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2 Sheets-Sheet 1

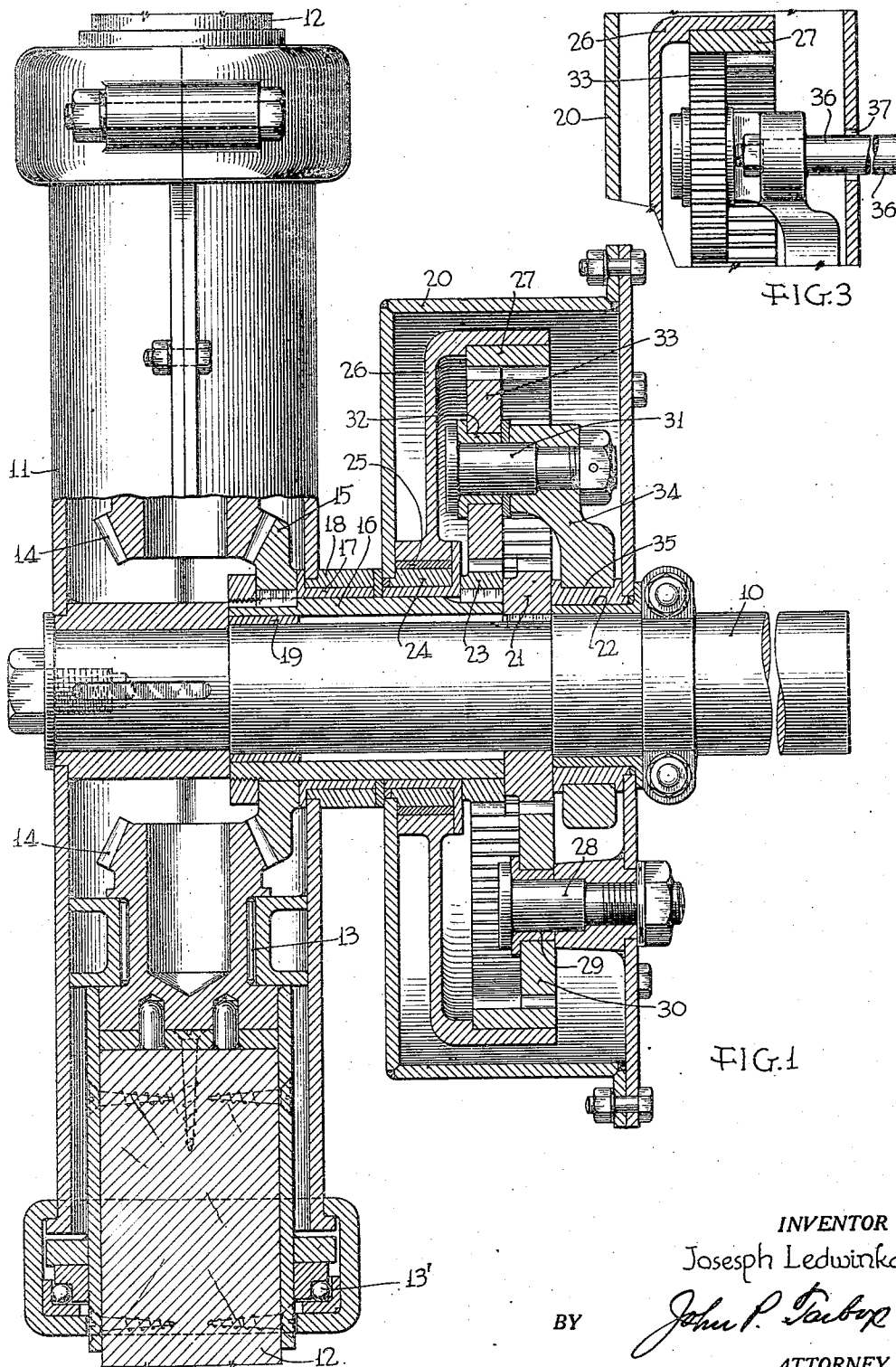


FIG. 1

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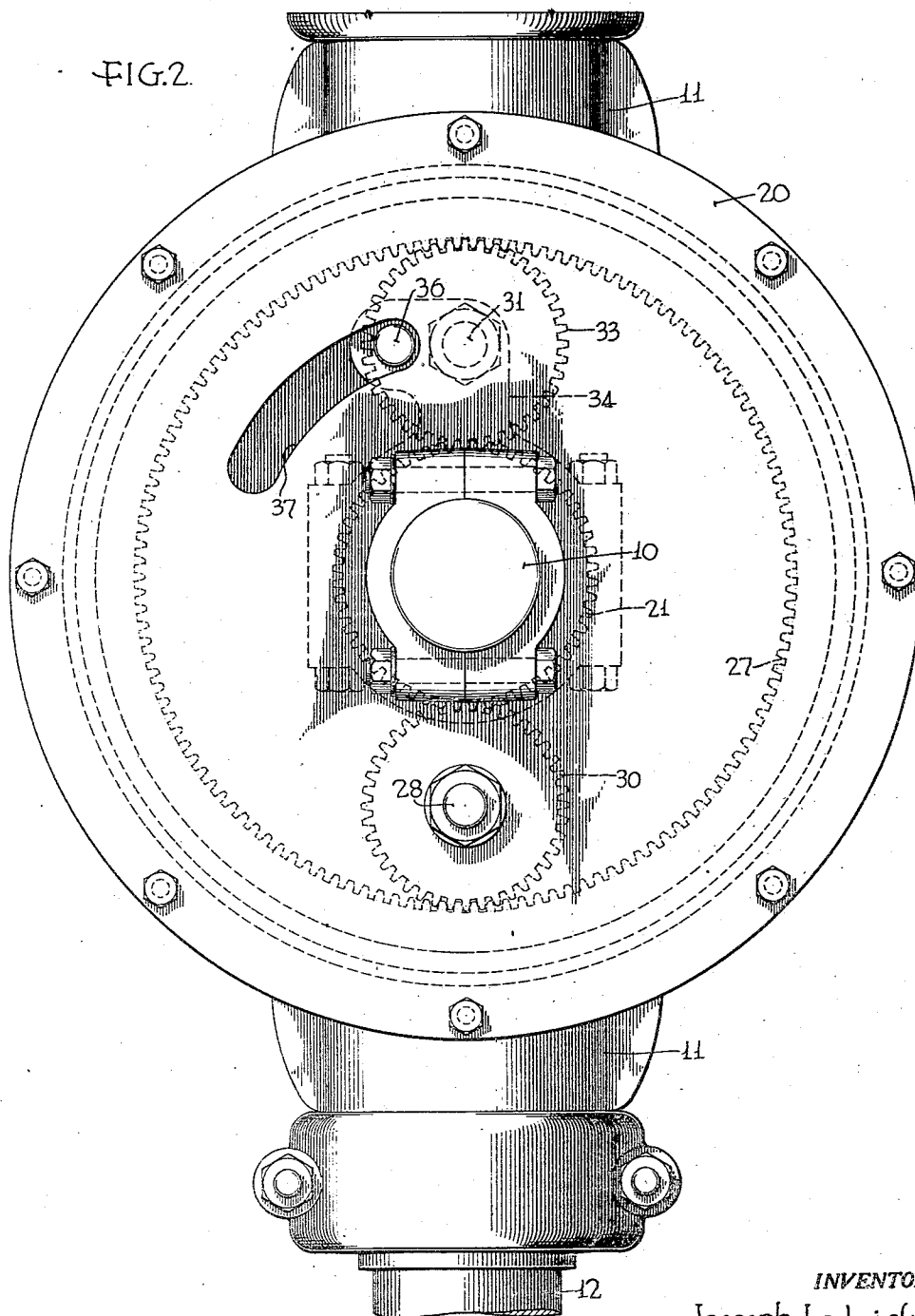
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PROPELLER DRIVE WITH PITCH-CHANGING MECHANISM

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2 Claims. (Cl. 74—395)

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The invention relates to a drive for propellers or the like having means for varying the pitch of the blades.

It has heretofore been proposed in numerous instances to provide gearing in a propeller drive for changing the pitch of its blades either while the propeller was rotating or when stationary. Most such devices have, however, been open to various objections, some of which are excessive complication, excessive wear, and undue noisiness in operation.

It is among the objects of the invention to simplify such devices, and to reduce the cost of their manufacture and maintenance.

