Oct. 14, 1952 J. V. EMMONS 2,613,710

MACHINE BIT FOR DRILLING WOOD

Filed Aug. 2, 1951 2 SHEETS—SHEET 1

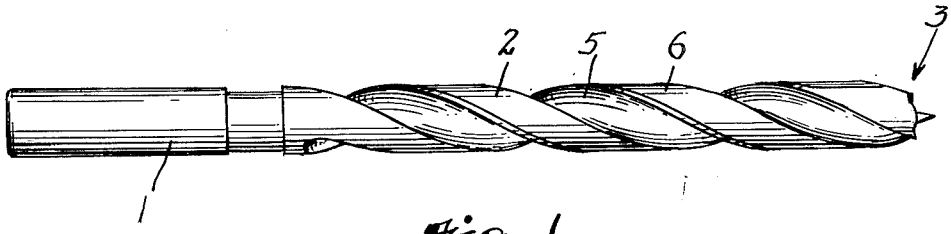


Fig. 1

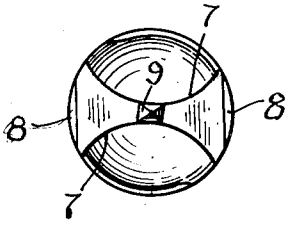


Fig. 2

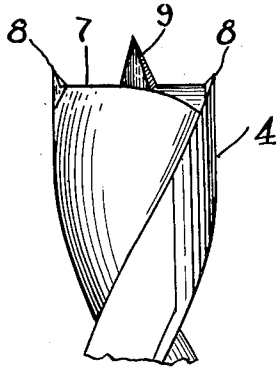


Fig. 3



Fig. 4

INVENTOR.
JOSEPH V. EMMONS
BY
Oberlin & Limbach
ATTORNEYS.

Oct. 14, 1952 J. V. EMMONS 2,613,710

MACHINE BIT FOR DRILLING WOOD

Filed Aug. 2, 1951 2 SHEETS--SHEET 2

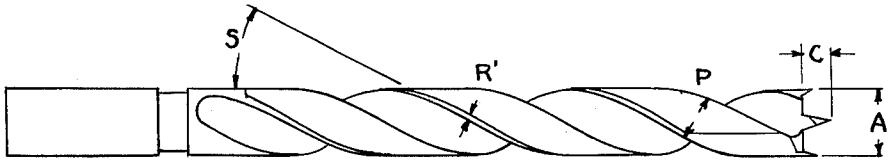


Fig. 5

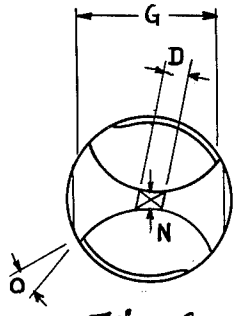


Fig. 6

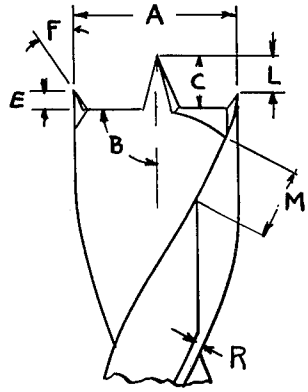


Fig. 7

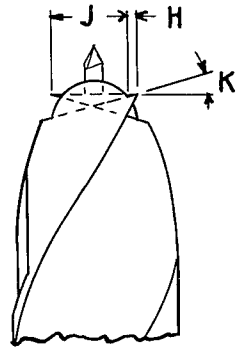


Fig. 8

	Range	Example
A Diameter at Point		
B Angle of Cutting Lips to Axis	80° to 100°	90°
C Height of Brad	20% to 40%	25%
D Width of Brad	15% to 25%	20%
E Height of Spurs above cutting edges	3% to 8%	5%
F Angle of Spurs	30° to 40°	35°
G Distance between bases of spurs	85% approx.	85%
H Distance from spur to cutting edge	5% to 15%	10%
J Width of spurs front to back	35% to 55%	45%
K Angle of lip clearance	5° to 15°	10°
L Distance in height between brad and spurs	10% to 20%	15%
M Length uncleared section on heel back of point	10% to 90%	50%
N Web Thickness at Point	8% to 16%	12%
O Rake Angle of Cutting Lip at Outside Corner	10° to 25°	15°
P Width of Land	40% to 50%	45%
R Width of Margin at Front	4% to 8%	6%
R' Width of Margin at Back	4% to 8%	6%
S Helix Angle	22° to 35°	28°
Back Taper per Inch	.001" to .005"	.0025"
Web Increase per Inch	0 to .012"	.006"
Surface Finish	Electropolished	

Notes:

The short dimension of the base of the brad is the web thickness.

