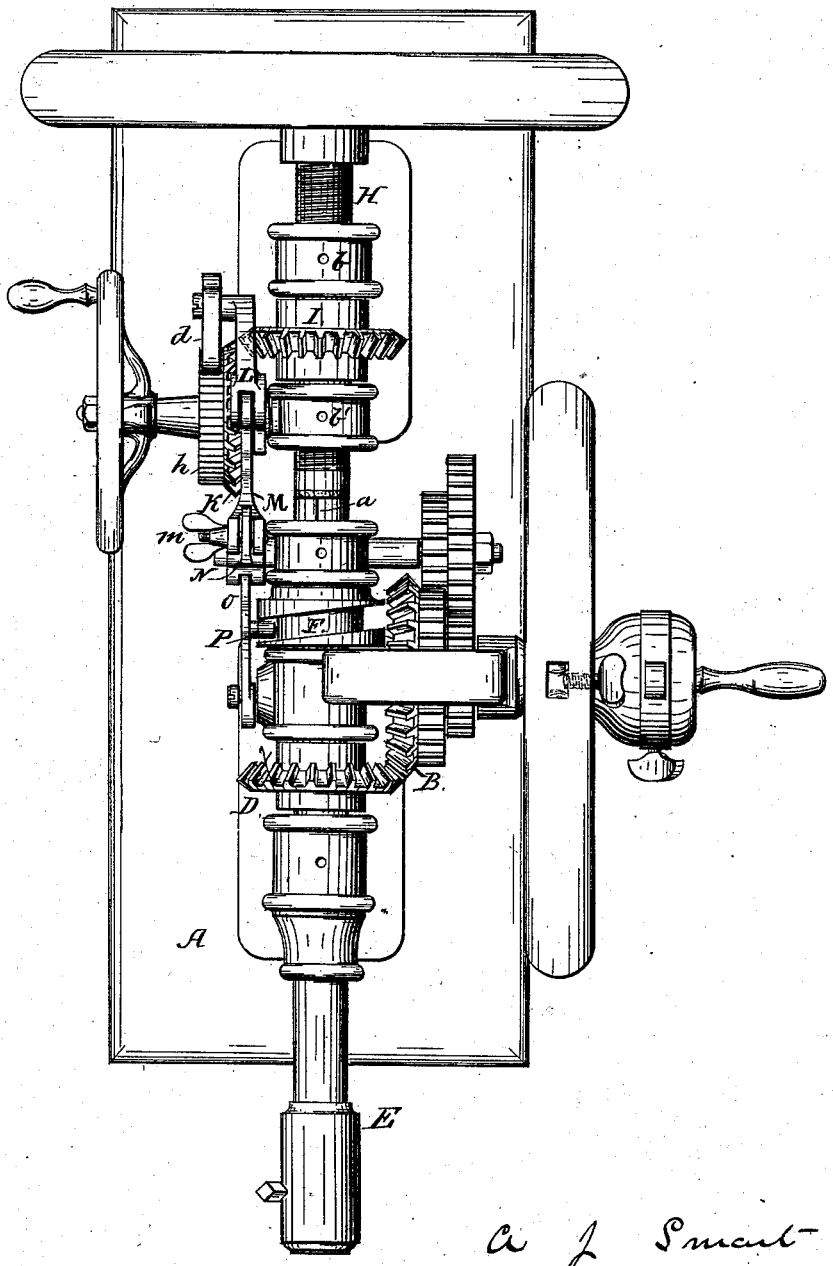
4 Sheets—Sheet 1.

A. J. SMART.

Machine for Drilling Metal.

No. 206,979. Patented Aug. 13, 1878.

FIG. 1.



