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ACOUSTICAL TILE DRILL

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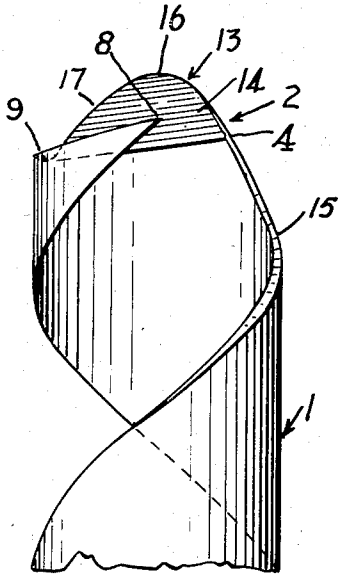


Fig. 1

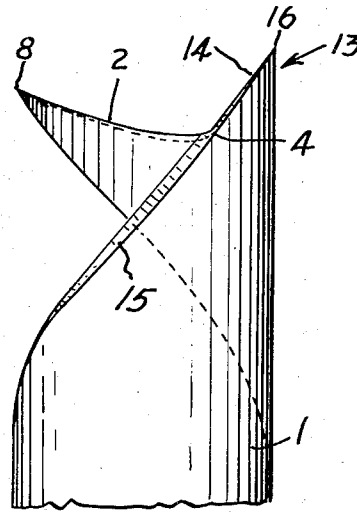


Fig. 2

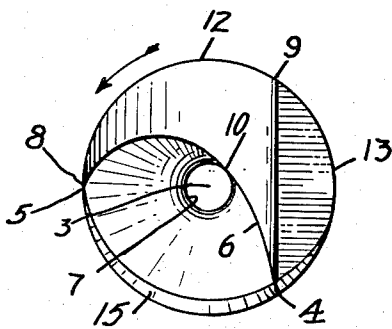


Fig. 4

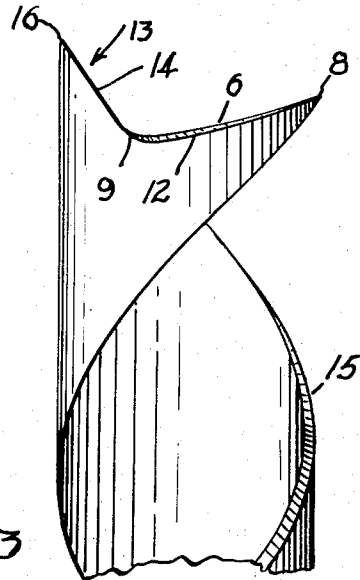


Fig. 3

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ACOUSTICAL TILE DRILL

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5 Claims. (Cl. 145—117)

This invention relates, as indicated, to single-fluted drills. It pertains particularly to drills which are designed for operation in relatively-soft, non-metallic fibrous material such as, for example, acoustical board. Acoustical board is ordinarily made of soft fibrous material in order to provide the maximum sound-deadening effect and in order to increase such sound-deadening effect, it is common practice to drill small holes into one face of such board, which holes are generally about $\frac{3}{16}$ " in diameter but which may be larger or smaller, for example, $\frac{1}{8}$ " or $\frac{1}{4}$ " and do not extend all the way through the board. A drill in order to perform this function must be able to form a clean sharp hole and to carry out of the hole all of the material which has been cut away.

It is a principal object of this invention to provide a drill which has a specific combination of properties suiting it especially for this particular purpose.

It is a further object of this invention to provide a drill of the character described which may be made at a relatively low cost and which is capable of being resharpened repeatedly by very simple operations.

Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a side elevation of the forward end and point of a drill constructed in accordance with this invention;

Fig. 2 is a view of the same drill shown in Fig. 1 taken on a plane at right angles to the plane on which Fig. 1 is taken;

Fig. 3 is a view of the drill shown in Figs. 1 and 2 taken on a plane 180° with respect to the plane on which Fig. 2 is shown; and

Fig. 4 is an end elevation view of the point of the drill.

Referring now more specifically to the drawing, and more especially to Figs. 1 and 2, the drill here illustrated as one embodiment of this invention comprises a cylindrical main body portion generally indicated at 1, on the end of which is formed the cutting end of the tool generally indicated at 2. In this connection and throughout the following description, the words "cutting end" are used to denote the entire forward structure of the tool which, during normal usage, performs most of the functions for which the tool is used.

