

United States Patent

Koslow

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[54] TAPER DRILL

[72] Inventor: George Koslow, 149 Church Street, New York, N.Y. 10007

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[51] Int. Cl. B23b 51/02

[58] Field of Search 408/202, 226, 229, 230

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Primary Examiner—Francis S. Husar

Attorney—A. H. Caser

[57] ABSTRACT

There is provided a tapered drill bit for making straight holes with portable electric drills characterized by having improved features of safety, drilling ease, speed, and utility.

8 Claims, 10 Drawing Figures

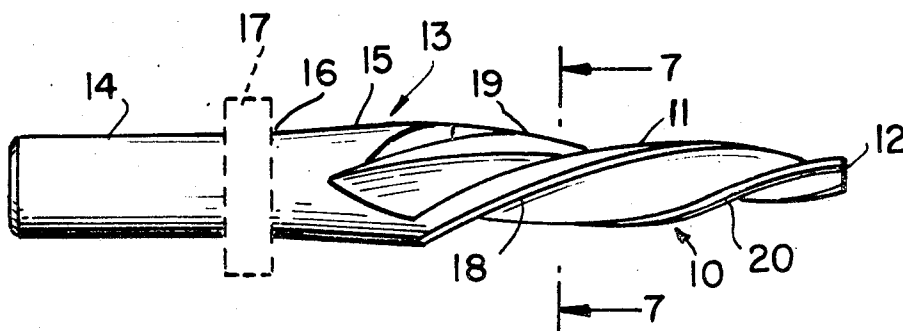


FIG. 1

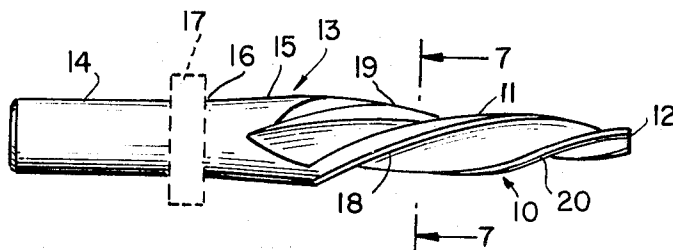


FIG. 1a

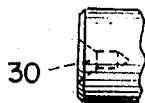


FIG. 1b

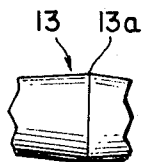
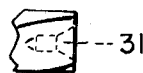


FIG. 2

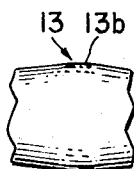


FIG. 3

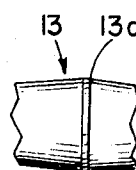


FIG. 4



FIG. 5

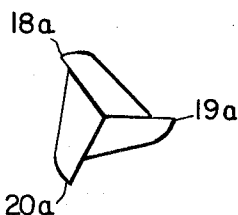


FIG. 6

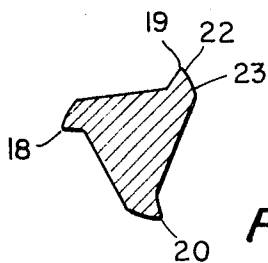


FIG. 7

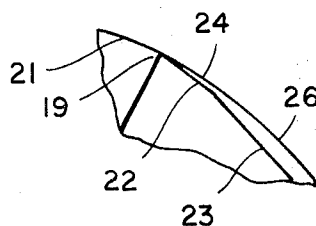


FIG. 8

INVENTOR.
GEORGE KOSLOW

BY *A. H. Caser*
ATTORNEY

TAPER DRILL

BACKGROUND OF THE INVENTION

The field of the invention comprises drills or bits. Drills, or drill bits as they are often called, have been used a long time for making holes. They work well when used in drill presses because designed for such application, but in recent years they have been used increasingly in portable electric or air-powered drills, and here their use leaves much to be desired. Thus, the portable tool is hand held, and therefore the pressure is not uniform and often too small; there is a tendency for the operator to lean to the side owing to fatigue, and this may lead to jamming and perhaps injury; and with larger bits, say above about $\frac{3}{8}$ -inch diameter, the problems are aggravated because the operator's strength is taxed. The resulting holes are usually not square, or may be out of round, and in any event require much time. In addition, as the drill end or point comes out through the back of the workpiece, it tends to act like a screw and to pull itself forward, and in the result the bit may break, or it may jam in the hole and thus cause the portable drill to twist out of the operator's hands before he can release the switch, leading to possible injury.