WITNESSES

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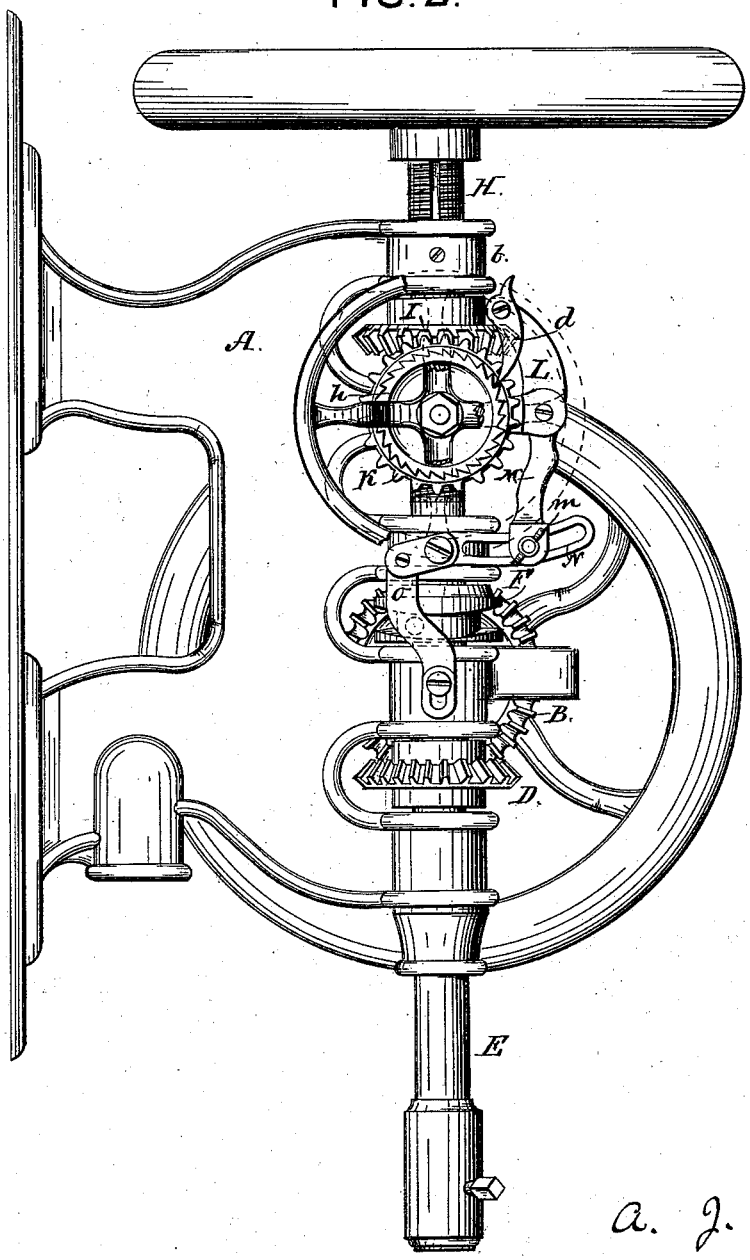
FIG. 2.



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4 Sheets—Sheet 3.

