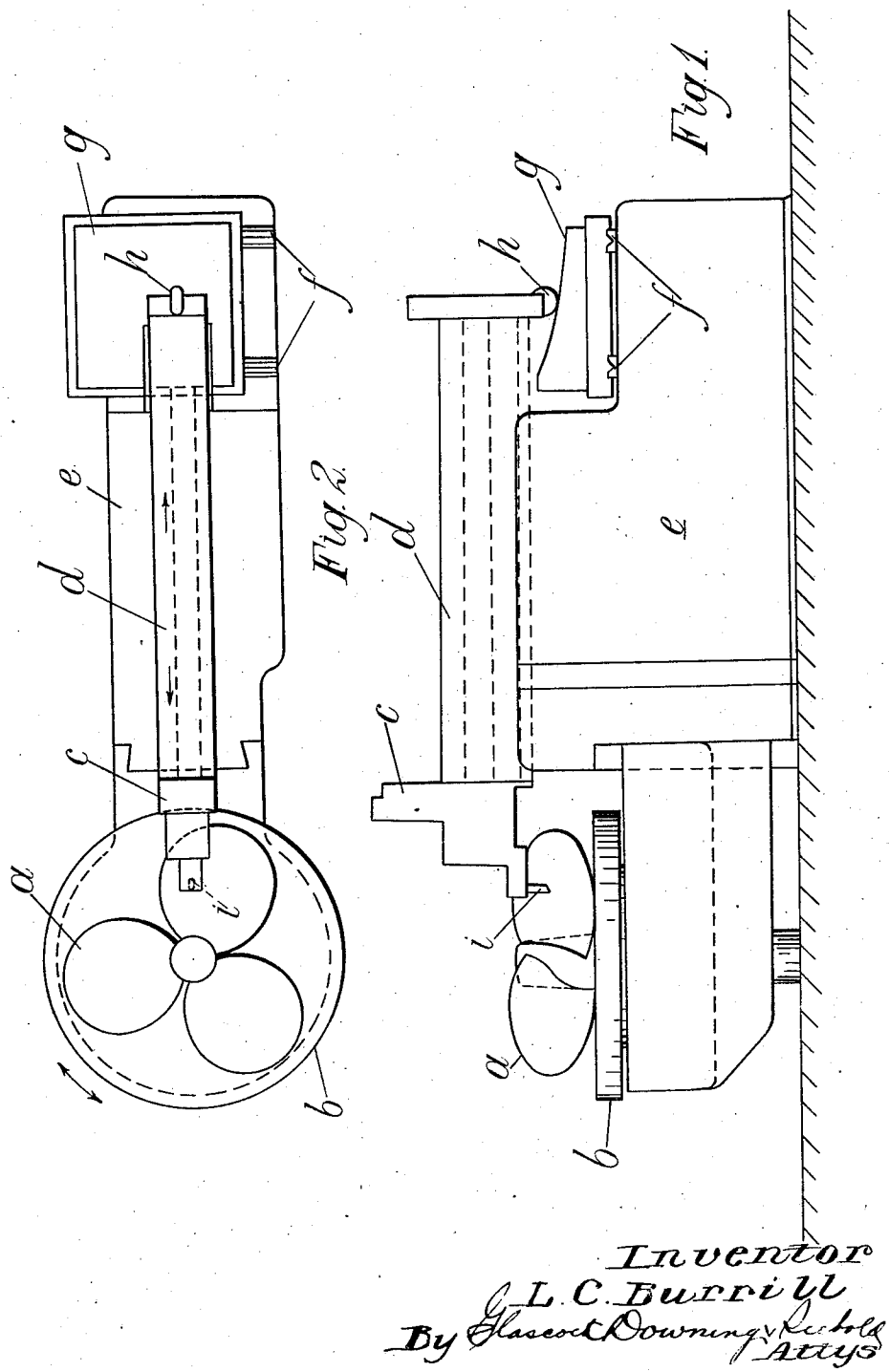
April 9, 1946. L. C. BURRILL 2,397,917

MARINE PROPELLER PLANER

Filed March 7, 1944 5 Sheets-Sheet 1



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MARINE PROPELLER PLANER

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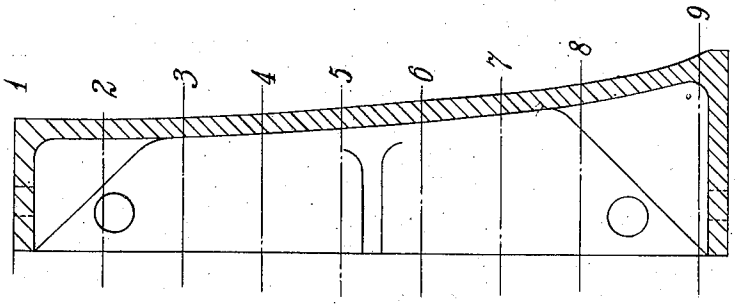


