March 4, 1947. T. M. GRADY 2,416,689

PROPULSION MECHANISM

Filed Sept. 27, 1944

Fig. 1.

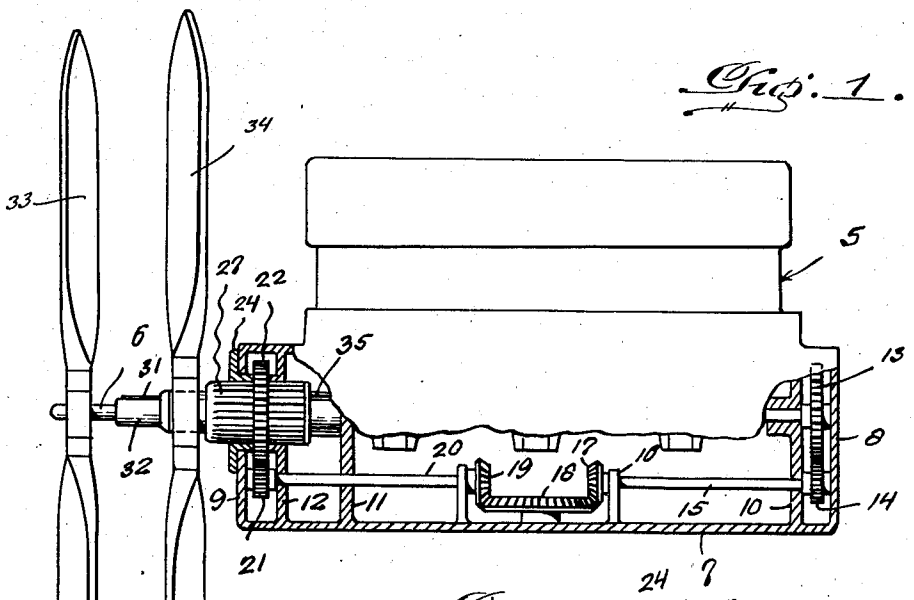


Fig. 2.

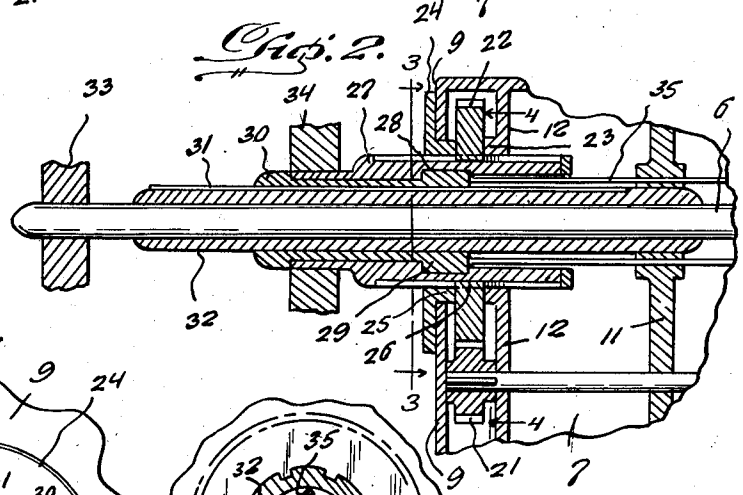
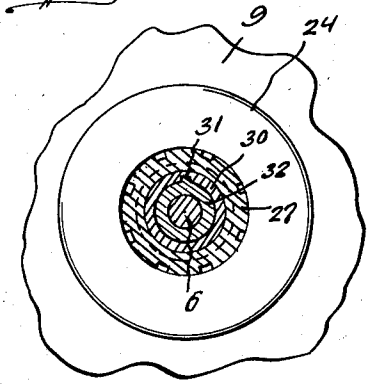


Fig. 3.



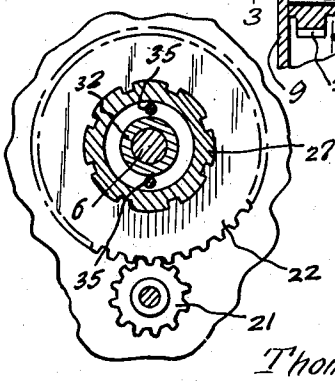


Fig. 4.

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PROPULSION MECHANISM

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4 Claims. (Cl. 170—135.5)

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This invention relates to new and useful improvements in propulsion mechanisms and more particularly to aircraft or marine craft propulsion wherein propellers moving or rotating in opposite directions are utilized.

The principal object of the present invention is to provide propulsion means of the character stated wherein the propellers are driven in a positive manner and wherein the parts are arranged so as to minimize wear as much as possible and to enhance the prospects of durability.

Another important object of the invention is to provide a propulsion mechanism in which oppositely rotating propellers are provided, with one of the propellers capable of being adjusted with respect to the other in order to arrive at the critical efficiency of the propellers under varying conditions in order to obtain the greatest power available.