These portable tools and the drill bits used therein do not produce accurate work, but for the purposes of the user, the quality is sufficient. Generally, he simply wants to make a hole, as in iron work, sign hanging, fire escape repair, etc., which will accept a bolt or rivet.

The drill bits described herein provide desirable improvements over the conventional bits, particularly in respect of safety. Thus, they will not jam as they complete the hole, nor will they jam if the operator leans to one side while drilling. This freedom from jamming removes the most common cause of injuries sustained by portable drill users. An improvement in drilling time is also apparent, the drills being capable of producing holes in, generally speaking, about half the time of conventional drills. Increased utility is possible as the new drills can provide holes of any desired diameter, within the limits described below, and they can be resharpened. While their accuracy is not greater than the conventional, the foregoing advantages make a contribution in this respect and are meritorious in and of themselves.

SUMMARY OF THE INVENTION

Broadly speaking, the tapered drills of the invention comprise a tapered body or cutting portion, a rear shank portion for engagement by a chuck, and between these portions an intermediate shank portion which has a progressively decreasing diameter as it extends from the tapered body to the rear shank portion. By virtue of such decreasing diameter, the drills will not jam as they complete the hole. Other and preferred features of the invention, with their advantages, are described below.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated in the accompanying drawings, in which

FIG. 1 is a side view of a drill of the invention;

FIGS. 1a and 1b are enlarged partial views of the shank end and the cutting end, respectively, of the drill, showing a modification;

FIG. 2 is a broken view of the central section of the drill of FIG. 1, with other construction omitted, showing how the body or cutting portion merges into the intermediate shank portion;

FIGS. 3 and 4 are like FIG. 2 but showing modifications;

FIG. 5 is a partial view of the cutting end of the drill but showing a modification;

FIG. 6 is an enlarged end view of FIG. 5;

FIG. 7 is an enlarged sectional view along line 7-7 of FIG. 1; and

FIG. 8 is an enlarged fragmental view of a cutting edge of FIG. 7.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

Referring to FIG. 1, the drill 10 comprises a tapered body or cutting portion 11 of progressively increasing diameter extending from a cutting end 12 of small diameter substantially to a rearward section 13 of large diameter. At the back end of the drill is a rear shank portion 14 which is engaged by the chuck of the drilling machine, be it a drill press or a portable tool, and between such portion and the section 13 is an intermediate shank portion 15. The latter has a progressively decreasing diameter as it extends from section 13 to a reduced portion 16. At portion 16 is a collar 17, which is preferably incorporated in the drill, although as indicated by the broken-line outline, the collar is an optional structure; it is useful to prevent the chuck from striking the workpiece as the drill passes through the hole. Shank 14, which comprises the drill holding or driving means, may be straight, as shown, or may be provided with a conventional Morse taper or other type of external or internal driving means.

The body 11 has at least one cutting edge, and usually has two or three, although it may have more. There are three cutting edges on the drill 10, identified as 18, 19, and 20 (note also FIG. 7). As is apparent, each edge is disposed in a right-to-left spiral, some times termed a left hand spiral, and in this way, assuming right hand rotation, there is avoided the tendency of the drill to pull itself forward into and through the hole during drilling.