Fig. 4

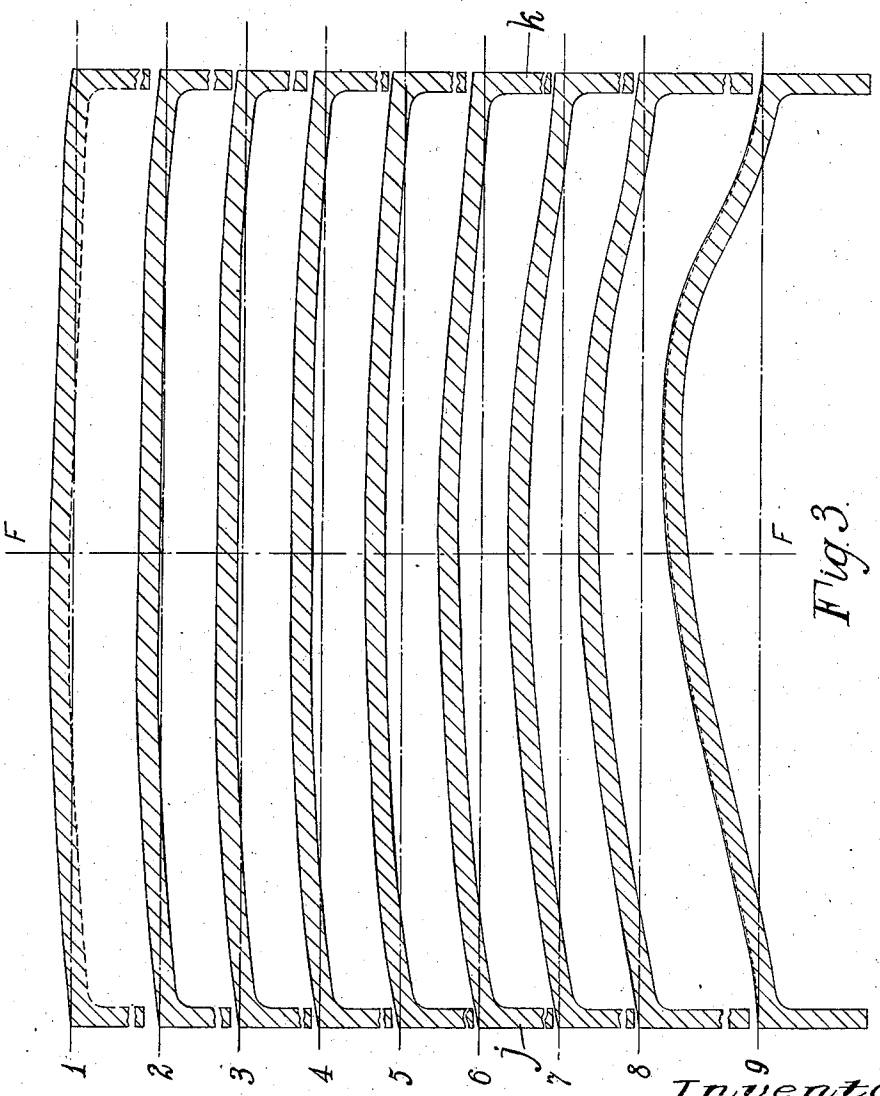


Fig. 3

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MARINE PROPELLER PLANER

