(No Model.)

# J. J. KENYON.

## DRILL GRINDING MACHINE.

No. 523,897. Patented July 31, 1894.

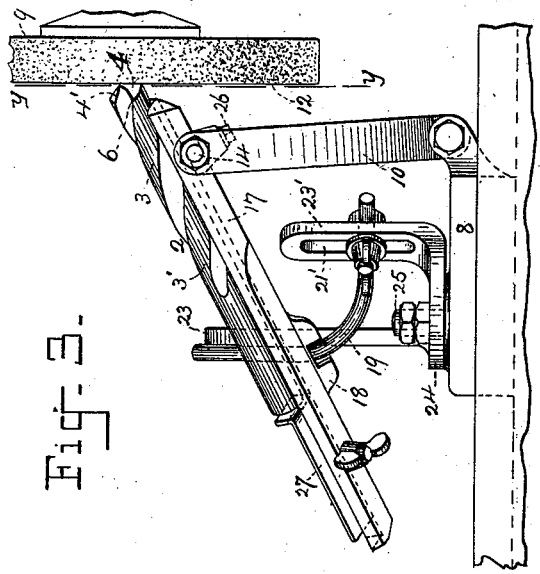

Fig. 3.

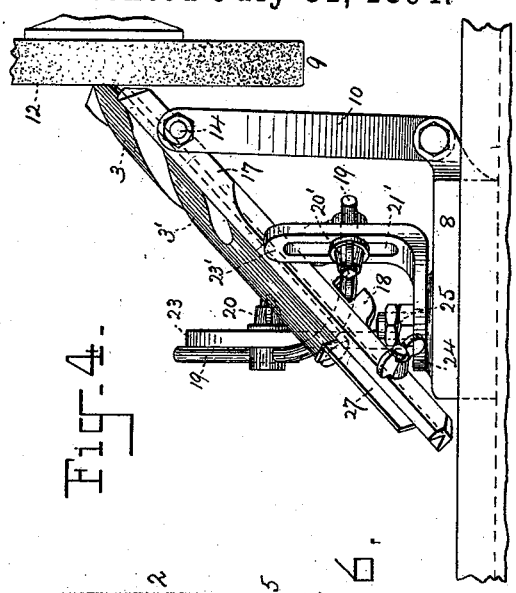

Fig. 4.

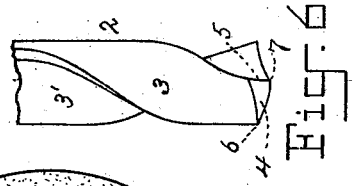

Fig. 6.

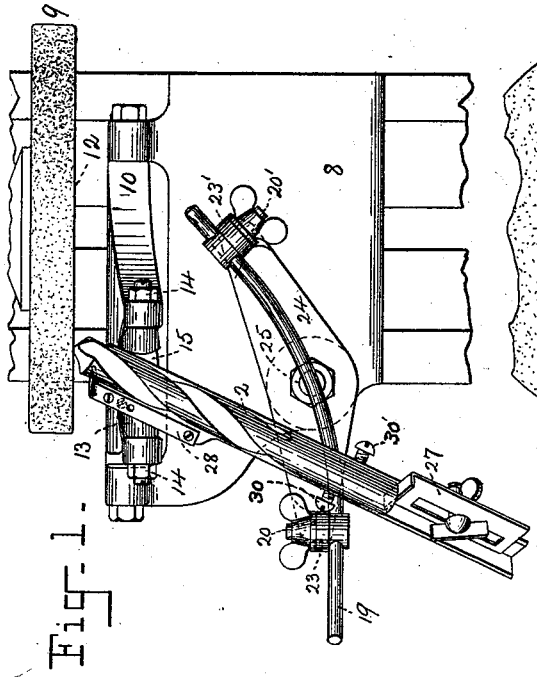

Fig. 1.

