(No Model.) 2 Sheets—Sheet 1.

O. S. WALKER.

DRILL GRINDING MACHINE.

No. 411,845. Patented Oct. 1, 1889.

Fig. 1.

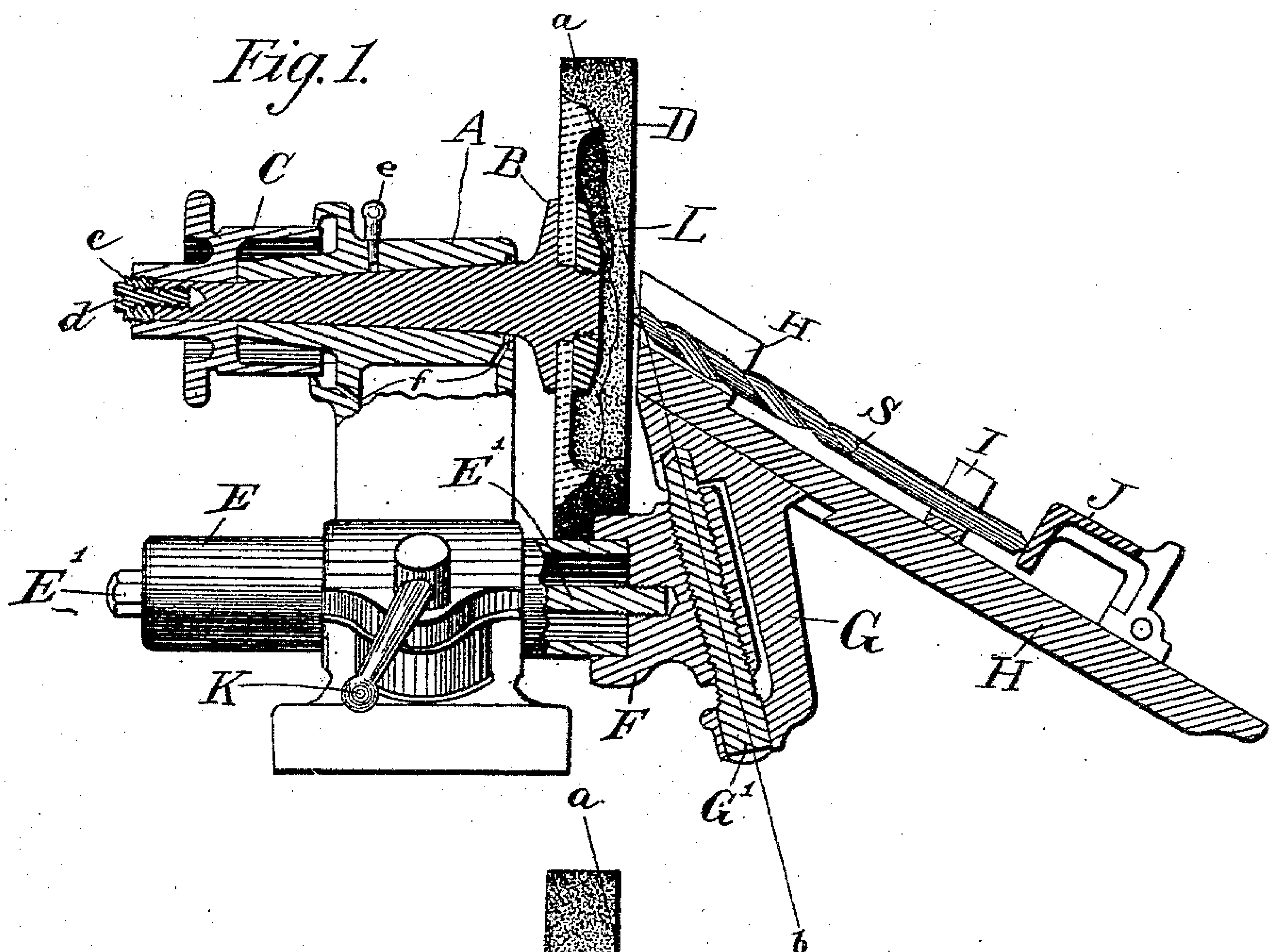


Fig. 2.