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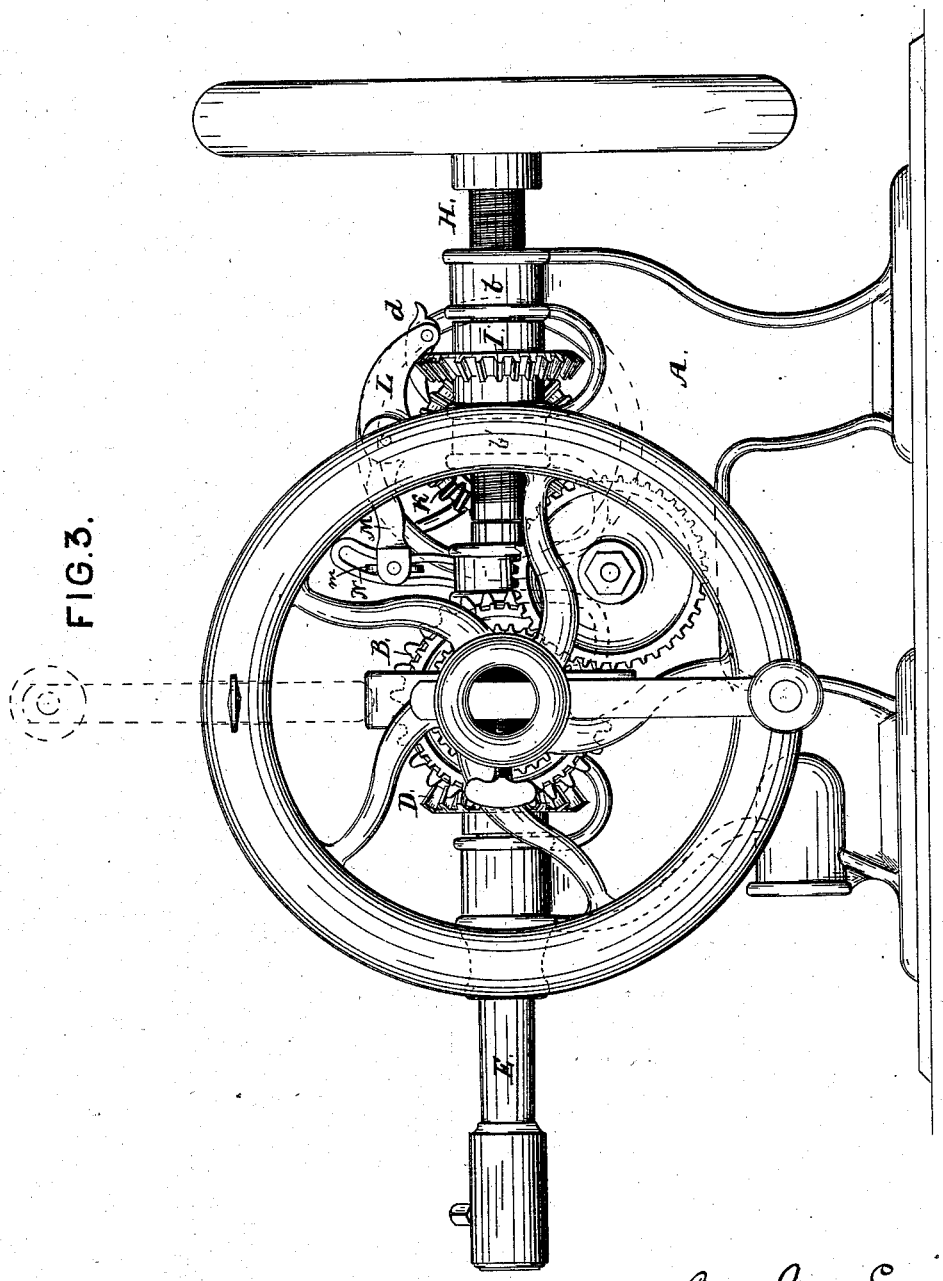
FIG. 3.



WITNESSES

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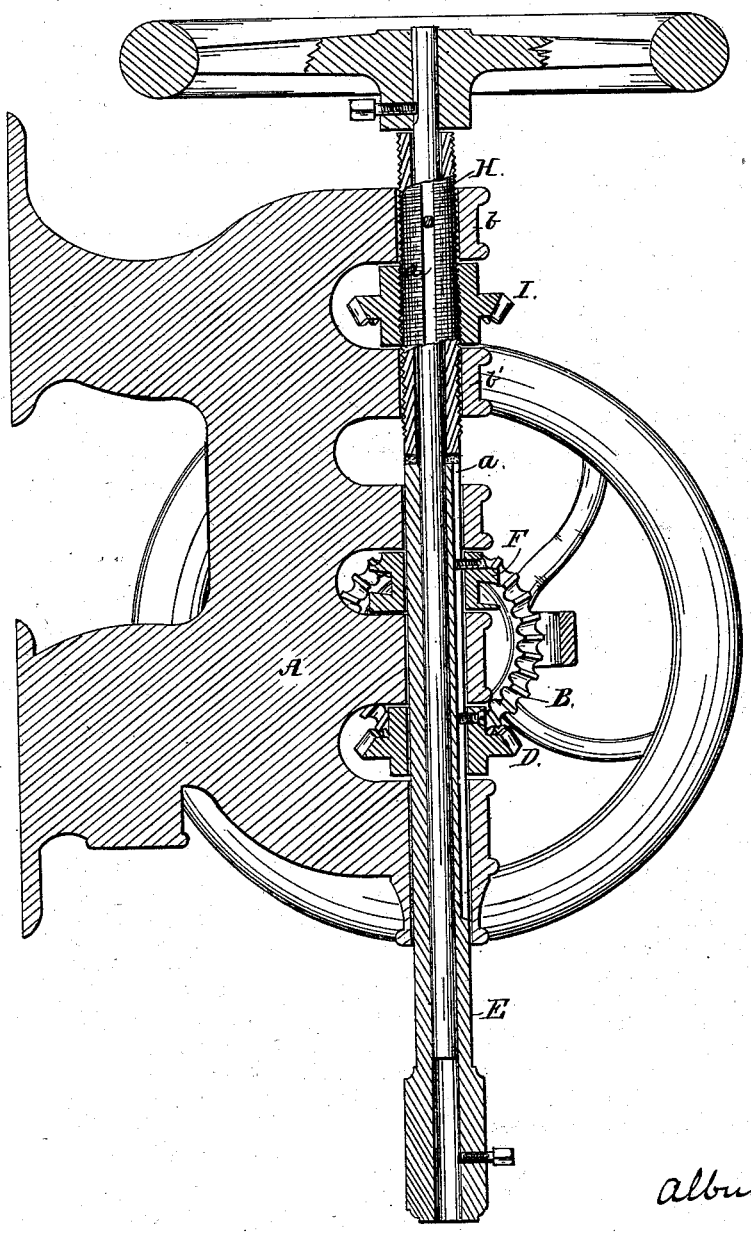
FIG. 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

