May 5, 1936. J. F. BROWN 2,039,628

PROPELLER DEVICE

Filed April 13, 1935 5 Sheets-Sheet 1

Fig. 1.

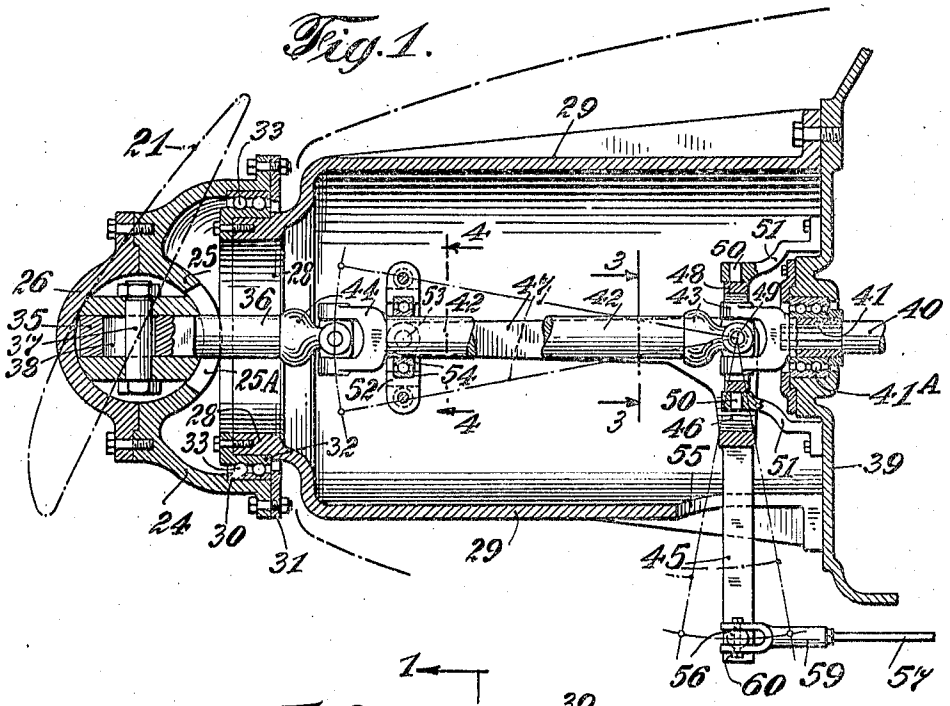
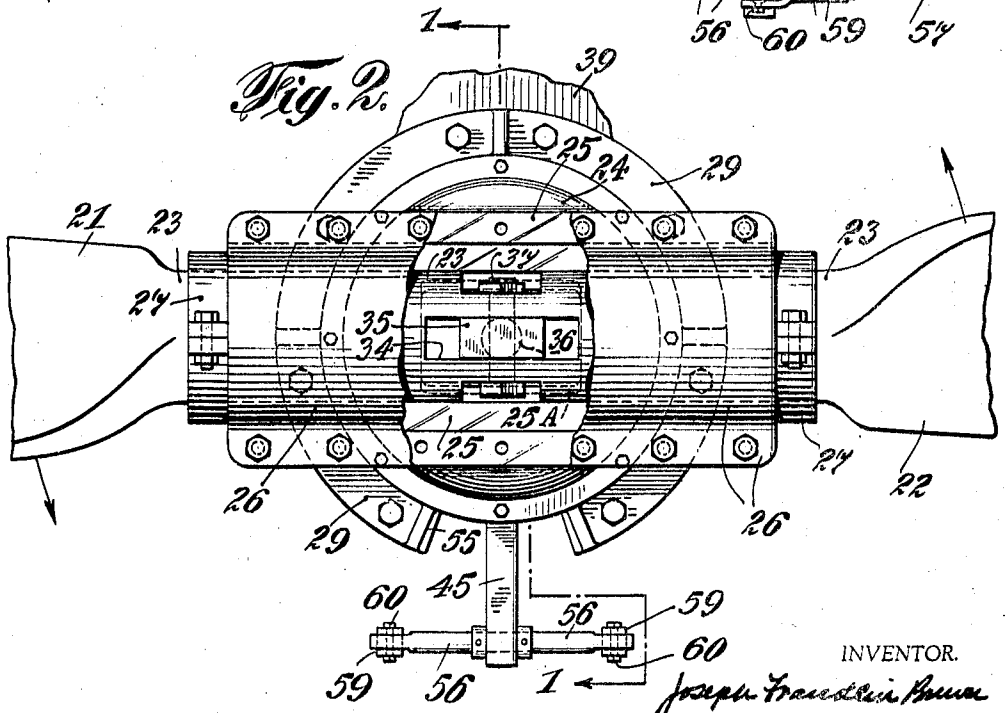


Fig. 2.



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PROPELLER DEVICE

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Fig. 3.

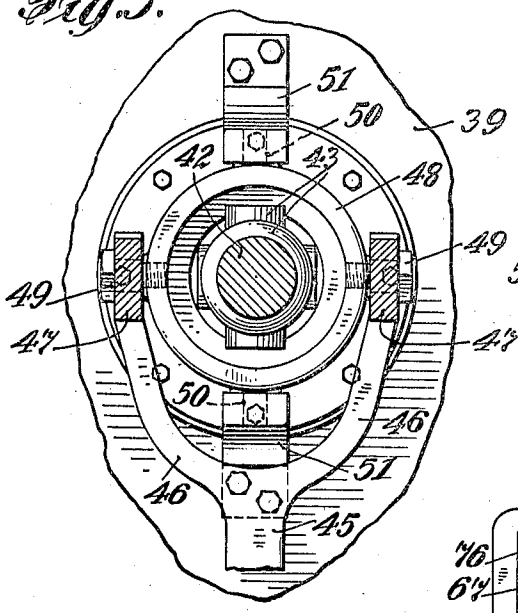


Fig. 4.

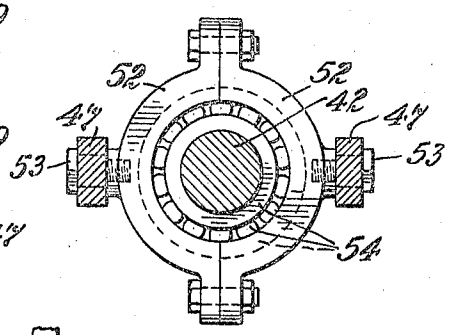


Fig. 7.

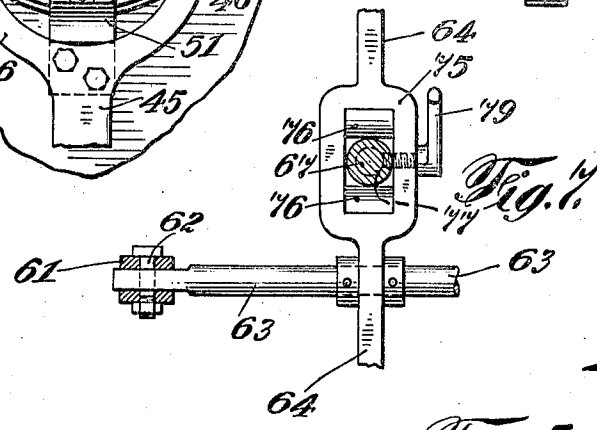


Fig. 5.