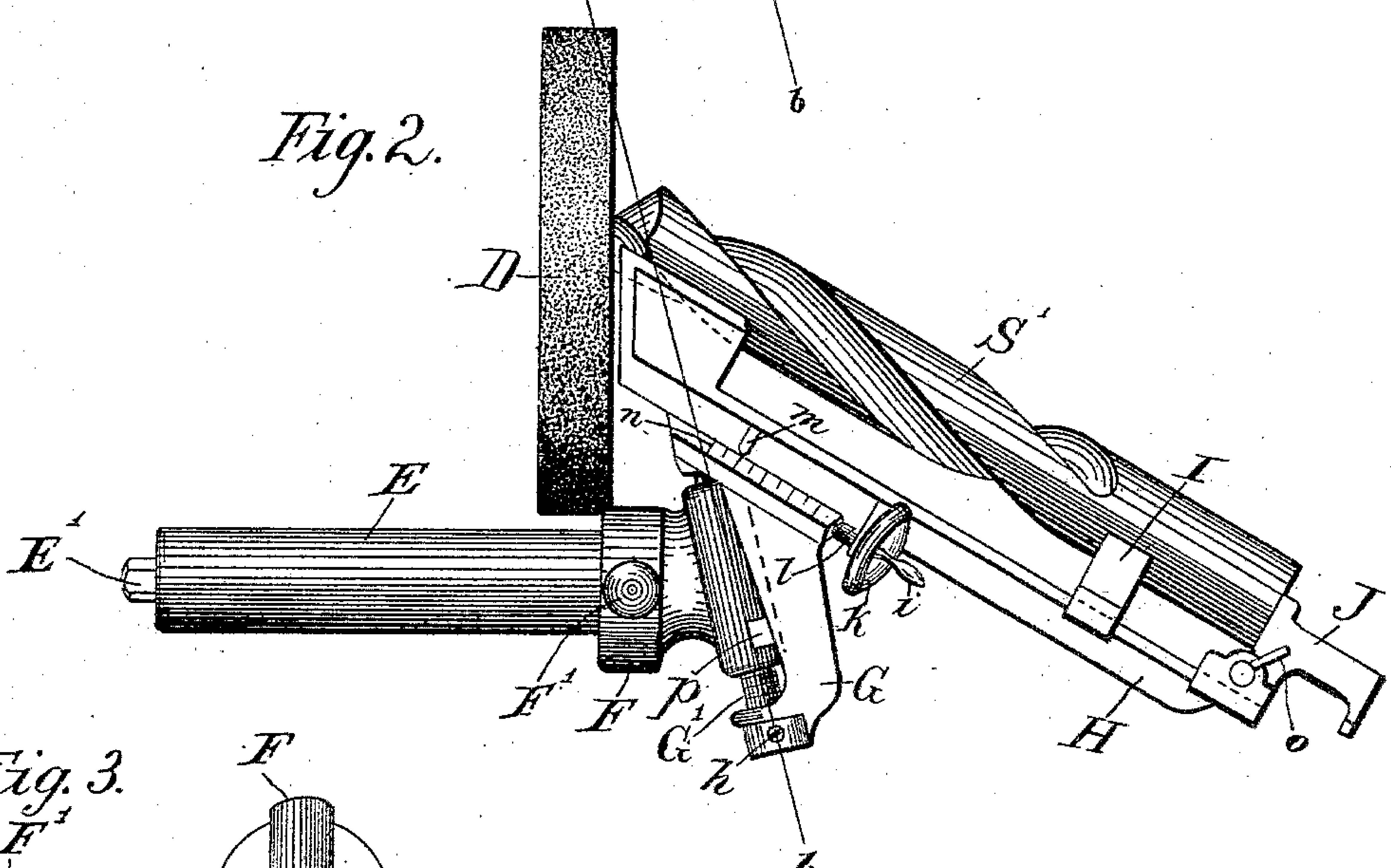


Fig. 3.

