2 Sheets—Sheet 1.

I. S. & J. W. HYATT.

BORING MACHINE.

No. 185,928. Patented Jan. 2, 1877.

Fig. 1.

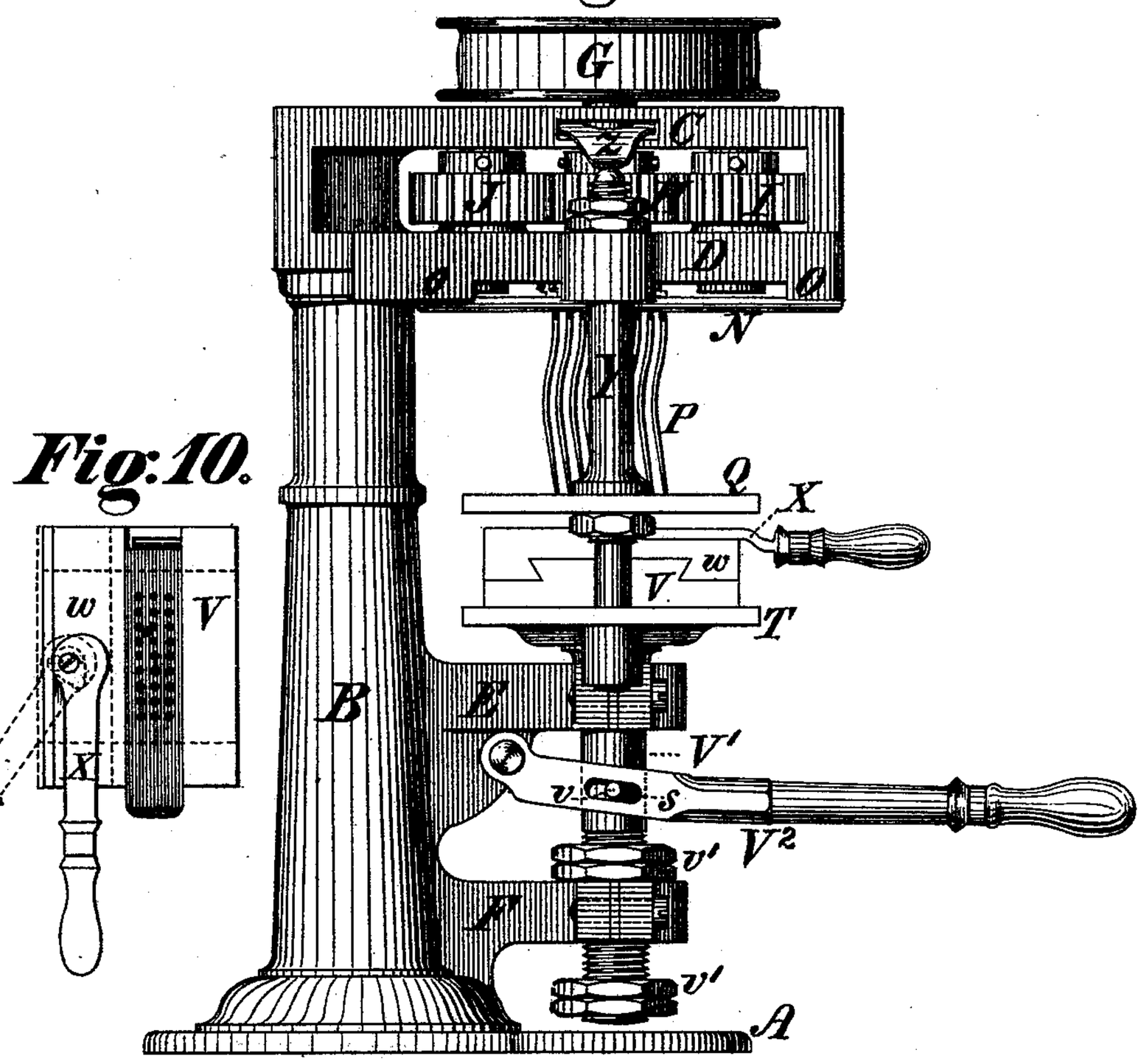
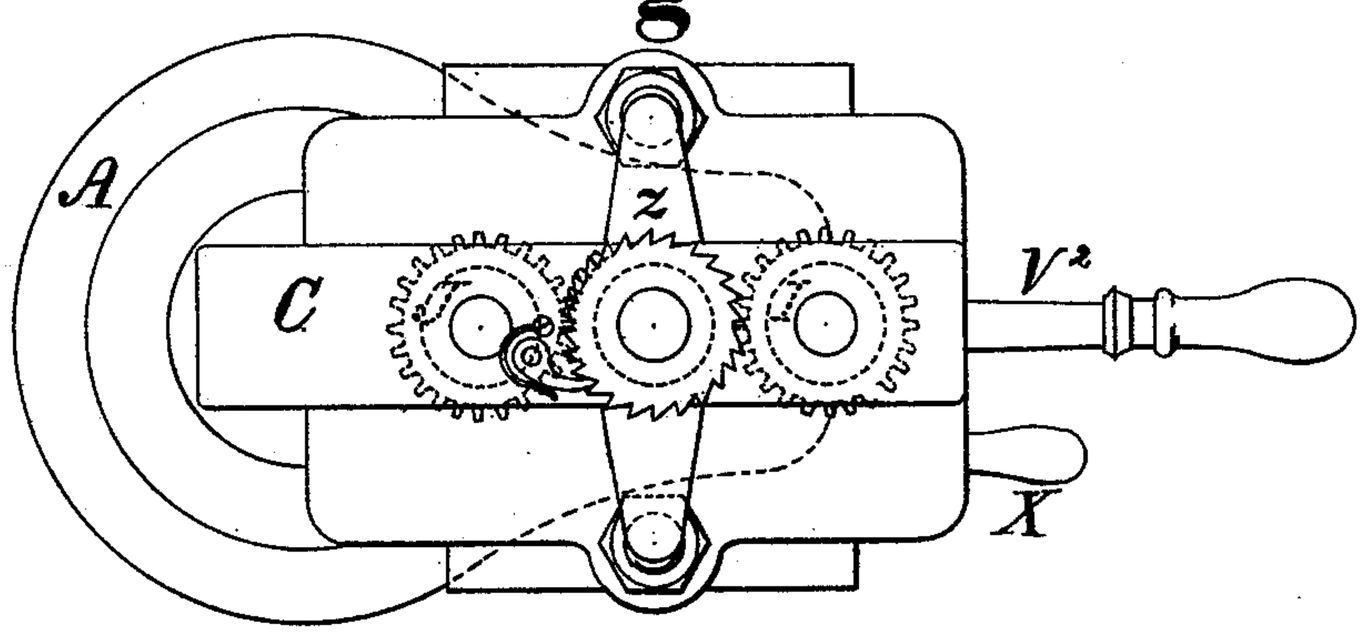


