April 17, 1962 O. W. SCOTT 3,029,876

PROPELLER

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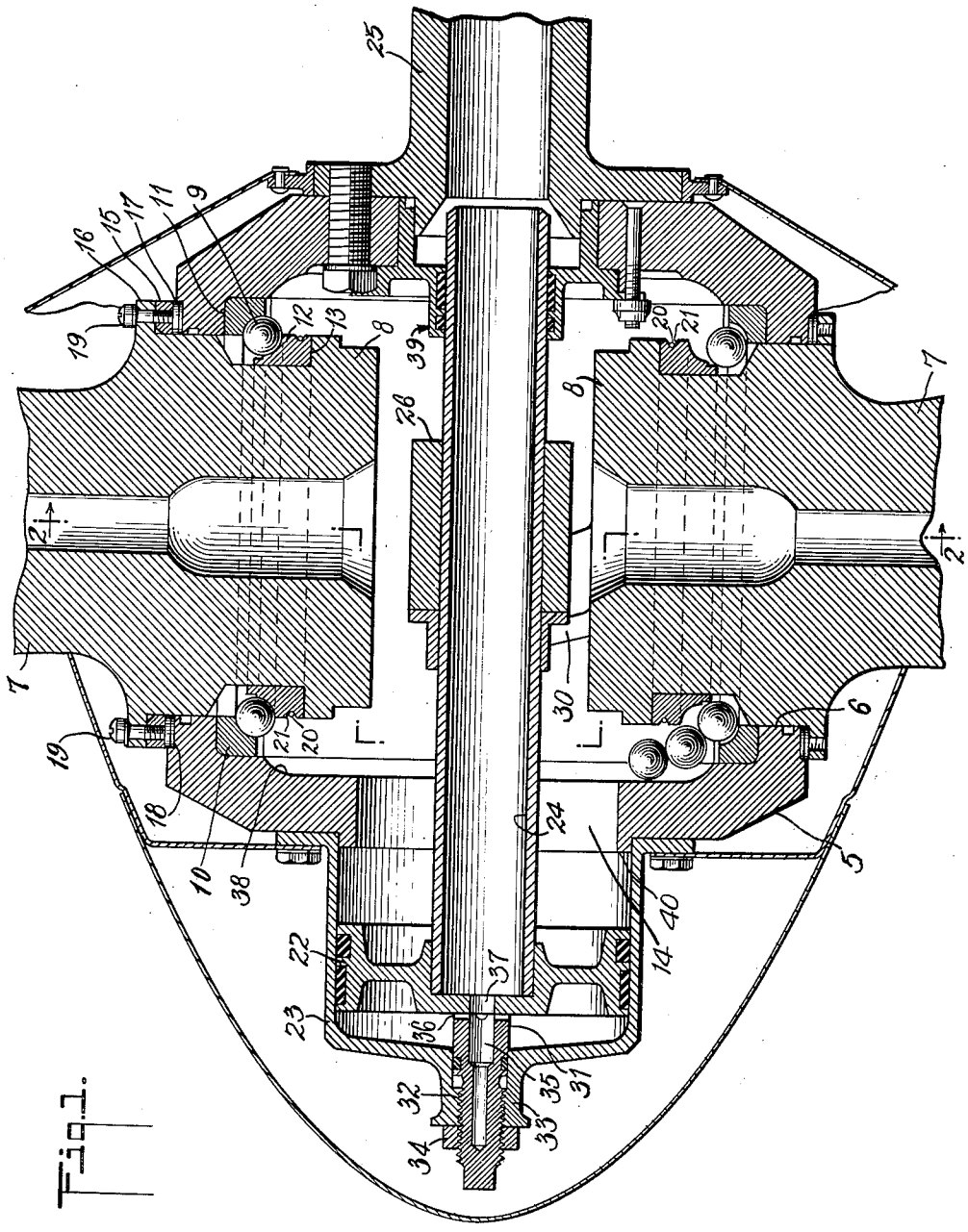


Fig. 1.