These objects are attained in large part by a very compact arrangement of the pitch-changing gearing in the space between the propeller and the engine driving it, preferably enclosing this gearing in a housing, either separate or forming an extension at the outer end of the engine casing, and between the engine and propeller, the housing being adapted to contain a lubricant affording constant lubrication of the parts. The gearing is so arranged as to permit the use, in large part of simple and inexpensive friction bearings, and the gears entering into the device are also of the simple spur gear form, including for compactness, elimination of noise, and balanced arrangement about the propeller shaft, an internal spur gear.

These and other objects and advantages and the manner in which they are attained will become apparent from the following detailed description when read in connection with the drawings forming a part of this specification.

In the drawings:

Figure 1 is an elevational view of a propeller drive according to the invention, the major portion of which is shown in central vertical longitudinal section;

Figure 2 is an end elevational view of the parts shown in Figure 1, as seen from the right of that figure; and

Figure 3 is a fragmentary sectional view similar to the section of Figure 1, but along a line off center as indicated by the line 3—3 of Figure 2.

In the drawings, the invention has been shown more or less diagrammatically as applied to a model constructed by applicant. It will be understood that the specific construction shown is intended to be merely illustrative and, in the actual practice of the invention, the construction would be changed to conform to existing and well-known practices.

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The shaft 10 represents the usual propeller shaft, driven from the engine either directly or through reduction gearing. The end of the shaft projecting outwardly from the engine casing, not shown, may be of the stepped construction shown, the reduced front end of which has non-rotatably secured thereto, as shown, a propeller hub 11 which carries the propeller blades, as 12, shown in this instance as being two in number. It will be understood, however, that the number of blades may be varied. These blades are each rotatably mounted in the hub through an inner radial bearing as 13, and an outer combined radial and thrust bearing 13', these bearings being of suitable anti-friction form.

To the inner end of each blade is secured to rotate therewith a bevel gear 14, the gears 14 of all the blades meshing with a bevel gear 15 non-rotatably secured as by a key to a short sleeve shaft 16 mounted to rotate concentric with the driving shaft 10. The sleeve shaft rotates in a bearing 17 interposed between it and an inwardly extending sleeve 18 on the hub 11 and a bearing 19 between it and the shaft 10. Surrounding the shafts 16 and 10 just inwardly of the sleeve 18 is a closed casing 20 housing the gearing interconnecting the shafts 10 and 16 and adapted normally to drive them at the same speed and in the same direction, but adjustable to rotate the shafts at different speeds to vary the pitch of the propeller blades.

This gearing may comprise a gear 21 non-rotatably secured to the shaft 10 just inwardly of the bearing 22 through which the shaft is mounted in the inner side wall of the casing, and a gear 23 alongside thereof which is non-rotatably secured to the inner end of the sleeve shaft 16.

The sleeve shaft 16 is further mounted to rotate in a bearing sleeve 24 extending inwardly from the outer wall of the casing 20. Surrounding this bearing 24 on the casing is revolvably mounted on bearing 25, an independently revolvable gear housing 26 having non-rotatably secured thereto the internal gear 27 which spans the width of the gears 21 and 22 and is arranged in the same transverse plane.

On a stud 28 fixed to the inner wall of the casing 20 is rotatably mounted, through bearing 29 an intermediate gear or pinion 30 which meshes with the gear 21 fast on the shaft 10 and with the internal gear 27.

On a similar stud 31 and substantially diametrically opposite the stud 28 is rotatably mounted on bearing 32 a second intermediate

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gear or pinion 33 meshing with the gear 23 on the sleeve shaft 16 and with the internal gear. The stud 31 like the stud 27 is normally held in fixed position, and the gear ratios between gears 21 and 23 and their intermeshing pinions 30 and 33 is such that rotation of the shaft 10 will produce a drive of the sleeve shaft 16 in the same direction and at the same speed as the shaft 10.

In normal operation, then, the pitch of the blade does not change during rotation of the propeller.

To provide for change in pitch, provision is made for causing differential rotation between shafts 10 and 16. This may be brought about by mounting the stud shaft 31 on a support arm 34 which is rotatably mounted through the bearing 35 for angular movement about the axis of the shaft 10.