Fig. 10.

Fig. 2.



Witnesses.

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Henry L. Ruth

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Isaiah Smith Hyatt.
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by their Attorney.
Henry Baldwin Jr.

2 Sheets—Sheet 2.

I. S. & J. W. HYATT.

BORING MACHINE.

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Fig. 3.

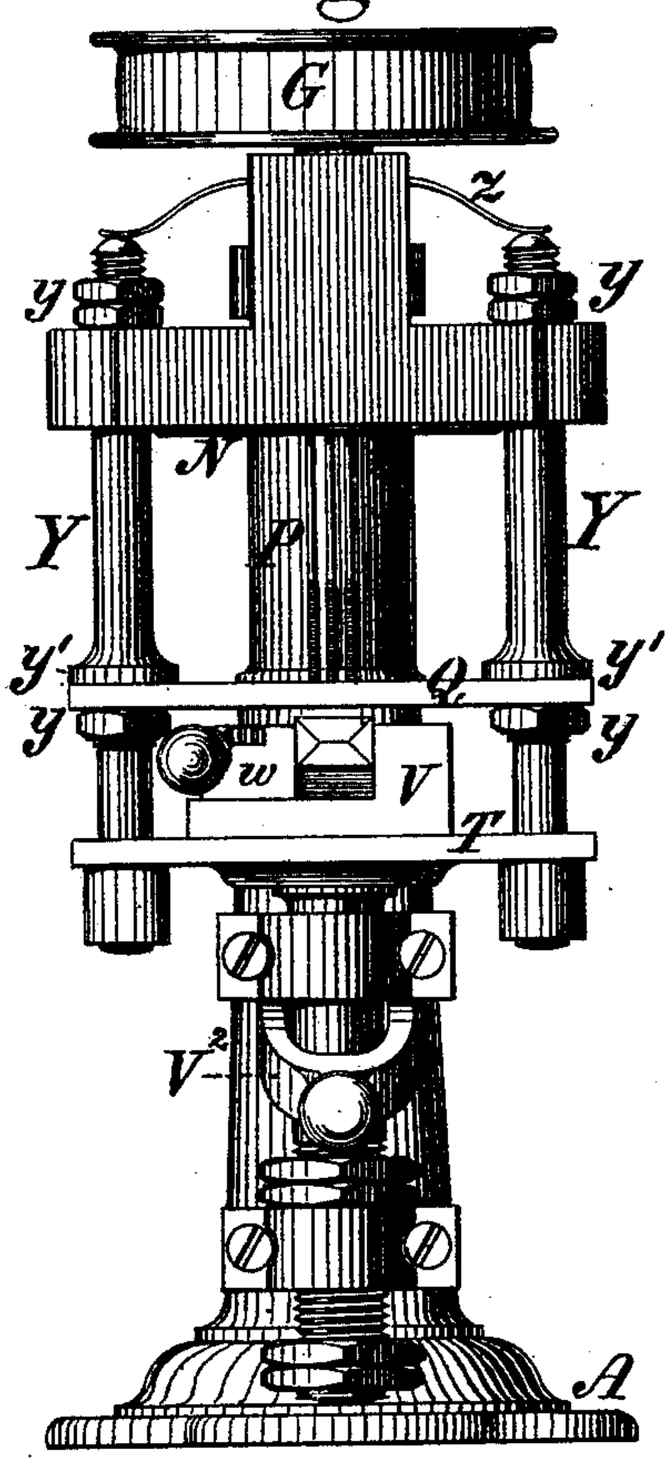


Fig. 4.

