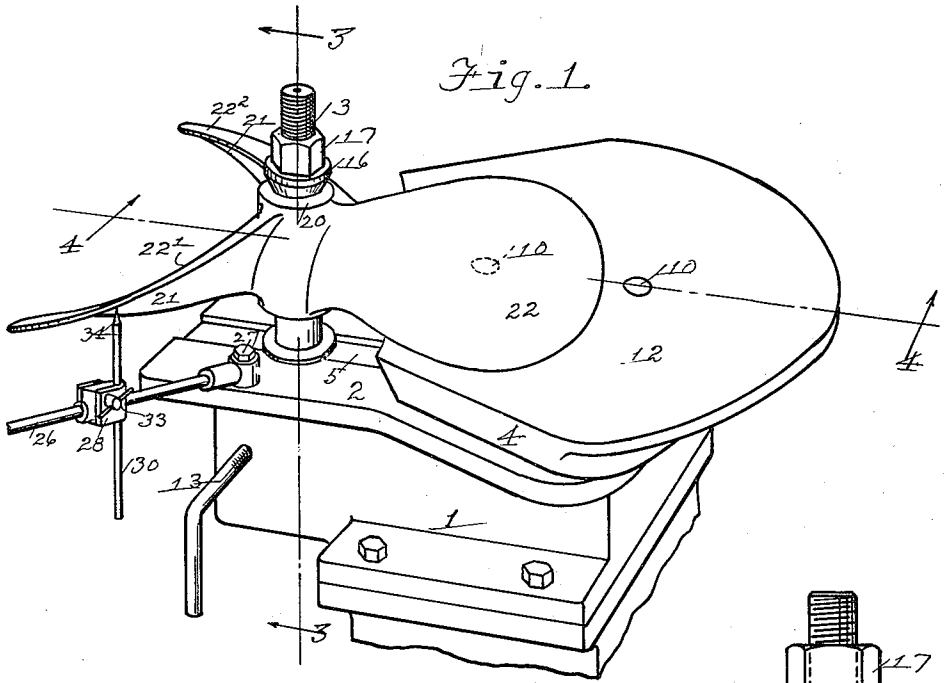
Sept. 10, 1935. J. R. WARREN 2,013,705

PROCESS FOR SHAPING HELICAL BODIES AND MEANS FOR CARRYING OUT SAID PROCESS

Filed Nov. 29, 1933 3 Sheets-Sheet 1

Fig. 1.



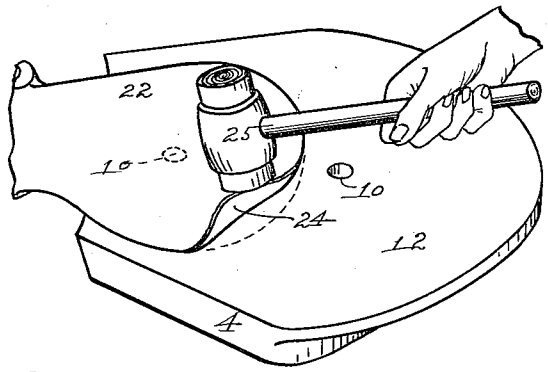


Fig. 2.

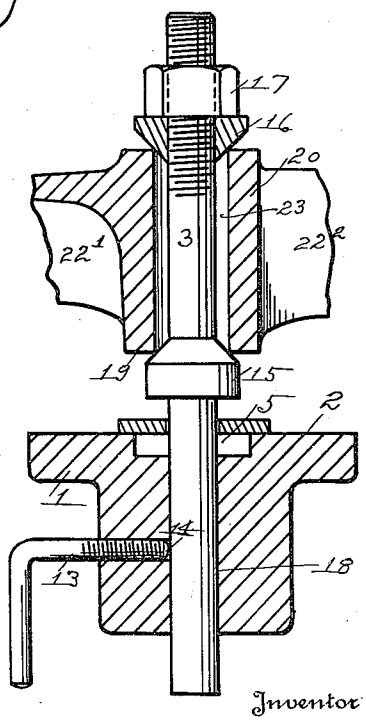


Fig. 3.