Such angular movement of the arm 34 and pinion 33 will at once bring about a differential speed relation between the shafts 10 and 16 in a manner which requires no further explanation. To bring about the angular adjustment, the arm may be provided with a pin 36 paralleling the axis of the shaft and extending through a slot 37 in the inner wall of the casing. The ends of this slot may serve as limits limiting the movement of the blades to maximum pitch in each direction. In such case, the position of the parts in Figure 2, would indicate the highest pitch angle in one direction. If the pin 36 were moved from the position shown to the center of the slot, the pitch of the blades would be zero, and movement to the opposite end of the slot would move the blades to the limit of the reverse pitch.

It is to be understood that, the pin 36 could be moved manually to adjust the pitch, as by suitable connections to the pilot's cockpit or the movement might be effected automatically by any one of the known means for effecting automatic change of pitch with variation in propeller shaft speed or otherwise.

It will be seen that the arrangement of the gearing within a closed casing and the use of an internal gear as part of the transmission tends to eliminate noise and facilitates the lubrication of the gearing. The arrangement shown also provides a most compact arrangement of the gearing in the longitudinal direction, thereby decreasing the overhang of the propeller shaft beyond its foremost bearing on the engine casing. In fact, the bearing 22 might be a bearing disposed at the front of the engine casing, and the housing might be secured directly to the front wall of said casing. If desired, the operating pin 36 may be extended radially, instead of axially, as shown, when it would extend through a slot in the outer cylindrical face of the housing 20.

Further, with the arrangement shown and described, simple friction bearings may in most cases be used, such bearings may be moulded non-metallic bearings impregnated with graphite or otherwise made self-lubricating. For example, bearings 19, 24, 25 and 35 may be of this nature. The bearings for the pinions 30 and 33 may be simple needle bearings and high speed anti-friction bearings are required only for the bearings 17 and 22. Thus, the bearings, are for the most part, of simple and inexpensive form, and similarly, the gears are simple spur gears, which are also inexpensive. An exceedingly practical, efficient and inexpensive mechanism of this class has been provided.

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While a specific embodiment of the invention has been herein shown and described, it will be understood that changes may be made by those skilled in the art without departing from the main features of the invention and such changes are intended to be covered by the claims appended hereto.

What is claimed is:

1. In a device of the class described, a pair of shafts rotatable about a common axis, one driving and one driven, and continuously intermeshed gearing forming a driving connection between said shafts, said gearing comprising an external gear fast to said driving shaft and a similar gear fast to said driven shaft and disposed in side by side relation to said first-named gear, an internal gear having a peripheral toothed portion encircling said external gears and spanning in width the combined width of their peripheries and further having a mounting portion disposed axially at one side only of said external gears for supporting it through a plain radial bearing for rotation about the common axis of said shafts, and a single pair of external gears rotatably mounted on respective normally fixed axes disposed on substantially diametrically opposite sides of said common shaft axis, the gears of said pair having their planes of rotation offset from each other in the direction of the common shaft axis, one meshing with the gear fast to said driving shaft and the other meshing with the gear fast to said driven shaft and both meshing with said internal gear and together forming the sole driving connection between said driving and driven shafts and said internal gear, the axis of one of said pair of external gears being mounted for angular adjustment about the common shaft axis to advance or retard the speed of one shaft with respect to the speed of the other.

2. In a device of the class described, a pair of shafts rotatable about a common axis, one driving and one driven, and continuously intermeshed gearing forming a driving connection between said shafts, said gearing comprising an external gear fast to said driving shaft and a similar gear fast to said driven shaft and disposed in side by side relation to said first-named gear, an internal gear having a peripheral portion encircling said external gears and spanning in width the combined width of their peripheries and further having a mounting portion, disposed wholly axially at one side of said external gears, for supporting it through a plain radial bearing for rotation about the common axis of said shafts, and a single pair of external gears rotatably mounted on respective normally fixed axes disposed on substantially diametrically opposite sides of said common shaft axis, the gears of said pair having their planes of rotation offset from each other in the direction of the common shaft axis, one meshing with the gear fast to the driving shaft and the other meshing with the gear fast to the driven shaft and both meshing with said internal gear, the axis of one of said pair of gears being carried by a support mounted, through a plain radial bearing disposed axially at the opposite side of said first-named external gears from the mounting portion of said internal gear, for rotary adjustment about the common shaft axis to advance or retard the speed of one shaft with respect to the speed of the other.

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