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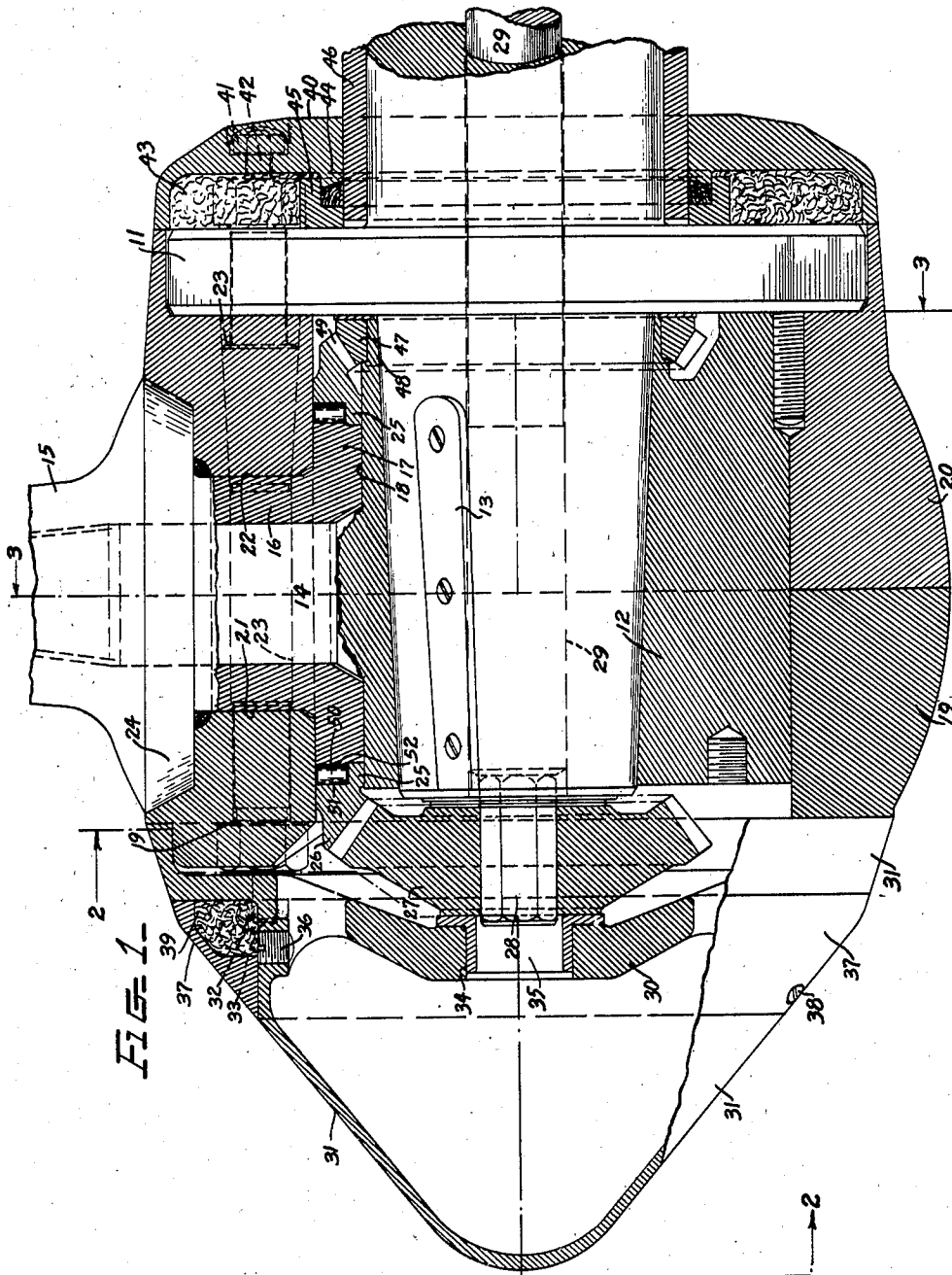
R. J. RUTHS ET AL