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PROCESS FOR SHAPING HELICAL BODIES AND MEANS FOR CARRYING OUT SAID PROCESS

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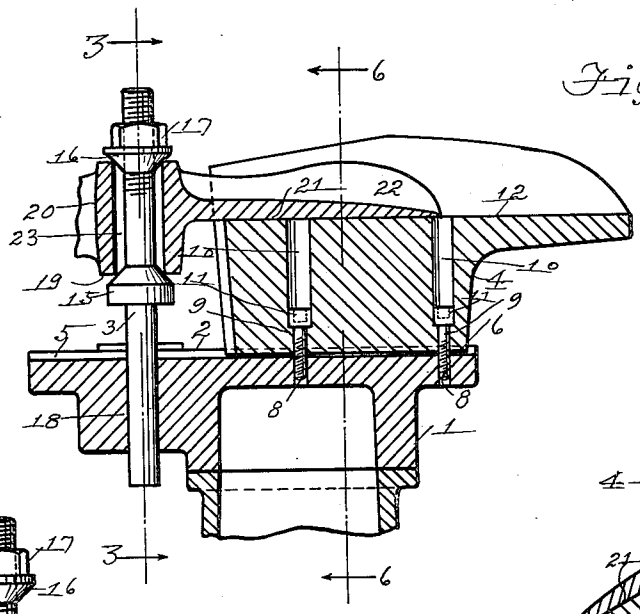
Fig. 4.



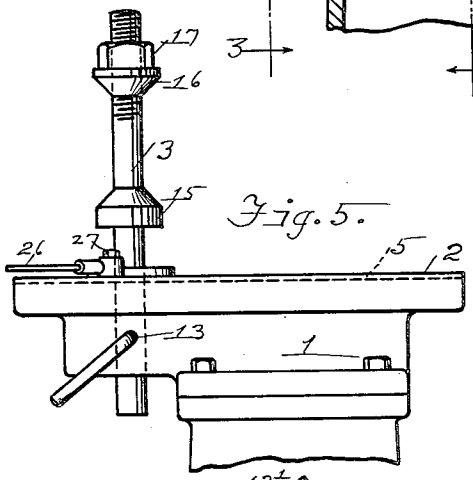


Fig. 5.

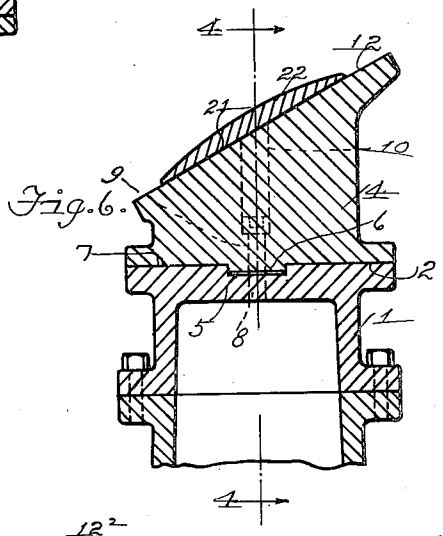


Fig. 6.

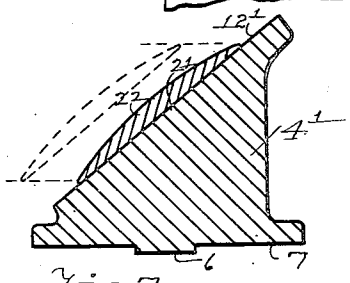


Fig. 7.

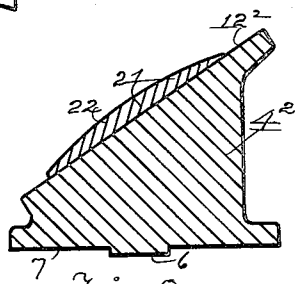


Fig. 8.

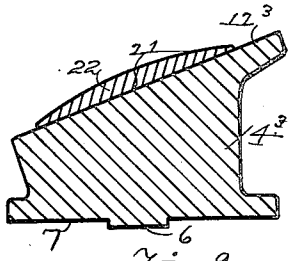


Fig. 9.

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PROCESS FOR SHAPING HELICAL BODIES AND MEANS FOR CARRYING OUT SAID PROCESS

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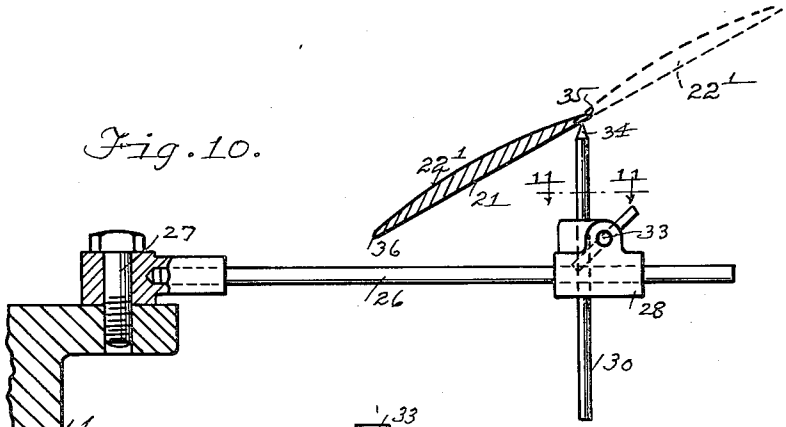
Fig. 10.



