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DRIVING MECHANISM FOR TWO IN OPPOSITE DIRECTION ROTATING AIR PROPELLERS BY MORE THAN ONE MOTOR

Filed April 18, 1940

Serial No. 330,323

2 Sheets-Sheet 1

*Fig. 1.*

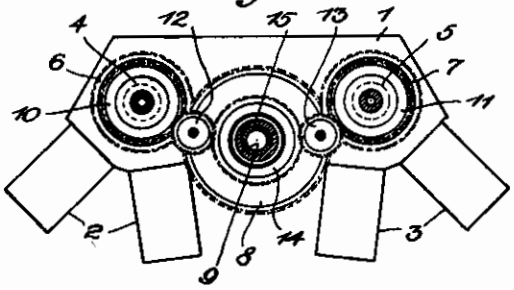
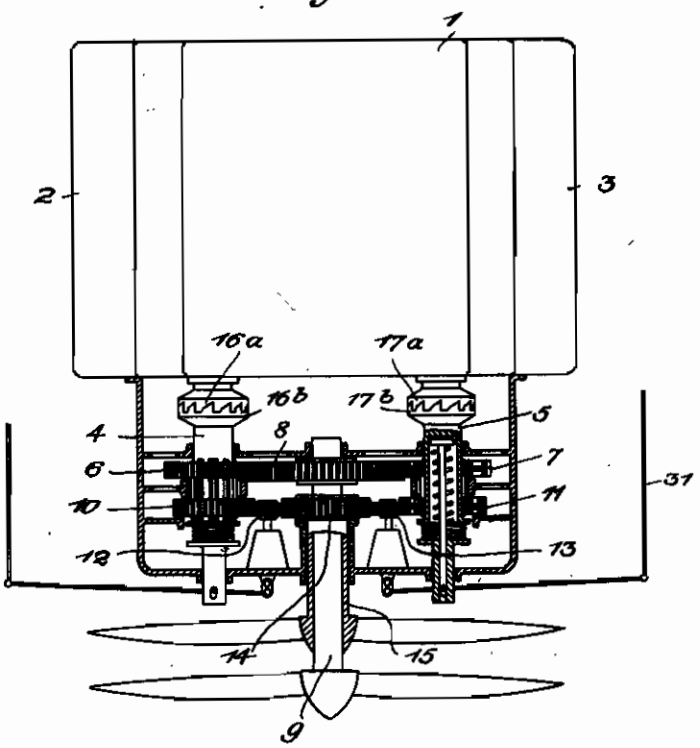



*Fig. 2.*

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INVENTOR

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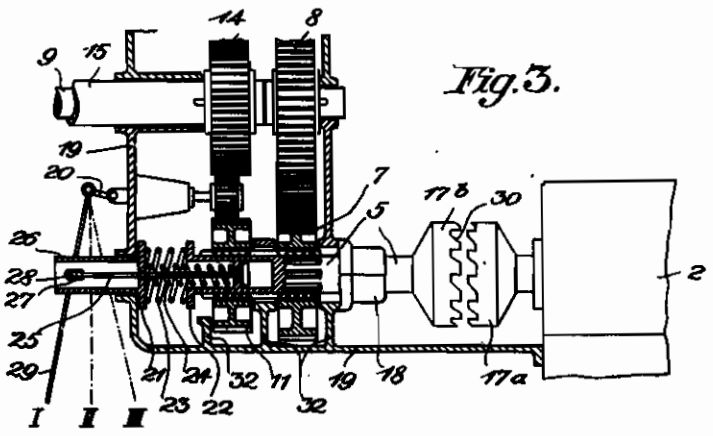



Fig. 3.

Fig. 4.