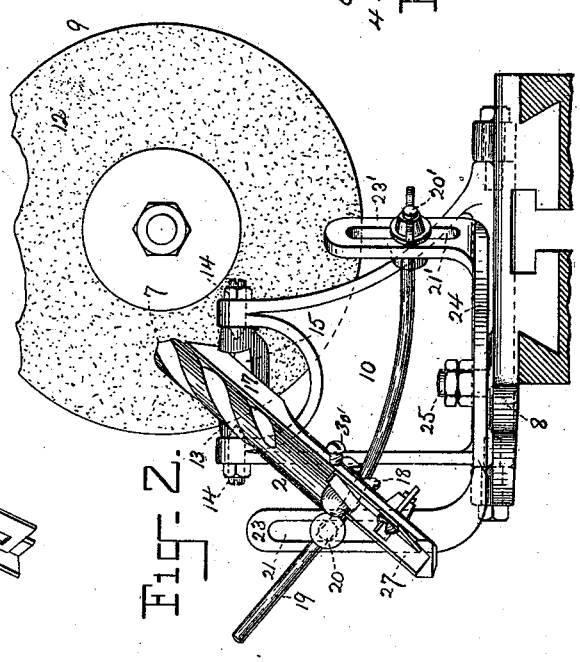

Fig. 2.

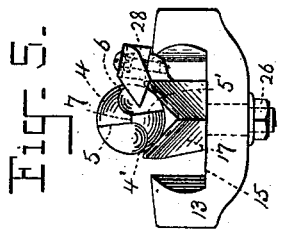

Fig. 5.

Witnesses.

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# UNITED STATES PATENT OFFICE.

JOHN J. KENYON, OF SUNCOOK, NEW HAMPSHIRE.

## DRILL-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 523,897, dated July 31, 1894.

Application filed April 18, 1894. Serial No. 508,040. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN J. KENYON, a citizen of the United States, residing at Suncook, in the county of Merrimac and State of New Hampshire, have invented certain new and useful Improvements in Drill-Grinding Machines; and I do hereby 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 figures of reference marked thereon, which form a part of this specification.

This invention relates to apparatus by which drills for machine work are enabled to be ground accurately, and is embodied in mechanism whereby the drill is presented properly to the grinding tool, in order to create a surface adapted to perform the best work; furthermore in mechanically changing the position of the drill with respect to the grinding wheel for every portion of the active face of the drill presented to the grinding disk.

As a drill is a rotary body which is being constantly fed in right lines, the path of travel of each and every portion of said drill is in the curve of a helix with a pitch determined by the rapidity with which the drill advances into the substance. Thus in order to have a drill perform the best work and afford it a better bearing and that it may present a maximum cutting edge, experiments have shown that the active surface of the drill should be ground to coincide with a helical surface.

The purpose of my invention is to so grind drills that accuracy and uniformity in the cutting surface of a drill are obtained, while the parts are so designed that the shape of the said surface helicoidal in form can be easily changed, and extremes can be produced.

The gist of my invention is embodied in a drill holder; which is upheld at its front end by a pivotal rocker arm; this arm is adapted to swing toward or from the plane of revolution of the grinding disk. Further the front end of said holder is secured by a pivot to the free end of the rocker-arm, while an adjustable guide-bar at the rear serves to govern the movement of the holder, the latter carrying the end of the drill in a helicoidal plane. Thus my device provides for three adjustments by merely swinging the drill-holder through a predetermined path of movement. First, constant contact of the drill is obtained by aid of the rocker arm; secondly, while as the holder is advanced upon the curved rod, the end of the drill describes a helix of constantly varying pitch; thirdly, as the drill moves in a helical curve the longitudinal axis is constantly changing with respect to the face of the grinding disk and as the holder moves on the rod and approaches the said disk more material on the drill is cut away and "clearance" is produced.

In my device I do away with the use of all screw feed movement.

Other minor features of adjustment will be hereinafter more fully set forth in detail.