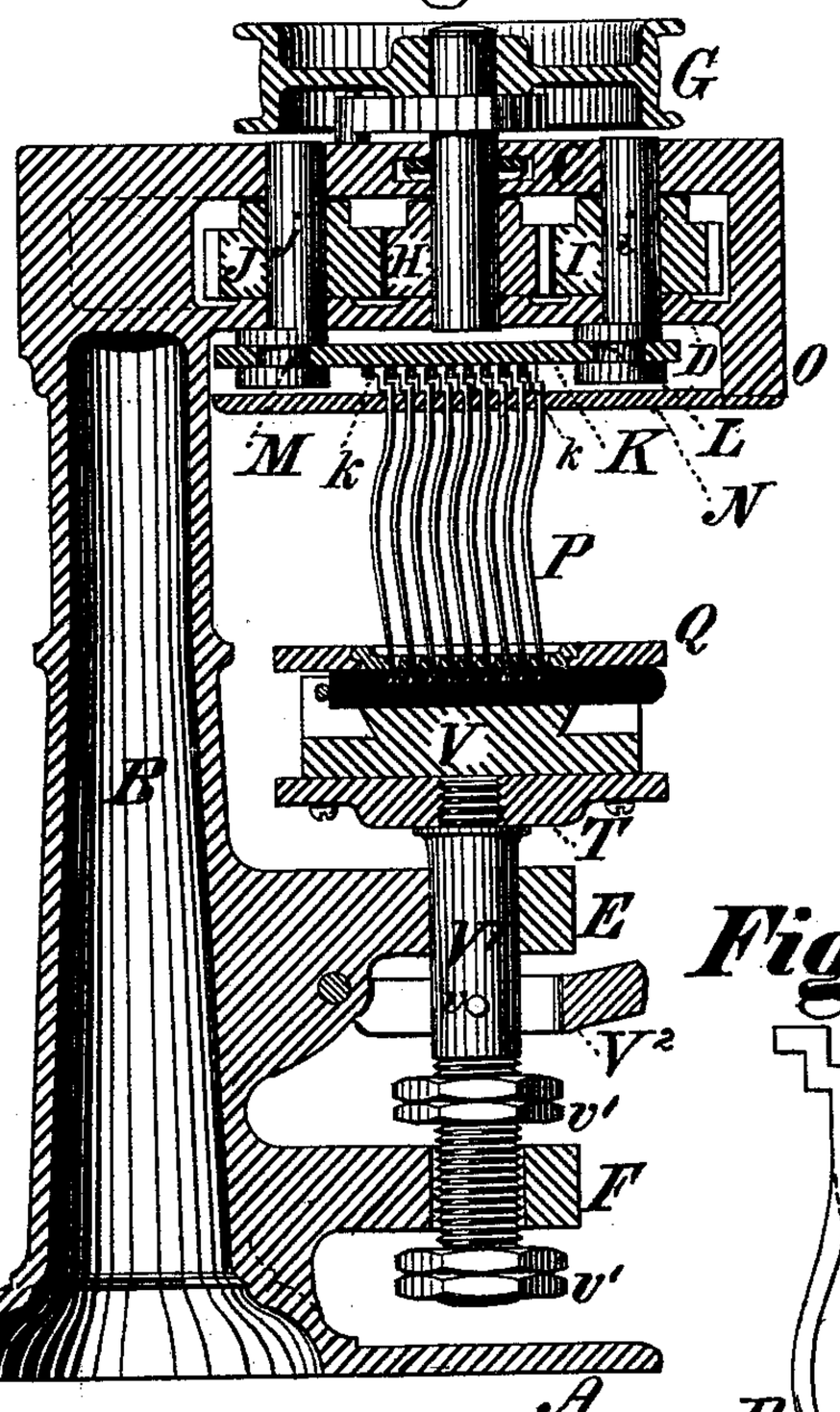


Fig. 8.

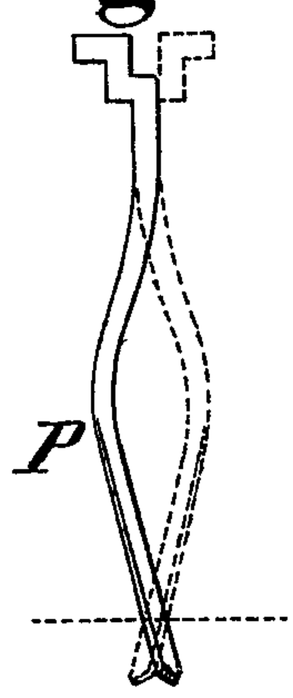


Fig. 5.

Fig. 9.

