April 22, 1941. A. G. MELDE 2,239,615

L-SHAPED CUTTER KNIFE

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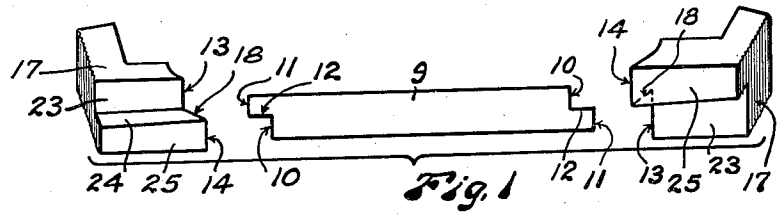


Fig. 1

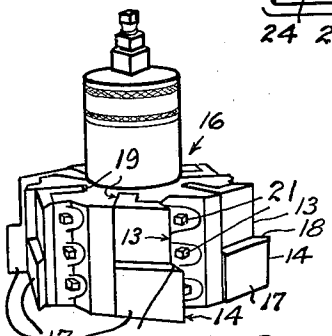


Fig. 2

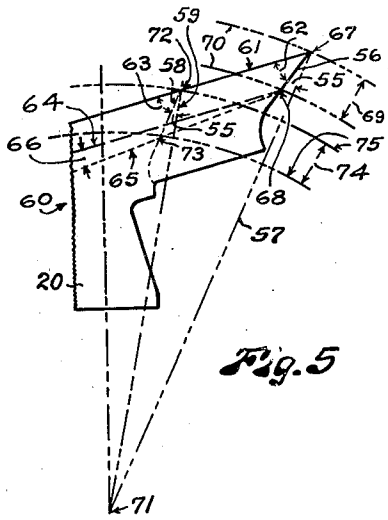


Fig. 5

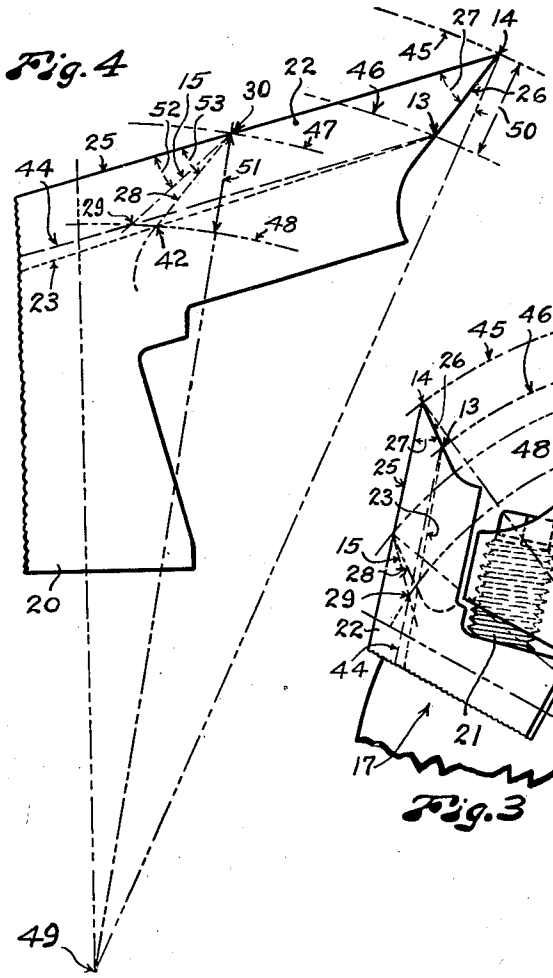


Fig. 4

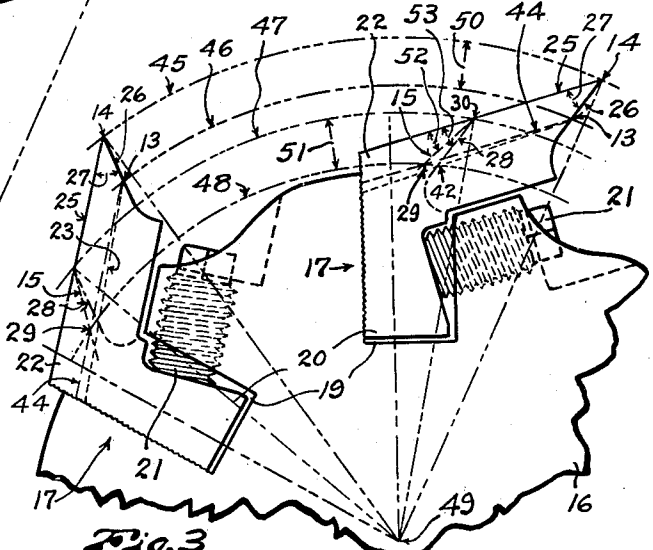


Fig. 3

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L-SHAPED CUTTER KNIFE

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3 Claims. (Cl. 144—230)

This invention relates to the art of cutter knives. More particularly this invention relates to L-shaped cutter knives of the milled to pattern type which are secured to rotating cutter heads.

L-shaped cutter knives are commonly used in the wood-working arts. A rotating cutter head is provided with a plurality of substantially radially extending cutter shank receiving slots, into each of which slots the shank member portion of an L-shaped cutter knife is positioned and secured. The knife portion of the L-shaped cutter knife is formed integral with and extends at an angle to said shank member portion, as 105°, thus forming the L shape.

Cutter knives are generally designated in the trade as either a milled to pattern type or a ground to pattern type. In a milled to pattern type, the pattern is formed in the knife which is intersected by the grinding face in a common plane, thus forming the cutting edges. On the other hand, a ground to pattern type of knife is one where the pattern is formed by grinding the knife with configurations following the pattern to be formed so that the grinding face is in as many planes as the particular pattern requires. L-shaped milled to pattern type of knives are also known to the trade as "Generated knives" and "Peripheral milled knives."

In milled to pattern types of cutter knives the patterns most commonly employed are for: flooring, ship-lap, double V ceiling, bullnose casing, stepping, cribbing, shelving, molding and many others. In a milled to pattern knife for cutting flooring there are two pattern surfaces, while in knives for cutting bullnose casing, stepping, cribbing and others there are a multiplicity of such surfaces. The particular problem which this invention solves is present when a plurality of pattern surfaces are present.