All % dimensions are in terms of A-diameter at the point.

INVENTOR.
JOSEPH V. EMMONS
BY
Oberlin & Limbach
ATTORNEYS.

Patented Oct. 14, 1952 2,613,710

UNITED STATES PATENT OFFICE

2,613,710

MACHINE BIT FOR DRILLING WOOD

Joseph V. Emmons, Shaker Heights, Ohio, assignor to The Cleveland Twist Drill Company, Cleveland, Ohio, a corporation of Ohio

Application August 2, 1951, Serial No. 239,939

9 Claims. (Cl. 145—117)

1

In machine bits for use in wood, some of the results it is desirable to obtain are as follows: low feed pressure, low torque, minimum binding of the bit in the hole, good chip clearance, minimum heating of the point, the production of smooth holes, easy and smooth breakthrough at the bottom of the hole, moderate self-feeding of the bit without excessive hogging in of the bit, dependable centering of the hole, and others.

It is a principal object of my invention to provide an improved machine bit for drilling wood by which the above desirable results may be achieved to a degree not possible with bits heretofore available.

To the accomplishment of the foregoing and related ends, said 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 drawings:

Fig. 1 is a side elevational view of one form of bit constructed in accordance with the principles of my invention;

Fig. 2 is an end view of the operating end of the bit;

Fig. 3 is a fragmentary side elevational view of the bit shown in Fig. 1, drawn to an enlarged scale;

Fig. 4 is a view similar to Fig. 3 but taken at right angles to the plane on which Fig. 3 is taken; and

Figs. 5 to 8 inclusive are like Figs. 1 to 4 respectively excepting that in Figs. 5 to 8 dimensional reference letters are used by which, in the table at the bottom of the sheet of the drawings containing such figures, the corresponding dimensions for a drill constructed in accordance with my invention are given.

Referring now more specifically to the drawings and more especially to Figs. 1 to 3, the drill here illustrated as an example of one embodiment of my invention comprises a straight shank tool in which the shank is indicated at 1, the body of the tool being generally indicated at 2 and the point or end of the tool being generally indicated at 3. The novel features of my improved tools reside in the body and the point. Any type of shank may be used to adapt the tool for use with any particular type of machine, the straight shank shown has been illustrated merely for convenience.

2

The component parts of the body and point comprise the flutes 5 and lands 6 on the body 2 and the cutting edges 7, spurs 8 and brad 9 on the point. The term "point" as used throughout the specification and claims is intended to designate the operating end of the bit which as indicated above includes the cutting edges, the spurs and the brad. Webster's Unabridged Dictionary indicates that the term "point" means the operating end of a bit or drill wherein it says—"some twist drills are provided with oil grooves, tubes or holes in the body for carrying the lubricant to the drill point when cutting." For facility of description and understanding these component parts will now be referred to in the order just enumerated.

The flutes

The body of a bit constructed in accordance with my invention has two helical flutes 5, the helix angle of which should be from about 22° to about 35°, best results being secured with a helix angle of about 28°.

The depth of the flutes should be such as to leave a web thickness of the body which is from 8% to 16% of the diameter at the point, which thickness is preferably on the order of about 12%. The web thickness will preferably increase as the web approaches the shank end of the flutes, such increase amounting to as much as .012 inch per inch of length of the body, the amount of such increase being preferably on the order of about .006 inch per inch of the length of the body.

The shape of the flutes should be such that when the cutting lips 7 are formed on the ends of the lands 6 at the point, such cutting lips shall have a rake angle O as shown in Fig. 6 of from about 10° to about 25°, preferably about 18°.