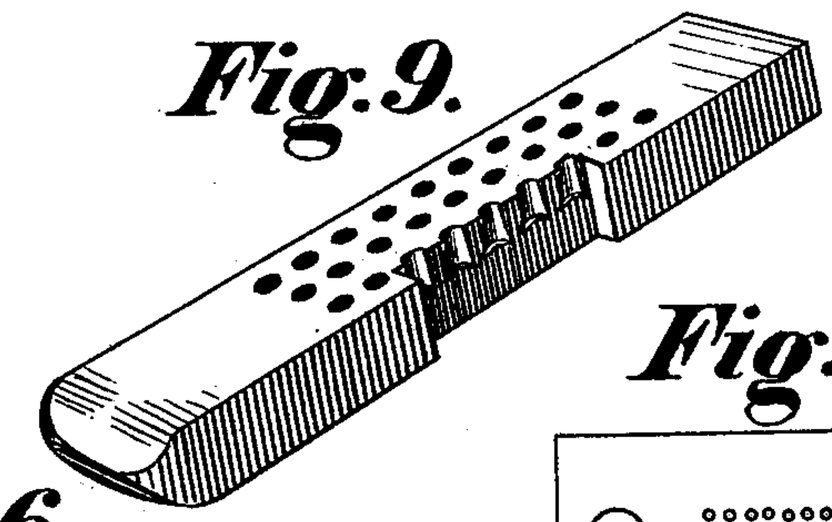


Fig. 6.

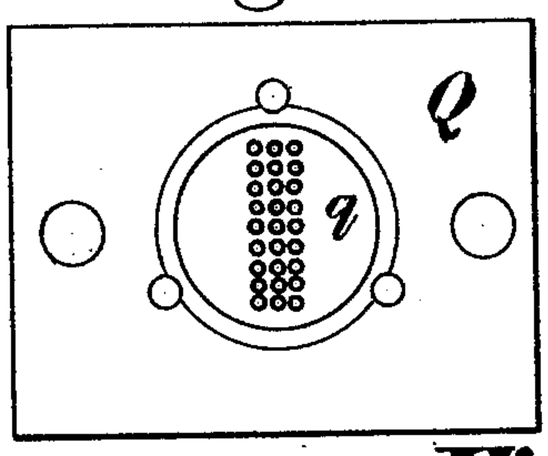
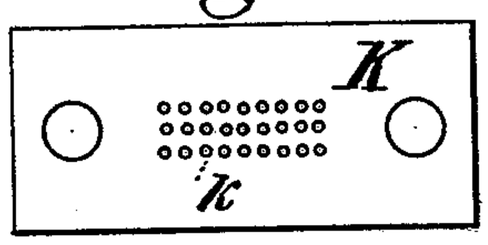


Fig. 7.