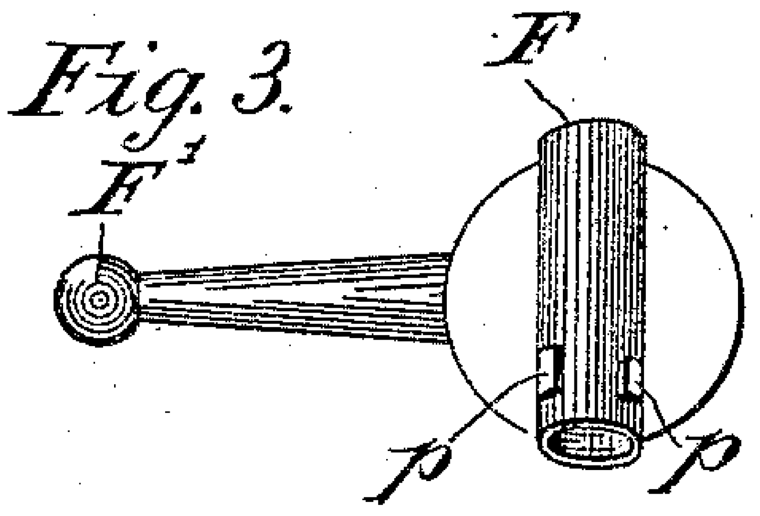
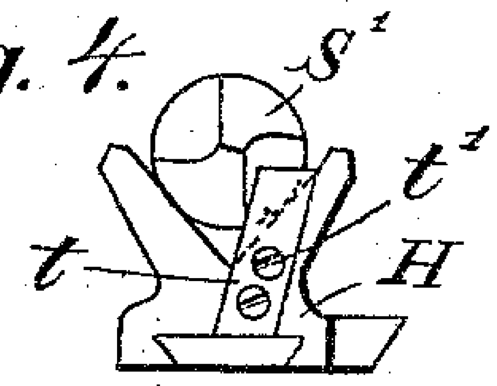


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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DRILL GRINDING MACHINE.

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Fig. 5.