In order to facilitate clearance of the escaping chips and generally to reduce friction, the flutes should be highly polished as for example by an electrolytic process. The utilization of electro-polished flute surfaces not only provides a low coefficient of friction, but also facilitates easy removal of the chips from deep holes. The relatively large flute area, the specified helix angle of the flutes and the provision of electro-polished surfaces on the flutes are the factors which are responsible for the good chip clearance observed in the operation of tools constructed in accordance with my invention.

The lands

The lands 6 which in addition to providing the base upon which the point is formed, determine

also the outside dimensions of the tool. The width of the lands measured along the line indicated by dimension P in Fig. 5 should be from 40% to 50% of the diameter of the bit at its point, preferably about 45%. The width of the lands determines the dimensions of the flutes at the circumference of the body of the tool and the required rake angle of the cutting lips controls the shape of the flutes so that these two factors determine the configuration of the surface of the flutes.

The lands should be so formed that the outside diameter of the body of the tool should have a back taper on the order of .001 inch to .005 inch per inch of length, preferably about .0025 inch per inch of length, with the smaller end at the shank.

Throughout the major portion of their length extending from the shank end thereof toward the tip, the lands are provided with clearance areas, the width of which is such as to leave an uncleared margin which is not more than 25% of the width of the land or, stated in another way, the width of the margin left by these clearance areas should be from about 4% to about 8% of the diameter of the bit at its point and such width should preferably be about 6% of such diameter.

The lands should be left uncleared as at 4 in Fig. 3 for a length extending rearwardly from the point of the bit equal to about 50% of the diameter of the bit at its point, such distance being measured along the heel edge of the land. As indicated in the table on sheet 2 of the drawings, the length of the uncleared section of the lands measured along the heel of the land back of the point may range from about 10% to about 90% of the diameter of the bit at its point. The relatively narrow width of the lands coupled with the relatively thin web of the tools provides such ample flute area as to make possible easy clearing of the chips.

The substantial back taper of the body of the tool helps to prevent binding of the tool in deep holes. The cleared lands on the rearward part of the body also assist in reducing the friction between the tool and the walls of the hole. The uncleared portion of the lands adjacent the point of the tool, as hereinafter more fully explained, provides a peripheral area on the lands of full diameter upon which may be formed the spurs in their proper location and on which such spurs may be maintained through many resharpenings of the tool.

The cutting edges

As previously indicated in connection with the description of the flutes, the cutting edges are formed on the ends of the lands by surfaces which intersect the flute surfaces. These cutting edges, which may be accurately referred to as cutting lips, have a concave curvature commonly called a hook which gives the outside corner a sharp point with a definite rake angle that facilitates severing the chip. This rake angle as shown by O in Fig. 6 at the outside corner should be on the order of about 10° to about 25°, 15° being preferred.

As one of the factors contributing to low feed pressure, the cutting edges or lips are provided with a clearance measured as indicated at K in Fig. 8 which should be from about 5 to about 15°, preferably 10°.

The spurs

In tools constructed in accordance with my invention there are two critical factors concerning the spurs. First, they are located a definite distance behind the outside corner of the adjacent cutting lip. This distance indicated by the dimension H on Fig. 8 should be from 5% to 15% of the diameter of the bit at its point, preferably about 10%. The second critical factor concerning the spurs is the distance by which they extend forwardly of the cutting edges. This distance is designated by the dimension E on Fig. 7 and should be from 3% to 8%, preferably 5% of the diameter of the bit at its point.

The spurs should have a width from front to back as designated by the dimension J on Fig. 8 equal to 35% to 55%, preferably 45% of the diameter of the bit at its point. The angle of the surface of the spurs, designated by the dimension F on Fig. 7 should be from 30° to 40°, preferably 35°. The distance between the bases of the spurs, designated by the dimension G on Fig. 6 and which is determined of course by a combination of their height E and their angle F as shown on Fig. 7 will be approximately 85% of the diameter of the bit at its point.