Other important objects and advantages of the invention shall become apparent to the reader of the following description.

In the drawings:

Figure 1 is a side elevational view of the propulsion mechanism with a portion in section.

Figure 2 is a fragmentary vertical sectional view through the gear means.

Figure 3 is a cross section taken on the line 3—3 of Figure 2.

Figure 4 is a sectional view taken on the line 4—4 of Figure 2.

Referring to the drawings wherein like numerals designate like parts, it can be seen that numeral 5 generally refers to a substantially conventional internal combustion engine of an aircraft or marine craft type.

Numeral 6 denotes a crankshaft for the engine 5 and a crankcase 7 is provided for this shaft. The crankcase 7 has end walls 8, 9. Uprights 10, 11 and 12 are provided in the crankcase 7. On the rear end of the crankshaft 6 and between the end wall 8 and the upright 10 is a gear 13 which meshes with a pinion 14 on a horizontally disposed shaft 15, the latter being journaled through the upright 10 and a bearing 16. The shaft 15 has a beveled pinion 17 meshing with a large beveled gear 18 which, in turn, drives a beveled pinion 19 on the adjacent end of a shaft 20 which extends forwardly through the uprights 11, 12, as shown in Figure 1.

The forward end of the shaft 20 carries a pinion 21 which meshes with a large ring gear 22 operating between the upright 12 and the end wall 9. The upright 12 has an inwardly disposed guide portion 23 for engagement against one side

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of the gear 22 while a bearing plate 24 is provided at the outside of the front wall 9 and has an inturned bearing portion 25 for engaging the front side of the gear 22.

The gear 22 is splined, as at 26, to a rotary sleeve 27, this sleeve 27 having an internal circumferential groove 28 for receiving a circumferential enlargement 29 on a slide sleeve 30. The sleeves 27 and 30 may be moved longitudinally as a unit on the splined hollow casting 32 and since the propeller 34 is fixed on the sleeve 27 the propeller 34 moves with the unit for an adjusted position. The sleeve 27 and the propeller 34 rotate as a unit. The sleeve 27 is rotatably mounted or journaled on the sleeve 30 including its annular enlargement 29.

The slide sleeve 30 has an internal longitudinal groove for receiving a key 31 on a casting 32 which extends rigidly from the crankcase. Through the casting 32 is disposed the forward end of the crankshaft 6. On the crankshaft 6 at its forward end is a propeller 33, while on the forward reduced end of the rotary sleeve 27 is a second propeller 34.

In the operation of the mechanism, it can be seen that the direct drive of the crankshaft 6 of the engine 5, rotates the propeller 33 in one direction.

The drive through the gears 13, 14, 16, 18, 19, 21, and 22 serve to rotate the inner propeller 34 in the opposite direction to that of the propeller 33.

Obviously, the wash of air from the outside propeller 33 strikes the propeller 34 and the latter cuts through this wash in an opposite direction, thus promoting an increase in speed with but a nominal increase in fuel consumption.

As disclosed in Figure 2, the rotary sleeve 27 with the propeller 34 is capable of being moved forwardly or rearwardly and in order to accomplish this control rods 35 extend from the annular enlargement 29 of the sleeve 30 to a suitable control point. Thus it can be seen, that the critical point of efficiency can be reached by properly adjusting the spaced relation of the propeller 34 with respect to the propeller 33. Ordinarily, the propeller 34 should be spaced sufficiently distant from the propeller 33 to be out of or substantially out of the high pressure area created by the propeller 33 in order to be in the position of maximum efficiency. Of course, the higher the speed of propeller 33 the longer would be the high pressure area back of it; therefore, the distance between the propellers should be accordingly increased. The use of two propellers instead of one,

as proposed by me, would substantially double the lift or pull and since the propellers rotate in opposite directions, the torque created by the propellers would be substantially balanced.

It is to be noted that my gearing mechanism is of such construction that the gears are prevented from wobbling. The long shafts 15 and 20 prevent the gears 14, 17, 19 and 21 from wobbling. The gear 22 is prevented from wobbling by the inturned portions of the housing 9, 12 and 24. The thrust strain and stress on the bevel gear 18 is balanced besides the gear 18 could be provided with a long hub adapted to receive a long stub shaft or trunnion.

While the foregoing specification sets forth the invention in specific terms, it is to be understood that numerous changes in the shape, size and materials may be resorted to without departing from the spirit and scope of the invention as claimed hereinafter.