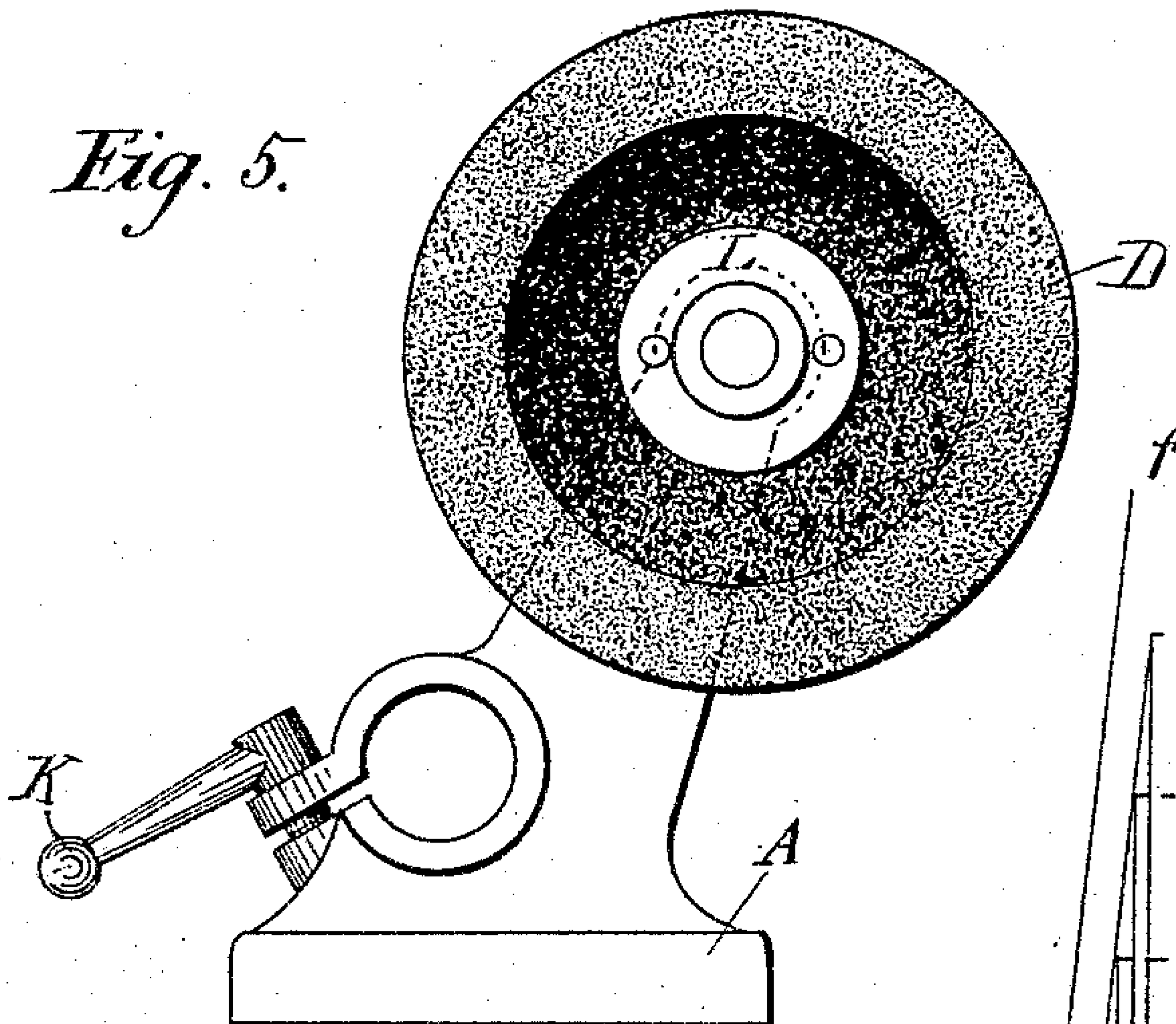


Fig. 8.