Witnesses.

D. C. Fraley

Wm. B. Ruth.

Inventors.

Isaiah Smith Hyatt.
John Wesley Hyatt.
by their Attorney
Henry Baldwin Jr.

UNITED STATES PATENT OFFICE.

ISAIAH S. HYATT AND JOHN W. HYATT, OF NEWARK, NEW JERSEY; SAID JOHN W. HYATT ASSIGNOR TO SAID ISAIAH S. HYATT.

IMPROVEMENT IN BORING-MACHINES.

Specification forming part of Letters Patent No. **185,928**, dated January 2, 1877; application filed February 19, 1876.

To all whom it may concern:

Be it known that we, ISAIAH SMITH HYATT and JOHN WESLEY HYATT, both of Newark, in the county of Essex and State of New Jersey, have jointly invented certain new and useful Improvements in Boring-Machines, of which improvements the following is a specification:

In various branches of the arts it is necessary to provide, in metal, wood, and other materials, holes, having a greater diameter in one part than in another. This has heretofore been done by enlarging or countersinking the upper part of the hole with a separate tool after it has been bored entirely through, or by counterboring, so as to give the hole its smaller diameter, with straight-edges in the lower part of its length, and its greater diameter with straight or inclined sides in the upper part of its length.

In other branches of the arts it has been proposed to bore or drill holes of greater area below than at the surface, by means of drills or bits which could be folded together or brought into line with the shaft to which they are attached, so as to pass them in or out of the bore, and which could be gradually spread to an increasing angle with the shaft as the hole became enlarged by their action. Instances of such proposed use of expanding bits may be found in various patents heretofore granted for boring rocks, &c.; but none of these would in any respect meet the requirements of our invention.

It is the object of our invention to bore or drill a single hole, or simultaneously a series of holes, either entirely or partially through metal, wood, or other materials, and while operating only from one surface, and without using any countersink or counterbore or expanding bit, to produce at one operation a hole, or a series of holes, which shall be enlarged on the under side if carried entirely through the material, or, if not carried entirely through, shall have a gradually-increasing diameter from top to bottom, or shall be larger beneath than at the surface of the material, and we designate these as undercut holes.

The first feature of our machine consists in a drill or bit, the upper end of which defines its axis of rotation, while its lower end describes a frustum of a cone about the same axis, the shank between the two ends of the drill being first bent or inclined away from the upper end, and then inclined back to the lower end, the extent of the bends or inclinations varying according to the greater or less angle at which the cutting-edge is to operate. The cutting-edge may be straight or angular, concave or convex, and the upper end of the drill or bit may have any shape adapted to the means used for driving it. In case a series of these bits or drills are used together, the upper ends should be cranked, as hereinafter more fully described.

As distinguishing such drills or bits from any heretofore known or used, we designate them as bent drills.

The second feature of our machine consists in a plate, which insures the proper action of the bent drill in producing the undercut hole, and at the same time acts as a templet, defining the work. This plate has a hole through it for each drill, and this hole tapers from the upper surface of the plate conformably with the angle of inclination given to that part of the drill which passes through it to do its work.

In general terms it may be given as the rule that the hole through the plate is the inverse of the undercut hole to be drilled, some allowance being made for the spring or play of the drill in its eccentric revolution, to avoid binding.

When a series of drills are used together the plate will, of course, have a corresponding series of these tapering holes. This plate we call the fulcrum-plate.

The third feature of our machine consists in devices for clamping and supporting, and raising and lowering, the material to be bored, and for maintaining the proper relations between the work and the drill.

A further feature of our machine consists in a rotatory plate, from which depend a series of pins or studs, which we call crank-pins, corresponding with the cranked upper ends of a series of drills, upon each of which one of the pins acts, the plate being driven

by gearing, so that the crank pins or studs give a positive rotary motion to the drills. This plate we call the crank-plate.

A further feature of our machine consists in combining with the crank-plate a fixed plate, above which the cranked upper ends of the drills project, and in which the straight part or necks of the drills are supported and maintained in proper relation to the pins in the crank-plate, so that the drills may be uniformly actuated. This plate we call the journal-plate.

