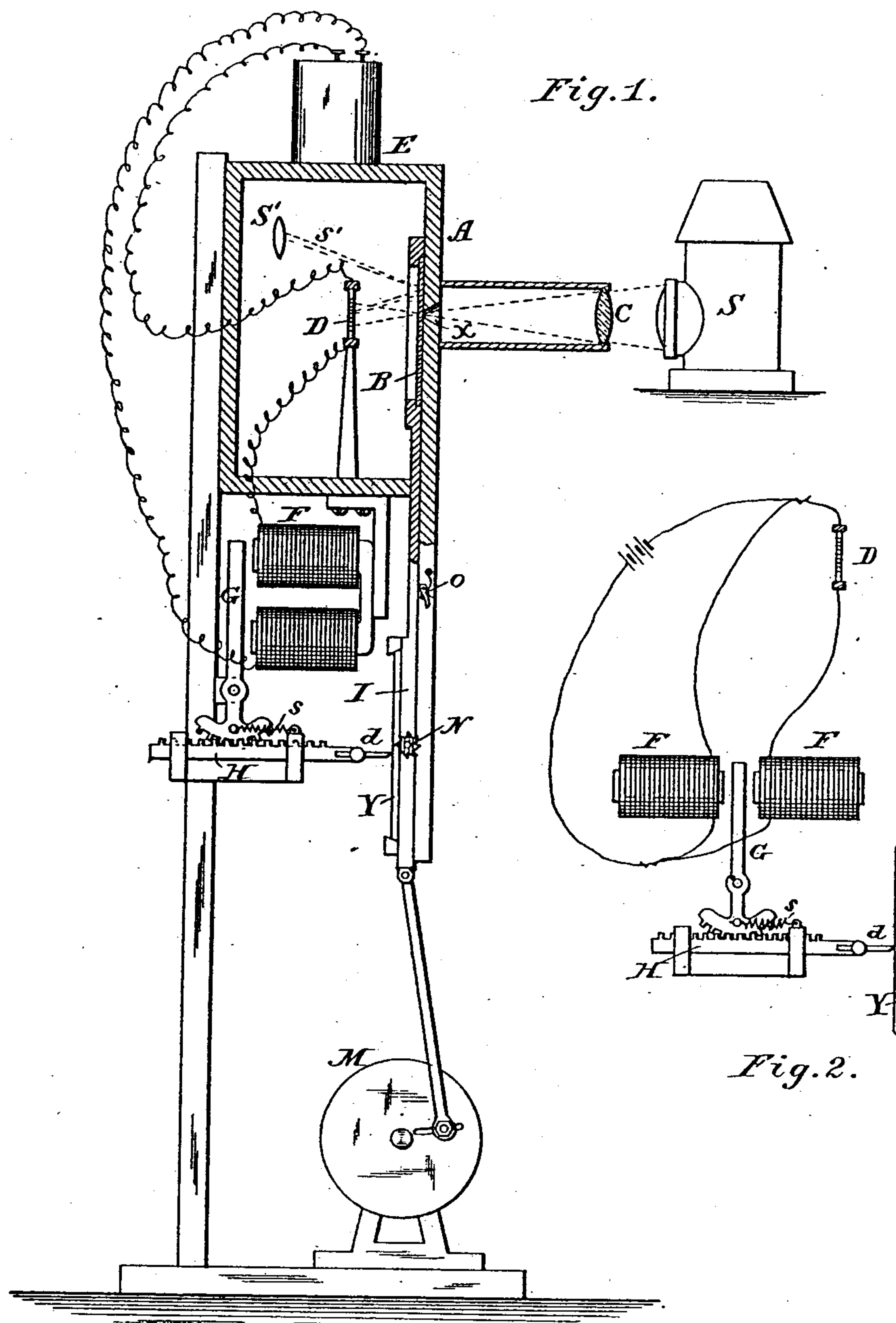
(No Model.)

F. BAIN.

METHOD OF AND APPARATUS FOR CUTTING AND SHAPING OBJECTS.