2,208,602

HUB CONSTRUCTION FOR VARIABLE PITCH PROPELLERS

Filed Aug. 10, 1938

4 Sheets-Sheet 1



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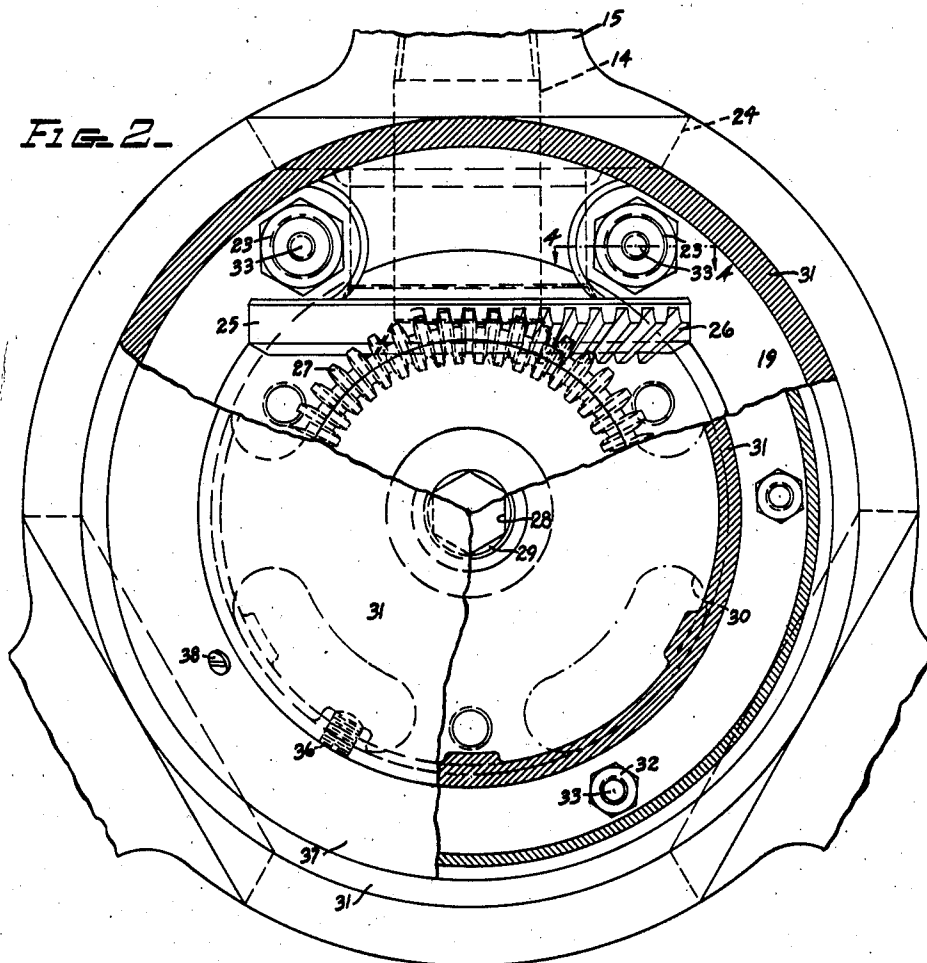
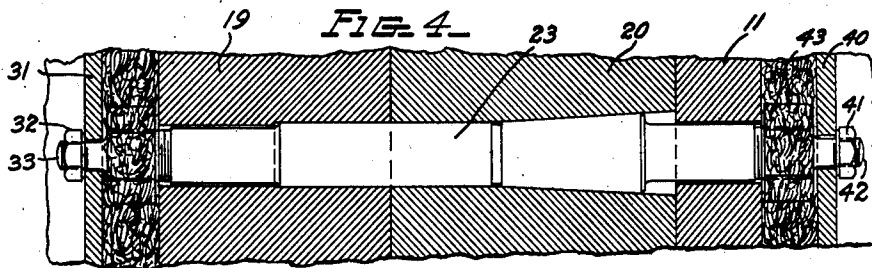
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HUB CONSTRUCTION FOR VARIABLE PITCH PROPELLERS