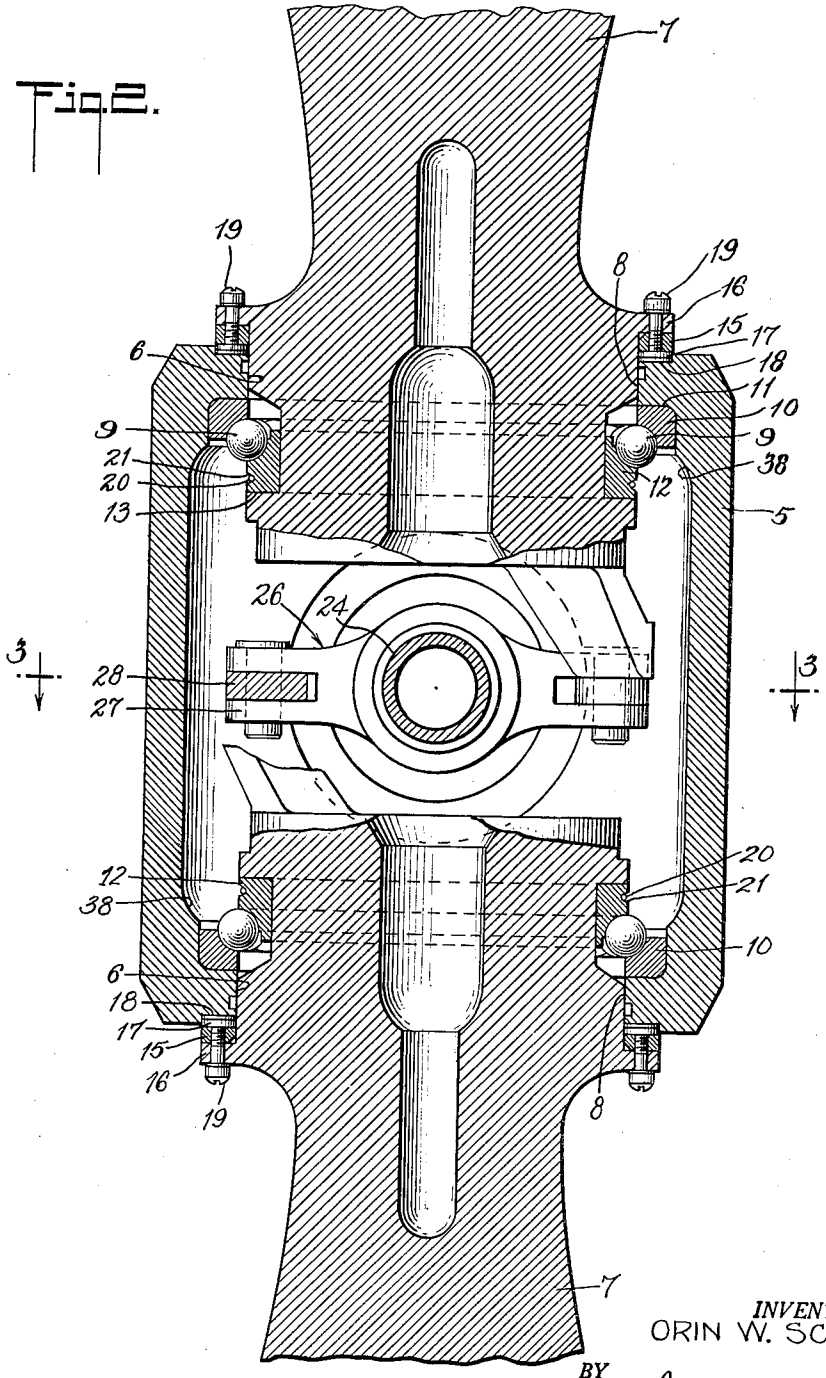
INVENTOR.
ORIN W. SCOTT
BY
Philip S. McLean
ATTORNEY

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Fig. 2.



INVENTOR.
ORIN W. SCOTT

BY

Philip S. McLean
ATTORNEY

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Fig. 3.