The drawings herewith presented represent in Figure 1 a plan of a drill-grinding machine embodying my invention. Fig. 2 is a front elevation. Fig. 3 is a side elevation in which the drill is in position when the act of sharpening first begins. Fig. 4 is a similar view at the completion of the act. Fig. 5 is an end view of the drill and drill holder. Fig. 6 is an elevation in part of a twist drill for purposes of explanation.

This machine embodying my invention is particularly adapted for the sharpening or grinding of twist drills, so termed, one of which shown at 2 is formed as is usual with two grooves, and two ribs or webs 3. 3'., these latter terminate at the lower end of the drill in two similarly shaped, oppositely disposed surfaces 4. 4'. the front edges 5. 5'. or those which first contact with the material as the drill rotates being designated as the cutting edges, while the opposite but corresponding portions 6. 6'. are called the heels. Moreover these latter are formed by increasing the angle at which the drill is held with respect to the grinding stone when the cutting edge is produced. This is what is termed "backing off" and is equivalent to a deeper cut or a stronger feed and gives the drill proper clearance.

Examination of the surfaces 4 4' of any drill ground by my machine will show that they are composed of a series of straight lines which emanate from a common point 7, (the apex of the drill,) and conjointly create a helicoidal surface with a gradually increas-

ing pitch from the cutting edge to the heel, as before stated, to give proper clearance to the tool.

In order to produce such a surface as above premised, I proceed as follows: A base or standard 8, preferably of metal, is provided of any suitable shape, and constructed to fit the bed of an ordinary lathe upon the arbor of which may be mounted the emery or other grinding disk 9. However, the standard may be mounted and operated elsewhere in connection with a grinding disk set up for this special class of work. On the rear side or that adjacent to the disk 9 is positioned a rocker-arm 10, which is pivotally secured at its lower portion and arranged to rock toward or from the front cutting surface 12 of the disk 9, see Figs. 3 and 4. Spanning the top or free end of this arm is a bar 13, movable axially upon pivots 14. 14. This bar is flattened in part to afford a bearing surface 15 upon which rests one end of the tool-holder 17 fastened at 26. This holder is equipped with a notched plate 18, so placed that it will engage a guide-rod 19, which is curved and upheld adjustably by means of two bolts 20. 20′. These latter engage in vertical slots 21. 21′. cut in upright posts 23 23′ which form part of a horizontally movable plate 24 secured to the standard by a pivot 25. These several parts are arranged to allow the angle of the guide-rod to be changed either vertically or horizontally, or shifted to a greater or less angle with respect to the face 12 of the disk 9, and in this way enables the operator to vary the angle of the cutting edge, as likewise the pitch of the helicoidal surfaces 4 4′.

The tool-holder 17 consists of a longitudinal receptacle, V shape in cross section, to adapt it for drills of various sizes. A sliding rest 27 serves to uphold the drill when the latter is pressed against the grinding disk. A stop 28, projecting transversely in part over the end of the holder nearest the disk 9, prevents rotation of the drill during the act of grinding, by engaging under one of the ribs of the drill.