In order to illustrate the invention, by way of example cutter knives having a plurality of pattern surfaces and used in making ship-lap are illustrated and described. However, it is to be expressly understood that the invention is not limited to knives for cutting any such specific pattern and that the same is illustrated and described only by way of example of L-shaped milled to pattern cutter knives having at least two pattern surfaces.

L-shaped knives are characterized by a relatively long life in that the knives may be ground and reground because of the great amount of material present in the knife member portion.

A particular difficulty heretofore existing in the art was the care and precision and calculation necessary in grinding or sharpening the L-shaped milled to pattern type of cutter knives. In an L-shaped cutter knife for cutting ship-lap, the outer end of the cutter knife was ground at an angle as 35° to provide the cutting edges. The cutting edges so provided cut in more than one cutting circle to provide the desired pattern. Referring to Figure 1, the cutter knife must cut away material from the stock to form the surfaces 10, 11 and 12 of the board 9. The cutting edges 13 and 14 of the L-shaped cutter knife must thus cut in radially spaced cutting circles. In regrinding the cutter knife, care must be taken to insure that the cutter knife will cut the same pattern after sharpening. By cutting the same pattern it is meant that the relative positions of the surfaces 10, 11 and 12 of the board 9 must be maintained uniform despite the fact that the cutter knives must be sharpened frequently from time to time. For reasons hereinafter explained, the grinding angle of the prior art cutter knives (which angle corresponds to grinding angle 27 of Figs. 3 and 4) must be gradually and continually changed with continued sharpening so that the same pattern will be maintained. When it is remembered that a number of cutter knives are operating together on the same cutter head and each must cut the identical pattern for accuracy and efficiency, and that cutter heads commonly employ two to sixteen cutter knives, a practical difficulty was encountered when the knives must be resharpened in properly calculating the grinding angle so that each cutter knife would cut the identical and original pattern. This practical difficulty in the art was greatly enhanced by the fact that cutter knives are generally sharpened at the mill where the use of precision tools is not always possible.