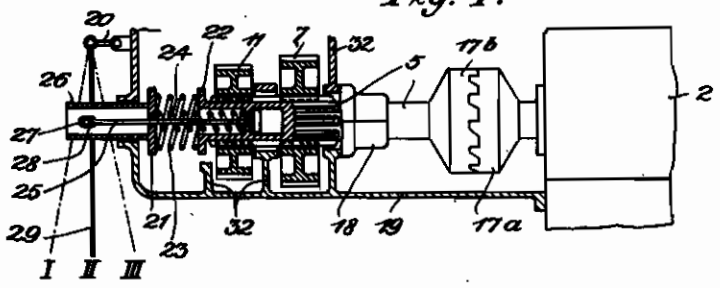
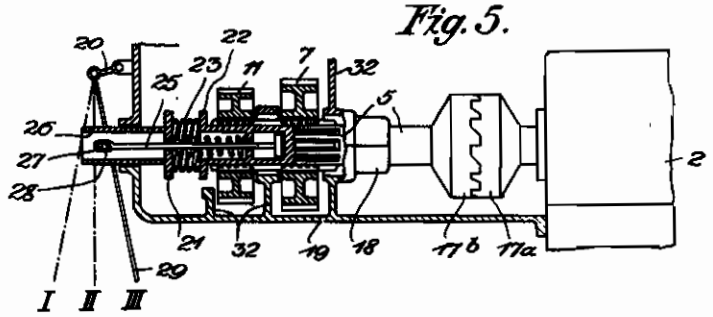



Fig. 5.

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# ALIEN PROPERTY CUSTODIAN

## DRIVING MECHANISM FOR TWO IN OPPOSITE DIRECTION ROTATING AIR PROPELLERS BY MORE THAN ONE MOTOR

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Application filed April 18, 1940

The invention relates to a driving mechanism for two in opposite direction rotating air propellers by more than one motor and in such a manner, that the shafts rotating in opposite direction are commonly driven by all motors. This arrangement has the advantage that by the cutting out of a motor nevertheless the motors driven in opposite direction are still driven by the other motors. The disengaging gear is adjustable at different steps in such a manner, that in the lowest adjusting step in case of small interruptions, e. g. in an output decrease by a stopping of the ignition, defective fuel supply or the like and in the highest adjusting step in case of serious interruptions e. g. by a fracture or corrosion, the corresponding motor, where the interruption occurs, will be disengaged.

In particular claw-clutches are provided as free-wheel couplings, with a coupling spring, the tension of which is adjustable during the working of the clutches and the side-flanks of which clutch teeth are executed in such a manner that the coupling parts are separated from each other as soon as the driven coupling parts rotate with a greater speed than the driving parts. In an advantageous manner the spiral pressing springs of different length are mounted concentrically to each other in the clutches in such a manner that when coupling or uncoupling the clutches, said springs come into or out of action the one after the other. Thereby the adjusting means of the clutches are constrainedly connected in such a manner with the means for letting in or disengaging the clutch that when the operating lever is thrown in firstly a letting-in takes place, then the lowest and hereafter the highest working step becomes active, whilst the indicated position will be reached in opposite direction when the operating lever is thrown out.

The separate clutches may be actuated by hand or particularly the adjustment of their working steps may be effected by means of a control device, a relais or the like from any function of the driving motors or of the driven device e. g. from the air propeller shaft through a revolution controller in such a way that with a decrease of the number of revolutions of the air propeller shaft below an allowable limit all the clutches become adjusted in their lowest working step so that the clutch of the motor, wherein the source of disturbance must be searched, uncouples without more.

Such an arrangement enables the person controlling the driving mechanism, when the output of the driving set decreases to find immediately the motor wherein the disturbance occurs and to stop this motor without stopping the common driven shaft, after which the disturbance can be removed and the motor be put in action again.

The execution of the teeth of the free-wheel clutch as well as of the adjusting device for adjusting the coupling springs is preferably the same as shown and described in the pending U. S. application Serial No. 302,868 of the same inventor.

The motors and the cylinders of the separate motors are mounted upon a common crank casing making an angle with each other. In this manner a correct and fixed connection of the motor units is obtained, which enables also a simple fixation in the air craft.

In the drawing one form of execution according to the invention is shown diagrammatically. Herein shows:

Fig. 1 a multiple motor driving mechanism for in opposite direction rotating propellers in front view;

Fig. 2 said mechanism in plan view, and

Figs. 3, 4 and 5 the driving of a single motor in three different adjusting positions of the clutch.

The cylinders 2 and 3 of the combustion engine mounted upon a common crank-casing 1 belong to crank shafts 4 and 5.

The ends of the crank shafts 4 and 5 bear gear wheels 6 and 7 respectively, engaging a common gear wheel 8, the latter being connected with the air propeller shaft 9.