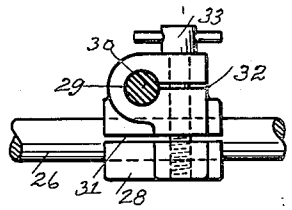


Fig. 11.

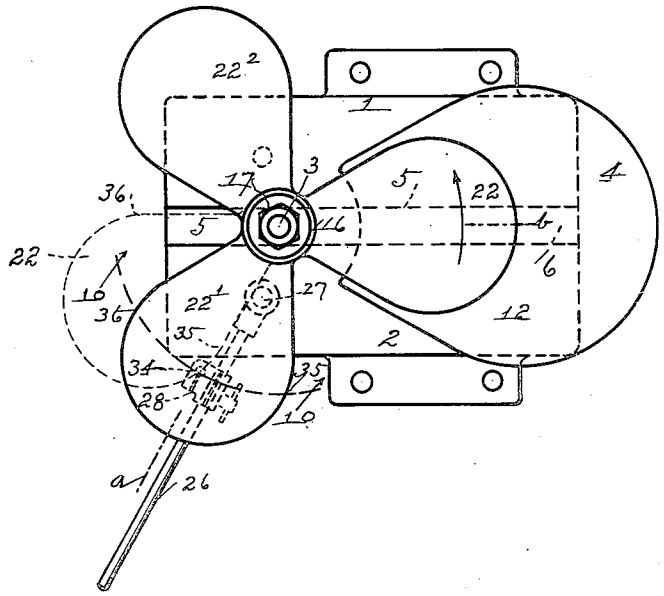


Fig. 12.

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Patented Sept. 10, 1935

2,013,705

UNITED STATES PATENT OFFICE

2,013,705

PROCESS FOR SHAPING HELICAL BODIES AND MEANS FOR CARRYING OUT SAID PROCESS

John R. Warren, Grand Rapids, Mich., assignor to Charles R. Evenson and James A. Webber, both of Grand Rapids, Mich., co-partners doing business as Michigan Wheel Co.

Application November 29, 1933, Serial No. 700,185

13 Claims. (Cl. 153—32)

The present invention relates to structures for shaping thereon helical bodies, as the blades of screw propellers and the like; and its object is to provide an improved structure of this character which shall be economical in construction and simple and effective in operation; and further, to provide therefor a gage for testing the shape of such blades and particularly their relative angular positions; and further, to provide an improved process or method for thus shaping such blades.

These and any other objects hereinafter appearing are attained by, and the structure finds preferable embodiment in, and said process may be carried out by, the structure particularly described in the body of this specification and illustrated by the accompanying drawings, in which:—

Figure 1 is a view in perspective of a structure for shaping or re-shaping thereon the blades of a screw propeller, showing such a propeller positioned thereon;

Figure 2 is a similar view of portions thereof, but showing one of said blades deformed;

Figure 3 is a vertical sectional view (enlarged) of parts of the same taken on line 3—3 of Figures 1 and 4;

Figure 4 is a vertical sectional view of parts thereof taken on line 4—4 of Figures 1 and 6;

Figure 5 is an elevational front view of portions of said structure;

Figure 6 is a vertical sectional view of portions of the structure and propeller blade thereon taken on line 6—6 of Figure 4;

Figures 7, 8, and 9 are vertical sectional views respectively of differently faced anvil members or blocks of said structure with propeller blade thereon, taken on vertical planes corresponding to said line 6—6 of Figure 4;

Figure 10 is an elevational view (enlarged) of a gage of said structure, partially sectioned vertically, and a vertical sectional view of said blade taken on dotted curved line 10—10 of Figure 12;

Figure 11 is a plan view (further enlarged) of a portion of said gage, partially sectioned horizontally on line 11—11 of Figure 10; and

Figure 12 is a plan view (reduced in size) of said structure with propeller thereon.