It is an object of the present invention to provide a form of L-shaped milled to pattern type of cutter knives which are so designed that the original grinding angle may be maintained throughout the life of the knives and at the same time the original pattern will be maintained. It is a further object of the invention to provide a cutter knife having at least two pattern surfaces which are angularly positioned relative to each other, so that the grinding face intersecting said pattern surfaces may be ground at a constant predetermined angle throughout the life of the cutter knives.

It is an object of the present invention to provide another form of L-shaped milled to pattern type of cutter knives having at least two pattern

surfaces and which knives are so designed that the original cutting angle (hereinafter more fully explained but to be distinguished from grinding angle), may be maintained throughout the life of the knives and at the same time the original pattern will be maintained.

The above mentioned general objects of my invention, together with others inherent in the same, are attained by the mechanism illustrated in the following drawing, the same being preferred exemplary forms of embodiment of my invention, throughout which drawing like reference numerals indicate like parts:

Figure 1 is a perspective view showing two detached L-shaped cutter knives and a piece of board in end elevation therebetween to illustrate the cutting of ship-lap;

Fig. 2 is a perspective view of a cutter head with a plurality of L-shaped cutter knives in place;

Fig. 3 is a fragmentary sectional view on a larger scale showing a fragment of a cutter head with L-shaped cutter knives of my invention in slots in said cutter head;

Fig. 4 is a detached view on a scale two times that shown in Fig. 3 of a cutter knive of my invention operatively positioned as respects its center of rotation; and

Fig. 5 is a detached sectional view, on the same scale as Fig. 3, of a cutter knife of my invention designed to maintain the cutting angle constant throughout the life of the cutter knife and at the same time maintain the original pattern.

Referring more particularly to Fig. 2, a cutter head 16 mounts a plurality of L-shaped cutter knives 17. The spindles (not shown) supporting the cutter head 16 are adjustable so that the cutter knives 17 may be moved toward and away from the board being cut as desired. In view of the fact that a number of types of cutter heads and supporting means therefor are used in the art, and in view of the fact that the same form no part of this invention, they are not illustrated.

In order to better explain the invention, I have shown in Fig. 1 two detached L-shaped milled to pattern type cutter knives 17 which, upon rotation, will cut their patterns upon the respective edges of the board to form a pattern as ship-lap. The L-shaped cutter knives 17 shown in Fig. 1 are paired. The cutting edge 14 of each cutter knife cuts on the largest cutting circle of the knife, which circle will be termed the extreme swing or extreme cutting circle. These cutting edges 14 provide the surfaces 10 on the board. The cutting edges 13 of the cutter knives cut on a cutting circle of less diameter, which circle will be termed the jointing cut circle. The cutting edges 13 provide the surfaces 11 on the board. The cutting edges 18 cut the surface 12 on the board which is parallel to the faces of the board.

Referring to Fig. 3, the cutter head 16 is provided with a plurality of substantially radially extending slots 19. The shank portion 20 of a cutter knife is inserted into a slot 19 and securing means, as gib-screws 21, hold the shank portion 20 in the desired position. The knife member portion 22 is formed integral with the shank portion 20. In the particular cutter knife shown in the figures, the knife member 22 forms an angle with the shank member 20 of 105°. While this angle may vary, in practical cutter knives now used in the arts it ranges from 95° to 120° and more commonly at either 105° or 110°.

The pattern is milled into the cutter knife 17 by providing pattern surfaces 23, 24 and 25. These surfaces are intersected by the grinding face 26 to provide the cutting edges 13, 18 and 14. The grinding angle 27, which is the angle between the surface 25 and the grinding face 26, is shown in Figs. 3 and 4 as an angle of 35°. In the knives commonly used in commercial production, this angle may vary between 20 and 50° and more commonly varies between 30° and 40°.