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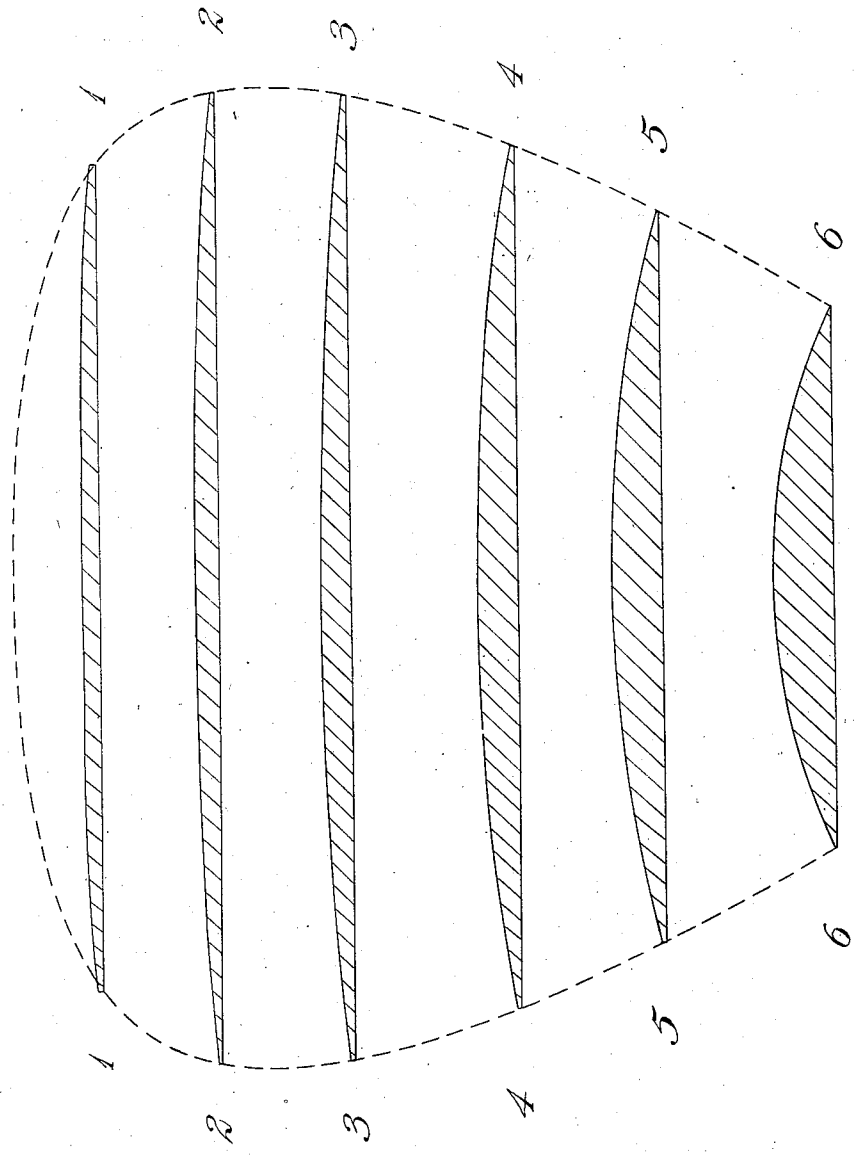


Fig. 5.