As shown in FIG. 8, each cutting edge has primary and secondary clearances between it and the walls of a hole being drilled. In this view, a cutting edge is shown at 19, being an enlargement of the edge 19 of FIG. 7, and the wall of a hole is shown partially at 21. It is apparent that between the outermost surface 22 of the drill and the wall 21, there is a clearance, here designated the primary clearance, and this corresponds approximately to an angle of 2° to 8° , considering the angle to be defined by surface 22, cutting edge 19, and the curved wall of the hole designated 24 for convenience. Also, between the outer surface 23 of the drill and the wall of the hole, the latter designated 26 for convenience, there is a secondary clearance corresponding approximately to an angle of 5° to 12° , which angle is larger than that defining the primary clearance. For convenience, the primary clearance may be identified as 22-24 and the secondary clearance as 25-26. During drilling, if cut particles lodge in the primary clearances, the drill will still be able to cut, for it may be noted that the primary clearances can empty themselves of particles by discharging them into the larger secondary clearances. By contrast, conventional drills have a primary clearance corresponding to an angle of 0° , i.e., they have no primary clearance but rather are cylindrical at the location in question, and if cut particles are pushed against the side of the rotating drill, it will not cut, or will not cut well.

Although the clearance surfaces 22 and 23 are shown as flat in FIG. 8, they may be, and usually are, slightly concave, as produced by the grinding wheel. They may also be slightly convex, and in such case the two surfaces may become one single surface.

As may be apparent, the drilling may be stopped short of full penetration of the drill in order to make a hole of any desired diameter intermediate the diameter of cutting end 12 and the diameter of the section 13. Holes of a diameter smaller than the largest diameter of section 13 will, of course, be tapered, but usually this is not of importance. However, the drill is intended primarily to produce a straight nontapered hole of a diameter corresponding to the largest diameter of the tapered body portion 11.

At FIGS. 1a and 1b, which show portions of each end of the drill, a center recess 30, 31 is provided in the drill ends to facilitate mounting of the drill in a tool grinder for resharpening. Such recesses may or may not be present on any or all the modifications having a blunt cutting end, as desired, although they may be seen to constitute a useful structure.

In FIG. 2, the section 13 is the same as in FIG. 1, comprising a circumferentially extending edge which may be designated 13a. In a general way, FIG. 2 indicates that the drill comprises two conical portions, one to the right of edge 13a and the other to the left of it. Actually, the drill of FIG. 2 is less expensive to fabricate than the other modifications, entailing in essence the formation of two conical portions.

In FIG. 3, the section 13 is the same as in FIGS. 1 or 2 except that the edge 13a of FIG. 2 has been rounded as at 13b. Such rounding will reduce the wear that may occur with an edge like 13a.

In FIG. 4, the section has been extended, so to speak, to form a cylindrically shaped portion 13c of rather short length, the purpose again being to reduce the wear that may occur with edge 13a.

Resharpener of the cutting edges of all the drills is possible, using a conventional tool and cutter grinding machine in which a drill is supported at each end thereof, as in the recesses described, or by the shank. When reground, the drill of FIG. 1 will drill a hole of slightly smaller diameter than the original drill, while the drills of FIGS. 3 and 4 may be resharpened once or twice without reducing the diameter of the drilled hole; in either case, the drills can if desired be made slightly oversize to compensate.

In FIGS. 5 and 6, a modified point or cutting end is shown which is capable of drilling a hole directly, i.e., without using a pilot drill. Such points are conventional. The blunt cutting end 12 of FIG. 1 requires that a pilot drill be used to start the hole. In FIG. 6, the cutting end has three cutting edges, identified as 18a, 19a, and 20a.

While the preferred cutting edges have a right-to-left spiral, or left-hand spiral (for right-hand rotation of the drill), for the reason described, it is also possible to dispose the edges in a left-to-right, or right-hand, spiral, or to dispose them in a non-spiral arrangement wherein each edge lies in a plane that passes through it and the longitudinal center line of the drill. The last-mentioned nonspiral disposition of the cutting edges, i.e., wherein the flutes or channels between the cutting edges are straight, while less preferable for jam-free operation, nevertheless has some advantages in respect of fabrication economy, adaptability to certain types of materials, and suitability for receiving carbide inserts to increase the drill life. It may also be noted that other dispositions of the cutting edges are possible, including a spiral arrangement where the spirals are unequal, or an arrangement comprising mixed spiral and straight flutes, or an arrangement in which the flute spacing is unequal.