Further features of our machine, consisting in combinations of the above-mentioned and other parts, will be found hereinafter described and specified.

In the accompanying drawings, which form part of this specification, is represented a drilling-machine for boring a series of undercut holes simultaneously, and embodying our invention in the best form of construction now known to us; but we contemplate various modifications and applications of its prominent features.

In the machine shown, Figure 1 is a side view in elevation. Fig. 2 is a plan or top view, the driving-pulley being removed. Fig. 3 is an end view in elevation. Fig. 4 is a vertical longitudinal central section. Fig. 5 is a plan or top view of the fulcrum-plate. Fig. 6 is a vertical central section on an enlarged scale of the fulcrum-plate, showing the taper of the holes therein. Fig. 7 is a plan or top view of the crank-plate, showing the arrangement of the crank-pins therein. Fig. 8 is a view, in elevation and on an enlarged scale, of a bent drill, the longitudinal dotted lines showing the figure described by it in making an undercut hole. The transverse dotted line represents the line of contact between the top of the work and the bottom of the fulcrum-plate, and this indicates the course of the lower end of the drill from the surface of the material to the bottom of the hole. Fig. 9 is a perspective view of a drilled block, partly in section, showing the undercut holes therein, and Fig. 10 is a plan or top view of the clamping device, the finished work being shown in position, while the dotted lines show the movements by which the work is to be released.

Upon a suitable bed-plate, A, we cast or otherwise secure an upright post, B, from the front of which project at the proper points the horizontal plates C D, the bracket E, and the bearing F. The driving-pulley G has a vertical shaft supported in the plates C D, between which plates this shaft carries the gear-wheel H, meshing with the gear-wheels I J; also supported on vertical shafts *i j*, between the plates C D, as seen in Figs. 1 and 4. Beneath the plate D, and parallel therewith, is the crank-plate K, into the respective ends of which are fitted cranks L M, depending from the shafts of the wheels I J. (See Figs. 4 and 7.) Depending from this plate, and arranged in a figure corresponding with that in which the drills are arranged, are a series of fixed studs or pins, *k k*, corresponding in number with the drills, each of the pins acting upon the cranked end of one of the drills as the wheels I J rotate, and giving it a rotary motion about its axis, so that each drill is driven by a positive crank motion, the range of this motion corresponding with the throw of the cranks L M. (See Figs. 1 and 4.)

We have shown this construction only; but we contemplate such modifications of the means for driving the drills as may be found desirable under peculiar circumstances. One such modification consists in having the cranked ends of the drills pass through the crank-plate, the crank-pins being in such case omitted, and derive their motion immediately from the crank-plate, instead of intermediately through the pins. Other modifications, adapted to cases in which a single drill is used, are hereinafter described.

Below the crank-plate, and below the lower ends of the cranks L M, and parallel with the crank-plate, is the journal-plate N, which is firmly secured to the plate D by means of screws, so as to admit of its being readily removed when necessary. In this journal-plate there is a hole for each drill, and in this hole the straight neck of the drill fits and turns freely. These holes are so arranged that the cranked ends of the drills will be brought into proper relation, respectively, with the pins *k k* in the crank-plate K. (See Fig. 4.) In all cases there should be space enough between the crank-plate and the journal-plate to admit of the cranked ends of the drills turning freely in this space; and, in the instance shown, this space is secured by having transverse flanges O O across the respective ends of the plate D. Each of the bent drills P (see Fig. 8) has, near its upper end, a vertical neck, supported and turning freely in the journal-plate N, (see Fig. 4,) above which this end of the drill, in the construction shown, where a number of holes close together are to be bored simultaneously, is bent away from its axis of rotation, and at a right angle thereto, so as to form a shoulder parallel with the plate N, and resting upon the upper side of this plate. From this right-angled shoulder the end of the drill is carried up in a straight line, and then bent again in the same direction, and again at a right angle, so as to form a head parallel with the crank-plate, which head bears upon the under side of the crank-plate, and comes into the proper relation to one of the pins in the crank-plate. Each drill is thus supported by its neck in the journal-plate, by its shoulder upon the journal-plate, and by its head under the crank-plate, these affording ample bearings to insure steadiness in the rotation of the drills, and the angles thus formed admitting of a compact arrangement of the drills, which overlap each other, as seen in Fig. 4.

Below the vertical neck, which defines its axis of rotation, each drill is bent, as already described, and as is seen in Figs. 4 and 8.