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4 Sheets-Sheet 2



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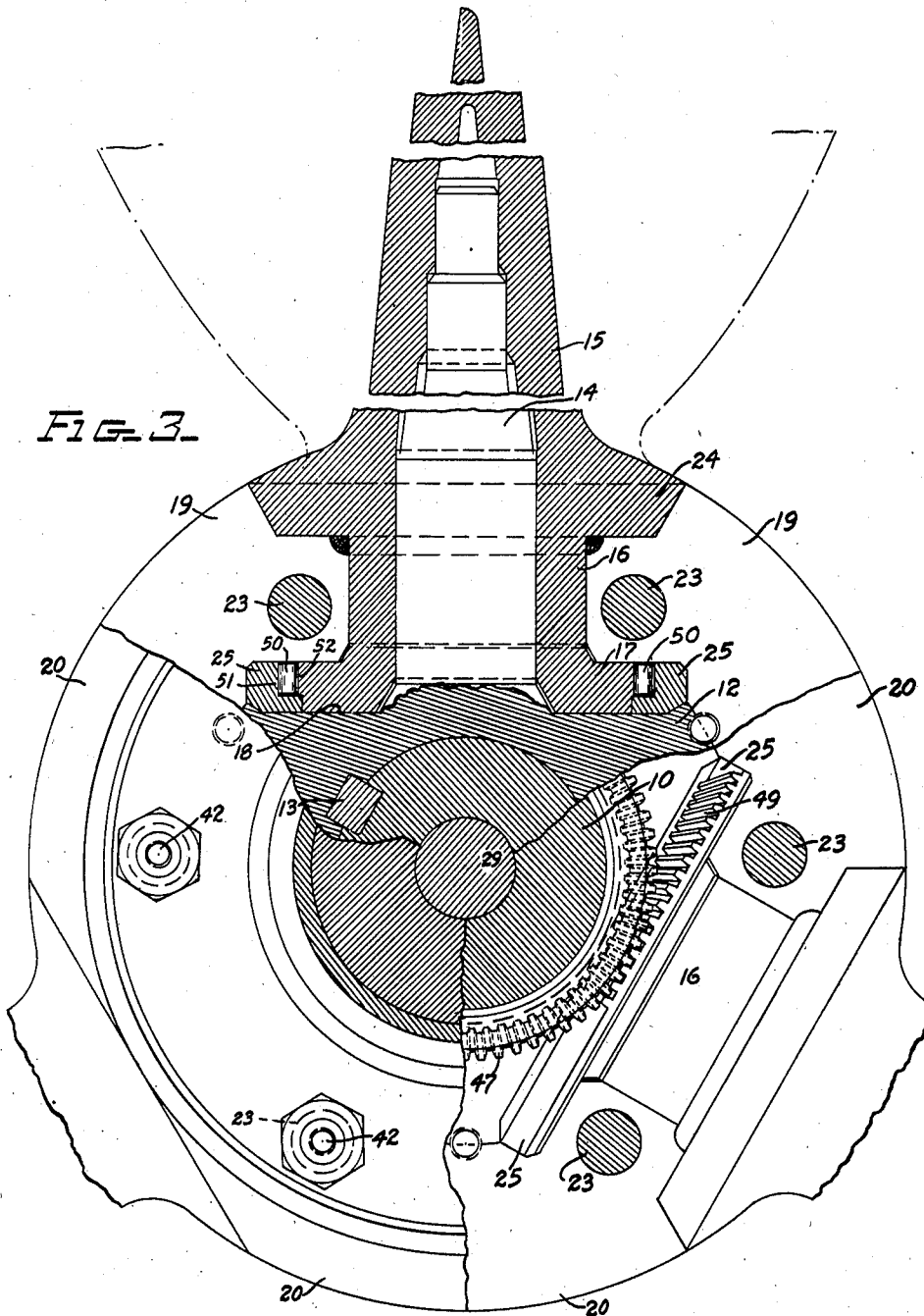
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HUB CONSTRUCTION FOR VARIABLE PITCH PROPELLERS