The cylindrical body of the tool is formed of a land and flute. The land is, of course, the helically-extending solid portion of the body 1 and the flute is the cutaway portion or helical groove in the cylindrical body. The flute extends from the cylindrical land on the leading side, when rotating in use, to the secondary clearance on the following side. The leading edge of the flute is therefore upon the cylindrical land and the following edge upon the secondary clearance.

As viewed in Fig. 4 the center or longitudinal axis of the drill is indicated at 3. One edge of the flute is indicated at 4 and the other edge of the flute is indicated at 5. The shape of the flute or surface of the land as

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indicated by the line 6 which extends between points 4 and 5 in Fig. 4 is such that it extends below or beyond the center or axis 3. This distance by which the flute extends below center is on the order of .010" to about .020" in the size of drill customarily employed for the drilling of acoustical tiles which, as indicated above, generally utilizes a drill which is of $\frac{3}{16}$ " in diameter. When other sizes are made, the flute should extend below the center from 5% to 12% of the diameter of the drill. When looking at the end of a single-fluted drill, in which the flute is machined below center, the drill as shown in Fig. 4 has the appearance of having a hollow core which is cylindrical and whose diameter is twice the distance by which the flute is ground below center. The apparent cylindrical core is bounded in Fig. 4 by the circle generally indicated at 7.

In order to properly clear the hole and carry out of the hole the fibrous material which the point of the drill has cut away, the helix angle is important. For best results, it has been found that a single-fluted drill which has a helix angle of about 45° will operate most efficiently. For some purposes helix angles of 40° to 60° may be employed.

The width of the flute is important also to the successful operation of a drill which is to work in fiber board such as is used for the production of acoustical tile and board. While the overall size of the drill has a bearing on the best value for flute width, it has been found that for drills which are on the order of $\frac{3}{16}$ in diameter, the flute width should be 60% to 95% of the width of the land or $\frac{5}{32}$ of an inch minimum in order to provide ample clearance for the discharge from the hole of the fibrous material which has been severed by the point of the drill. For other sizes the flute should be from 60% to 95% of the land width.

The body of the drill is, of course, preferably made of metal such as steel. A highly-polished flute surface is highly desirable to facilitate discharge of the severed material from the hole and at this point it may be noted that electro-polishing is a convenient mode by which such polished surface may be secured not only on the surface of the flute itself, but also on the outer surface of the cylindrical body 1 of the drill. Since the materials referred to above in which drills of this type operate are many times highly abrasive, it is within the contemplation of this invention to form a part or all of the cutting end or other portions of the drill of tungsten carbide or other hard metal inserts or bodies for the purpose of decreasing the rate of wear at the critical points.

While the size, shape and relative proportions of the flute and land are important to the successful operation of a tool of this kind, nevertheless, the success thereof is dependent to a very large extent upon the formation of the cutting end.

The cutting end 2 of the drill of the present invention is formed in part by the intersection of the cylindrical land of the tool with a substantially flat plane which extends at an angle to the longitudinal axis of the drill and in such relation to said land that the most forward point of said land in said plane is on one of the lines of intersection between said land and flute.

As most clearly illustrated in Fig. 4 the area between lines 4, 8 and 9 is flat and is formed by the aforesaid flat plane intersecting the end of the cylindrical body of the drill. The most forward point of the land in said plane is indicated at 8 and it is also the apex of the cutting edge of the tool.

The intersection of the flute and said plane just referred to forms an edge on the land where it intersects said plane, as indicated by the line 6 in Fig. 4. The cutting edge of the tool, extending between points 8 and 10 on line 6, is formed on the edge made by the intersection of the

land with said plane. It extends from the apex of said plane at 8 to the point 10 immediately adjacent to the axis of the body. It will thus be observed that the shape of the flute, that is, the shape to which it is machined determines the shape of the cutting edge. For best operation of tools of the character to which this invention relates, the flute should have a shape such that it will provide a hooked cutting lip on the cutting end of the tool. As shown in Fig. 4, this hooked cutting lip extends between the points 8 and 10 on the line 6. The edge of the cutting lip, that is, the edge formed by the intersection of the flute side of the land with the aforesaid plane forms the cutting edge which severs the work from the body of the fibrous board.

It will be noted that the cutting function performed at the end of the tool by the hooked cutting edge extends only from points 8 to 10, assuming of course that the tool rotates in the direction of the arrow on Fig. 4. The edge from point 10 to 4 moves backward out of contact with the work during such rotation of the tool. It will be here noted that while the cutting edge extending from point 8 to 10 severs all of the work encountered by that edge, there is a pillar of uncut work left in the center having the size of the circle 7. This uncut pillar is of assistance in insuring that the portion of the work which has been cut away is discharged efficiently from the hole. When no pillar is left, the cut portion tends to ball up and bind instead of being freely discharged. When the drill reaches the extent to which the hole is to be formed and is then axially retracted from the hole, the strength of the fibers in the pillar in the circle 7 is such that it always tears off at the base and the pillar is then discharged from the hole, leaving the hole clean and free of all severed material.

