(No Model.)

# M. C. JOHNSON.

## DRILLING TOOL.

No. 542,223. Patented July 2, 1895.

Fig. 1.

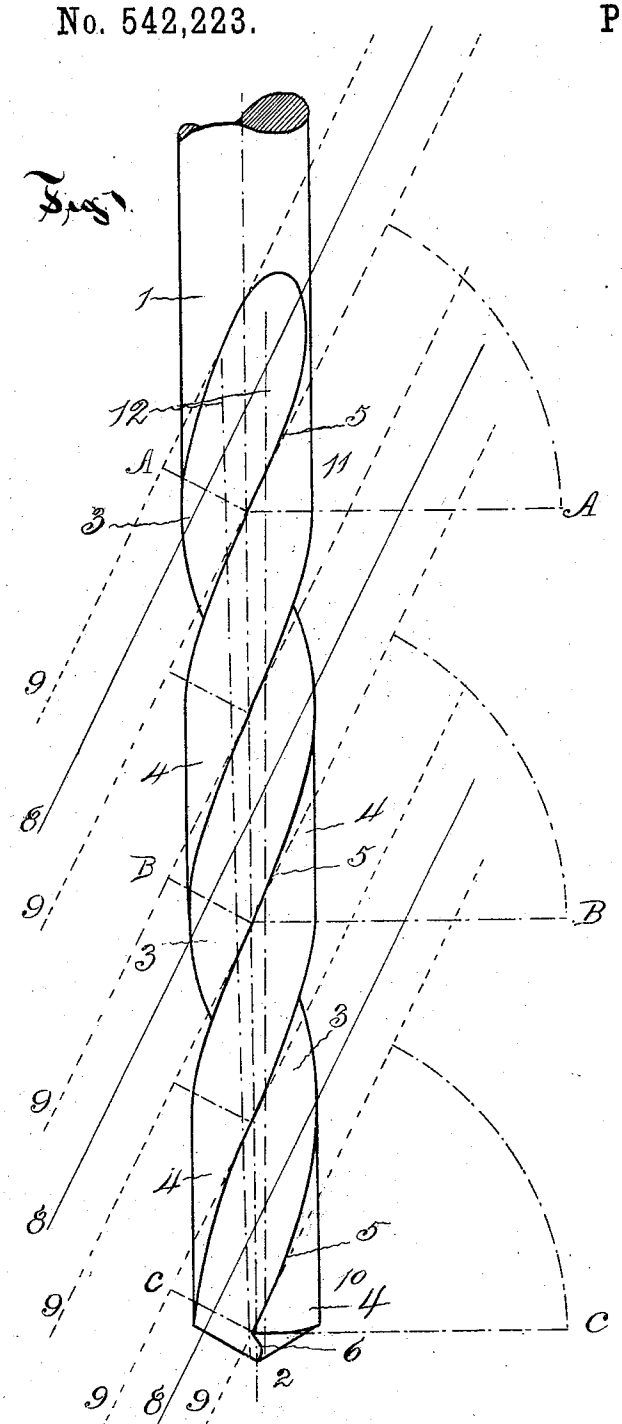



Fig. 2.

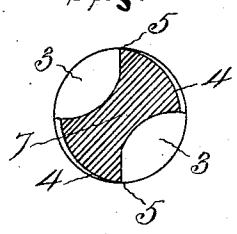



Fig. 3.

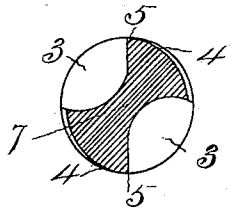
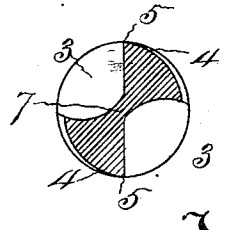



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## DRILLING-TOOL.

SPECIFICATION forming part of Letters Patent No. 542,223, dated July 2, 1895.

Application filed April 19, 1893. Serial No. 471,002. (No model.)

*To all whom it may concern:*

Be it known that I, MOSES C. JOHNSON, of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Drilling-Tools, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

The invention relates to the class of boring-tools that are commonly known as "twist-drills."

The object of the invention is to produce a drill having two spiral grooves that are stiff and strong, so as to resist any tendency to untwist, bend, or break; that will always, until it is worn down to the shank, maintain lips having a constant cutting angle of maximum efficiency to properly raise the chips without an expenditure of excessive force, and that will freely clear itself of chips without unnecessary friction.

To this end the invention resides in a twist-drill which has two parallel spiral grooves of uniform pitch and equal width from end to end, but of gradually-decreasing depth from point to shank, whereby the lands are of equal width, the lines of the cutting-edges of the lands are uniform in pitch and parallel with the pitch of the grooves, and the web gradually increases in thickness from point to shank, as more particularly hereinafter described, and pointed out in the claim.