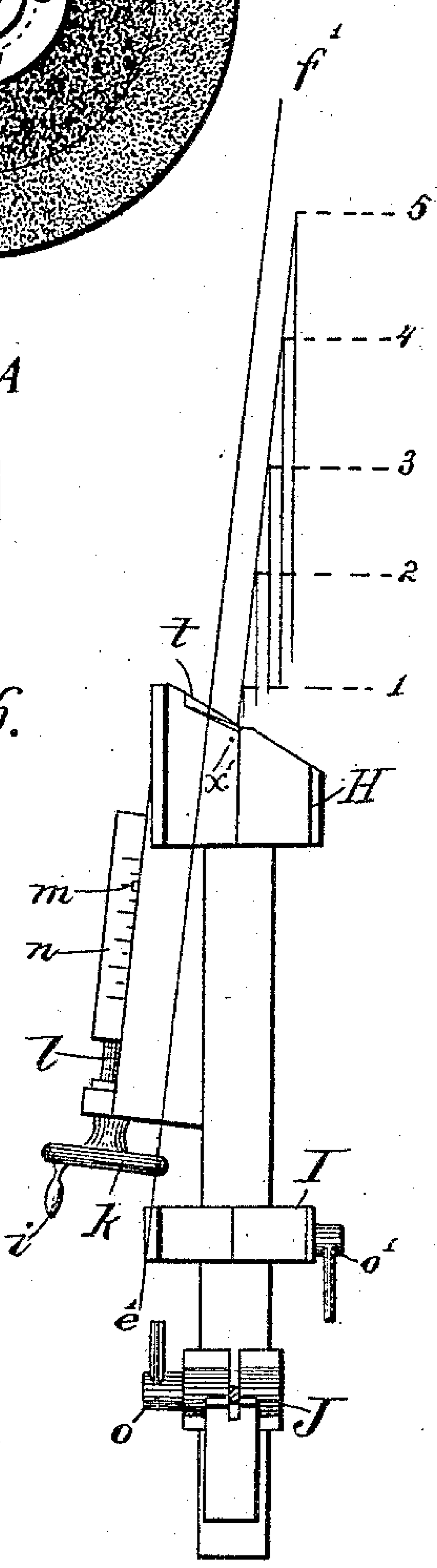
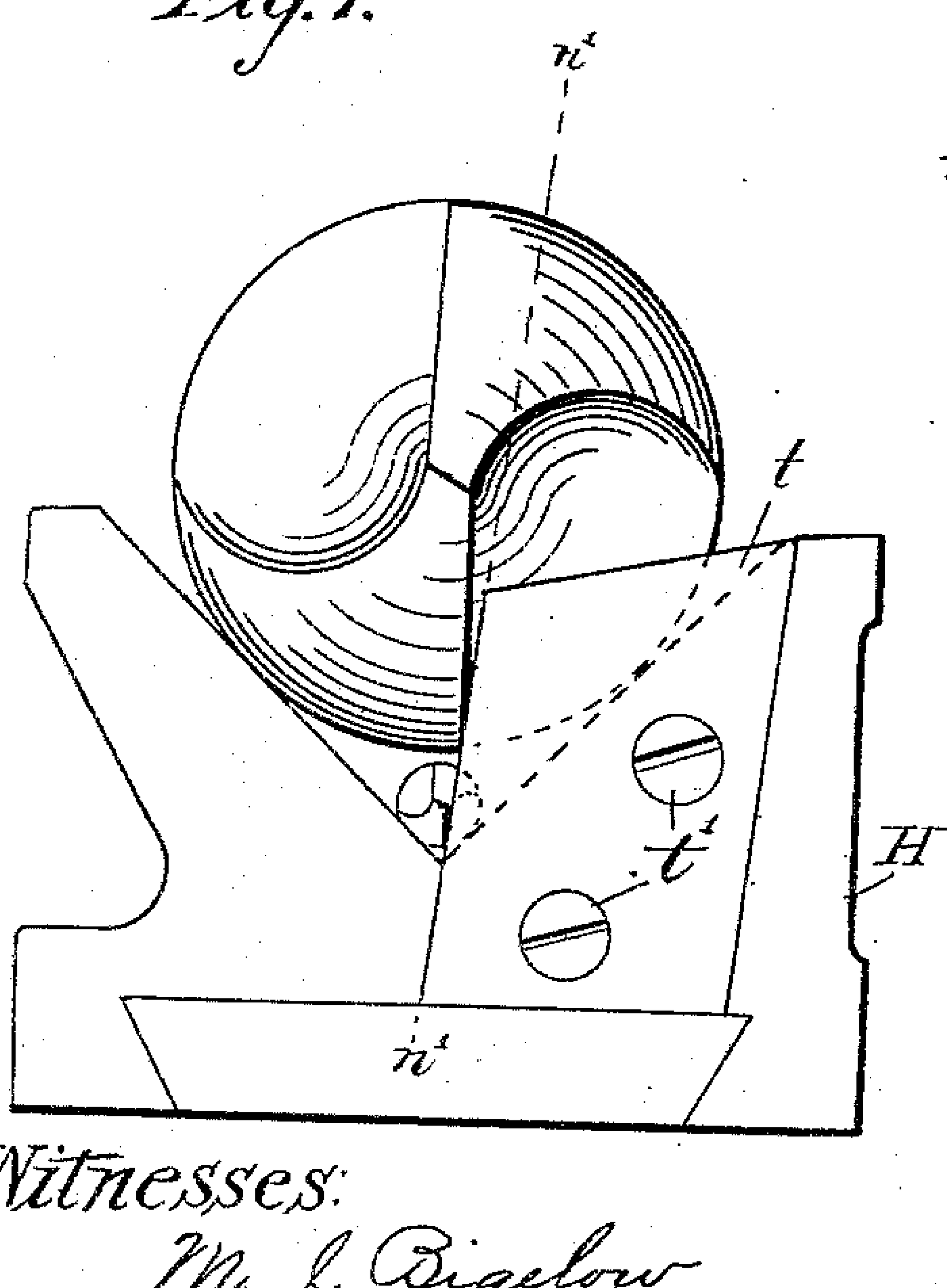
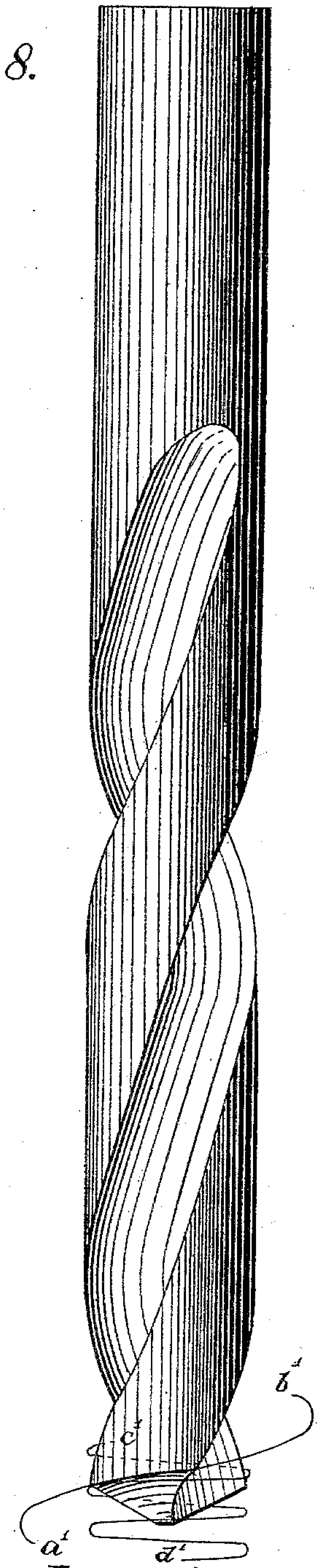