As indicated above, the angle of the plane which intersects the end of the land bears such a relation to the axis of the tool and to the land itself that it will provide the necessary clearance behind the cutting edge. This clearance is in effect in two directions. In the first place, the area immediately behind the cutting edge which lies between lines 6 and 12 as most clearly illustrated in Figs. 4 and 3 extends rearwardly from the cutting edges 8 to 10 towards 12 and similarly the area on the end of the land which lies between the most forward point 8 and the points 4 and 9 likewise extends rearwardly of the point 8 towards the line 4, 9. This relationship between the two clearance areas is vitally important in the successful operation of a tool in fibrous material.

In order to preliminarily score the work and to insure the formation of a clean, round hole, the cutting end of the tool is provided with a spur 13 formed by the intersection of a plane generally indicated at 14 on Fig. 1 and Fig. 3 with the end of the land, the plane 14 being at such a position and so angularly related to the land and the axis of the tool that the spur left on the point of the tool extends axially and circumferentially in maximum circumferentially trailing position with respect to the most forward portion 8 of the cutting edge. This spur extends axially to its tip 16 for a distance which is at least slightly ahead of the point 8.

It will be observed that this location places the scoring portion of the spur 17 on the opposite side of the axis from the hooked end 8 of the cutting edge. This arrangement tends to balance the sideways thrust of these two operating edges so that a straighter, rounder hole can be produced. To keep friction at a minimum, the wedge angle of the spur should preferably be between the limits of about 15° to about 25°.

It should now be noted that the plane which forms the area on the end of the land between locations 4, 8 and 9 slopes rearwardly toward the base of the spur 13. This is important to the successful operation of the tool and for best results in not only shearing the fibrous material cleanly and efficiently, but also in order to properly provide for removal of the cutaway parts from the hole.

The trailing edge of the land generally indicated at 15 formed by the intersection therewith of the helical flute is provided with a secondary body clearance which extends for a substantial distance rearwardly onto the body of the tool for the purpose of decreasing the frictional resistance between the point of the tool and the work and for providing more space for the clearing of chips. For best results, it is preferred to have such secondary clearance 15 extend for a distance rearwardly onto the body of the tool at least for a distance which is about as great as the normal depth to which the end of the drill enters the board during operation. It should be noted that this secondary clearance area 15 extends up to and intersects with the spur 13 so that actually the line extending from point 9 to point 4 does not extend to the outer circumference of the cylindrical body of the tool, but only to the inner line of the secondary clearance area 15. This secondary clearance may be increased in width until it removes a substantial part of the rearward portion of the spur. It may also be a rounded surface if desired. It may also be omitted if desired, in which case the spur and the flute intersect at the rearward terminus of line 6.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. A single-fluted drill comprising a main body portion having a helical land defining a helical flute, the cutting end surface at the forward end of the drill lying substantially in a plane inclined to the longitudinal axis of the drill, a cutting edge being formed by the intersection of said end surface with the wall of the flute, said cutting edge terminating at its most forward portion in a point where the cutting edge intersects the peripheral surface of said land, a spur extending circumferentially and axially forwardly from said end surface and having a scoring edge disposed axially forward of the point of said cutting edge, said spur and the point of said cutting edge being substantially diametrically opposed.

2. The drill according to claim 1 characterized in that said spur and said scoring edge thereof is defined by the intersection of the peripheral surface of said land with an inner beveled surface that intersects said end surface in a line extending generally chordwise across said end surface, said end surface being inclined axially rearwardly from the point of the cutting edge to such line and providing clearance for said cutting edge.

3. The drill according to claim 2 characterized in that such beveled surface forms with the outer surface of said land a spur having a wedge angle from about 15° to about 25°.

4. The drill according to claim 2 characterized in that said land, along its trailing edge, is provided with a secondary body clearance which extends onto said spur and relieves at least a portion of the trailing edge of said spur.

5. The drill according to claim 2 characterized in that such beveled surface forms with the outer surface of said land a spur having a wedge angle from about 15° to 25° and in that said land, along its trailing edge, is provided with a secondary body clearance which extends at least to such spur and relieves a portion of the trailing edge of said land adjacent to said spur.

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