Referring more particularly to Fig. 4, the cutting edge 14 will cut on a cutting circle 45 (extreme cutting circle) and the cutting edge 13 will cut on a cutting circle 46 (jointing cut circle), thus determining the surfaces 10 and 11 of the board. The distance between these surfaces of the board, that is the surface 12, will be determined by the radial difference between the cutting circles 45 and 46, which difference is the distance 50. As the knife member 22 is ground away in sharpening, subsequent grinding faces, as a subsequent grinding face 28, will be provided. The intersection of a subsequent grinding face 28 with the pattern surface 25 will determine a subsequent cutting edge 30 which is comparable to the cutting edge 14 in providing the extreme cutting circle. Also, the intersection of a subsequent grinding face 28 with the pattern surface 23 will determine a subsequent cutting edge 42 which is comparable to the original cutting edge 13 in providing the jointing cut circle. In order to maintain a radial difference between the cutting edges 30 and 42, a distance 51 in a radial direction must be equal to the original radial distance 50. Thus the cutting edge 42 must cut on a cutting circle 48, which is a radial difference 51 away from the cutting circle 47 on which the cutting edge 30 cuts.

From the foregoing, it is clear that the pattern surface 23 must pass through the intersection of the subsequent grinding face 28 and a cutting circle 48. If the subsequent grinding face 28 is positioned relative to the pattern surface 25, so that the grinding angle 53 is equal to the original grinding angle 27, then the pattern surface 23 is not parallel to the pattern surface 25.

In the prior art the pattern surface, comparable to the pattern surface 23 of this invention, was parallel to the pattern surface 25. Such pattern surface of the prior art would lie in the plane of line 44 which is parallel to 25. The line 44 intersects the circle 48 at 29 which would therefore represent a cutting edge of the prior art devices. The grinding face of such prior art devices would therefore pass from 30 to 29 along line 15. However, the angle 52 is no longer equal to the original grinding angle 27 and is approximately 25° as distinguished from the originally selected grinding angle of 35°.

In the prior art structures it was therefore necessary to gradually and continually change the grinding angle, as the knife member was ground away, or else the pattern, and particularly the extent of the surface 12 of the board 9, would change.

As distinguished from such prior art structure where it was necessary to continually and gradually change the grinding angle, I provide in the form of my invention shown in Figs. 3 and 4 a knife member where the grinding angle may be maintained constant as the knife member is being ground away in sharpening and at the same time the pattern maintained. This means that if the manufacturer specifies that a grinding angle of 35° should be used to provide the desired pattern, that it is only necessary to

set a grinding device at a 35° angle in the sharpening of the knife members.

The dash line **44** is drawn parallel to the surface **25** and the surface **23** (shown by dotted line) forms an angle of approximately two degrees (2°) thereto as shown in Figs. 3 and 4. This dotted line **23** represents the pattern surface which is intersected by the grinding face **26** to form the cutter edges cutting on the jointing cut circle, as cutter edge **13**, to form the surface **11** on the board. The cutting edges cutting on the extreme cutting circle, as cutting edge **14**, cut the surface **10** on the board.

The radial distance between the arcs **45** and **46** is the same distance as that between the arcs **47** and **48**. In other words, radii from the center **49** will provide equal portions **50** and **51**. The distance **50** or **51** will determine the depth of pattern or the surface **12** of the board as the cutting edges of the knife operate in cutting circles about a center. It is apparent that if the surface **23** were parallel to the surface **25** as is dash line **44**, then the angle represented by **52** will be approximately 25°, whereas the original grinding angle **27** was 35°. However, if the surface **23** is provided at an angle in accordance with this invention, the grinding angle **53** may be maintained at 35° and still the depth of pattern determined by the distance **51** will be equal to the original depth of pattern represented by **50**.