Fig. 6.

Fig. 7.





Witnesses:
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F. E. Knight.

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UNITED STATES PATENT OFFICE.

OAKLEY S. WALKER, OF WORCESTER, MASSACHUSETTS.

DRILL-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 411,845, dated October 1, 1889.

Application filed December 23, 1887. Serial No. 258,925. (No model.)

To all whom it may concern:

Be it known that I, OAKLEY S. WALKER, a citizen of the United States, residing at Worcester, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in Twist-Drill-Grinding Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to twist-drill-grinding machines, the object being to produce an improved form of grinding for the end surface of each drill-lip.

It has been particularly my object in the invention herein described to produce a device that does not necessitate the chucking and centering of the drills, the operation of the same being obvious to ordinary unskilled workmen, and the adjustment for each size of drill being plainly indicated on the machine.

To this end my invention consists of several novel and valuable features of construction, and especially of an improved drill holding and operating device, hereinafter more fully described. This device is so arranged that the drills are held in place during the grinding operation by their own gravity aided by the hand of the operator, thus effecting a saving of the time usually spent in adjusting the same in a chuck.

This drill holding and operating device consists of a rigid and a movable V-grooved drill-support, a reversible drill-stop, an improved lip-rest permanently set and adjusted for all sizes of drills, and an angular graduated slide so constructed as to perform the triple duty of giving the drill two adjustments and feeding the same against the grinding-wheel by means of the same feed-screw.

The device consists, further, of a threaded axis of oscillation upon which the correspondingly-threaded drill-holder swings or oscillates helically and gives the drill-lip a screw-thread surface or helicoid. The advantages of this shape of drill-lip may be briefly enumerated as follows: If the movement of any point on the surface of the drill-lip be followed as the drill is fed to its work with a regular feed advancement, it will be found that the said point will describe a helix of greater or less pitch, according as the feed is accelerated or retarded, and if the drill be stopped in the midst of its cutting the shape found at the bottom of the hole will be a helicoidal instead of a conical surface, and it follows that a drill-lip ground to a helicoidal surface will be best adapted for cutting under such conditions.

Other devices have been tried heretofore that produce surfaces of various shapes, including right cylinders and cones and various-warped surfaces, and machines also that make a surface approximating a helicoid by means of cams and like devices. The last-named class of machines, however, employ an axis that is coincident with the axis of the drill, and the resultant surface leaves the drill-point rounded on too small a radius, and the cutting properties of the end of the drill web or point are in a measure destroyed. The central web of a twist-drill is made with a thickness proportionate to the diameter of the drill, and is necessary to give strength and stiffness to the same; but it forms a point of great resistance to the drill in cutting, and should be shaped in the best form to make its scraping action as free as possible. In my invention I aim to grind this point on as long a radius as practicable and obtain best results. If a drill-lip be ground on an axis that coincides with the axis of the drill, and any circular element on this lip-surface—as, for instance, an element midway between the periphery and point on a drill of one inch radius—be taken, the radius of this element of surface will be one-half the radius of the drill, or will coincide with the radius of the drill at this point. If, however, the axis of the ground surface be conceived as inclined to the axis of the drill, it is evident that the curvature of the lip at the periphery may be the same as in the first case, while the radius of curvature near the drill-point may be much greater than it was in the first case, and consequently a drill-point is produced more nearly approximating a straight line and a clearer cutting-point is produced. I therefore employ an axis of oscillation considerably removed from and inclined to the axis of the drill, and produce a drill-lip surface of proportionately longer radius at the point than at the periphery of the drill and a helicoidal surface in contour.