Referring to FIG. 1, the taper of portion 15 need not necessarily be that of a true cone as such portion may also have convex or concavely shaped surfaces, although the portion is always conical.

As is thought to be clear from the foregoing, the drills provide improved safety of operation when used in portable tools, being free of any tendency to jam as they complete the hole, and also being free of a tendency to pull. By virtue of the tapered cutting portion they are free of jamming tendency if the operator leans to the side while drilling. Thus injuries are avoided. Faster, easier drilling is possible by the avoidance of jamming and pulling, and also by the reduction of torque and axial pressure required. And the utility of the drills is improved by their ability to drill holes of varying diameter, as described. The drills can be resharpened, and this capability may be increased by extending the flutes into the tapered shank portion 15.

It will be understood that the drills may be fabricated of any metal heretofore used, or suitable, for making drills. It will

also be understood that any of the modifications may be provided with the stop collar 17, or it may be omitted from any modification; that the recesses 30 and 31 of FIGS. 1a and 1b may be present on any modification or omitted; that the cutting end may be blunt as at 12 of FIG. 1 or pointed as in FIG. 5; and that any of these features, and the others described above, may be combined in any desired way.

It will further be understood that the invention is capable of obvious variations without departing from its scope.

In the light of the foregoing description, the following is claimed:

1. A tapered drill for drilling hard materials having improved features of safety, drilling ease, and utility comprising a tapered cutting body of progressively increasing diameter extending from a cutting end of small diameter substantially to a rearward section of largest diameter, said tapered body being capable of cutting a straight hole in a workpiece of a diameter corresponding to said largest diameter of said rearward section, an intermediate shank portion extending rearwardly from said section and having a progressively decreasing diameter, said intermediate shank portion by virtue of the decreasing diameter thereof providing jam-free operation of the drill as the hole is completed, the tapering of said cutting body providing jam-free operation if the drill is accidentally leaned to one side during drilling, and a rear shank portion extending rearwardly of said intermediate shank portion for engagement by a chuck of a drilling tool.

2. Drill of claim 1 wherein said tapered cutting body has at least one cutting edge, each said edge being disposed in a right to left spiral, thereby to avoid pulling of the drill into said hole during drilling using right-hand rotation of the drill, a reduced portion between said intermediate shank portion and said rear shank portion, and a collar at said reduced portion for engaging said workpiece to prevent further passage of the drill therethrough.

3. A tapered drill having improved features of safety, drilling ease, and utility comprising a tapered cutting body of progressively increasing diameter extending from a cutting end of small diameter substantially to a rearward section of large diameter, said tapered body having at least one cutting edge with each said edge being disposed in a right-to-left spiral, thereby to avoid pulling of the drill into a workpiece during drilling, said tapered body being capable of cutting a straight hole in said workpiece of a diameter corresponding to the largest diameter of said body, each said cutting edge having primary and secondary clearances with respect to the walls of a hole being drilled in said workpiece, an intermediate shank portion extending rearwardly from said section and having a progressively decreasing diameter, said intermediate shank portion aiding to provide jam-free operation of the drill, a collar adjacent the back end of said intermediate shank portion for engaging the workpiece and preventing further passage of the drill therethrough, and a rear shank portion extending rearwardly of said collar for engagement by a chuck or other driving means.

4. Drill of claim 3 wherein said section of large diameter comprises a circumferentially extending edge.

5. Drill of claim 3 wherein said section of large diameter comprises a circumferentially extending rounded portion.

6. Drill of claim 3 wherein said section of large diameter comprises a cylindrical portion of short length.

7. Drill of claim 3 wherein said small diameter cutting end is blunt.

8. Drill of claim 3 wherein said small diameter cutting end is pointed and able to start its own hole.

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