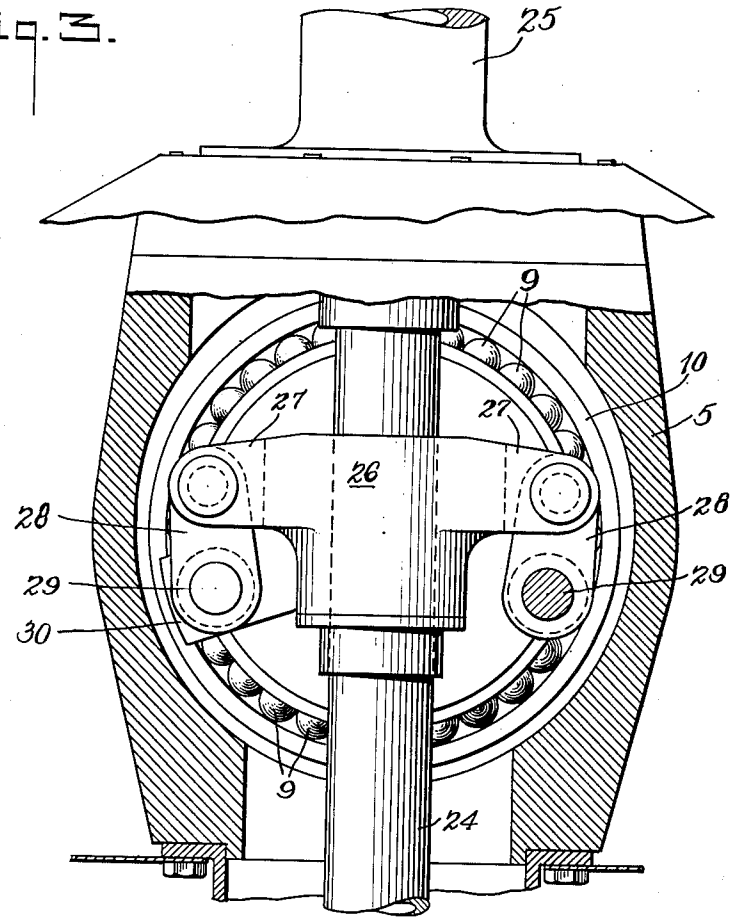
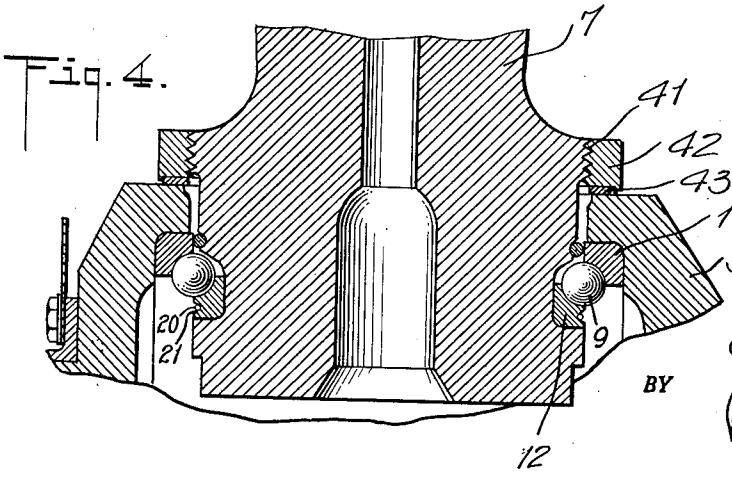


Fig. 4.