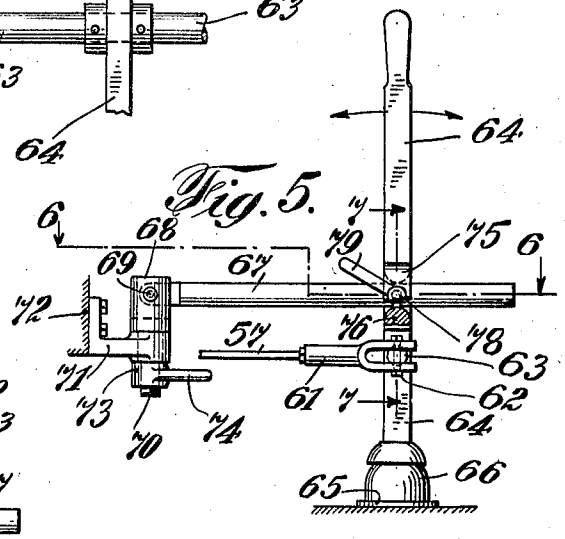
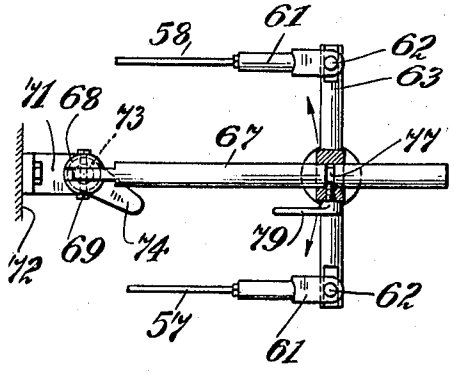


Fig. 6.



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PROPELLER DEVICE

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Fig. 8.

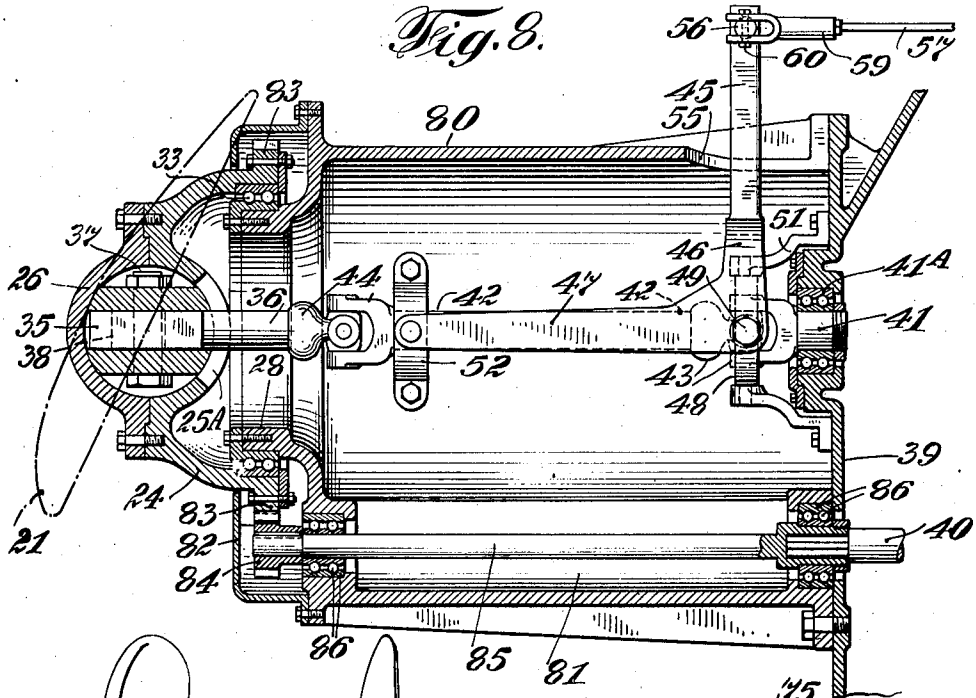




Fig. 10.

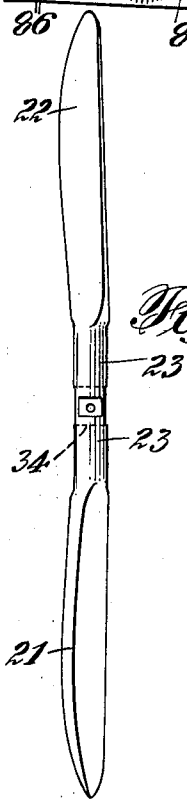


Fig. 11.

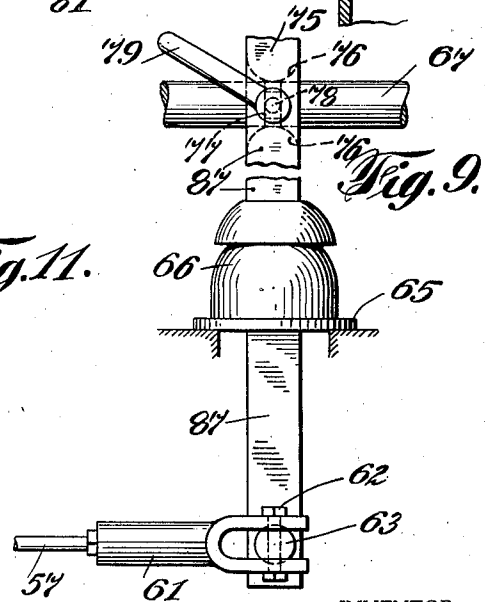


Fig. 9.

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PROPELLER DEVICE

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Fig. 13.

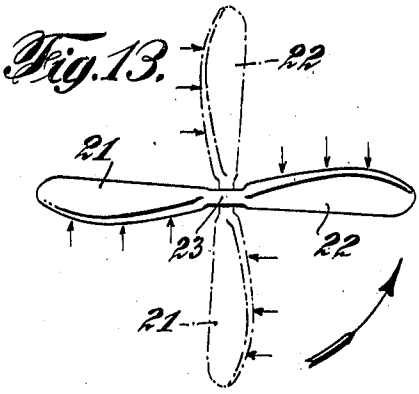


Fig. 12.

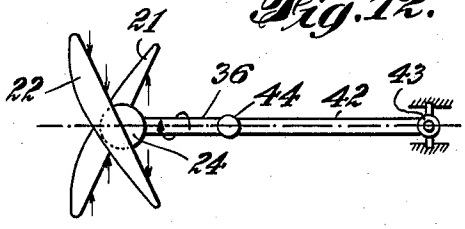


Fig. 15.