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4 Sheets-Sheet 3



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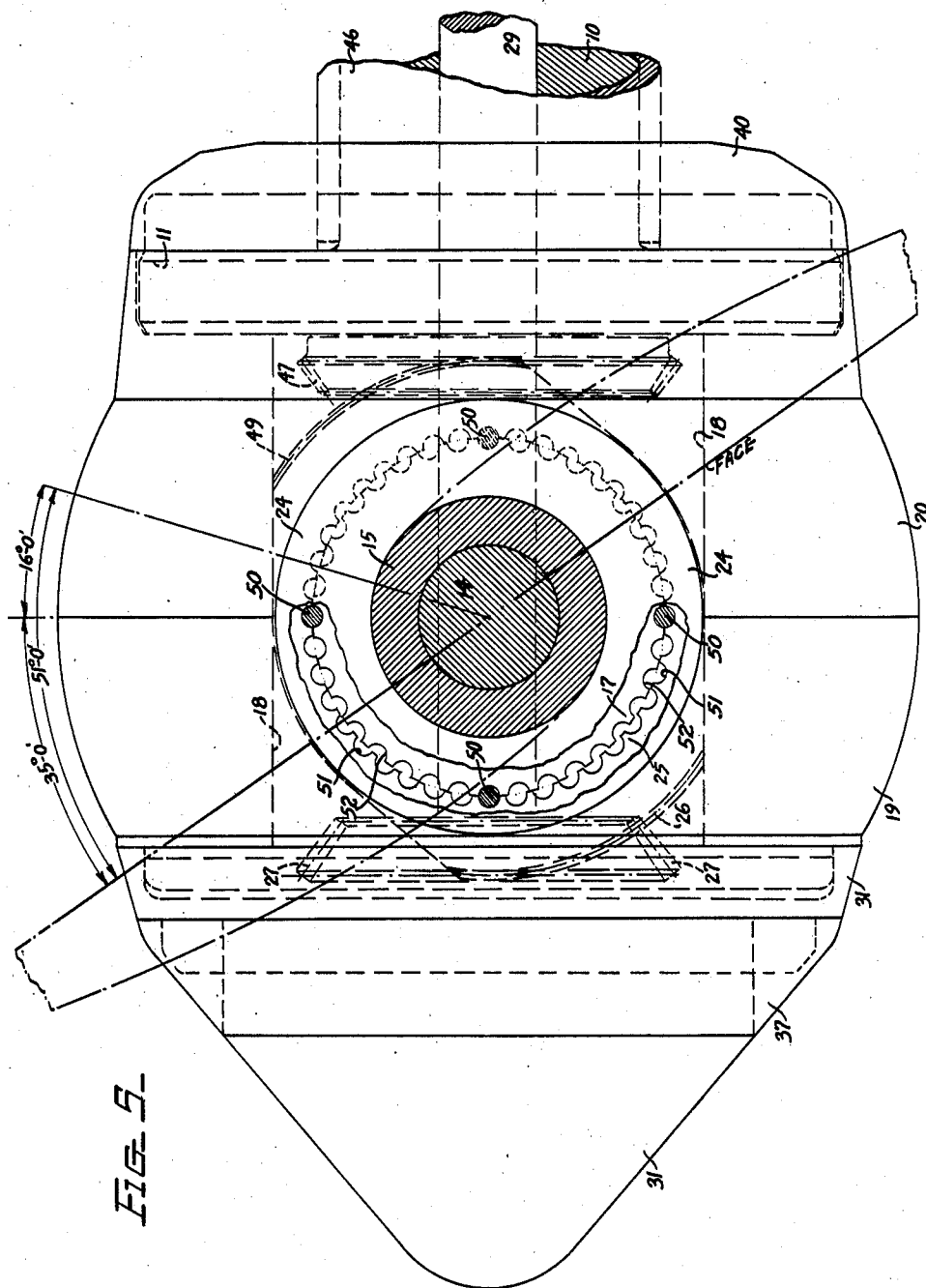
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HUB CONSTRUCTION FOR VARIABLE PITCH PROPELLERS