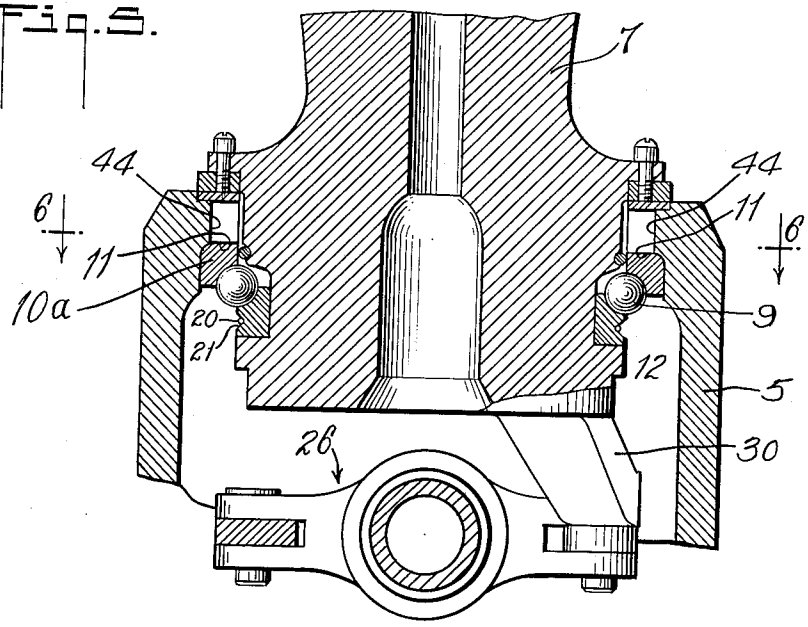
INVENTOR.
ORIN W. SCOTT
BY
Philip S. McLean
ATTORNEY

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Fig. 5.



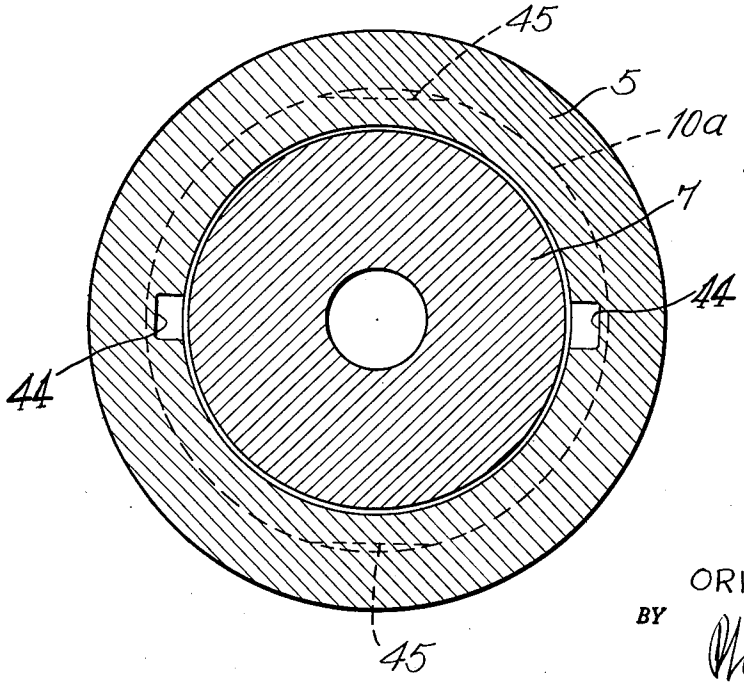


Fig. 6.

INVENTOR.
ORIN W. SCOTT

BY Philip S. McLean,
ATTORNEY

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PROPELLER

Orin W. Scott, Wichita, Kans., assignor to Beech Aircraft Corporation, Wichita, Kans., a corporation of Delaware

Filed May 27, 1960, Ser. No. 32,322
4 Claims. (Cl. 170—160.58)

The invention here disclosed relates to propellers, particularly of the constant speed type.

Objects of the invention are to provide improved retention means for the propeller blades which will eliminate need for the customary split hub or machined hub thread constructions and which will be of particularly simple and inexpensive design.

Other special objects of the invention are to provide a propeller hub structure which may be arranged for either pressure operation to high pitch or the reverse and which may be arranged to be either single acting or as a full feathering propeller.

The foregoing and other desirable objects are accomplished by certain novel features of construction, combinations and relation of parts, all as hereinafter set forth, illustrated in the accompanying drawings and broadly covered in the claims.