Having described the invention, what is claimed as new is:

1. In an aircraft engine including a housing therefor and having propellers operatively mounted on said engine in tandem fashion, said engine having a crank shaft extension projecting forwardly beyond said housing and having the forward propeller fixedly mounted on said crank shaft in a forward position, in combination with a tubular fixed support mounted on the housing and containing an intermediate portion of said crank shaft extension, a slidable sleeve slidably splined on said tubular fixed support, a rotating sleeve having an annular groove in association with said slidable sleeve and mounted on said tubular support said slidable sleeve having a circumferential enlargement received in the annular groove of said rotating sleeve, the forward end of said rotating sleeve having the rear propeller fixedly mounted thereon, means connected to said circumferential enlargement for adjustably sliding said slidable sleeve and said rotary sleeve and its rear propeller as a unit to and fro relative to said forward propeller, in further combination with gear mechanism propelled by said crank shaft to rotate said rear propeller in a direction of rotation opposite from that of the forward propeller, said gear mechanism being actuated by a spur gear mounted on the rear end of said crank shaft.

2. In an aircraft engine and tandem propeller unit, including a housing, a crank shaft in said housing and having an end thereof protruding from said housing, a shaft concentrically arranged with respect to said crank shaft, a propeller fixedly mounted on the projecting end of said crank shaft, a second propeller mounted on said concentrically arranged shaft, said concentric shaft and its propeller being slidably adjustable relative to said first named propeller, means connected to said concentric shaft to actuate it and its propeller to adjusted position, in combination with a spur gear splined on said concentric shaft, said spur gear having guiding walls adjacent its splined construction to prevent said gear from wobbling or binding on said concentric shaft, said guiding walls being on the forward end of said housing, in further combination with a gear mechanism a gear carried by the other end of said crank shaft, a stub shaft rotatably supported within said housing, a pinion carried by an end of said stub shaft in mesh with said last named gear, a large bevel gear mounted for rotation about a vertical axis in said housing, a small bevel gear carried by the other

end of said stub shaft and in mesh with said bevel gear, a second stub shaft arranged in aligned relation with respect to said first named stub shaft and rotatably supported in said housing, a second small bevel gear carried by an end of said second named stub shaft in mesh with said large bevel gear, and a pinion carried by the other end of said second named stub shaft in mesh with the spur gear splined on said concentric shaft, whereby said propellers are driven in rotary directions opposite to each other and substantially at the same speed of rotation.

3. In a tandem propeller assembly for airplane engines, including a housing provided with an extension, a crank shaft in said housing and having an end projecting from the extension of said housing, a fixed tubular bearing extension concentrically arranged with respect to said crank shaft, said tubular extension being shorter than said crankshaft projecting end and having a spline extending along its outer portion throughout the major portion thereof, a sleeve having an internal groove slidably mounted on said tubular extension, said sleeve having a circumferential enlargement on its rearmost portion, in combination with a rotary sleeve concentric with said first-named sleeve, said rotary sleeve having an annular offset portion receiving said circumferential enlargement, said sliding sleeve having an upset end portion located to engage the forward end of said rotary sleeve, a propeller fixedly mounted on the projecting end of said crank shaft, a second propeller fixedly mounted on the forward end of said rotary sleeve, said rotary sleeve having a splined surface portion extending through both walls of the extension of said housing in further combination with a spur gear in said housing fitting said rotary sleeve and the splines thereof, one of the walls of the extension of said housing being inturned so as to engage the side face of said gear and the other of the walls of the extension of said housing having in association therewith a bearing in engagement with the other side face of said gear to prevent it from wobbling, means connected to said circumferential enlargement for slidably moving said sleeves and the propeller carried by said rotary sleeve as a unit to adjust said propeller relative to the propeller carried by the projecting end of said crank shaft, in further combination with gear mechanism actuated by said crankshaft to rotate said spur gear and the propeller carried by said rotary sleeve in a direction opposite to that of the crank shaft and the propeller carried thereby.

4. In a tandem propeller assembly for airplane engines, said engine having a crankshaft, a crankshaft casing having a gear housing at the front and rear ends thereof, said crank shaft having an end thereof extending through and projecting from said front gear housing, a propeller carried by the projecting end of said crank shaft, an adjustable rotary sleeve concentrically arranged on the portion of said crank shaft extending through said front gear housing and carried thereby, a second propeller carried by said sleeve, a spur gear splined on the portion of said sleeve within said front gear housing, means in said front gear housing in association with said spur gear for preventing the latter from wobbling, a second spur gear fixedly mounted on the portion of said crank shaft within said rear gear housing, a stub shaft rotatably supported within said casing and having an end projecting into said rear gear housing, a pinion carried by the

projecting end of said stub shaft and in mesh with said second spur gear, a large bevel gear mounted for rotation about a vertical axis in said casing, a small bevel gear carried by the other end of said stub shaft and in mesh with said bevel gear, a second stub shaft arranged in aligned relation with respect to said first named stub shaft and rotatably supported in said casing, said second named stub shaft having an end projecting into said front gear housing, a pinion carried by the projecting end of said second named stub shaft in mesh with said first named spur gear, and a second small bevel gear carried by the other end of said second named stub shaft and in mesh with said large bevel gear, whereby the propeller carried by said sleeve is actuated in a direction opposite to that of the propeller carried by the crank shaft.

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