ALBERT J. SMART, OF GREENFIELD, MASSACHUSETTS.

IMPROVEMENT IN MACHINES FOR DRILLING METAL.

Specification forming part of Letters Patent No. **206,979**, dated August 13, 1878; application filed March 13, 1878.

To all whom it may concern:

Be it known that I, ALBERT J. SMART, of Greenfield, county of Franklin, and State of Massachusetts, have invented an Improvement in Drilling-Machines, of which the following description, taken in connection with the accompanying plates of drawings hereinafter referred to, forms a full and exact specification, wherein are set forth the nature and principles of the invention, by which the same may be distinguished from others of a similar class, together with such parts thereof as are claimed as new and are desired to be secured by Letters Patent of the United States.

My invention relates to that class of drilling-machines in which a screw is made to feed the drill to its work. In tools of this character it is necessary to have a provision by means of which the cutting-instrument can be made to automatically pass through the piece of metal under operation; and when the mechanism by which this is effected is attached to the tool, forming a part of it and deriving its movement from it, this provision is called "self-acting feed mechanism." This self-acting feed is a highly-essential feature in a drilling-machine, as it saves much time and supervision on the part of the operative.

Self-acting feed mechanisms under ordinary circumstances only force the cutting-instrument through the work at one unvarying rate of speed, or at a rate of speed exactly proportionate to the rotary motion of the drill. The machine may, however, be required to operate on materials of various degrees of hardness, such as wrought-iron, cast-iron, or brass, the different degrees of toughness of which will require the cutter to be forced through them at different rates of speed while the speed of the machine remains unaltered.

The objects of my invention are, first, to accelerate or retard the velocity of the progressive motion of the cutter as compared with its rotary motion; secondly, to cause a continuous self-feed mechanism to bear a varying proportion to the speed at which the machine is worked without stopping, retarding, or in any way interfering with the rotary motion of the drill-spindle; thirdly, to combine with a continuous, variable, self-acting feed mechanism provision for feeding by hand and for throwing the self-acting mechanism out of gear; and, fourthly, to relatively arrange the driving-shaft, operating-gears, drill-spindle, feed mechanism, and balance-wheel in such a manner as to produce a more convenient and compact drilling-machine than any heretofore in use.

In the accompanying plates of drawings, in which corresponding parts are designated by similar letters, Figure 1 is a front elevation of a drilling-machine provided with a variable continuous self-acting feed mechanism. Fig. 2 is an elevation of that side of the machine upon which the feed mechanism is placed. Fig. 3 is an elevation of that side of the machine to which the power is applied. Fig. 4 is a sectional elevation of the machine.

In the drawings, A is the cast-iron framing of the machine, upon which all the working parts are carried, and which is formed of a single casting. B designates the first-motion bevel-pinion, which rotates upon a fixed axle-spindle projecting from said frame, and is provided with a variable crank, which is capable of such adjustment of leverage as may be necessary to transmit the speed or power required. The said first-motion bevel-pinion gears with the bevel-wheel D on the drill-spindle E, which spindle is free to slide vertically in the eye of the wheel, while at the same time it is prevented from revolving in it by a feather which travels in the groove or key-seat, *a*. F indicates the cam-wheel which actuates the feed mechanism, and which is fitted upon said drill-spindle by means of a feather, so that while both revolve together the one may slide endwise within the other. H designates the tubular feed-screw, which is free to slide within the bosses or bearings *b* *b'*, but is prevented from rotating therein by a spline or feather attached to the upper bearing *b* and fitting a groove or key-seat cut upon the said feed-screw. Vertical travel in an upward or downward direction is imparted to the said feed-screw through the medium of the bevel-pinion I, fitted thereon, the boss of which is provided with an internal thread which engages with the external thread of the said feed-screw.