The drawings accompanying and forming part of this specification illustrate a present practical embodiment of the invention. Structure however may be modified and changed as regards the immediate illustration, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

FIG. 1 in the drawings is a substantially central longitudinal sectional view of a propeller having the invention incorporated therein with portions broken away and with the blade at the top shown rotatably held in its socket and the blade at the bottom lifted for entry of the bearing balls which lock the blade in place.

FIG. 2 is a transverse broken sectional view of the same on substantially the plane of line 2—2 of FIG. 1.

FIG. 3 is a broken horizontal sectional view on substantially the plane of line 3—3 of FIG. 2.

FIG. 4 is a broken sectional view illustrating a modified form of means for holding the blades locked in place.

FIG. 5 is a broken sectional view similar to FIG. 2 showing a one-piece outer race ring substituted for the split ring first illustrated.

FIG. 6 is a cross sectional view on substantially the plane of line 6—6 of FIG. 5 showing the hub socket notched for entry of the one-piece ring and this ring with flats on opposite sides to facilitate entry into the hub.

In the embodiment of the invention illustrated in FIGS. 1, 2 and 3 thre is a one-piece aluminum hub body 5 having cylindrical sockets 6 for the blades 7 and these blades have cylindrical shank portions 8 which will freely enter and then be caught and be rotatably held in the sockets.

The retainers for the blades are the bearing balls 9 operating between the outer split race rings 10 seated on shoulders 11 about the sockets 6 and the inner split race rings 12 seated on shoulders 13 on the inner ends of the cylindrical shank portions 8. The inner race ring as indicated in FIGS. 1 and 2 is enough smaller than the outer race ring to permit insertion of the blades with the inner rings in place, through the outer race rings.

Access for the bearing balls between the races is provided by displacing the blade shanks inwardly, as indicated at the bottom in FIG. 1, to separate the raceway rings far enough for the balls to enter when inserted through the open front of the hub at 14, before complete assembly.

After all the balls for one bearing have been dropped

into place the blade is shifted outward to its normal position with the balls properly engaged between the opposing rings as shown at the top in FIG. 1.

After loading the bearings in this way and thus locking the blades in place the parts are secured in this relation by inserting spacers 15 between the flanges 16 on the blades and supporting washers 17 of nylon or the like which washers may be seated in depressions 18 about the outer ends of the blade sockets.

These locking spacers are shown secured in place by screws 19 extended through the blade flanges 16.

These ball bearing retainers assembled in this way permit a one-piece form of hub body and eliminate any need for machining screw threads in the hub structure as in conventional practice.

The split outer race rings 10 will normally hold in place in their seats in the hub of themselves and the split rings on the blade shanks may be secured on the shanks by encircling retainer wires 20 received in grooves 21 in the companion ring parts, or the equivalent.

The construction disclosed is compact and takes up small space, leaving ample room in the hub for the hydraulic shift mechanism shown in the form of piston 22 operating in stationary cylinder 23 on the front of the hub and carried by a tubular piston rod 24 open to hydraulic pressure from the tubular propeller shaft 25 and carrying a yoke 26 having outstanding arms 27 connected by pivot links 28 with pins 29 on arms 30 connected with the respective blades.

The forward side of the piston is shown in FIG. 1 as abutted with a low pitch stop plug 31 adjustably screwed at 32 in an extension 33 of the cylinder and secured in adjusted relation by a lock nut 34.

The inner end of the stop plug is shown hollowed at 35 and ported in the side at 36 to pass fluid from the tubular piston rod by way of a central port 37 in the head of the piston.

The pitch change mechanism or the inner portions of the same may be installed before the blades are seated. FIG. 1 shows, at the bottom, how this mechanism does not interfere with the inward displacement of the blades required for inserting the balls.

A conventional governor may be used to boost engine oil pressure applied to the piston, which in this case is connected to force the blades toward high pitch (low r.p.m.). The reverse action may be accomplished by applying the oil pressure to the opposite side of the piston and counterweighting the blades in rotary toward high pitch. Also it will be appreciated that while a single acting propeller is shown the invention may be applied to a feathering propeller and or feathering and reversing propellers.