The operation of the machine is as follows, it being assumed that the adjustment of the guide rod 19 has been previously effected: The drill is placed in the V receptacle of the holder and held by the stop 28. The sliding rest has been moved along the holder in order to suit the length of drill to be ground and is to be so placed that the extremity of the drill shall project a short distance beyond the holder in order to allow the latter to complete a full oscillation without coming in contact with the grinding disk. In this way proper clearance is always accomplished. The holder is now swung back, as shown in Fig. 2, until the adjustable stop 30 is in contact with the post 23. A corresponding stop 30′ upon the opposite side is intended to regulate the length of the oscillation at the finish and stop the tool-holder at a fixed point for each particular class of drills if it is so desired. At this time the front or cutting edge of the surface 4, which for instance is to be ground, is coincident with the grinding surface 12 of the disk 9 or on the line *y y*. The axis of the drill is now inclined preferably at fifty-nine degrees with respect to the cutting surface, see line *y y*. However this angle may be varied to suit different varieties of drills, or in the event of employing the apparatus for grinding reamers and like tools it may be adjusted for any desired degree of angle. In case it becomes necessary to grind a cone it is merely necessary to substitute a guide wire of a constant curve and have the opposite ends of the wire in the same horizontal plane. These acts being accomplished the front edge of the holder is grasped and the latter as the disk cuts away the drill is swung slowly toward the post 23′, but as the guide-rod is of spiral shape the front of the drill moves in the curve of a helix, the pitch of which is regulated by the difference in the elevation of the two ends of the guide rod, as well as in the curvature of said rod. Furthermore as the lower extremity of the guide rod is nearest the disk 9 the heel of the drill or that portion which contacts with the disk 9, as the holder advances, is fed forward more than during the first movements of the holder; hence more material is cut away and "backing off" or "clearance" is thus effected and produced. Provided however the proper relation exists between the cutting edge and the heel, in other words when the proper clearance exists, an equal amount will be removed at all points of the surface, provided the holder is swung through an oscillation at the same time that the point of the drill is kept in contact with the grinding disk. The purpose of the rocker-arm is to permit the apex of the drill point to always remain contiguous to the surface of the disk 9, while the front end of the holder advances along the guide-rod or during the oscillation of said holder. It is further to be understood that the angle of the holder is intended to commence at fifty-nine degrees and then to change constantly with the surface of the disk 9, while the effect of the guide-rod obliquely with respect to said cutting face 12 is to increase the feed, or in other words remove more material and thus produce the effect called "backing off," or "clearance." In other words, a helicoidal surface having a uniform curvature is not created, but a surface in which the curvature is constantly increasing or one in which the pitch is varying uniformly and becoming sharper. This is obviously necessary, otherwise the entire surface 4 or 4′ would remain in contact with the substance being bored and no "clearance" would exist. Having ground one face the drill is turned axially through one hundred and eighty degrees and the other face presented to the disk and ground. Owing to the mechanical method adopted it is evident that with the same adjustments, the two faces

4 4′, of the drill must be identical in every respect.

What I claim is—

1. A device for grinding drills composed of a drill-holder, a rocker-arm serving to uphold one end and adapted to swing in a plane normal to the plane of rotation of the grinding disk, and a curved rod which engages the opposite end of said holder and is obliquely disposed to the plane of revolution of said grinding disk, substantially as and for the purposes herein explained.

2. In a drill-grinding apparatus a suitable standard, a drill-holder adapted for oscillation, a rocker-arm secured to said standard and supporting the holder upon its rear end, combined with an adjustable curved guide-rod, and means for connecting the front end of the holder thereto, whereby oscillation of the holder causes the rear end to describe a helicoidal surface, substantially as stated.

3. The combination with a drill-holder, a standard, an arm adapted to rock in a plane normal to the path of rotation of the grinding tool, an axially movable bar thereon and united to one end of the holder, of a horizontally movable plate, a curved guide-rod adjustably mounted on said plate, and means by which to interconnect the front end of the holder with the guide-rod, substantially as described.

4. In a drill-grinding machine, the combination with a standard fixed or otherwise, a movable plate thereupon, a curved rod adapted for horizontal and vertical adjustment, a rocker-arm likewise on said standard and arranged to swing in a plane normal to the path of rotation of the grinding tool, of a drill-holder, means for causing the front end of said holder to engage with the guide-rod, a pivot at the rear end of said holder, and an axially movable bar which receives said pivot and is mounted in the free end of the rocker-arm, substantially as explained.

5. In a drill-grinding apparatus, a movable standard, a pivotal horizontal plate, two vertically slotted posts, a curved guide-rod, both ends of which are adjustable respectively on said posts, a pivotal arm secured to the standard and adapted to rock in a plane normal to the path of revolution of the grinding tool, an axially movable bar in said arm, a drill-holder pivotally affixed at one end upon said bar, means by which to connect the opposite end of said holder with the guide-rod, and devices with which to position the drill and prevent it from turning, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN J. KENYON.

Witnesses:

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