In the accompanying drawings, the same letters indicating like parts in each, Figure 1 is a side elevation of my twist-drill-grinding machine, shown partly in section. Fig. 2 is a side elevation of the drill holding and operating device and the grinding-wheel. Fig. 3 is an end elevation of the swivel-head F, and shows handle F′ and the projections p, which serve as stops for the oscillating drill-holder. Fig. 4 is an end elevation of the **V**-shaped drill-holder, showing drill in place. Fig. 5 is an end elevation of the main supporting-standard, with the drill-operating mechanism removed and the grinding-wheel in place. Fig. 6 is a plan view of the drill-holder at a right angle to the top surface of the same. Fig. 7 is an enlarged end elevation of drill-holder, showing different-sized drills in place and the lip-rest. Fig. 8 is an elevation of a twist-drill illustrating the peculiarities of my improved surface for cutting lips.

A is the main standard of the machine, and D the annular grinding-wheel, which is held in place on the taper spindle B by the internally-threaded washer L.

C is the spindle-pulley, and is held by a feather-key not shown. In the outer end of the pulley C is screwed a bushing c, abutting against the end of the spindle B and held by central screw d. By unscrewing bushing c slightly and tightening screw d, the pulley C is forced farther onto the spindle B and adjustments thus made for wear. The oil-channels f serve to convey the waste oil from each end of the spindle to the hollow in the center of the standard, where it may be conveyed to a drip-cup. The standard A is bored and fitted with a clamping-screw, operated by the handle K to bind the cylindrical slide E in any desired position. On one end of slide E is mounted the swivel-head F, held by the central bolt E′ screwed tightly into the same and maintaining the proper tension.

The swivel-head F is provided with an aperture forming an inclined sleeve, which is internally threaded for the reception of the similarly-threaded shaft G′, which is fastened in the guide-bracket G by a set-screw h, and turning with the bracket G moves itself and the bracket along the line a b, according to the pitch of its screw-thread. On this guide-bracket G is mounted the drill-holder H and its attendant parts. The object of the swivel-head F is to allow the drill-holder to be moved across the grinding-wheel, parallel to the grinding-surface, to distribute the wear and maintain the truth of the wheel. The cylindrical slide E may be made to perform the functions of the swivel-head F by slightly loosening the clamping-screw K and permitting the cylindrical slide to rotate.

The drill-holder H is provided at the bottom with an angular slide working on dovetailed ways on guide-bracket G, and operated by means of the hand-wheel k and feed-screw l.

Graduations n on bracket G indicate the proper position of the slide by the pointer m for the different-sized drills.

The drill-holder H is provided with a planed guideway, at one end of which is a rigid **V**-shaped support for the drills, and adjustably mounted on the said guideway is the sliding **V**-shaped support I, held by a set-screw o', which is operated by a lever; and also there is likewise mounted the sliding drill-stop J, which is reversible and may be clamped in any position by the screw o.

t is the stationary lip-rest, held in place by screws t'.

n' n' is the line of drill-contact, and is shown inclined to the bisecting line of the **V**-angle, and intersecting the same near the apex of said angle, the object being to compensate for the variation in thickness of the drill-points. By this means the cutting-edges of all drill-lips placed against the rest are held parallel to each other.

The points numbered 1 2 3 4 5 in Fig. 6 show somewhat exaggerated the different positions of drills of large diameter, in reference to the axis of oscillation, which is fixed at the point x'.

In Fig. 8 the line c' d' is a somewhat magnified representation of a helix described by a single point on a drill-lip revolving with a regular feed advancement, and a' b' a line on the periphery of a drill-lip ground to a helicoidal surface, and shows a portion of a helix of greater pitch and longer radius than c' d', but conforming to it in a certain degree, or as much as is consistent with a good cutting drill-point and the proper clearance.