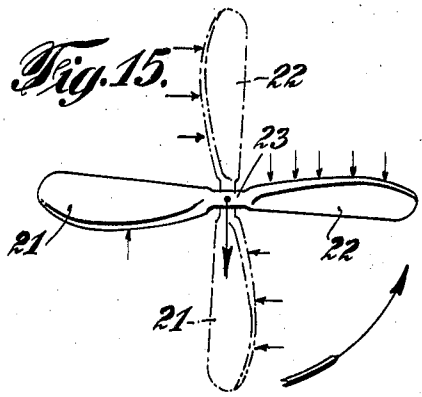


Fig. 14.

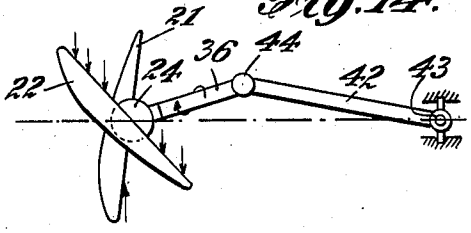


Fig. 17.

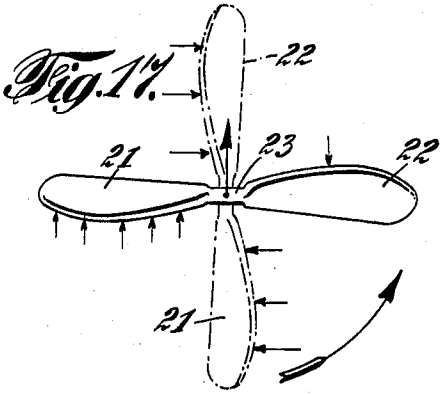
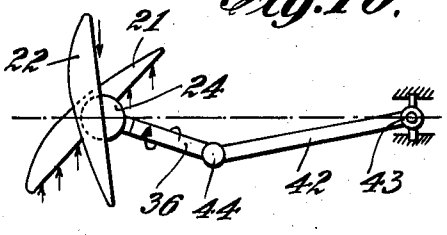


Fig. 16.



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PROPELLER DEVICE

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Fig. 19.

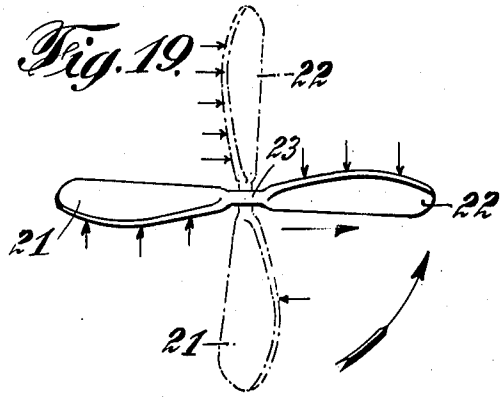


Fig. 18.

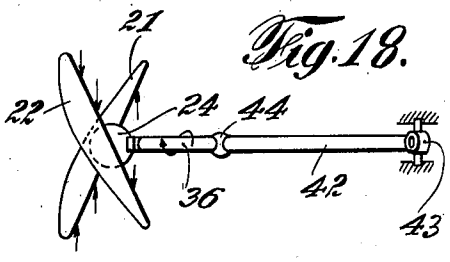


Fig. 21.

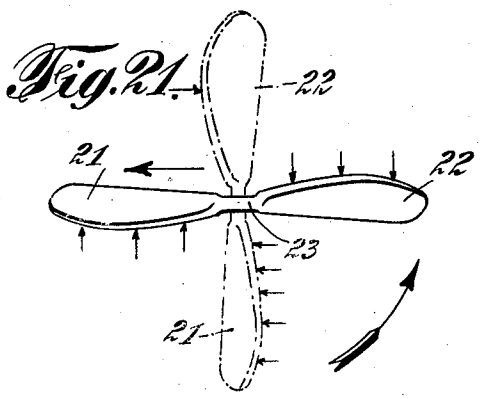


Fig. 20.

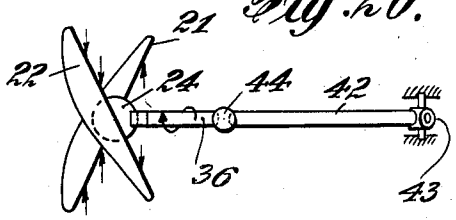


Fig. 23.

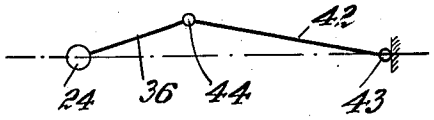


Fig. 22.

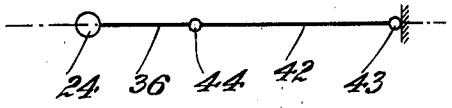


Fig. 24.



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Patented May 5, 1936 2,039,628

UNITED STATES PATENT OFFICE

2,039,628

PROPELLER DEVICE

Joseph Franklin Brown, New York, N. Y., assignor of one-half to Henry M. Stanley, New York, N. Y.

Application April 13, 1935, Serial No. 16,128

16 Claims. (Cl. 170—163)

My invention relates to propeller devices and refers particularly to those of the feathering blade type, and specifically to those in which the amount of feathering may be varied, and in which the feathering may be rotatively shifted universally to different places around the axis of rotation of the propeller.

Such a device, besides its tractive thrust, is capable of imparting thrust, to a variable extent, in any desired direction in a plane at right angles to the axis of rotation of the propeller. Thus a control force is made available which is entirely independent of the speed of travel.

Such control force may be utilized for making either short and quick or more gradual turns, either horizontally or vertically, or a combination of both of these at the same time.

Also, by the use of this control force, both landing and take-off can be effected at a low speed, with only a short take-off run, and a short taxi run in landing.

Propeller devices of this character are constantly becoming of increasing importance, particularly in airplanes and especially in military planes, in which quick maneuvers within a small space, irrespective of travel speed, are of paramount value.

Besides airplanes, the propeller device of my invention is well adapted for propelled dirigible buoyant air craft, as well as air craft of the helicopter type, which gives promise of greater practicability, and also substantially similarly with water craft in any instances where such a device would prove advantageous.

Among the objects of my invention are efficiency, dependability, durability, simplicity, low cost of production and upkeep, ease and convenience of manual control in use, together with other objects and advantages which will hereinafter become evident.

In carrying out my invention in a practical embodiment, I provide a lever arm having an initial neutral or non-feathering position in alignment with the axis of rotation of the propeller. This lever arm is in control of the feathering movements of the propeller blades, through an operating connection to the latter. One end of this controlling arm has a universal joint pivotal mounting which is rotatable with the propeller hub.

This universal mounting provides for swinging the lever arm, to a desired variable extent, away from and back toward or again to its central neutral position, and for thus swinging this lever arm universally in any direction, regardless of the rotation of the propeller hub and consequent revolution of the propeller blades, which results in imparting feathering movement to the blades as they revolve.

The amount of this feathering movement is determined by the extent of movement of the mentioned lever arm to an angular position, while the place at which the feathering takes place is determined by the direction of such lever arm movement.