In addition to reduced manufacturing and assemblage costs the propeller shown has advantages in the simplicity of blade retention and lower weight than in the usual split hub constructions or structures requiring the use of hub threads.

Assembling is facilitated and weight is kept down by cutting away the inner wall surface of the hub ends immediately inside the seats 11 provided for the inner race rings substantially as indicated at 38 in FIGS. 1 and 2. As particularly shown in FIG. 1 this provides ample clearance for the bearing balls when the blades are shifted inwardly to open up space between the opposed bearing rings.

The simple compact, light weight structure afforded by this invention is particularly desirable for low cost constant speed propellers.

A bearing for supporting and guiding the inner end of the hollow piston rod is shown at 39, FIG. 1

A high pitch stop may be provided, such as an annu-

lar shoulder 40 on the front of the hub, engageable by the inner side of the piston.

With the construction disclosed no special opening is required for entry of the bearing balls. The balls are simply dropped in through the opening in the front of the hub, then the blade is pulled out to correct position and spacers 15 installed to keep the blade in this relation.

Removal of the blade is the reverse, spacers 15 being taken out after removing the screws 19. The blade then is moved further into the hub and in this position the balls will drop out from between the races.

An alternate method of holding the blades in final position is shown in FIG. 4. This consists in providing a screw thread 41 on the blade and a ring nut 42 engaged with the thread to bear against a washer 43 seated on the hub. This is a simpler construction than that with the split spacers. The screw thread does not require special development since it is on a large portion of the blade shank, having low stresses and the only load carried in the thread is that of the weight of the blade in static position and loading that may result from engine backfire, which is low.

Under some circumstances a one-piece ring for the outer race, instead of the spit ring construction first disclosed may be preferred.

This variation is illustrated in FIGS. 5 and 6 where the outer race ring 10*a* is a continuous one-piece member which can be entered edgewise through opposed slots 44 cut in the end of the blade socket and then be turned into position seated against the shoulder 11.

To keep the notches 44 as small as possible and to facilitate this assembly operation the race ring may be made with clearance flats 45 on opposite sides.

What is claimed is:

1. A propeller comprising a hub having cylindrical blade sockets and internal undercut annular shoulders about said sockets, outer race rings seated on said internal shoulders, said outer race rings having inwardly faced ball tracks, the hub being enlarged inwardly of said outer race rings in the form of annular cavities open to said outer race rings, blades having cylindrical shanks insertable in said sockets through said outer race rings into position opposite said annular cavities, said shanks having external annular shoulders on the inner ends of the same, inner race rings seated on said external annular shoulders, said inner race rings being of a size to pass through said outer race rings and the blade shanks having movement inwardly in the sockets sufficient to carry the inner race rings clear of the outer race rings far enough for entry of bearing balls between companion race rings, the inner race rings having outwardly faced ball tracks opposed to said annular cavities when the blade shanks are fully entered into the sockets, the hub having an entry for admitting bearing balls into said annular cavities about the entered blade shanks, bearing balls of a size to match the companion race rings in the running position of the blade shanks in the sockets, said annular cavities being enough larger in diameter than the inserted blade shanks to freely receive said bearing balls whereby to hold a row of balls about the fully inserted end of a blade shank so that said balls may pass from that annular cavity into position between the companion race rings and whereupon said blade shank may then be shifted outwardly in its socket to lock the row of balls between the race rings and whereupon such blade will then be rotatably held against further outward movement in its socket and releasable means for rotatably retaining the blades in said outwardly shifted position with the entered rows of bearing balls holding the blades in their sockets.

2. The invention according to claim 1 in which said means for retaining the blades in outwardly shifted relation comprises flanges on the blades external of the hub, spacers removably inserted between said flanges and the hub and means removably securing said spacers in relatively rotatable relation between the blade flanges and hub.

3. The invention according to claim 1 in which said outer race rings are of one-piece construction and the hub having opposed notches in the ends of the sockets for admitting said one-piece rings in on-edge relation.

4. The invention according to claim 3 in which said one-piece rings have flats on opposite edge portions of the same to facilitate entry of the rings through said notches.

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