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4 Sheets-Sheet 4



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HUB CONSTRUCTION FOR VARIABLE PITCH PROPELLERS

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Application August 10, 1938, Serial No. 224,068
6 Claims. (Cl. 170-163)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to variable pitch propellers and it has for its principal object the provision of a propeller of the character described in which the pitch of the blades may be altered while the propeller is in motion and in which the pitch of the blades may be accurately adjusted relative to one another when the propeller is initially assembled.

With these and other objects in view, as well as other advantages that may be incident to the use of the improvements, the invention consists in the parts and combinations thereof hereinafter set forth and claimed, with the understanding that the several necessary elements constituting the same may be varied in proportion and arrangement without departing from the nature and scope of the invention, as defined in the appended claims.

In order to make the invention more clearly understood, there are shown in the accompanying drawings, means for carrying the invention into practical use, without limiting the improvements in their useful application to the particular construction, which, for the purpose of explanation, have been made the subject of illustration.

In the accompanying drawings:

Fig. 1 is a longitudinal sectional view through a propeller hub embodying the invention;

Fig. 2 is a view partly in end elevation of the after end of the hub and partly in transverse section taken on line 2-2 of Fig. 1;

Fig. 3 is a view partly in end elevation of the forward end of the hub and partly in transverse section taken on line 3-3 of Fig. 1;

Fig. 4 is a fragmentary longitudinal sectional view taken on line 4-4 of Fig. 2; and

Fig. 5 is an elevated view taken at right angles to Fig. 1, with parts broken away to better illustrate the vernier adjusting means for the individual propeller blades.

Referring to the drawings, a variable pitch propeller hub constructed in accordance with the invention is shown as comprising a main drive shaft 10 having a collar or annular flange 11 upset or otherwise provided thereon a short distance from its after end. A block 12 of substantially triangular cross-section is fixed as against rotary movement to the drive shaft 10 by means of a key 13 and is provided with a plurality of radially extending stub-shafts 14, preferably three in number, and preferably cast integrally therewith. Rotatably mounted on each of the stub-shafts 14 is a propeller blade 15 having a root portion 16 formed with an annular shoulder 17 which is seated within a groove or channel

18 formed in one of the flat faces of the triangular block 12. The blades 15 are held against displacement by means of a pair of ring members 19 and 20 which are formed with complementary semicircular recesses 21 and 22 embracing the root portions 16 of the blades 15 outside of the annular shoulders 17 thereof and which are secured together and to the flange 11 of the drive shaft 10 by means of longitudinally extending bolts 23 (Fig. 4), thereby tying the parts to the drive shaft as against longitudinal displacement. The blades 15 are also each formed with a collar 24 which seats within a correspondingly shaped recess formed in the ring members 19 and 20 and which cooperates with the collar 17 in reinforcing the blade and imparting lateral and longitudinal stability thereto.

Secured to each of the shoulders 17, in a manner presently to be described, is a ring 25 having a segmental bevel gear 26 formed thereon for intermeshing engagement with a beveled gear 27 which is splined for a limited amount of axial sliding movement upon the hexagonal end 28 of a quill shaft 29. This quill shaft extends coaxially through the main drive shaft 10 and is rotatable therein independently of the rotation of the drive shaft in order to rotate the propeller blades on their stub-shafts when it is desired to alter their pitch. The mechanism for rotating the quill shaft 29 is the subject of a separate application, Serial No. 224,066.