A drill of this class must have a sharp and properly-shaped point, so that excessive pressure is not required for starting the hole, and so that the drill will be held central and will commence the hole round and true. To insure this the web at the point end of the drill must be thin. It is also necessary that the drill should be stiff and strong, to resist pressure required to feed, to overcome any tendency to untwist and bind against the walls of the hole under the torsional strain caused by the resistance of the metal being cut, to prevent bending out of its course should it bore into soft and spongy metal, and to prevent breaking should it strike hard places in the metal or should too much power be applied to the press. To eliminate these liabilities and enable the making of a proper point, the grooves are made of gradually-decreasing depth from point to shank, so that a web is left which may commence thin at the point and gradually increase in thickness toward the shank. It is also essential economically that the drill be so made that it can be used and resharpened until worn down close to the shank, for the drill rapidly wears away under repeated sharpenings, and it is also considered more desirable when short, for then it is stiffer than when long and can be fed faster and made to cut quicker. To permit this, the drill must turn a shaving the same when worn or ground down close to the shank as when new. Of course, if the cutting angle becomes more and more acute as the drill is worn down the cutting-lips are liable to break, and if the cutting angle becomes more and more obtuse the lips will not cut under and turn the shavings, but will scrape and abrade the chips from the metal, which requires additional pressure to force the drill into its work and reduces the speed of boring. The cutting angle at the point of the drill is that which has the greatest efficiency, and to maintain this constant the grooves are so made that the cutting-edges of the lands are always of the same pitch with relation to the axis of the drill. It is also very necessary that the drill should freely clear itself of the chips which are turned, and to provide for this the grooves must have sufficient area and be of suitable shape to prevent any clogging which would break up the chips and cause such friction that the drill would heat and the chips and drill bind against the walls of the hole, so that the application of great force would be required for turning the drill if it did not become completely stopped. To allow for this clearing of the chips and still keep the pitch of the cutting-edges of the lands uniform, so that the cutting angle will be constant, the grooves are formed of the same width from end to end on a uniform pitch.

Referring to the accompanying drawings, Figure 1 is a side elevation of a twist-drill embodying the improvement. Fig. 2 is a transverse section on dotted line A A. Fig. 3 is a similar section on line B B, and Fig. 4 is a section on line C C.

In the views, 1 indicates the shank of the drill, which may be formed in any commom manner to any regular style; 2, the point, which is ground to the correct shape; 3, the

two parallel spiral grooves, of equal width and uniform pitch, that gradually decrease in depth from point to shank; 4, the lands of uniform pitch and equal width; 5, the cutting-edges of the lands, that are uniform in pitch and parallel with the pitch of the center of the grooves; 6, the cutting-lips formed at the point ends of the grooves, and 7 the web, that gradually increases in thickness from point to shank.

The lines 8 are drawn to show the pitch-lines of the center of the grooves, and 9 are the pitch-lines of the edges of the grooves, which are, of course, also the pitch-lines of the edges of the lands. These lines are of equal distances apart and are all parallel, showing that the width of the grooves is the same and the pitch of the grooves and the lands are uniform and parallel. The angle 10 shows the cutting angle at the point, while that at 11 indicates the cutting angle that would be formed near the shank, and these being the same the cutting angle must be constant. The dotted lines 12 indicate the taper of the web, that increases in thickness from point to shank.

This drill is formed by giving a solid cylindrical steel rod a rotary motion and feeding it at the same time between rapidly-revolving milling cutters or burrs, that are placed with their axes inclined obliquely to the axis of the rod. These cutters have blades or teeth that are somewhat circular in outline, corresponding with the shape of the groove to be cut, and in order to cut the grooves on the same pitch the rod is rotated evenly and fed with a regular uniform movement to the cutters. This insures that the pitch of the grooves will be the same from end to end; but to decrease the depth of the grooves and leave a web of increasing thickness the cutters are gradually drawn away from the axis of the rod which is being cut. Simply drawing the cutters away from the axis of the rod to decrease the depth of the grooves would cause the grooves to grow narrower and narrower, so that they would not have sufficient area to properly clear the chips. This would also cause the pitch of the cutting-edges of the lands to gradually increase, and to provide against this and keep the pitch of the grooves uniform and the pitch of the cutting-edges of the lands uniform and parallel with the pitch of the grooves, and also to make the grooves of uniform width, so as to present a pleasing appearance and provide sufficient area for the discharge of the chips, the axes of the cutters with relation to the rod are moved more and more oblique as they are drawn away from the center of the rod during the cutting from the point to the shank. This changing of the axes of the cutters causes them to cut more and more across the length of the rod, while the pitch of the cut remains the same, for the feeding and rotating of the blank continues regular, and this compensates for the decrease of area of groove caused by drawing of the cutters away from the center, for when the cutters are gradually turned to cut across the drill they make a wider cut, the changing of the axes of the cutters being so proportioned to the movement away from the axis of the rod that the grooves are of uniform width from end to end.

In the form of drill embodying the invention illustrated in the drawings the cutting angle is about sixty-two and one-half degrees at the point, and this angle will always remain the same, for the pitch of the cutting-edges of the lands is always the same, being about one turn in six. The web of this drill is thin at the point, so that a correct point can be ground, and it gradually increases in thickness toward the shank. The grooves are of uniform pitch from end to end and of the same width, which makes the edges of the lands the same pitch, because the milling-cutters at the start are at an angle with the axis of the rod of about twenty-seven and one-half degrees, and are gradually turned as they are drawn from the axis of the rod until they stand at the finish at about an angle of thirty-seven and one-half degrees.

The contour, angle, and area of the groove at all parts of its length are proportional to combine the greatest torsional strength, the most efficient chip clearance, and the best form of cutting-lip.

Drills embodying this invention are stiff, strong, and attractive in appearance. They have a maximum amount of wear, for they can be resharpened and used clear down to the shank. They always cut with the same ease and efficiency, and they freely clear themselves of all chips without sacrificing cutting efficiency or strength.

I claim as my invention—

A boring tool having a shank and a point, with parallel grooves of decreasing depth extending full width on a spiral of uniform pitch from point to shank, and parallel lands extending full width on a spiral of uniform pitch from point to shank, the edges of the lands and the center line of the grooves being parallel and on the same pitch from end to end, substantially as specified.

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