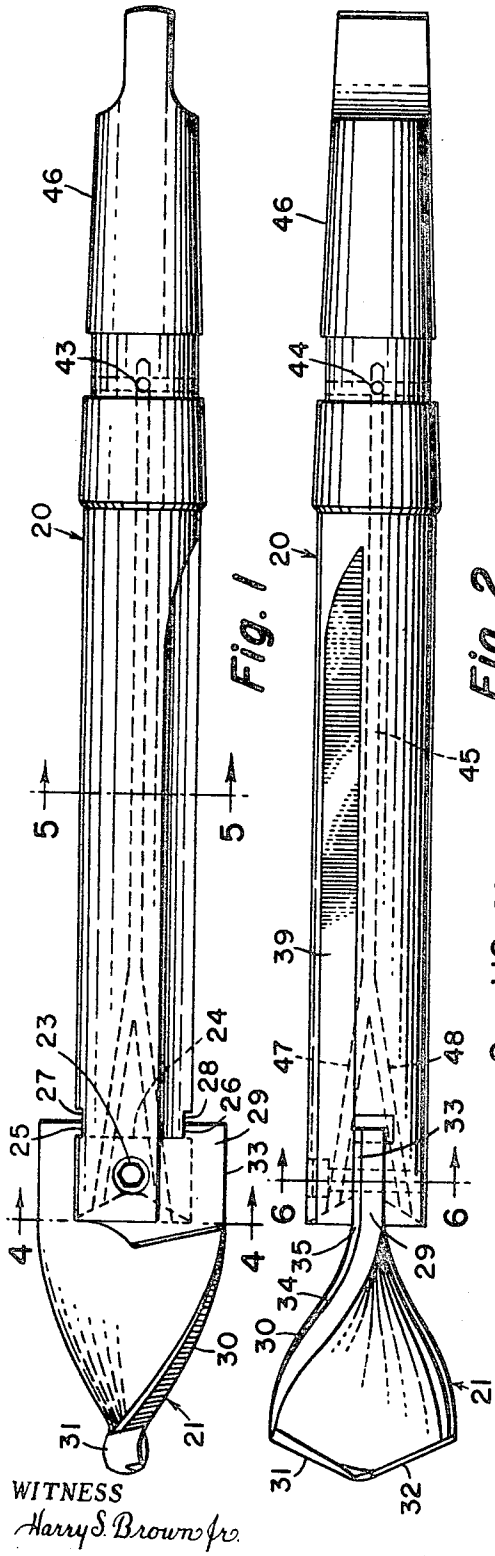
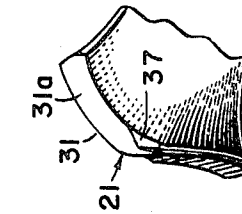
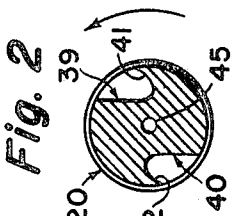
April 8, 1969 A. TOURISON 3,436,990

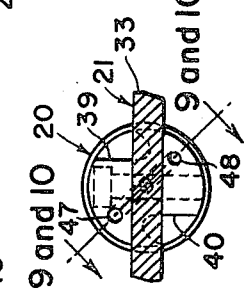
SPADE DRILL

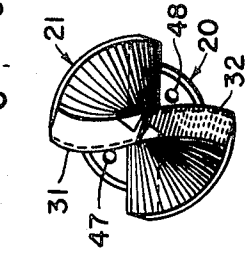
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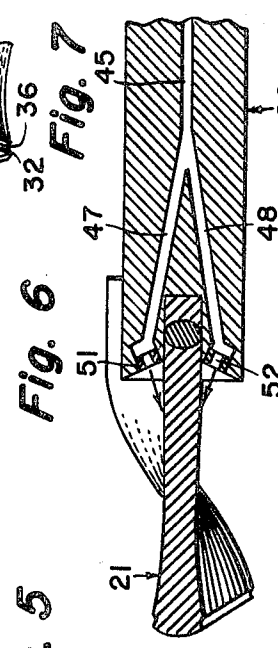


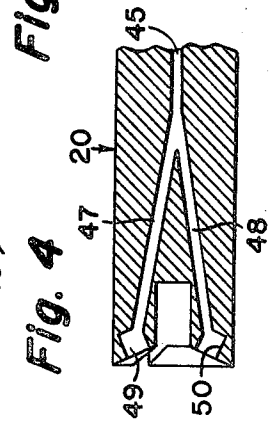


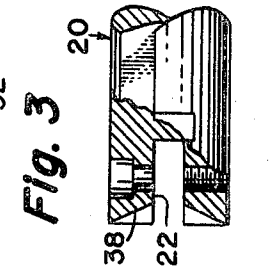












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SPADE DRILL

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U.S. Cl. 77—68 4 Claims

ABSTRACT OF THE DISCLOSURE

A drilling tool including a holding bar and a helical twisted cutting bit mounted in the end of the holding bar.