Manually controlled operating means are provided for the mentioned lever arm. Such means desirably include a universally pivoted handle lever having special operating connections with the mentioned feathering-producing lever arm whereby movement of this handle lever results in a corresponding movement being transmitted to such lever arm.

More particularly, in one form of my invention, in which it is carried out with a two-bladed propeller, the two propeller blades are rigidly connected together by means of a shaft or shank which is journaled in and extends through a propeller hub barrel at right angles to and intersecting the axis of rotation of this hub.

This propeller-blade shaft or shank forms one of the pivots of the mentioned universal pivotal mounting of the universally swingable lever arm. This pivotal mounting includes another pivot by which the lever arm is connected to the rotatable propeller shank to swing on an axis at right angles to the pivotal axis of the latter and at right angles to and intersecting the axis of rotation of the propeller hub.

The mentioned swinging lever arm may be also employed as a propeller shaft for rotatively driving the propeller, excepting with a geared propeller of the type in which the propeller is rotatively driven by means of gearing connections to its hub. Both of these two ways of embodying my invention are disclosed herein.

For a particular description of the illustrated forms of my invention reference will be had to the accompanying drawings, in which similar parts are designated by similar numerals.

Figure 1 is a central longitudinal vertical section on the line 1—1 of Figure 2, of the front end portion of an airplane, showing one form of my invention.

Figure 2 is a broken front elevation.

Figure 3 is an enlarged broken vertical section on the line 3—3 of Figure 1.

Figure 4 is an enlarged vertical section on the line 4—4 of Figure 1.

Figure 5 is a partly broken side elevation of a manually operable controlling lever and its immediate adjuncts.

Figure 6 is a horizontal section on the line 6—6 of Figure 5.

Figure 7 is a somewhat enlarged broken vertical section on the line 7—7 of Figure 5.

Figure 8 is a view similar to Figure 1 of a modification having a geared propeller.

Figure 9 is a view similar to Figure 5 of the manual controlling lever pertaining to Figure 8.

Figures 10 and 11 are front and side elevations of the propeller shown in Figures 1, 2 and 8.

Figures 12 to 21 inclusive are diagrammatic representations illustrating the feathering operation of this propeller, Figures 12, 14, 16, 18 and 20 being side elevations, and Figures 13, 15, 17, 19 and 21 being front elevations.

Figures 22, 23 and 24 are diagrammatic partial plan views of Figures 12, 18 and 20.

The variant form of my invention shown in Figures 8 and 9 will be described later, as to the respects in which it is different from that shown fully in the other figures of the accompanying drawings to which reference will now be had.

A two-bladed propeller comprises a pair of similar blades 21—22 which are rigidly connected together by means of an intermediary shaft or shank 23. The propeller shank 23 extends diametrically through a hub barrel at the front of a rotatable propeller hub 24, and is journalled for rotative movement in a split bearing formed by the hub barrel. The hub barrel has a rear half 25 formed upon the hub 24, and a forward half 26 which is firmly fixedly secured to the rear half 25. The propeller shank 23 is shown as provided with stop collars 27—27 at the opposite ends of its bearing in the propeller hub barrel 25—26.

The hub 24 is rotatably mounted upon and carried by the front annular neck portion 28 of a strong casing or housing member 29. The hub 24 is mounted and retained upon the housing neck 28 by means of an anti-friction bearing, shown as of the ball type, comprising an outer race 30 carried by the hub 24 and held in place by a flange ring 31, an inner race 32 fixedly carried by the neck 28, and interposed bearing balls 33.

The axis of the propeller shank 23 intersects the axis of rotation of the propeller hub 24 at right angles thereto. In the particular construction illustrated, the propeller shank 23 has through it a central longitudinally extending slotted rectangular opening 34. The front flattened end portion 35 of a rearwardly extended lever arm 36 fits into this slot 34 and is mounted to swing therein upon a pivot pin 37 which passes through a slotted opening 38 which is slotted longitudinally of the lever arm 36. The reason for having this opening 38 in the form of a slot will be evident later.

It will be noted that the axis of the pivot pin 37 extends at right angles to the axis of rotative movement of the propeller shank 23 and at right angles to and intersecting the axis of rotation of the propeller hub 24. Thus the propeller shank 23 and the pivot pin 37 constitute a universal pivotal mounting for the lever arm 36 on the hub 24, such mounting being carried by the hub 24 to rotate therewith.

The lever arm 36 has a central neutral or inactive position in alignment with the axis of rotation of the propeller hub 24, as shown in Figures 1, 12 and 22. In this neutral position of the lever arm 36 no feathering action of the revolving propeller blades 21 and 22 takes place.

This condition of the propeller blades 21 and 22 is clearly indicated in Figure 13 by means of the small arrows, the number of which indicates the amount of air resistance during the revolution of these blades, showing such resistance as being equal upon both of these blades in the full line position of the latter and likewise equal in an intermediate broken line position of these blades.

It is now evident that the lever arm 36 is capable of being swung away from its central neutral position and of being then disposed in an angular position in any plane which is radial to the axis of rotation of the propeller hub 24. The arm 36 passes through and has freedom to rock within an opening 25A through the rear half 25 of the hub barrel. This swinging lever arm 36 is in control of the feathering movements of the revolving propeller blades 21 and 22.

By reason of the described universal mounting of the lever arm 36, it will be clear that this lever arm may be swung universally to a greater or less extent in any desired direction, and may be thus moved from any one position to any other position without necessarily being returned to its neutral position, and that such swinging movements of this lever arm may take place without regard to the rotation of the propeller hub 24 and the consequent revolution of the propeller blades 21 and 22 carried by this hub.

It is evident from the preceding description that when this swinging lever arm 36 is disposed at any other than its neutral position, then feathering movement will be transmitted to the revolving propeller blades 21 and 22. It is evident that the amount of feathering movement of the revolving blades 21 and 22 will be increased as the lever arm 36 is moved away from its neutral position and will be decreased by movement of this lever arm toward its neutral position.

The place in the revolution at which maximum feathering, whether the later be much or little, takes place depends upon the directional positioning of the angularly disposed lever arm 36 relatively to its central neutral position, and such maximum feathering place or diametrical plane may be circularly shifted by circular movement imparted to the angularly inclined lever arm 36. Manually controlled means adapted thus to swing the lever arm 36 in any direction and to a greater or less extent will be described later.

In Figure 14, the lever arm 36 is shown as having been swung upwardly, thereby to produce the condition of air resistance upon the revolving propeller blades 21 and 22 which is indicated by the small arrows in Figure 15, the result of which would be to produce a downward thrust against the ascending propeller blade 22, and only a very slight upward thrust against the descending propeller blade 21, while such air resistance would be equalized upon these propeller blades when they have reached the intermediate vertical position shown in broken lines. The result would be to depress the nose of the airplane.

Correspondingly, Figures 16 and 17 indicate an opposite or upward thrust upon the nose of the plane, which would tip the latter upwardly. Figures 18, 19 and 23 taken together similarly indicate a horizontal thrust towards the right, as viewed from the front of the plane in Figure 19, the result being to turn the airplane to the left. Figures 20, 21 and 24 indicate an opposite thrust, or towards the left as viewed from the front in

Figure 21, for turning toward the right, as viewed by the pilot.