In these drawings is shown a structure for shaping thereon the blades of boat propellers or the like, or re-shaping such blades which may have become deformed, this structure as shown comprising a base 1 having a horizontal top face 2, a vertical spindle 3 and an anvil member or block 4. This block is removably held on the base's face in a fixed position by suitable means, as the groove 5 extending in the base's face 2 radially from the axis of said spindle and fittingly receiving the rib 6 extending downwardly from the horizontal bottom 7 of said block, and by screw bolts 8 extending through holes 9 in the block and threaded in the base, said holes having enlarged upper portions 10 receiving the heads 11 of said bolts as shown in Figure 4. This anvil block has an upper face 12 formed as a segment of a helix winding about the axis of said spindle. Other anvil blocks 4^1, 4^2, 4^3 such as are shown in Figures 7, 8, and 9 each having like ribs 6 fitting in said groove and like holes for said bolts, but having upper helical faces 12^1, 12^2, 12^3 of different pitch may be applied to said base.

The spindle 3 may be fixed in desired vertical position relatively to said base by suitable means as by screwing down the set screw 13 (threaded through the base) to a position wherein its inner end 14 engages or bites into the side of the spindle as seen in Figure 3. This spindle has an upwardly-conical annular flange portion 15 and a downwardly-conical surrounding member or loose collar 16, and its threaded upper end carries a nut 17.

When the bendable or malleable blades of a propeller or the like are to be shaped, or such deformed blades are to be re-shaped to proper helical shape and condition, the operator selects the anvil block, such as the block 4, 4^1, 4^2, 4^3, whose upper face corresponds to the desired helical shape and pitch and secures the same on the base by the screw bolts 9. He removes the nut 17 and collar 16 and thrusts the spindle into the central bore 23 of the propeller's hub 20, replaces said collar and nut and screws the nut down so as to clamp the propeller on the spindle between the conical upper part of its flange 15 and the conical lower part of the collar 16, these conical parts entering the opposite ends of the bore and centering the propeller on the spindle. He turns the propeller and spindle (the set screw 13 being out of engagement therewith) so as to position the under side 21 of one of the blades, as blade 22, flatwise on the face 12 of the anvil block, and then shapes said blade, or re-shapes its deformed portions (such as shown at 24 in Figure 2) into conformity with said face as by hammering with a suitable hammer 25 as indicated in Figure 2.

This particular blade being thus made to conform to said face of the anvil block, the propeller is turned to position another blade 22^1, or 22^2 on the anvil block's said face, and this blade is

brought into such conformity in the same way. In such turning movements of the propeller, the spindle turns in its bearing 18 and may move axially therein.

I provide a gage, especially well shown in Figures 10 and 11, for determining or testing the shape of the blades particularly their relative angular positions about the propeller's axis. This gage comprises, in its illustrated form, a bar 26 pivotally mounted in a convenient position as 27 on the base to swing in a horizontal plane, and having a surrounding block 28 slidable to desired positions on the bar and having a bearing 29 in which a rod 30 is slidable vertically. This block is split at 31 and 32 and is provided with a screw 33 for clamping the block and the rod in their adjusted slid positions. This gage may be used in the following manner:

When one of the propeller's blades (as the blade 22) has been brought into said correspondence (as before explained) with the face of the anvil block, it may be turned (in clockwise direction) to the position shown in dotted lines in Figure 12, and the gage being turned on its pivotal mounting 27 to the position seen in said view wherein the pointed upper end 34 of vertical rod 30 is in a line radial of the spindle's axis which line and another line thus radial form an angle in a horizontal plane which is identical with the proper interrelative angular position of the blades.

In a propeller having three blades, this angle formed by the dotted lines *a* and *b* in Figure 12 is an angle of 120 degrees. In a propeller having four blades this angle would be 90 degrees, and so on. The rod 30 is slid vertically to a position wherein its point 34 touches the under side 21 of the already formed or re-formed blade 22 at its forward or upper edge 35 (now in said dotted line position). The gage is thus set and clamped in proper position by turning down the threaded pivot pin 27 and bolt 33. The propeller is now turned anticlockwise to bring the under side 21 of said blade 22 again on the face of the anvil block, and the propeller being slowly thus rotated, this blade 22 will ride up on said face (the spindle rising in its bearing 18) and the point 34 of the rod 30 will trace a circular path (like that indicated in the dotted section line 10—10 of Figure 12) on the under side 21 of blade 22^1 (which blade is now over the gage) said path extending from the forward edge 35 of blade 22^1 to its rearward edge 36 in such turning movement of the propeller—that is, if this under side 21 of blade 22^1 already corresponds with the under side of the shaped or re-shaped blade 22 and with the face of the anvil block and if said two blades are at the proper angular position apart. But, if there is not such correspondence and if the blades 22, 22^1 are not correctly spaced angularly about the propeller's axis, the gage will indicate these facts so that the necessary changes in such angular position, etc. may be made. The gage may however be used for testing the relative angular positions of the blades by turning its bar 26 on pivot 27 to other positions and moving rod 30 into contact with the under side of one blade while another blade's under side contacts the face of the anvil block and then rotating the propeller as above described; and the gage may be used after all the blades are brought into conformity with the face of the anvil block.