The bevel gear 27 is held against axial displacement from the quill shaft 29 and in accurate mesh with the segmental bevel gears 26 of the several propeller blades by means of a spider portion 30 of a hollow hub cap 31 which is secured to the ring portion 19 of the hub by means of nuts 32 threaded onto reduced extremities 33 of the bolts 23. The spider portion 30 of the hub cap is formed with a central opening 34 within which a flanged bearing bushing 35 is disposed for abutting engagement with the beveled gear 27. The flange of this bushing may be reduced in thickness or shimmed up in assembly so as to insure an accurate intermeshing of the gears 26 and 27. In the event that the quill shaft 29 exceeds the exact length required it is free to extend through the opening 34 in the spider 30. Also, the hexagonal portion 28 of the quill shaft is of sufficient length to provide for slight discrepancies in the length of the quill shaft. Packing grease is introduced into the hub cap 31 and the space around the gear 27, through suitable holes in the hub cap which are closed by screw plugs 36. The entrance of water or sand

into this portion of the hub or the escape of grease therefrom at the points where the nuts 32 secure the hub cap to the ring member 19 is prevented by means of a packing ring 37 which is secured to the hub cap by screws 38 and is provided with a suitable packing 39 enclosing the nuts 32 and reduced extremities 33. In a like manner, leakage at the points where the bolts 23 pass through the collar 11 of the drive shaft is prevented by a packing plate 40 which is secured to the forward end of the hub by means of nuts 41 which are threaded onto reduced extremities 42 of the bolts 23. This plate contains a suitable packing 43 enclosing the ends of the bolts 23 and is formed with an annular portion 44 cooperating with a packing gland 45 surrounding the shaft 10. The shaft 10 may be provided with a non-corrosive sleeve 46 fixed thereto if desired.

Although the bevel gear 27 meshes with each of the segmental gears 26 so as to turn the propeller blades in unison, when it is desired to alter the pitch of the blades, additional means is provided to prevent binding of the parts which may be caused by infiltrations of sand and the like. This consists of an idler bevel gear 47 which is mounted on a reduced portion 48 of the block 12 for intermeshing engagement with segmental bevel gears 49 formed on the ring 25 opposite to the segmental gears 26. This idler gear transmits power from one of the beveled gears 26 to the others so that while the beveled gear 27 is exerting a push upon the gears 26 the idler gear 47 will be exerting a pull thereon at points diametrically opposed thereto, whereby if the rotation of one of the blades be impaired for any reason the gears of the blades not so impaired will assist the gear 27 in overcoming this resistance.

The rings 25 carrying the segmental gears 26 and 49 are fixed to the collars 17 of the propeller blades by means of pins 50 which engage recesses 51 and 52 formed in the inner and outer circumferential surfaces of ring and collar respectively. With particular reference to Fig. 5, it will be noted that there are four more recesses in each of the rings 25 than in the collars 17 so that a vernier adjustment may be obtained. In this manner the blades 15 may be adjusted accurately to the same pitch when the propeller is initially assembled.

It will be understood that the above description and accompanying drawings comprehend only the general and preferred embodiment of the invention and that various changes in construction, proportion and arrangement of the parts may be made within the scope of the appended claims without sacrificing any of the advantages of the invention.

The invention described herein may be manufactured and/or used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

We claim:

1. A variable pitch propeller comprising a drive shaft having an annular flange formed thereon, a block fixed to said drive shaft and having a plurality of stub-shafts extending radially therefrom, blade members mounted on said stub-shafts for rotary adjustment thereon, an annular flange formed on the inner end of the root portion of each of said blade members, a pair of ring members surrounding said drive shaft and secured together and to said annular flange and

engageable outside of said shoulders on opposite sides of said root portions to prevent radial displacement of said blade members from said stub-shafts, a bevel gear fixed to each of said root portions, a quill shaft extending through said drive shaft and rotatable therein, a second bevel gear fixed to said quill shaft and intermeshing with said first mentioned bevel gear for rotating said blade member on said stub-shafts to vary the pitch thereof and an idler beveled gear mounted for rotation in said hub and intermeshing with the beveled gears on said blade members for transmitting power therebetween at points diametrically opposite to the bevel gear on said quill shaft.