It will be clear from the above description that the propeller hub **24** and the angularly swingable feathering-producing lever arm **36** rotate together. Hence this lever arm **36** is capable of forming also a propeller shaft adapted to transmit revolution to the propeller blades **21** and **22**, and in the particular form of my invention now under consideration, this lever arm **36** is shown as thus utilized to perform such a double function.

The rear end of the tubular housing **29** is firmly and rigidly secured to the front wall **39** of the airplane engine crank-case. The forward end of the engine shaft **40** is shown as splined into a tubular stub shaft **41** so as to be adapted to rotate the latter. The stub shaft **41** is journaled, by means of an anti-friction bearing **41A**, as shown in Figures 1 and 3, in the crank-case front wall **39** of the engine, in axial alignment with the axis of rotation of the propeller hub **24**.

The stub shaft **41** is coupled to the combined lever arm and propeller shaft **36** for rotating, and also for swinging, the latter by means of an intermediate coupling shaft **42**. The forward end of the stub shaft **41** is coupled to the rear end of the intermediate shaft **42** by means of a universal coupling **43** of the gimbal type, and the forward end of this intermediate coupling shaft **42** is similarly coupled to the rear end of the propeller shaft **36** by means of a similar universal coupling **44**.

When the lever arm **36**, which forms the propeller shaft, is swung away from its neutral position, as above described, then the corresponding angular movement of the coupling shaft **42**, as it swings upon the pivots of its universal coupling **43**, will draw the propeller shaft **36** rearwardly, and the slot **38** in its forward end portion **35** provides for such longitudinal movement of the propeller shaft **36** relatively to its pivot pin **37**.

The mentioned manually controlled means for swinging or rocking the combined feathering-producing lever arm and propeller shaft **36** are adapted to act upon the coupling shaft **42**. The operating parts of this feature are more particularly shown in Figures 1, 2, 3 and 4. An operating lever of the bell-crank type has a universal pivotal mounting which surrounds the pivots of the universal coupling **43**, radially outward from this coupling.

This bell-crank lever comprises a depending lower arm **45** having upwardly extended twin branches **46—46** which turn forwardly into a pair of parallel arms **47—47**. At the junction of the arms **46—46** with the arms **47—47**, this bell-crank lever is pivoted on a horizontal axis to the opposite sides of a gimbal ring **48**, by means of studs **49—49**. This provides for the rocking or swinging movement of this bell-crank lever in a vertical plane.

The ring **48** is pivoted on a vertical axis, by means of studs **50—50**, to a pair of similar upper and lower brackets **51—51** which are fixedly secured to the crank-case front wall **39** of the engine. These vertical pivots **50—50** provide for rocking movement of this bell-crank lever in a horizontal plane.

It is obvious that the conjoint functioning of the horizontal pivots **49—49** with the vertical pivots **50—50** provides for universal rocking movement of the bell-crank lever, in any direction and directly from any one angular position to another.

It will be noted that the horizontal pivots **49—49** and the vertical pivots **50—50** are in the same vertical plane and that the latter pivots are in the same vertical plane with the two right-angular pivots provided by the universal joint coupling **43**. Thus the forwardly extending lever arm **47—47** and the intermediate coupling shaft **42**, which is directly between these lever arms, are adapted to have similar swinging movements in common about their described pivotal mountings. It is to be noted that the coupling shaft **42** has rotative as well as swinging movement.

The forward ends of the lever arms **47—47** are connected to the forward end portion of the shaft **42** for imparting swinging movement to the latter in any direction. This operating connection is provided by means of a split bearing ring **52**, to which the ends of these arms **47—47** are connected by means of pivot studs **53—53**, upon which, however, there will be very little if any pivotal movement of the bell-crank lever. The ring **52** is positioned upon the shaft part **42** by means of an interposed anti-friction bearing **54**, through which the lever arms **47—47** are adapted to impart swinging movement to this shaft **42**, while at the same time providing for the rotation of the latter.

The described bell-crank lever is adapted to be manually operated from the pilot's cockpit by means of its depending lower arm **45**, which extends through a slot **55** provided longitudinally through the lower rear end portion of the tubular housing **29**. The lower end of the lever arm **45** fixedly carries a horizontal cross-bar **56** providing oppositely extended lever arms of equal length. Similar left and right operating rods **57** and **58** have their forward ends operatively connected respectively to the opposite ends of the cross-bar **56** by means of similar clevises **59—59** and vertical pivot pins **60—60**.

It is evident from the preceding description that forward or backward movement of the operating rods **57** and **58** both at the same time and in the same direction will swing the described bell-crank lever in a vertical plane, while the movement of these rods in directions opposite to each other will rotate the bell-crank arm **45**, thereby to swing its forwardly extended arms **47—47** laterally or in a horizontal plane.

Thus simultaneous unitary forward movement of these rods **57** and **58** will swing the shaft-forming lever arm **36** in an upward direction, thereby to produce a feathered condition of the propeller blades **21** and **22** similar to that illustrated in Figures 14 and 15. Similarly, simultaneous rearward movement of the rods **57** and **58** will result in a feathering of the propeller blades **21** and **22** in a manner similar to that shown in Figures 16 and 17, in which the lever arm **36** is shown as having been swung downwardly.

From the preceding description, it will be evident that movement of the operating rods **57** and **58** in opposite directions, with the rod **57** moved forwardly, and the rod **58** moved rearwardly, the twisting or rotative movement thereby imparted to the bell-crank arm **45** will shift the forwardly extended bell-crank arms **47—47** towards the right, as viewed in Figure 4, thereby swinging the lever arm **36** in the same direction. This will produce a feathered condition of the propeller blades **21** and **22** similar to that indicated in Figures 18, 19, and 23.

Similarly, relative movement of the operating

rods 57 and 58 in an opposite direction relatively to each other will in like manner result in a feathered condition of the propeller blades 21 and 22 similar to that indicated in Figures 20, 21 and 24.

It is evident that the unitary and the relative movements of the operating rods 57 and 58 may be superimposed upon each other, for thus producing other feathered conditions of the propeller blades 21 and 22, different from and intermediately disposed relatively to the four different positions of feathering illustrated in Figures 14 to 21 inclusive.

The operating rods 57 and 58 extend rearwardly to the pilot's cockpit and have their rear ends pivotally connected, by means of similar clevises 61—61 and vertical pivot pins 62—62, to opposite ends of a horizontal cross-bar 63. At its middle the cross-bar 63 is fixedly carried by an upstanding handle lever 64 at an intermediate point along the length of the latter below its middle. The lower end of the handle lever 64 is universally pivoted in a floor bracket 65 by means of a ball-and-socket joint 66. The vertical position of the operating lever 64 shown in Figures 5, 6, and 7 is its central or neutral position which corresponds to the neutral position of the feathering-producing lever arm 36 shown in Figures 1 and 2, and to the non-feathering condition of the revolving propeller blades 21 and 22, as it further shown in Figures 12, 13 and 22.