The fulcrum-plate Q is provided with a hole for each drill, and each of these holes is countersunk, so that it tapers from the upper surface to the bottom of the plate, the incline given to the taper coinciding with the inclination of the lower part of the drill from its extreme point of divergence to the cutting-edge, and some allowance being made for the spring or play of the drill. (See Figs. 4 and 6.) The holes in the fulcrum-plate of course conform to the arrangement of the drills, and have their centers coincident with the centers of the corresponding holes in the journal-plate.

To facilitate the changes of figure in arranging the drills for different styles of work, and to accommodate more readily such changes as involve a greater or less number of drills, we make the part *q* of the fulcrum-plate, which contains these holes and determines the pattern or figure in which they are to be reproduced in the drilled material, of a separate piece, which is properly fitted and secured in the plate Q, as seen in Figs. 5 and 6, so that it can readily be removed and replaced, thus saving the expense and trouble of changing the entire fulcrum-plate. Underneath the fulcrum-plate is the feed-plate T, which supports the clamp V, Figs. 1, 4, and 10, in which the work is held, fed to the drills, and maintained in position to be bored. This plate T is mounted upon the upper end of the vertical shaft V^1, which passes through and plays up and down in suitable boxes formed in the bracket E and bearing F. One side, *w*, of the clamp V slides laterally toward and from the center, and is moved and held in position by a cam-lever, X, Fig. 10, or by any other of the many well-known devices used for such purposes. This clamp has a recess, of shape conformable to that of the work to be bored, and in this recess the work is placed and held in the proper relation to the cutting-edges of the drills.

Strong rods Y Y pass through the feed-plate, the fulcrum-plate, and the plate D, and are provided with nuts *y* and shoulders *y'*, so as to connect and hold these plates together in proper relative positions and against lateral pressure, and to admit of their adjustment and respective movements up and down. (See Fig. 3.) The plate D is fixed, as already described, but the feed-plate moves up and down toward and from the fulcrum-plate, and these both move together up and down toward and from the plate D as the work progresses.

Upon the upper ends of the rods Y Y the spring *z* is made to bear, so as to keep the fulcrum-plate down upon the work in the clamp. A strong forked lever, V^2, embraces the shaft V^1, between the bracket E and bearing F, and has its ends secured to the bracket by a pivot. Pins *v* in the shaft V^1 pass through the slots *s s* in the lever, and upon these pins as a fulcrum the slotted lever lifts the feed-plate toward the drills. Means of adjusting the range of movement of the feed-plate are provided in the lock-nuts *v'* upon the shaft V^1, above and below the bearing F.

The operation of the machine is as follows: The drills being arranged in the journal-plate to conform in number and position, and in outline, to the series of holes to be bored, and the pins in the crank-plate and the hole in the fulcrum-plate corresponding in number and position with the drills, power is applied through the pulley G, and the drills are set in motion. The work being placed in the clamp and secured by the cam-lever, the lever V^2 is raised until the upper surface of the work is brought up against the under side of the fulcrum-plate and in contact with the points of the drills. As the drills gradually penetrate the work, the lever V^2 is raised gradually, and the work thus kept pressed up against the cutting-edges of the drills and in contact with the under side of the guide-plate until the desired depth is given to the holes. The lever V^2 is then lowered, and with it the feed-plate, thus withdrawing the finished work from the action of the drills.

Where a single drill is used, or where a series of drills are used with such spaces between them as to admit of a simpler mode of driving them than that above described, the upper ends of the drills may be straight, instead of being cranked, and an ordinary chuck for each, or other well-known means of driving them separately or together, may be adopted.

Such variations in practice may be desirable in boring holes of different sizes in the same work.

Having thus described the nature and objects of our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The bent drill, hereinbefore defined, constructed substantially as and for the purposes described.

2. The fulcrum-plate, hereinbefore defined, constructed substantially as described, with a removable part, *q*, for the purposes set forth.

3. The combination of the drill, the crank-plate, the journal-plate, and the fulcrum-plate, substantially as described.

4. The combination, with the feed-plate, of the clamp V, or its equivalent, for holding the work, substantially as described.

5. The combination of the drill, the crank-plate, the journal-plate, the fulcrum-plate, and the feed-plate, substantially as described.

6. The adjusting and supporting rods Y Y, in combination with the fulcrum-plate.

7. The adjusting and supporting rods Y Y, in combination with the fulcrum-plate and the feed-plate.

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