To grind a drill with my device the clamping-screw K is loosened and the cylindrical slide E is pulled out and clamped, so that the drill-holder is some distance away from the grinding-wheel, and a drill is then laid in the **V**-shaped supports, the movable support I and drill-stop J being suitably adjusted for the purpose, and the lip of the drill to be ground being placed in contact with the lip-rest t and extending about an eighth of an inch beyond it. The drill-holder is then moved by means of the feed-screw l and hand-wheel k until the pointer indicates on the guide-bracket G the graduation that corresponds to the diameter of the drill being ground. The drill is now held in place by one hand, while the cylindrical slide E is moved until the drill comes in light contact with the grinding-wheel. The cylindrical slide is then clamped rigidly in place, and with one hand holding the drill the other operates the feed-screw l by means of the hand-wheel k, and at the same time oscillates the drill and holder until the guide-bracket comes in contact with the stops p on either side. The drill may be repeatedly reversed in the drill-holder with one hand until both lips be ground exactly alike.

Clearance is obtained on drills ground with my invention by means of the threaded axis, which advances the drill as it is being ground, and a variation of clearance necessary for varying diameters of drills is obtained by means of the angular slide on the drill-holder H, before mentioned, which carries the drills forward and away from the axis of oscillation in regular proportion to their diameters, giving varying radii of grinding and varying lateral adjustment for the different degrees of clearance required, as clearly shown in Fig. 6.

In Figs. 1 and 2 the different radii of grinding on drills S and S′ are shown. The line *a b* is the axis of oscillation.

The points 1, 2, 3, 4, and 5 indicate different positions of the drill-points, and the parallel lines drawn to each of these points respectively represent center lines of drills in each position, as the drill-holder is carried out in the direction *e′ f′* by the feed-screw *l*.

In the foregoing specification I have described an angular slide moving in a direction oblique to the axis of the drill, thus giving the drill a longitudinal and lateral adjustment with but one movement of the slide. The lateral adjustment of the drill, however, may be obtained in another manner with my device, as follows: In placing a drill in my grooved V-shaped drill-holder the center of each succeeding drill of larger diameter will rest higher up in the V-holder, which is obvious, and it is also evident that the centers of all drills will lie in the right line, which bisects the angle of the V. If the V-holder be inclined away from the axis of oscillation in a lateral direction, this bisecting line will also be inclined away from the same, and, as the drill-centers always lie in the bisecting line of the V, they will have an increased lateral adjustment from the axis of oscillation proportionate to their increased diameters, a result precisely similar to that obtained by means of the angularity of the slide previously described, the slide in this case maintaining the axis of the drills in the same vertical plane. I do not, therefore, confine myself to an angular slide to obtain proportionate lateral adjustment for different-sized drills; but

What I claim as new, and desire to secure by Letters Patent of the United States, is as follows:

1. The V-grooved drill-holder H, in combination with the stationary drill-lip rest *t*, which has its line of drill-contact inclined to the bisecting line of the V-angle and intersecting the same near the apex of said angle, as and for the purpose described.

2. The combination, with the drill-holder H and guide-bracket G, of an inclined and screw-threaded axis of oscillation, along which the drill-holder is helically advanced by said screw-thread when oscillated, as above set forth.

3. In combination with the V-grooved drill-holder H, the separate drill-stop J, and the independent V-shaped support I, which is adjustable in a direction parallel to the axis of the drill, as described.

4. The combination of the drill-holding mechanism, comprising drill-holder H, guide-bracket G, separate drill-stop J, and the independent adjustable V-shaped support I, with the cylindrical slide E, constructed and operated as and for the purpose set forth.

5. The combination of the drill-holding mechanism above described, supported on a cylindrical slide provided with a swivel, arranged to swing the drill to any desired part of the grinding-surface, as described.

6. The drill-holder H, the stationary lip-rest *t*, and the guide-bracket G, combined with the inclined and screw-threaded axis of oscillation G′, arranged to helically advance the drill along the axis toward the grinding-wheel as the drill-holder is oscillated, as described.

7. The angular sliding drill-holder H and guide-bracket G, combined with the swivel-head F, arranged to swing the drill across the grinding-surface in a plane parallel to the same, as and for the purpose described.

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