It is evident that forward movement of the handle lever 64 will impart unitary forward movement to the operating rods 57 and 58, which as already described, will result in a feathering action of the revolving propeller blades 21 and 22 similar to that shown in Figures 14 and 15, thus to depress the nose of the plane. Rearward movement of this lever 64 will in a similar manner produce the feathering action indicated in Figures 16 and 17, thereby to apply a lifting thrust to the nose of the plane.

In order to apply a horizontal thrust toward the left to the nose of the plane as viewed by the pilot, which would be toward the right as viewed from the front in Figure 19, the handle lever 64 is to be swung laterally toward the left of the pilot, while to produce an opposite lateral or horizontal thrust on the nose of the plane as shown in Figure 21, the handle lever 64 would be swung laterally in the opposite direction, or toward the right.

The means for accomplishing these lateral or horizontal thrusts in the particular device shown in the drawings comprises a laterally swingable radius arm or angle lever 67. The forward end of this arm 67 is provided with a stationary universal pivotal mounting. It is there pivoted in a slotted head 68 by means of a horizontal pivot pin 69. The head 68 is carried by a vertical pivot stud 70 which is journaled in a bearing formed by a bracket 71, fixedly secured to a stationary part 72 of the airplane. The end portion of this vertical pivot stud 70 is screw-threaded and provided with a clamp nut 73 having a handle 74. This clamp nut 73 provides for locking the arm 67 against horizontal swinging movement, for a purpose which will be made clear later.

The swinging radius arm 67 passes rearwardly through a yoke 75 formed on the handle lever 64 above the cross-bar 63. The opposed inner lateral side faces of this yoke are flat and engage with the radius arm 67, so as to prevent rotative movement of the operating lever 64 relatively to the radius arm 67 in a horizontal plane. The upper and lower faces 76—76 of the opening provided by the yoke 75 are rounded, in order to provide for a desirable amount of relative rocking movement in a vertical plane between the lever 64 and the radius arm 67.

The cylindrical radius arm 67 is provided with an annular stop groove 77 which coincides with the fore-and-aft neutral position of the handle lever 64, as shown in Figures 5, 6 and 7. A stop screw 78, provided with an outer handle 79, is threaded through one side of the yoke 75 so as to be engaged in or withdrawn from the groove 77. At other points along the length of the radius arm 67 this screw 78 may act as a set screw against the arm 67. The purpose of this arrangement will be evident later.

The clamp nut 73 and the combined stop screw and set screw 78 may be made use of either separately or both together. When both are tightened, as indicated in Figures 5, 6 and 7, the handle lever 64 will be locked at its neutral position. Thus this handle lever may be released by the pilot and will require no attention until it is desired to produce a feathering action of the propeller blades 21 and 22, as already described. Similarly, the handle lever 64 may be locked at any desired inclined position, in which it is producing any of the described feathering actions of the propeller blades 21 and 22.

Figures 8 and 9 illustrate the adaptation of my invention to an airplane in which the engine is geared to the propeller.

A housing 80, which corresponds to the housing 29, has a downward extension 81 along its bottom, with its inner end slot 55 at the top. At its front end the housing 80 carries an outer gear cover 82. The propeller hub 24 carries a gear ring 83 which meshes with and is driven by a smaller gear or pinion 84.

The pinion 84 is fixedly carried upon the front end of an intermediary coupling shaft 85, the rear end of which is coupled to the front end of the engine shaft 40 to be driven thereby. The coupling shaft 85 is journaled in the opposite ends of the housing extension 81 by means of anti-friction bearings 86—86.

The operating lever, of bell-crank form, has its arm 45 extended upwardly. Therefore the rear or cockpit cross-bar 63 is carried by the lower end of a handle lever 87 which is extended below its ball-and-socket universal fulcrum pivot 66. Feathering of the propeller blades 21 and 22 is caused to take place in the same manner as already described.

The operation of the mechanical elements and parts, in their relation to each other, has already been described. The operation of my device as a whole, in use, is summed up as follows:—

It will now be evident that by the use of my invention a variable mechanically produced thrust in any direction can be applied to the front end of the fuselage of an airplane. Thus my device can be used alone for effecting any maneuver, without the use of any other control means.

It is similarly evident that my device is capable of use conjointly with the use of the usual controls, which latter depend for their operative effectiveness upon the slip stream of air due to the speed of travel. Provision is made for the use of the latter controls alone, by merely maintaining my device at its neutral or non-operative position.

By the use of the device of my invention, parasitical drag is largely eliminated.

The device of my invention provides sensitivity of control under all conditions of flight. Maneuvers can be executed in a brief time within a small area.

In taking off with an airplane having only the usual controls, sufficient lift force for rising is obtained before control speed is attained, necessitating a take-off run of greater length, while my device enables take-off at low speed of travel, with a short run.

Similarly, my invention enables landing to be effected, on land or water, at a low speed of travel, with a correspondingly short taxi run. In fact, a vertical or pancake landing can be made with relative safety, lateral balance then being maintained by means of the usual ailerons. Thus my invention enables vertical descent, while at any height in the air, with full control of the airplane.

The dangers of a stall are eliminated, since when equipped with my invention, the airplane will then be under control and can be instantly righted, without being permitted to slide backward, without control, and thus be likely to go into an undesired tail-spin.

From the disclosure of my feathering blade propeller device as applied to an airplane, it is evident that such device is adapted to be substantially similarly advantageously employed in an air craft of the helicopter type.

In such case, balance can be maintained without having a low center of gravity, great maneuverability is obtained, and a high speed of translation or travel for this type of craft is attainable. Such travel is in the plane of rotation of the air foil or propeller and is produced directly by the feathering action of the propeller blades. The latter at the same time, or without travel, are of course adapted to provide a variable lift thrust. Efficiency is attained with economy in the consumption of power.

In the case of a dirigible lighter-than-air craft, the operation of the propeller device of my invention is, in many respects, similar to that of its use upon an airplane, but is different in other respects.

Such a craft equipped with my invention would have altitude control, with no need for carrying ballast. Balance could be maintained without need of low suspension of weight. There would thus be less structural resistance to forward speed. Thrusts for landing could be produced, which would eliminate the need of having a large landing screw.

In this type of air craft, swiveled propellers, which have a limited range of usefulness and are slow in operation, could be dispensed with and replaced with the quick-acting directionally changeable thrust device of my invention; or the swiveling could be retained in conjunction with the device of my invention. In the latter case, universally directable angular thrusts could be instantly obtained with only slight changes in the plane of rotation of the propeller.

It is believed now to be evident that my disclosed invention has many valuable attributes and constitutes a decided advance in the art to which it relates.

It is obvious that various modifications may be made in the constructions shown in the drawings and above particularly described, within the principle and scope of my invention as defined in the appended claims.