2. A variable pitch propeller comprising a drive shaft, a hub fixed to said drive shaft, a plurality of blades having their root portions mounted in said hub for rotation about radially extending axes, a bevel gear mounted on the root portion of each of said blades, a quill shaft extending coaxially through said drive shaft and rotatably mounted therein, a second bevel gear fixed to said quill shaft and intermeshing with each of said first mentioned bevel gears for rotating the same about their respective axes, a third bevel gear rotatably mounted in said hub and intermeshing with each of said first mentioned bevel gears to effect their rotation in unison, and means for securing the root portions of said blades to said first mentioned bevel gears, said securing means having a vernier adjustment about said axes so that said blades will be interlocked for movement in unison at a uniform pitch.

3. A variable pitch propeller comprising a drive shaft, a hub fixed to said drive shaft, a plurality of blades having their root portions mounted in said hub for rotation about radially extending axes, a bevel gear mounted on the root portion of each of said blades, a quill shaft extending coaxially through said drive shaft and rotatably mounted therein, a second bevel gear fixed to said quill shaft and intermeshing with each of said first mentioned bevel gears for rotating the same about their respective axes, a third bevel gear rotatably mounted in said hub and intermeshing with each of said first mentioned bevel gears to effect their rotation in unison, and means for adjustably securing the root portions of said blades to said first mentioned bevel gears, said securing means each including a member engageable with recesses in said root portion and in said bevel gear, the recesses in said bevel gear exceeding in number the recesses in said root portion so that said blades will be interlocked for movement in unison at a uniform pitch.

4. A variable pitch propeller comprising a drive shaft having an annular flange formed thereon, a block fixed to said drive shaft, blade members mounted on said block for rotary adjustment thereon, an annular shoulder formed on the inner end of the root portion of each of said blade members, a pair of ring members surrounding said drive shaft and secured together and to said annular flange and engageable outside of said shoulders on opposite sides of said root portions to prevent radial displacement of said blade members from said block, a bevel gear on each of said blade members, a quill shaft extending coaxially through said drive shaft, a bevel gear fixed to said quill shaft and intermeshing with each of said first mentioned gears for rotating said blades on said block to vary

the pitch thereof, and an idle beveled gear mounted for rotation coaxially of said drive shaft and intermeshing with the beveled gears on said blade members for transmitting power therebetween at points diametrically opposite to the bevel gear on said quill shaft.

5 5. A variable pitch propeller comprising a drive shaft, a block fixed to said drive shaft and having a plurality of stub-shafts extending radially therefrom, blade members mounted on said stub-shafts for rotary adjustment thereon, an annular shoulder formed on the inner end of the root portion of each of said blade members, a pair of ring members surrounding said drive shaft and secured together and engageable outside of said shoulders on opposite sides of said root portions to prevent radial displacement of said blade members from said stub-shafts, a bevel gear on each of said blade members, a quill shaft extending coaxially through said drive shaft, a bevel gear fixed to said quill shaft and intermeshing with each of said first mentioned gears for rotating said blades on said stub-shafts to vary the pitch thereof, and an idle beveled gear mounted for rotation coaxially of said drive shaft and intermeshing with the beveled gears on said blade members for transmitting power therebetween at points diametrically opposite to the bevel gear on said quill shaft.

6. A variable pitch propeller comprising a drive shaft having an annular flange formed thereon, a block fixed to said drive shaft and having a plurality of stub-shafts extending radially therefrom, blade members mounted on said stub-shafts for rotary adjustment thereon, an annular shoulder formed on the inner end of the root portion of each of said blade members, a pair of ring members surrounding said drive shaft and secured together and to said annular flange and engageable outside of said shoulders on opposite sides of said root portions to prevent radial displacement of said blade members from said stub-shafts, a bevel gear on each of said blade members, a quill shaft extending coaxially through said drive shaft, a bevel gear fixed to said quill shaft and intermeshing with each of said first mentioned gears for rotating said blades on said block to vary the pitch thereof, and an idle beveled gear mounted for rotation coaxially of said drive shaft and intermeshing with the beveled gears on said blade members for transmitting power therebetween at points diametrically opposite to the bevel gear on said quill shaft.

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