This invention relates to the construction of a form of drilling device which usually consists of a replaceable cutting bit mounted in the end of a holding bar. The conventional drill of this type has a flat bit of greater width than the bar, producing a spade-like appearance giving rise to the term "spade drill." This term distinguishes the device over the other common form of drill referred to as a "twist" drill, which has a helical configuration substantially throughout its length of many diameters. One of the factors limiting the effectiveness of a twist drill is the large torsional deflection. This resilience combines with the well-known "stick-slip" characteristic of friction

The present invention provides many of the advantages to produce a chattering action rather than a smooth cut. of the twist drill while eliminating most of the torsional deflection, and with it eliminating the chattering. A short helical portion back of the cutting edge makes possible continued re-sharpening without weakening the bit or sacrificing the required angular relationships of the cutting edge. The length of the helical portion is selected in terms of the pitch of the helix to give desired bearing characteristics in the drilled hole. This also defines a space in which coolant can be projected straight at the working portion of the cutter. The combined effect of the short helical portion with the flat portion engaging the bar produces a pair of bearing surfaces on the opposite sides of the bit having combined straight and helical sections meeting at an angle, with these compound bearing areas being relatively close to the cutting edge to provide maximum stability.

The best combination of these flat and helical bearing areas, and the best helical length (in terms of angular displacement about the drill axis, known as "lead," or "pitch" of a helix) is produced by limiting the axial length of the helical portion to between 45 and 90 degrees of rotation, which is to say that the cutting edge is displaced from the flat portion of the bit by this amount. The short bits resulting from this requirement can be made by casting or forging, permitting the use of many desirable alloys not usable in twist drills. The term "helical" may be considered here as including some twisted configurations that depart from a true helix, such as a bending of each side of the bit along lines extending outward and rearward from the point.

This invention also provides a holding bar that improves the action of the streams of coolant. These streams are positioned to make use of the configuration of the bit and the space defined by it. The flow of chips from the cutting area outward along the bar induced by the coolant is also assisted by reducing the tendency of the chips to jam between the bar and the wall of the hole. This action is obtained by the disposition of the surfaces defining the chip-flow channels in the side of the holding bar, particularly with regard to the angular relationship between the junction of these surfaces with the periphery of the bar.

The several features of the invention will be analyzed in further detail through a discussion of the particular embodiments illustrated in the accompanying drawing. In the drawing:

FIGURE 1 is a side elevation of an assembled drilling device including a boring bar and a cutting bit.

FIGURE 2 is a further side elevation, with the unit rotated 90 degrees about its axis from the FIGURE 1 position.

FIGURE 3 is an end view of the device as shown in FIGURE 2.

FIGURE 4 is a section on the plane 4—4 of FIGURE 1.

FIGURE 5 is a section on the plane 5—5 of FIGURE 1.

FIGURE 6 is a section on the plane 6—6 of FIGURE 2.

FIGURE 7 is a perspective view of the cutting edge of the replaceable bit.

FIGURE 8 is a partial section showing the end of the holding bar.

FIGURE 9 shows a section on the plane 9—9 of FIGURE 4.

FIGURE 10 shows an assembled drilling device utilizing modified coolant passages.

The drilling device shown in FIGURES 1 through 5 includes the holding bar generally indicated at **20** and the replaceable cutting bit **21**. The bit **21** is received within the slot **22** (refer to FIGURE 8), and is held in place by the screw **23** which traverses the bar **20** on the opposite sides of the slot **22**, and also traverses an appropriately located hole in the bit **21**. The rear edge of the bit is offset as shown at **24**, producing the surfaces **25** and **26** which engage the milled flats **27** and **28** on the bar **20** to maintain the alignment of the bit with respect to the bar.

The bit **21** has a flat portion **29** which engages the slot **22**, and the helical portion **30** extending axially from the end of the holding bar **20**. The axial length of this extension is best defined in terms of the amount of angular displacement of the helix forming the portion **30**. Reference to FIGURE 3 will show that the cutting edges **31** and **32** can be considered as disposed close to a plane which is displaced by 90 degrees from the planar surfaces defining the flat portion **29**. Reference to FIGURE 3 will establish that the result of this arrangement is that the edges of the bit provide bearing surfaces that engage the wall of the hole being drilled at points corresponding to the ends of perpendicular diameters. This configuration results in accurate placement of the cutting bit both parallel to and transversely with respect to the general alignment of the cutting edges. As the bit is re-sharpened, the axial length of the helical portion **30** is progressively reduced. In terms of the "advance" of the helix, this axial length can be decreased from 90 degrees to 45 degrees without seriously impairing the alignment characteristics. As the sharpening continues beyond this point, the advantages of the bit configuration progressively decreases.

It is also significant to note that the edges defining the bit **21** are a compound surface which includes the straight portions **33** and the helical portions **34** meeting at the point **35** at what amounts to the apex of an angle. Preferably, the edge of the bit **21** is machined in such a manner that the bearing is confined to a relatively narrow strip, with remainder of the thickness of the bit being formed with a clearance angle. The relatively short helical length of the bit combines with the axial straight portions **33** to produce a combined guiding surface having the effect of minimizing the tendency of the bit to wander as it encounters irregularities in the surface of the hole being drilled.