I do not specifically limit myself to disclosed minor details of construction or design, nor to a particular relationship of parts and elements, nor to size or shape or materials, these being given simply as a means for clearly describing the device of my invention.

What I claim is:—

1. In a propeller device, in combination, a rotatable propeller hub, driving means adapted to rotate said hub, a journal bearing in said hub with its axis transverse to the axis of rotation of said hub, a propeller blade journaled in said bearing and extending outwardly from said hub, a lever arm, a universal pivotal mounting for said lever arm carried by said hub to rotate therewith and by means of which said lever arm is mounted upon said hub for swinging movement universally in any direction relatively to a central neutral position of said lever arm, said lever arm in its neutral position being in alignment with the axis of rotation of said hub, an operating connection between said lever arm and said propeller blade adapted to rotate the latter in its said journal bearing upon the swinging movement of said lever arm, and manually controlled means adapted to swing said lever arm in any desired direction relatively to its neutral position.

2. In a propeller device, in combination, a rotatable hub, driving means adapted to rotate said hub, a two-bladed propeller including a propeller shank which rigidly connects said propeller blades together, a journal bearing for said propeller shank extending through said hub at right angles to and intersecting the axis of rotation of said hub, a lever arm, a pivotal mounting for said lever arm by which it is connected to said propeller shank to swing on an axis at right angles to the journal axis of the latter and at right angles to and intersecting the axis of rotation of said propeller hub, said lever arm having a central neutral position in alignment with the axis of rotation of said hub and being adapted to be swung in any direction relatively to its neutral position, and manually controlled means adapted to swing said lever arm to any angular position desired in universal relation to its neutral position.

3. In a propeller device, in combination, a pair of oppositely extended propeller blades, a rotatable propeller hub in which said blades are pivoted for oscillating rocking feathering movement, a rockable coupling connection between said blades adapted to impart unitary rocking movement to said blades, and means adapted to rock said coupling connection for thereby causing feathering movement of said blades, said means including a universally fulcrumed lever arm having a neutral position in alignment with the axis of rotation of said hub.

4. In a propeller device, a pair of oppositely extended propeller blades, a shaft fixedly connecting said blades to each other, a rotatable propeller hub in which said shaft is journaled, and means adapted to transmit rocking movement to said shaft in said hub thereby to cause feathering movement of said blades, said means including a lever arm having a pivotal connection to said shaft with a pivotal axis at right angles to the journal axis of said shaft, said lever arm having a neutral position in alignment with the axis of rotation of said hub.

5. In a propeller device, in combination, a rotatable propeller hub, driving means adapted to rotate said hub, a journal bearing in said hub

with its axis transverse to the axis of rotation of said hub, a propeller blade journaled in said bearing and extending outwardly from said hub, a lever arm, a universal pivotal mounting for said lever arm carried by said hub to rotate therewith and by means of which said lever arm is mounted upon said hub for swinging movement universally in any direction relatively to a central neutral position of said lever arm, said lever arm in its neutral position being in alignment with the axis of rotation of said hub, an operating connection between said lever arm and said propeller blade adapted to rotate the latter in its said journal bearing upon the swinging movement of said lever arm, and manually controlled means adapted to swing said lever arm in any desired direction relatively to its neutral position, said lever arm being extended rearwardly from said hub, said manually controlled means including a bell-crank lever, a universally pivotal fulcrum mounting for said bell-crank lever in alignment with the axis of rotation of said hub rearwardly from said lever arm, said bell-crank lever comprising a forwardly extended bell-crank arm and a transversely extended bell-crank arm, a coupling between said forwardly extended bell-crank arm and said rearwardly extended lever arm including a universal joint, and a cross-bar fixedly carried by said transversely extended bell-crank arm by means of which universal swinging movement is adapted to be imparted to said forwardly extended bell-crank arm for thereby causing feathering movement of said propeller blade.

6. In a propeller device, in combination, a rotatable propeller hub, driving means adapted to rotate said hub, a journal bearing in said hub with its axis transverse to the axis of rotation of said hub, a propeller blade journaled in said bearing and extending outwardly from said hub, a lever arm, a universal pivotal mounting for said lever arm carried by said hub to rotate therewith and by means of which said lever arm is mounted upon said hub for swinging movement universally in any direction relatively to a central neutral position of said lever arm, said lever arm in its neutral position being in alignment with the axis of rotation of said hub, an operating connection between said lever arm and said propeller blade adapted to rotate the latter in its said journal bearing upon the swinging movement of said lever arm, and manually controlled means adapted to swing said lever arm in any desired direction relatively to its neutral position, said lever arm being extended rearwardly from said hub, said manually controlled means including a bell-crank lever, a universally pivotal fulcrum mounting for said bell-crank lever in alignment with the axis of rotation of said hub rearwardly from said lever arm, said bell-crank lever comprising a forwardly extended bell-crank arm and a transversely extended bell-crank arm, a coupling between said forwardly extended bell-crank arm and said rearwardly extended lever arm including a universal joint, a universally swingable handle lever, and operating connections from said handle lever to said transversely extended bell-crank arm whereby said rearwardly extended lever arm is caused to partake of the swinging movements of said handle lever thereby to cause feathering movement of said propeller blade.

7. In a propeller device, in combination, a rotatable propeller hub, driving means adapted to rotate said hub, a journal bearing in said hub with its axis transverse to the axis of rotation of said hub, a propeller blade journaled in said bearing and extending outwardly from said hub, a lever arm, a universal pivotal mounting for said lever arm carried by said hub to rotate therewith and by means of which said lever arm is mounted upon said hub for swinging movement universally in any direction relatively to a central neutral position of said lever arm, said lever arm in its neutral position being in alignment with the axis of rotation of said hub, an operating connection between said lever arm and said propeller blade adapted to rotate the latter in its said journal bearing upon the swinging movement of said lever arm, and manually controlled means adapted to swing said lever arm in any desired direction relatively to its neutral position, said lever arm being extended rearwardly from said hub, said manually controlled means including a bell-crank lever, a universally pivotal fulcrum mounting for said bell-crank lever in alignment with the axis of rotation of said hub rearwardly from said lever arm, said bell-crank lever comprising a forwardly extended bell-crank arm and a transversely extended bell-crank arm, a coupling between said forwardly extended bell-crank arm and said rearwardly extended lever arm including a universal joint, a universally swingable handle lever, operating connections from said handle lever to said transversely extended bell-crank arm whereby said rearwardly extended lever arm is caused to partake of the swinging movements of said handle lever thereby to cause feathering movement of said propeller blade, and means adapted for locking said handle lever at any of its positions thereby to maintain a desired feathering movement of said propeller blade.