The crank shafts 4 respectively 5 are provided besides the gear wheels 6 respectively 7 with gear wheels 10 respectively 11, driving through transmitting gears 12 respectively 13 a gear wheel 14 connected to the air propeller shaft 15 rotating in a direction opposite to the shaft 9.

Between each motor 2 and 3 and its gear wheels (6, 10 and 7, 11) is mounted a free-wheel coupling (16*a*, 16*b* and 17*a*, 17*b*). These free-wheel couplings are executed as claw-clutches with bevelled front surfaces of known construction in such a manner, that at an approach introducing the engagement of the coupling parts, the same will repel each other as long as the part originally rotating with greater speed begins to become the part with a slower speed.

As soon as a motor fall behind an axial pression is produced at the bevelled surfaces by which the couplings teeth and through this the clutch parts are removed from each other, so that the coupled connection is released. The moment at or the load by which this release will occur, is determined by a step-wise acting spring.

For this purpose for instance the coupling parts

17b, as shown in Figs. 3, 4 and 5, are supported movably in length direction in the bearing 18 of a casing 19. Upon the shaft 5 of the coupling part 17b are mounted slidable in length direction but unrotatable, the gear wheels 7 and 11 engaging the gear wheels 8 resp. 13/14 of the corresponding driving shafts 9 and 15. At the same time the gear wheels 7 and 11 are locked against an axial movement in the casing 19 by stops 32. In the hollow shaft 5 of the coupling part 17b is mounted a cam rod 25 slidable over a small distance and rotatable as driver, reading in a tube 26 axially movable and rotatably supported in the casing 19. At the outer free end of this cam rod 25 a slot 27 is provided engaged by a cam pin 28 of an operating lever 29. At the same time the cam pin 28 passes a boring in the tube 26. The operating lever 29 is hingedly connected to the casing 19 by a short link 20. Between a flange 21 of the tube 26 and a flange 22 at the end of the coupling part 5, a tensioned spiral spring 23 is mounted and within this spring 23 another spiral spring 24 is mounted about the rod of the camrod 25, the spring 24 forming in first instance no part of the tensioned connection between the flange of the tube 26 and the flange 22 of the coupling part 5.

The arrangemcnt works in the following manner:

In the position I shown in Fig. 3 the actuating lever 29 has drawn the cam rod 28 by means of the pin 28 completely to the left and this cam rod maintains also the coupling part 17b out of engagement.

When the actuating lever 29 is moved from the position I shown in Fig. 3 into the position II of Fig. 4, the pin 28 drives the tube 26 with the flange 21 to the right in the casing 19 and stronger tensioned spring 23 presses first against the flange 22 of the coupling shaft 5 and moves the coupling part 17b as far to the right until the latter after being synchronized by the action of the bevelled front flanks 30 engages the coupling part 17a. In this position the spring 24 does not yet exert any influence and upon the coupling part 17b acts only the pressure of the spring 23. This pressure is strong enough to ensure a positive engagement of both coupling parts but not strong enough to prevent a release of the clutch in the above-described manner as soon as the corresponding motor falls behind in its output, for instance by an interrupted ignition, fuel supply or the like with respect to the other motors. If therefore during the working the total output of the driving mechanism falls behind, it is only necessary to adjust the clutches of all the motors in the first spring step and the disturbance is to find out the motor of which the coupling springs out.

When necessary, the clutches may be provided with a distance indicator so that the controller can see which coupling is disengaged.

When the actuating lever 29 is put in the position III of Fig. 5, then the tube 26 moves more to the right and the tension of the spring 23 is increased. At the same time the flange 21 of the tube presses also upon the spring 24 and loads the shaft 5 of the coupling part 17b too. The pressure of both springs is now so strong that the clutch is fit to disengage only then, when the motor 2 cuts out completely, for instance stops suddenly. The other motors are able to continue unhindered and both shafts are still driven.

The adjustment of the actuating lever 29 for the clutches is effected in a suitable manner from the driver's seat by means of a rod 31 (Fig. 2). The number of commonly driving motors is unlimited within the scope of the invention as well as its construction and driving art.

FRITZ NALLINGER.