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MARINE PROPELLER PLANER

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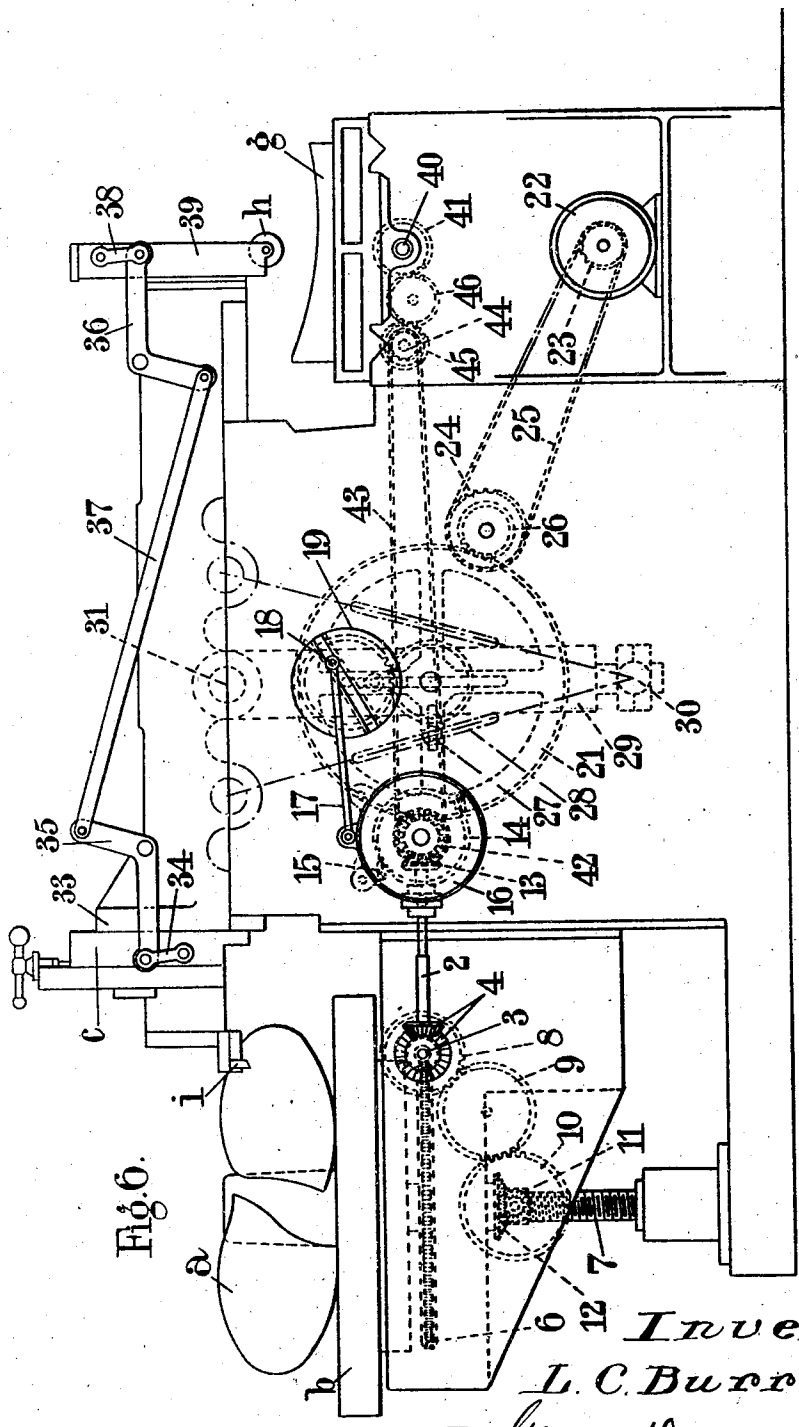


Fig. 6.