The actual cutting edges of the bit **21** are best shown in FIGURE 7. The conformation on the opposite sides of the axis is the same, with the cutting edges **31** and **32** being defined by the intersection of the back surfaces as shown at **31***a* with the chip-breaker grooves as shown at **36**. These are standard configurations in the art of sharpening drills. Preferably, the area adjacent the point of the drill is machined with the "point splitting" recesses **37** to reduce the amount of material in direct abutting engagement with the end of the hole being drilled.

The holding bar **20** is constructed to facilitate the flow of chips from the cutting area out past the bar to the point of emergence of the hole from the workpiece. Two factors are primarily responsible for this improved performance, one of these being a concave conical surface **38** defining the end of the bar **20**. It has been conventional practice for the ends of holding bars to be convex, with the net result that chips tend to move outward into the limited space between the periphery of the bar and the wall of the hole, thus tending to produce a jamming action. The concave configuration of a surface **38** tends to urge the chips into the passage defined by the side recesses **39** and **40** and the wall of the hole being drilled. It is significant that the portions **41** and **42** of these side recesses are surfaces which are inclined "back" from a radius to the axis of rotation of the bar. This inclination produces a tendency to move the chips away from the wall of the hole toward the axis of rotation of the bar, and thus inhibit a jamming of the chips between the periphery of the bar and the hole. This action, together with the flow of coolant, improves the removal of the chips.

Coolant is supplied to the drilling device via the transverse passages **43** and **44** which lead into the axial passage **45**. The coolant supply is delivered to the device through the chuck or collet (not shown) of the machine which holds the drilling device at the tapered surface **46**. From the axial passage **45**, the flow is diverted through the passages **47** and **48** to the point where these passages emerge at the concave surface **38**. The diverging sprays produced by this configuration can be modified through the arrangement shown in FIGURES 9 and 10. Here the diverging passages **47** and **48** terminate in the recesses **49** and **50** which are machined with an opposite inclination to the axis of the holding bar, and of sufficient diameter to admit the drilling equipment used for establishing the passages **47** and **48**. The recesses **49** and **50** may be provided with ring-shaped inserts as shown at **51** and **52**, having the net effect of producing a convergent flow in the direction of the arrows shown in FIGURE 10. This convergent flow will result in projecting a stream of coolant in the helical space defined on opposite sides of the cutter **21**, and will throw the coolant directly at the active area of the cutting bit where the generation of heat is most intense. One of the significant advantages of the short helix of the cutter **21** is that a straight line representing the path of the flow of coolant of the arrangement shown in FIGURE 10 may be projected through the helical space without deflection or interruption from contact with the surfaces defining this helical space.

Referring to FIGURE 6, a modified form of holding bar is illustrated in which the screw **53** locks the cutter **54** with respect to the bar **55** by intersecting the cutter at an acute angle with respect to the flat sides of the cutter. This arrangement has the effect of increasing the spaces **56** and **57** defining the chip-flow passages. A comparison of FIGURE 6 with FIGURE 4 will show that the driving effect of the holding bar is confined to opposite sides of the cutting bit, and the remainder may be largely machined away to provide for the passage of the chips. The angular relationship of the locking screw **53** will permit more of the material of the bar to be cut away so that the chip flow space is increased.

The particular embodiments of the present invention which have been illustrated and discussed herein are for illustrative purposes only and are not to be considered as a limitation upon the scope of the appended claims. In these claims, it is my intent to claim the entire invention disclosed herein, except as I am limited by the prior art.

I claim :

1. A drilling tool, comprising:

a holding bar; and

a drill bit having a flat portion normally engaged in the end of said bar, said bit being of greater circumscribed diameter than said bar, and also having a helical twisted portion of substantially constant radius extending from the end of said bar and terminating at opposite cutting edges, said helical twisted portion extending axially for a distance corresponding to between forty-five and ninety degrees of advance of said helical portion.

2. A drilling tool as defined in claim **1**, wherein a straight line can be extended throughout the length of said twisted portion from each of said cutting edges within the space defined by said twisted portion inside a circumscribed cylinder around said twisted portion, whereby a coolant stream can be projected from said holding bar directly at the area on said drill bit adjacent said cutting edges.

3. A drill bit as defined in claim **1**, wherein the edges of said axially extending helical portion form bearing surfaces having an angular configuration.

4. A drilling tool, comprising:

a holding bar having a driving portion provided with concave end surfaces disposed primarily in diametrically opposite ninety degrees sections on opposite sides of a slot for receiving a drill bit, said holding bar also having a torque-transmitting portion extending axially from said driving portion, and having a chip-passage surface extending axially and having a concave configuration in cross section whereby said chip-passage surface intersects the peripheral surface at an angle less than ninety degrees to urge chips away from the wall of a hole being drilled; and

a drill bit including a flat axial portion normally engaging said holding bar, a helical twisted portion of substantially constant radius extending from the end of said flat portion and terminating at opposite cutting edges, said helical twisted portion extending axially for a distance corresponding to between forty-five and ninety degrees of advance of said helical portion.

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U.S. Cl. X.R.

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