No. 288,395.

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR CUTTING AND SHAPING OBJECTS.

SPECIFICATION forming part of Letters Patent No. 288,395, dated November 13, 1883.

Application filed June 14, 1883. (No model.)

To all whom it may concern:

Be it known that I, FORÉE BAIN, of Chicago, Cook county, Illinois, have invented a certain Mode of Cutting or Forming Objects, of which
5 the following is the specification.

My invention consists in controlling an engraving, cutting, or impression tool or instrument by means of light or heat rays, so that the operations of said tool correspond to the
10 varying conditions of a pattern from which said rays are passed, and all parts of which are successively subjected to said rays.

In carrying the invention into practical effect I use a pattern (a photographic negative
15 or positive, or any polished or transparent or translucent plate or sheet having upon it a pattern formed by lines or shades) which will to a greater or less extent obstruct the transmission or reflection of rays of light or heat
20 from a flame, or heated or luminous body. In passing the rays to or through said pattern-plate I prefer to use a lens that will focus said rays upon the plate, and to then pass the latter back and forth, or otherwise move it so
25 that every portion will in succession be subjected to the rays. It will be obvious that if the rays passed thus from a pattern-plate of varying opacity are thrown upon a substance or device which will respond to the varying
30 intensities of the rays the latter may be made the means of effecting the adjustment of a cutting-tool traversing the surface of or traversed by the object to be cut in unison with the movement of the pattern-plate. Different
35 appliances, depending upon the character of the work to be performed, are used in carrying out this mode of operation. In producing intaglio or relief a burr or drill or milling-tool may be used. For engraving, a gouge, chisel,
40 or cutting-tool is employed. In any case the tool traverses the object to be cut; or the latter moves beneath the tool in unison with the movement of the pattern-plate, and the position of the tool, determining the depth or character of the cut, is regulated by the intensity
45 or quantity of heat or light rays passing from the traversing pattern.

In Figure 1 of the drawings is illustrated an apparatus for automatic engraving, in which
50 A is a case, closed except at one point, where

an opening, *x*, permits the passage of rays of light or heat emanating from a source, as S, in this case represented as a lantern focused upon a pattern-plate, B, (in this case a photographic negative or positive,) by means of a
55 lens, C. Fig. 2 shows a modification in which two magnets or solenoids are used in branch circuits, one branch including the selenium-cell.

The rays passing through the pattern-plate
60 are received upon a block of selenium or a selenium-cell, D, which forms part of an electric circuit, the resistance in which will therefore be proportioned to the amount of light or heat to which the cell is subjected. When
65 a pattern-plate is used adapted to reflect more or less light, according to the design upon the plate, the radiant energy may emanate from any source, as S', and be transmitted to the face of the plate and reflected therefrom to the
70 selenium or other circuit-controlling medium, as indicated by dotted lines *s'*. As shown, the circuit includes a battery, E, and electro-magnet F, the armature G of the latter being pivoted and extended to form a lever geared or
75 connected with an arm, H, carrying a graver, *d*. A spring, *s*, capable of having its tension nicely regulated, is arranged to lift the armature from the magnet.

The plate *v* to be engraved moves beneath
80 the graver in unison with the pattern-plate B. As shown, both are upon a slide, I, which is reciprocated longitudinally, and moved laterally step by step, so that gradually all parts of the pattern-plate are traversed by the rays
85 and all parts of the plate I are carried beneath the graver. The slide may be caused to partake of any of the movements common to engraving-machine slides or plate-holders, the means of providing such movements being too
90 well known by those skilled in the art to need particular description. In the drawings, for an example, however, I have illustrated one of the most primitive, the longitudinal reciprocation being produced by a crank or slotted
95 rotating disk, M, and the lateral step-by-step motion by a screw-rod having a ratchet, N, on one end connected to the slide and engaging with a spring-pawl, O, on the bed or frame of the machine. As the strength of the current 100

increases and decreases with the intensity of the rays received upon the selenium-cell, there is a corresponding variation in the power of the electro-magnet, and the armature thereof is subjected to a varying force tending to draw it to the magnet against the power of the spring, so that the graver is withdrawn from and pressed against the plate, according as the heat or light rays are less or more obstructed in their passage through the pattern-plate. The depth of the cut is thus regulated and caused to correspond with the varying influence of the radiant energy, inasmuch as in proportion as the passage of the rays is interfered with by the increased opacity of the pattern the strength of the current will be varied and will produce a corresponding variation in the adjustment of the tool.