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MARINE PROPELLER PLANER

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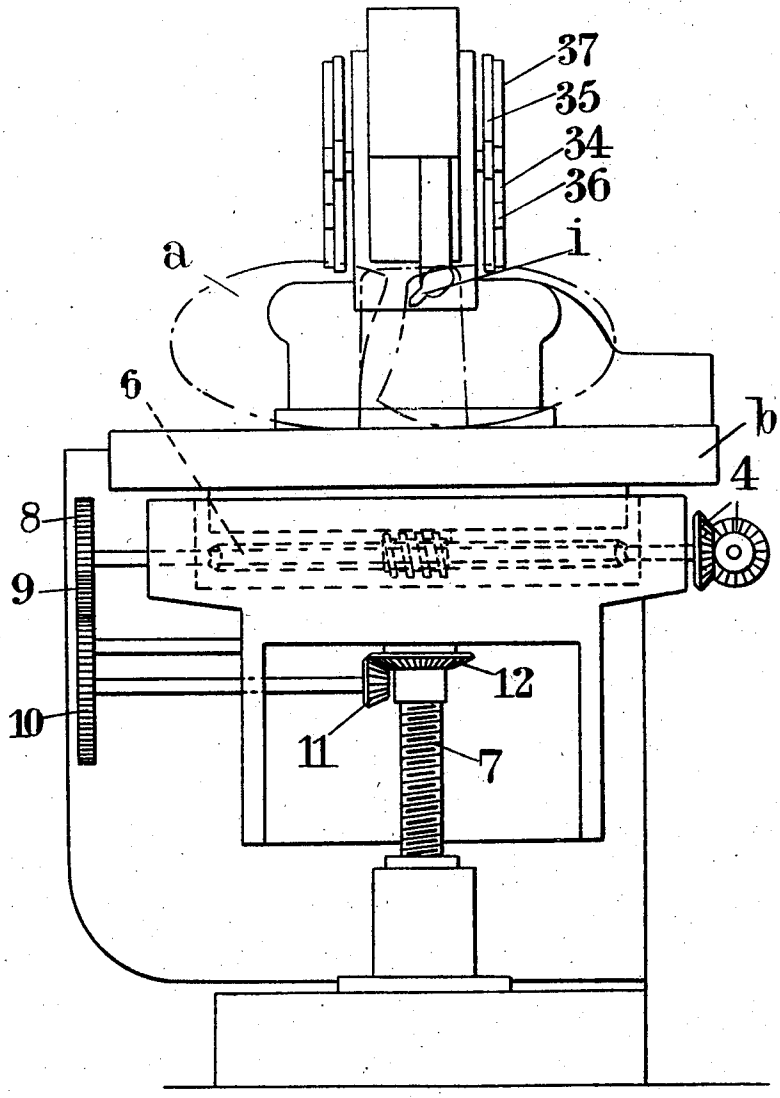


Fig. 7.

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Patented Apr. 9, 1946 2,397,917

UNITED STATES PATENT OFFICE

2,397,917

MARINE PROPELLER PLANER

Lennard Constantine Burrill, West Kirby, England, assignor to The Manganese Bronze and Brass Company Limited, London, England

Application March 7, 1944, Serial No. 525,368
In Great Britain March 17, 1943

3 Claims. (Cl. 90—24.3)

This invention relates to marine propellers and more specifically to the machining or shaping of the backs or in some cases of the faces of such propellers.

The machining of the faces of marine propeller blades having a uniform pitch helical surface is a comparatively simple operation, but not so the machining of the backs thereof, since these latter surfaces depart considerably from true helical surfaces.

One known manner of machining the backs of marine propellers is to employ a shaping head which in addition to its usual reciprocating rectilinear motion has vertical or lateral movements imparted to it determined by following mechanism operating in co-operation with the back of a master propeller.

The main object of the present invention is to provide improved or simplified means by which the backs and in some cases the faces of marine propellers may be machined automatically and without the aid of a master propeller.

The invention consists in apparatus for machining or shaping a marine propeller embodying features set forth in the claims appended hereto.

Referring to the accompanying diagrammatic drawings:

Figure 1 is an elevational view of one convenient form of apparatus embodying the present invention.

Figure 2 is a plan view thereof.

Figure 3 is a view showing vertical transverse sections of a typical former.

Figure 4 is a vertical longitudinal section on the line F—F of Figure 3.

Figure 5 shows six sectional views of one of the blades, and

Figure 6 is an enlarged elevational view showing more detail than Figure 1, and Figure 7 is an end elevational view of Fig. 6.

In carrying the invention into effect in one form illustrated by way of example in Figures 1 to 6 as applied to a machine for shaping the back of a three-bladed marine propeller, I mount the propeller *a* on a horizontal rotary indexing table or head *b* which can be raised or lowered by suitable gearing determined by the face pitch of the propeller to be machined. This mechanism conveniently comprises an intermittently rotated driving shaft 2 driving a worm shaft 3 by bevel wheels 4, the worm 5 engaging a worm wheel 6 rotationally rigid with but slidably connected with the indexing head *b*. The shaft 3 also serves to drive an elevating screw 7 for the head *b* through the intermediary of gear wheels 8, 9, 10 and bevel wheels 11, 12. The shaft 2 carries a bevel wheel 13 gearing with a further bevel wheel rigid with a ratchet wheel 14 with which a pawl 15 pivoted to a disc 16 is associated. The disc is coupled by a connecting rod or link 17 to a pivot pin 18 rigid upon but adjustable radially in relation to a disc 19; the disc 19 is rigid with a toothed wheel engaging an internally toothed member 21 to which drive is imparted from a motor 22 by means of sprockets 23, 24, a chain 25 and a toothed pinion 26. The member 21 carries rigidly a driving pin 27 engaging a slot 28 in a telescopic arm 29 pivoted at 30 to a fixed point and pivoted at 31 to a planing head *d* adapted to reciprocate in two directions at right angles in a vertical plane containing the axis of the propeller-carrying table *b*. The horizontally reciprocating part *d* of the planing head operates in slides carried by a frame *e* embodying the bearings of the propeller-carrying table *b* and this frame in addition embodies cross slides *f* in which a former member *g* is adapted to reciprocate.