In practice an L-shaped knife is not adjusted more than approximately one-half inch in a radial direction, this for the reason that outward radial movement of the shank member lessens the support from the cutter head. As the knife is being ground away, some of the adjustment may be taken by moving the spindles toward the work. In commercial practice generally both the spindles are moved toward the work and the L-shaped knives are moved radially outwardly to compensate for grinding away of the knives by sharpening. With my invention, although the knife may be cutting on smaller cutting circles, still substantially the same pattern will be cut on the board.

The angle between the pattern surface **25** and the pattern surface **23** (i. e., the angle between the lines **44** and **23**) is shown in the drawing in Figs. 3 and 4 as approximately two degrees (2°). However, the angle to be provided will depend on the cutting circle employed. It will also depend upon the grinding angle desired, i. e., the extent of the angle **27**. Also it will depend upon the angle of the pattern face **25** to the shank **20**. As previously stated, the angle of the shank **20** with the pattern face **25** may vary from 95° to 120°. Also the angle **27** may vary in practical operation from 20° to 50° and more commonly from 30° to 40°. The cutting circle or extreme swing may vary from approximately six inches (6") to twenty inches (20"). With such variations in mind, I have found that the angle between the pattern surface **25** and the pattern surface **23** may vary from approximately ½° to 2¼° and the depth of pattern maintained uniformly throughout the life of the cutter knife and with a constant grinding angle employed. It is clearly within the knowledge of those skilled in this art to ascertain, in view of the foregoing disclosure, the exact angle to be employed when the above variables have been selected or determined.

By way of summary as to this form of my invention, it is thus apparent that any of the cutter heads, as cutter head **16**, of the prior art and mounting means therefor may be employed in my invention. The L-shaped milled to pattern type of cutter knife of my invention embodies a shank member, as **20**, which is positioned substantially radially of the cutter head. The knife member portion **22** is integral with and forms substantially an L-shape with the shank member **20**. The knife member **22** is provided with more than one pattern surface, as surfaces **25** and **23**. These pattern surfaces are in planes which are not parallel and diverge away from each other as they approach the shank member **20**. The cutting edges, as **13**, **18** and **14**, are provided by a cutting face or grinding face **26** intersecting the pattern surfaces. Two or more cutting edges are thus provided, as **13** and **14**, which operate in cutting circles of different radii. By the angular relation between the pattern surfaces **25** and **23** the predetermined selected grinding angle of the cutting face, as angle **27**, may be maintained throughout the life of the cutter knife and at the same time the pattern cut by the cutting edges, as **13**, **18** and **14**, will be maintained as the original pattern.

In Fig. 5 I have shown a modified form of the invention where the cutting (as distinguished from grinding) angle and pattern are both maintained constant throughout the life of the knife. The cutting angle of a knife is determined by the angle between a radius and the grinding face. The cutting angle is so determined as a board will lie in a plane at a right angle to a radius of the cutting circle. In other words, the finished surface of a board will be tangent to the cutting circles of the cutting edges of the cutter knives.

In Fig. 5 it is apparent that the cutting angle **55** between the original grinding face **56** and a radius **57** is the same as the cutting angle **55** between a subsequent grinding face **58** and a radius **59**. The cutting angle **55** is maintained constant at the desired angle, as approximately 15° throughout the life of the L-shaped knife **60**, although the angle of grinding of the original grinding face **56** to the pattern surface **61**, i. e., angle **62**, is approximately 35°, while the angle of grinding of a subsequent grinding face **58** has increased to approximately 50°.

In many instances a particular cutting angle as selected to provide for the most accurate and efficient work. In selecting a particular cutting angle various factors are considered such as the character of the wood as to moisture, hardness, grain, etc. and speed of production. In prior art milled to pattern L-shaped cutter knives if a particular cutting angle were selected, the same could not be maintained throughout the life of the knife and at the same time maintain the original pattern. By my invention both the cutting angle and the pattern may be maintained constant throughout the life of the knife if so desired.