It will also be seen that when any blade is positioned flatwise on the anvil block's face it may, if desired, be clamped in that position by turning down the set screw 13 and the nut 17; and when it is desired to clamp another blade in the same position on said face, the nut 17 may be loosened sufficiently to permit the propeller to be turned about the spindle to thus position said other blade whereupon the nut 17 being again screwed down this other blade will be so clamped.

The invention being intended to be pointed out in the claims, is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings or hereinbefore described.

I claim:

1. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle adapted to be received in the hub bore of the propeller and an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore.

2. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle adapted to be turnably received in the hub bore of the propeller and an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore.

3. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle adapted to be received in the hub bore of the propeller and an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and means for releasably holding said blade thus positioned.

4. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle movable axially to adjustable fixed positions and adapted to be received in the hub bore of the propeller, an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and means for releasably holding the spindle in axially adjusted positions.

5. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle movable axially to adjustable fixed positions and adapted to be received in the hub bore of the propeller, an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and means for releasably holding said blade thus positioned.

6. A structure of the class described for shaping thereon the blades of a screw propeller, com-

prising a spindle movable axially to adjustable fixed positions and adapted to be received in the hub bore of the propeller, an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and means for releasably holding said blade thus positioned comprising a conical flange on the spindle and a conical collar movable axially thereof the flange and collar being adapted to engage in the opposite ends of the bore and threaded means on the spindle for moving the collar toward the flange to clamp the hub therebetween.

7. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle adapted to be turnably received in the hub bore of the propeller and an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and a gage for testing the shape of said side mounted turnably in a plane perpendicular to the spindle and having a rod movable into contacting relation with said side of the blade when the same is turned to a position over the rod.

8. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a spindle adapted to be turnably received in the hub bore of the propeller and an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blades, the spindle and said member being so related that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and a gage for testing the shape of said side comprising a bar mounted turnably in a plane perpendicular to the spindle, a block movable on the bar to adjusted positions and a rod movable on the block into contacting relation with said side of the blade when the same is turned to a position over the rod.

9. A method of shaping the blades of a screw propeller which includes the acts of providing an anvil having a face in shape a segment of a helix conforming with the desired helical shape of the blades, positioning a blade flatwise on said face and holding the propeller's axis concentric with the axis of the helix of which said face is a segment, and then hammering said blade on said face into shape conforming to said face.

10. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a base having a bearing, a spindle turnable and slidable in said bearing and adapted to be received in the hub bore of the propeller, an anvil member on the base in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blade, the spindle and said member being so related on the base that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and releasable means for clamping the spindle centrally of the bore.

11. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a base having a bearing, a spindle turnable and slidable in said bearing and adapted to be received in the hub bore of the propeller, an anvil member on the base in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blade, the spindle and said member being so related on the base that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and releasable means for clamping the spindle centrally of the bore, said means comprising a conical flange on the spindle and a conical collar movable axially thereof the flange and the collar being adapted to engage in the opposite ends of the bore and means for moving the collar toward the flange to clamp the hub therebetween.

12. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a base having a bearing, a spindle turnable and slidable in said bearing and adapted to be received in the hub bore of the propeller, an anvil member on the base in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blade, the spindle and said member being so related on the base that a side of a blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and releasable means for clamping the spindle centrally of the bore, said means comprising a conical flange on the spindle and a conical collar movable axially thereof the flange and the collar being adapted to engage in the opposite ends of the bore and a nut threaded on the spindle for moving the collar toward the flange to clamp the hub therebetween.

13. A structure of the class described for shaping thereon the blades of a screw propeller, comprising a base, a spindle extending perpendicularly thereto and adapted to be received in the hub bore of the propeller, and an anvil member having a face in shape a segment of a helix winding about the spindle's axis in conformity with the desired helical shape of the blade, the spindle and said member being so related that a side of the blade may be positioned flatwise on said face while the spindle is held centrally of the bore, and the base and said member having mutually engaging parts whereby the base and said member are removably held in one turned position about the spindle's axis.

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