A cutting tool *i* is mounted in a holder *c* carried in a vertical slide carrier 33 and bell crank levers 35 and 36 and links 34, 37 and 38 connect the holder *c* with a vertically slidable carriage 39 furnished at its lower end with a roller *h* engaging a former member *g* comprising a rectangular plate in plan view the upper surface of which is furnished with predetermined contours. Intermittent lateral movement is imparted to the former member by means of a lead screw 40 carrying rigidly a toothed wheel 41 which is driven from a sprocket wheel 42 rigid with the bevel wheel driving the bevel wheel 16 through the intermediary of a chain 43, sprocket wheel 44 and gear wheels 45 and 46. The arrangement is such that when the planing head is reciprocated the tool *i* carried thereby is caused to perform a motion compounded of two rectilinear motions at right angles; both these motions take place in the vertical plane containing the axis of the table *b*, the tool *i*, the planing head *c*, *d* and the roller *h*.

The latter moves laterally to the full extent of the movement provided in the same time as the table rotates through an angle representing the angular span of one of the propeller blades.

The contours of the former member are so determined that the cutting tool performs the desired cut on each forward stroke thereof in order to produce the desired finished shape for the back of each blade in succession.

Owing to the necessarily finite dimensions of the roller, allowance must be made therefor in shaping the contours of the former member; con-

veniently the roller may be of 3 inches diameter, 1½ inches in width and rounded at the periphery to a radius of ¾ inch.

A typical former member is illustrated in Figures 3 and 4 for a 3-bladed propeller having blades 20" in length, the sections 1 to 9 in Figure 3 being taken at points corresponding with radii of 20.5", 18", 16", 14", 12", 10", 8", 6" and 3" respectively. The edge *j* of the former corresponds with the leading edge of a blade while the edge *k* corresponds with the trailing edge of the blade.

Sections of a blade are shown in Figure 5, those shown at 1, 2, 3, 4, 5, and 6 being taken at 14", 12", 10", 8", 6" and 3" radii respectively.

As regards the derivation of the former sections (Figure 3) from the propeller blade drawing (Figure 5) the helical blade sections are first laid out in pitch, and then one particular radius is chosen to be the "basic radius," the linear measure of 10° rotation at that section projected on to the expanded base being taken as the separation of 10° points at all other radii. That is to say, for the basic radius, which is 10" in the blades of Figure 5 the projected linear scale is unchanged, while for other radii the projected scale is increased or decreased according to whether the section under consideration is at a lesser or greater radius than the basic radius, the ratio of expansion or contraction being in inverse linear proportion of the radii in question.

I claim:

1. Apparatus for machining or shaping a marine propeller comprising a frame, a horizontal rotatable and vertically movable propeller supporting head arranged at one end of the frame, a tool holder mounted to reciprocate in two directions at right angles to each other on the frame and in the same vertical plane for coacting with the head, a former member reciprocably mounted on the other end of the frame and movable transversely of the tool holder and in operable driving connection with the head and a roller on the tool holder above and in continuous contact with the operative face of the former member.

2. Apparatus as claimed in claim 1 wherein the shaping is performed by a planing operation.

3. Apparatus for machining or shaping a marine propeller embodying a planing head, guides thereon for carrying a vertical reciprocating tool holder and a roller, means for reciprocating said planing head, means on said planing head connecting said tool holder with said roller, a laterally reciprocating former member maintained in continuous contact with said roller, an indexing table for said propeller and means for imparting thereto a compounded axial and rotary reciprocating motion.

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