Termination of the clearance areas on the lands short of the point by a distance M as previously described makes possible many resharpenings of the bit while, at the same time, maintaining the spurs as above defined. While the termination of the clearance areas on the lands at the forward portion of the tool has been shown in the drawings to be on a line which is parallel to the axis of the tool and while that arrangement is preferred for best results, nevertheless such line denoting the intersection between the cleared and uncleared portions of the land may extend at an angle to the longitudinal axis of the tool.

The brad

The brad is roughly in the form of a sharp-edged pyramid, the base of which is a parallelogram which is not a rectangle. It is an important point that the apex of the pyramid lies on the longitudinal axis of the tool. This arrangement provides a construction in which two opposite edges of the pyramid are higher than the other two edges so that they form cutting edges with clearance behind them.

It will be noted that the width of the brad at the base of the pyramid should be from 15% to 25%, preferably 20% of the diameter of the bit at its point. The thickness of the brad at the base of the pyramid is, of course, the thickness of the web at the point. The height of the brad above the cutting edges on the point as designated by the dimension C on Fig. 7 should be from 20% to 40%, preferably 25% of the diameter of the bit at its point. A further dimensional factor which is of importance is dimension L as shown on Fig. 7 which is the amount by which the brad extends forwardly beyond the spurs. This distance should be at least 10% of the diameter of the bit at its point. For most uses of the bit the brad should extend beyond the spurs about 15% of the diameter of the bit with 25% the usual maximum. However, for some special uses even longer brads may be desirable.

The foregoing is believed fully descriptive of the physical structure of the tool. The tool may be formed of any suitable metal from which machine wood bits are commonly formed. Carbon steels having a carbon content from about 0.60% to about 1.20% will be found eminently suited for this purpose. Alloy steels characterized by the

presence therein of useful amounts of alloying elements such as chromium, manganese, tungsten, molybdenum and vanadium may also be used to advantage.

In the formation of a tool of this kind, manufacturing procedures may be employed which are conventional in the production of tools of this kind.

The construction above defined achieves the objectives previously outlined. The following factors are in part responsible for these desirable results:

The low torque is obtained by the small amount of wood displaced by the specified spur construction and by the easy severing of the chip by the drawing cut of the hooked cutting lip.

Minimum heating of the point is accomplished by the specified dimensions and location of the spurs which displace a minimum amount of wood and by the efficient hooked cutting lip which severs the chip by a drawing cut.

Smooth holes are produced by the specified construction of the spurs which only score the wood slightly without themselves severing a chip. The walls of the hole are thus formed by a smooth scoring, not a chip severing cutting action. The cutting lips which sever the chips are always lower than the spurs. They do not need to touch the walls of the hole. In other words, the diameter of the bit from corner to corner of the cutting lips may be slightly less than the diameter across the crest of the spurs.

Easy and smooth breakthrough at the bottom of a hole is accomplished by the specified relationships of the height of the brad, the spurs and the cutting lips. The brad breaks through first, the spurs next and the cutting lips last. The small difference in height between the crest of the spurs and the cutting lips results in only a small button to be pushed out at the bottom which is easily broken up when drilling through stacks of thin material.

Moderate self-feeding is secured by the specified helix angle, the hooked lip and the specified angle of lip clearance.

The advantages of partial self-feeding to the operator are that the rate of penetration is under his control. By using light pressure he can drill slowly to secure a smoother hole, to ease the breakthrough, or to drill out a knot. By using heavy pressure he can secure a hole in a minimum of time. Such control is not possible with auger bits where the rate of feed is fixed by the lead of the screw.

Dependable centering of the hole is obtained by the construction of the brad which has cutting edges on two sides of the pyramid. It thus cuts its way into the wood and has a reduced tendency to follow the grain.

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 wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas which terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle.

2. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas having a width such that the remaining margin on the cleared land has a width not more than 25% of the width of the land, which clearance areas terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle.

3. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas which terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle; cutting edges on the ends of said lands; and the ends of said lands provided with axially and circumferentially extending spurs.

4. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas which terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle; cutting edges formed on the ends of said lands; and the ends of said lands provided with axially and circumferentially extending spurs, in a trailing position with respect to said cutting edges, and extending axially beyond the cutting edges by a distance equal to about 3% to about 8% of the diameter of the bit at its point.

5. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas which terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle; cutting edges, extending substantially at right angles to the longitudinal axis of the bit, having a positive rake angle of from about 10° to about 25° at their outer ends on the circumference of the tool, formed on the ends of said lands, clearance for said cutting edges provided by the forward end surfaces of the lands on which said cutting edges are formed being inclined by an angle of about 5° to about 15° to a plane which includes said cutting edges and is normal to the longitudinal axis of the bit; and the ends of said lands provided with axially and circumferentially extending spurs, in a trailing position with respect to said cutting edges, and extending axially beyond the cutting edges by a distance equal to about 3% to about 8% of the diameter of the bit at its point.

6. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas which terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle; cutting edges, extending substantially at right angles to the longitudinal

axis of the bit, a brad comprising an extension of the web of the bit, between the inner ends of said cutting edges, and extending, substantially in the form of a sharp edged pyramid the base of which is a parallelogram and the apex of which lies on the longitudinal axis of the bit, forwardly of said cutting edges for a distance equal to about 20% to 40% of the diameter of the bit at its point and having a width equal to about 15% to about 25% of the diameter of the bit at its point; and the ends of said lands provided with axially and circumferentially extending spurs, in a trailing position with respect to said cutting edges.

7. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas having a width such that the remaining margin on the cleared land has a width not more than 25% of the width of the land, which clearance areas terminate rearwardly of the point on a line which is substantially parallel with the axis of the bit and the forward end of which is spaced from the forward end of the land on which it occurs by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the drill which throughout their circumferential extent lie on a common circle; cutting edges, extending substantially at right angles to the longitudinal axis of the bit, having a positive rake angle of from about 10° to about 25° at their outer ends, formed on the ends of said lands, clearance for said cutting edges provided by the forward end surfaces of the lands on which said cutting edges are formed being inclined by an angle of about 5° to about 15° to a plane which includes said cutting edges and is normal to the longitudinal axis of the bit; a brad comprising an extension of the web of the bit, between the inner ends of said cutting edges, and extending, substantially in the form of a sharp edged pyramid the base of which is a parallelogram and the apex of which lies on the longitudinal axis of the bit, forwardly of said cutting edges for a distance equal to about 15% to about 25% of the diameter of the bit at its point; and the ends of said lands provided with axially and circumferentially extending spurs, in a trailing position with respect to said cutting edges, and extending axially beyond said cutting edges by a distance equal to about 3% to about 8% of the diameter of the bit at its point.

8. A wood bit comprising a main body portion having alternate helical flutes and lands, the outer surface of the latter provided with clearance areas which terminate rearwardly of the point by a distance equal to about 10% to about 90% of the diameter of the point, thus providing uncleared land areas at the point of the bit which throughout their circumferential extent in any plane normal to the axis of the bit lie on a common circle and which taper to progressively larger circles toward the point of the bit; cutting edges formed on the ends of said lands; and the ends of said lands provided with axially and circumferentially extending spurs, in a trailing position with respect to said cutting edges, extending axially beyond said cutting edges by a distance equal to about 3% to about 8% of the diameter of the bit at its point, and the diameter across the crest of the spurs being greater than the diametrical distance between the outer ends of said cutting edges.

9. A wood bit comprising a main body portion having thereon alternately a helical flute and a land, the latter adjacent the point of the bit being uncleared, a cutting edge formed on the forward end of the land extending substantially at right angles to the longitudinal axis of the bit, having a positive rake angle of from about 10° to about 25° at its outer end on the circumference of the bit, clearance for said cutting edge provided by the forward end surface of the land on which said cutting edge is formed being inclined by an angle of about 5° to about 15° to a plane which includes said cutting edge and is normal to the longitudinal axis of the bit and the end of said land provided with an axially and circumferentially extending spur in a trailing position with respect to said cutting edge, and extending axially beyond the cutting edge a distance equal to 3% to about 8% of the diameter of the bit at its point.

JOSEPH V. EMMONS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
320,097	Swan	June 16, 1885
374,432	Simmons	Dec. 6, 1887
1,384,733	Woods	July 12, 1921
2,332,295	Bouchal	Oct. 19, 1943
2,600,286	Weiland	June 10, 1952