Rotary motion is imparted to the bevel-pinion I by the corresponding bevel-pinion K, the

boss of which rotates upon a fixed axle-spindle projecting from the frame.

L designates a bell-crank capable of partial rotation about the same axis as that of the bevel-pinion K. A pawl, *d*, is pivoted upon the outer extremity of the upper arm of the said bell-crank, which engages with a ratchet-wheel, *h*, upon the bevel-pinion K. The said bell-crank is connected with a slotted lever, N, fulcrumed to the frame by the connecting-rod M, which may be coupled with the long arm of the said lever N at any required distance from the fulcrum thereof by the clamping-screw *m*. The short arm of the said lever N is pivoted to a reciprocating rod, O, having a wrist, P, which engages with the cam-wheel F.

The rotation of the said cam-wheel with the drill-spindle communicates a reciprocating movement to the rod O, which, in turn, imparts a vibratory movement to the lever N, and the length of the arc traveled over by the bell-crank L will be proportionate to the distance between the fulcrum of the lever N and the point at which the connecting-rod M is coupled with the said lever.

The upper part of the drill-spindle is reduced in diameter to such an extent that it may be rotated within the tubular feed-screw, and the end thereof is slightly flattened in order that the balance-wheel may be fitted upon it.

It will be obvious from the foregoing description that as long as the coupling between the connecting-rod M and the vibratory lever N remains at a fixed distance from the fulcrum of the latter the self-acting feed mechanism will force the drill-spindle downward at a rate of speed always having the same ratio to the rotary motion of the said spindle.

The machine, however, may be required to operate on materials of different degrees of hardness, such as wrought-iron, cast-iron, or brass, the different degrees of toughness of which will require the cutter to be fed through them at different speeds, while the speed of the machine and the rotary motion of the cutter remain unaltered. To effect this result, the continuous self-feed mechanism is caused to bear a varying proportion to the speed at which the machine is worked by adjusting the distance of the said coupling or connecting rod from the fulcrum of the said lever N in such a manner as to accelerate or retard the progressive motion of the cutter as compared with its rotary motion. This adjustment of the self-acting feed mechanism may be made without obstructing or in any way interfering with the speed of the machine by clamping the said connecting-rod at the desired point upon the said vibrating lever while the same is in motion.

Various devices may be adopted for effecting this adjustment in lieu of the clamping-screw illustrated in the drawing without departing from the principle of my invention.

For convenience in feeding by hand, when operating certain classes of work for which the self-acting mechanism is not suitable, provision is made for throwing the self-actor out of gear. This is effected by merely disengaging the pawl from the ratchet-wheel.

The arrangement of the bell-crank, connecting-rod, vibratory lever, and reciprocating bar in the same vertical plane facilitates the transmission of force and insures compactness of construction.

Having thus described my invention, I claim and desire to secure by Letters Patent of the United States—

1. The combination, in a drilling-machine, of the drill-spindle, cam-wheel, reciprocating bar, vibrating lever, adjustable connecting-rod, and bell-crank, whereby the motion of the continuous self-feed mechanism is caused to bear a varying proportion to the rotation of the cam.

2. The combination of the first-motion bevel-gear, the bevel-gear keyed by a feather to the drill-spindle, the drill-spindle, the cam-wheel keyed by a feather to the drill-spindle, the reciprocating bar, the vibrating lever, the bell-crank and pawl, the ratchet-wheel and gears for operating the feed-screw, as and for the purposes described.

3. In a drilling-machine, the combination of the bevel-gear keyed by a feather to the drill-spindle, the drill-spindle, the cam-wheel keyed by a feather to the drill-spindle, the bevel-gear actuating the feed-screw, and a feed-operating mechanism interposed between the cam-wheel and the bevel-gear actuating the feed-screw, as and for the purposes described.

In testimony that I claim the foregoing I have hereunto set my hand this 6th day of February, 1878.

ALBERT J. SMART.

Witnesses:

GORHAM D. WILLIAMS,

FRED. A. FLAGG.

1750 worcd.