In Fig. 5 the L-shaped knife member **60** has a shank portion **20** which is similar to such similarly numbered portion of the previous figures. The pattern surface **61** corresponds to the pattern surface **25** of Figs. 3 and 4 and dash line **64** is parallel to the pattern surface **61** and therefore corresponds to dash line **44** of said figures. The pattern surface **65** corresponds in function with the pattern surface **23** but the variation in the angle **66** between **64** and **65** is greater than the angle between **44** and **23** of said figures. The

angle 66, to permit a constant cutting angle 55 and at the same time a constant pattern throughout the life of the knife, will vary from approximately ½° to 9° for commercial devices. The variables determining the exact degrees are the same as in the previous figures and include: the cutting circle to be employed, the angle of the L of the knife, and the selected cutting angle. While the cutting circles and the angle of the L will have the same variations, the cutting angle may vary from 0° to approximately 55°.

In Fig. 5 the cutting edges 67 and 68 correspond in function to the cutting edges 14 and 13 of Fig. 4. These cutting edges are spaced apart a radial distance 69 which will correspond in function to the radial distance 50 of Fig. 4. This radial distance 69 is the difference between the two circles 70 concentric about the center 71.

As the knife is ground away in sharpening and a subsequent grinding face 58 is provided, the same pattern will be provided, as the radial distance 74 between the two concentric circles 75 is the same distance as the distance 69. The cutting edges 72 and 73 provided by the grinding face 58 will cut on cutting circles 75 and are spaced apart the distance 74.

Thus by the use of my invention L-shaped cutter knives may be either ground at a predetermined grinding angle (Figs. 1–4) or at a predetermined cutting angle (Fig. 5) throughout the life of the knife and with a constant pattern maintained.

My invention is applicable to L shaped milled to pattern cutter knives when two or more pattern surfaces are present. In the interest of simplicity, I have described my invention in connection with such knives for cutting ship-lap. As the minimum pattern surfaces necessary in such knives to utilize my invention is two, I have so described my invention and in the claims have claimed such number as the minimum. In so claiming it is to be understood that such term does not limit the maximum number of pattern surfaces which may be present.

Obviously, changes may be made in the forms, dimensions and arrangement of the parts of my invention, without departing from the principle thereof, the above setting forth only preferred forms of embodiment.

I claim:

1. In a device of the class described, a cutter shank adapted to be connected with and positioned generally in a radial direction of a rotary cutter head; a knife member integral with and forming substantially an L-shape with said shank member; a first pattern surface on said knife member; a second pattern surface on said knife member extending in a plane diverging away from the plane of the first pattern surface as they approach the shank member; and a grinding face intersecting said two pattern surfaces and ground at a predetermined angular position and forming spaced apart cutting edges operable in radially spaced apart cutting circles when attached to a rotary cutter head, whereby relative radial variation in said cutting circles as the grinding face is reground at said predetermined angular position may be eliminated.

2. In a device of the class described, a cutter shank adapted to be connected with and positioned generally in a radial direction of a rotary cutter head; a knife member integral with and forming substantially an L-shape with said shank member; a first pattern surface on said knife member; a second pattern surface on said knife member extending in a plane diverging away from the plane of the first pattern surface by one-half to two and one-quarter degrees (½° to 2¼°) as they approach the shank member; and a grinding face intersecting said two pattern surfaces and ground at a predetermined grinding angle and forming spaced apart cutting edges operable in radially spaced apart cutting circles when attached to a rotary cutter head, whereby relative radial variation in said cutting circles as the grinding face is reground at said predetermined angle may be eliminated.

3. In a device of the class described, a cutter shank adapted to be connected with and positioned generally in a radial direction of a rotary cutter head; a knife member integral with and forming substantially an L-shape with said shank member; a first pattern surface on said knife member; a second pattern surface on said knife member extending in a plane diverging away from the plane of the first pattern surface by one-half to nine degrees (½° to 9°) as they approach the shank member; and a grinding face intersecting said two pattern surfaces and ground to provide a predetermined cutting angle and forming spaced apart cutting edges operable in radially spaced apart cutting circles when attached to a rotary cutter head, whereby relative radial variation in said cutting circles as the grinding face is reground to provide said predetermined cutting angle may be eliminated.

AUGUST G. MELDE.