The above-described apparatus illustrates the invention somewhat crudely, and for many operations would be variously modified. It, however, serves to illustrate the principle of my invention, and those skilled in the arts to which it appertains will readily see the various modifications necessary to adapt my invention to the various kinds of work. Without attempting to set forth all the modifications that have suggested themselves, I will mention a few that are obvious to every one skilled in electricity. Thus a solenoid may be advantageously substituted for an electro-magnet; or two solenoids or two magnets, one in a main and the other in a shunt circuit, (see Fig. 2,) may be arranged to operate simultaneously in opposite ways upon the armature or movable core, securing an increased effect, as in the regulating-magnets of electric lights. A galvanometer may be used instead of an electro-magnet, in which case the movement of the needle is made the means of intensifying or decreasing the magnetic action of a magnet or solenoid. Other means may be used where a weak current is made the means of operating a switch-regulator or other device, the movement of which throws in or cuts out other and stronger motor-currents, in the same manner as a relay. The magnet F may have a core of soft iron; or the core may be polarized, and the conductor may be so wound as to intensify or reduce the magnetic action. An equivalent of the selenium-cell in some cases would be a thermo device, as a thermo-pile generating its own current of greater or less intensity under the varying quantity of heat-rays, and controlling the operating-magnet directly or indirectly, as before described. Any desired means may be employed to secure a coincidence of movement of the pattern and the object to be operated on. These means will differ with the difference in the character of the work to be done. In some instances the object operated on will be curved or cylindrical, and will revolve as the pattern slides. In other cases, while there is a unison and coincidence of motion, the degree of motion will

differ, the duplicate in such case being proportionately larger or smaller than the pattern. It will therefore be understood that my invention may be embodied in various different apparatus, but that the principle of operation is the same—to wit, the governing of the position of the cutting or forming tool by the varying action of heat or light rays transmitted through or to and from a pattern-plate of varying opacity or reflecting-power. Without, therefore, limiting myself to the use of the means described and shown,

I claim—

1. The within-described mode of governing the position of a working-tool, which consists in controlling the tool in accordance with the action of a pattern on the radiant energy of rays of light directed to the pattern.

2. The within-described method of governing the working position of a tool, which consists in subjecting a pattern to rays of heat or light, and controlling the tool in accordance with the amount of radiant energy passing from the pattern.

3. The within-described method of governing the position of a working-tool, which consists in varying the amount of radiant energy derived from a ray of light or heat passing through a pattern, and controlling the position of the tool in accordance with that amount.

4. The combination, with a tool operating upon the object to be cut or formed, of an electrical regulating device whereby the position of the tool is adjusted according to the variations in an electrical current, and appliances whereby said current is varied by the varying degree of heat or light rays passing from their source to and from a pattern-plate, substantially as specified.

5. The combination, with a cutting or forming tool, of an electrical adjusting device, a pattern-plate moving in unison with the traverse of the tool or object to be formed, and a selenium-cell or its equivalent electrically connected with the regulating device and receiving the rays from the pattern-plate, substantially as set forth.

6. The combination, with a cutting or forming tool operating upon the object to be formed, an electrical regulating device whereby the position of the tool is adjusted, a transparent or translucent pattern-plate moving in unison with the said object and across rays of heat or light, and a selenium-cell or its equivalent arranged to receive said rays in electrical connection with the regulating device to control the latter, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FORÉE BAIN.

Witnesses:

CHARLES E. FOSTER,
L. C. YOUNG.