8. In a propeller device, in combination, a rotatable hub, driving means adapted to rotate said hub, a two-bladed propeller including a propeller shank which rigidly connects said propeller blades together, a journal bearing for said propeller shank extending through said hub at right angles to and intersecting the axis of rotation of said hub, a lever arm, a pivotal mounting for said lever arm by which it is connected to said propeller shank to swing on an axis at right angles to the journal axis of the latter and at right angles to and intersecting the axis of rotation of said propeller hub, said lever arm having a central neutral position in alignment with the axis of rotation of said hub and being adapted to be swung in any direction relatively to its neutral position, and manually controlled means adapted to swing said lever arm to any angular position desired in universal relation to its neutral position, said lever arm being extended rearwardly from said hub, said manually controlled means including an operating arm, a universally pivotal fulcrum mounting for said operating arm in alignment with the axis of rotation of said hub and from which fulcrum mounting said operating arm extends forwardly to the rear end of said rearwardly extended lever arm, a universal joint connecting said operating arm to said rearwardly extended lever arm, and means adapted for universally swinging said operating arm thereby to cause corresponding feathering movements of said propeller blades.

9. In a propeller device, in combination, a rotatable hub, driving means adapted to rotate said hub, a two bladed propeller including a propeller shank which rigidly connects said propeller blades together, a journal bearing for said pro-

peller shank extending through said hub at right angles to and intersecting the axis of rotation of said hub, a lever arm, a pivotal mounting for said lever arm by which it is connected to said propeller shank to swing on an axis at right angles to the journal axis of the latter and at right angles to and intersecting the axis of rotation of said propeller hub, said lever arm having a central neutral position in alignment with the axis of rotation of said hub and being adapted to be swung in any direction relatively to its neutral position, and manually controlled means adapted to swing said lever arm to any angular position desired in universal relation to its neutral position, said lever arm being extended rearwardly from said hub, said manually controlled means including an operating arm, a universally pivotal fulcrum mounting for said operating arm in alignment with the axis of rotation of said hub and from which fulcrum mounting said operating arm extends forwardly to the rear end of said rearwardly extended lever arm, a universal joint connecting said operating arm to said rearwardly extended lever arm, and means adapted for universally swinging said operating arm thereby to cause corresponding feathering movements of said propeller blades, said latter means including a bell-crank lever, a universally pivotal fulcrum mounting for said bell-crank lever surrounding said fulcrum mounting for said operating arm, said bell-crank lever comprising a transversely extended bell-crank arm and a forwardly extended bell-crank arm connected to said operating arm, and a cross-bar fixedly carried by said transversely extended bell-crank arm by means of which universal swinging movement is adapted to be transmitted to said rearwardly extended lever arm for thereby causing feathering movements of said propeller blades.

10. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a universally swingable lever arm having its swingable end extending rearwardly relatively to said hub, connections from said lever arm to said blades adapted to cause feathering movements of the latter upon swinging movement of said lever arm away from a neutral position of the latter in alignment with the axis of rotation of said hub, and manually controlled means adapted to swing said lever arm in any direction relatively to its neutral position.

11. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a propeller shaft adapted to rotate said hub and pivoted therein for universal swinging movements, connections from said propeller shaft to said blades adapted to cause feathering movements of the latter upon swinging movement of said shaft to an angular position relatively to a central position in alignment with the axis of rotation of said hub, manually controlled means adapted to swing said propeller shaft in any direction relatively to its central position, and means adapted to rotate said shaft regardless of any position to which it has been swung.

12. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a propeller shaft adapted to rotate said hub and pivoted therein for universal swinging movements, connections from said propeller shaft to said blades adapted to cause feathering movements of the latter upon swinging movement of said shaft to an angular position relatively to a central position in alignment with the axis of rotation of said hub, manually controlled means adapted to swing said propeller shaft in any direction relatively to its central position, and means adapted to rotate said shaft regardless of any position to which it has been swung, said latter means comprising a drive shaft in axial alignment with the axis of rotation of said hub, and an intermediate coupling shaft extending from said drive shaft to said propeller shaft, said manually controlled means being adapted to swing said coupling shaft in any direction relatively to said drive shaft.

13. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a propeller shaft adapted to rotate said hub and pivoted therein for universal swinging movements, connections from said propeller shaft to said blades adapted to cause feathering movements of the latter upon swinging movement of said shaft to an angular position relatively to a central position in alignment with the axis of rotation of said hub, manually controlled means adapted to swing said propeller shaft in any direction relatively to its central position, and means adapted to rotate said shaft regardless of any position to which it has been swung, said latter means comprising a drive shaft in axial alignment with the axis of rotation of said hub, and an intermediate coupling shaft extending from said drive shaft to said propeller shaft, said manually controlled means being adapted to swing said coupling shaft in any direction relatively to said drive shaft, said manually controlled means including locking means adapted to lock said propeller shaft at any position of its swinging movement.

14. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a propeller shaft adapted to rotate said hub and pivoted therein for universal swinging movements, connections from said propeller shaft to said blades adapted to cause feathering movements of the latter upon swinging movement of said shaft to an angular position relatively to a central position in alignment with the axis of rotation of said hub, manually controlled means adapted to swing said propeller shaft in any direction relatively to its central position, and means adapted to rotate said shaft regardless of any position to which it has been swung, said latter means comprising a drive shaft in axial alignment with the axis of rotation of said hub, an intermediate coupling shaft extending from said drive shaft to said propeller shaft, a universal knuckle-joint connecting said drive shaft to said intermediate shaft, another universal knuckle-joint connecting said intermediate shaft to said propeller shaft, and a slip connection acting in a longitudinal direction between said drive shaft and said hub adapted to accommodate the shortening effect of the conjoint swinging movements of said intermediate shaft and said propeller shaft, said coupling shaft and said knuckle-joints and said slip connection being adapted to co-operate to transmit rotation from said drive shaft to said propeller shaft.

15. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a propeller shaft adapted to rotate said hub and pivoted therein for universal swinging movements, connections from said propeller shaft to said blades adapted to cause feathering movements of the latter upon swinging movement of said shaft to an angular position relatively to a central position in alignment with the axis of rotation of said hub, manually controlled means adapted to swing said propeller shaft in any direction relatively to its central position, and means adapted to rotate said shaft regardless of any position to which it has been swung, said latter means comprising a drive shaft in axial alignment with the axis of rotation of said hub, and an intermediate coupling shaft extending from said drive shaft to said propeller shaft and adapted to transmit rotation to the latter, said manually controlled means including an operating lever extending alongside of said coupling shaft, a universal fulcrum pivot for said operating lever adjacent the rear end of said coupling shaft, a bearing in which said coupling shaft is journaled carried by the rear end of said operating lever, and means adapted to swing said operating lever universally in any direction relatively to a central neutral position thereby to cause feathering movements of said propeller blades.

16. In a propeller device, in combination, a rotatable propeller hub, a plurality of propeller blades carried by said hub to be revolved thereby and mounted thereon for rotatable feathering movements, a propeller shaft adapted to rotate said hub and pivoted therein for universal swinging movements, connections from said propeller shaft to said blades adapted to cause feathering movements of the latter upon swinging movement of said shaft to an angular position relatively to a central position in alignment with the axis of rotation of said hub, manually controlled means adapted to swing said propeller shaft in any direction relatively to its central position, and means adapted to rotate said shaft regardless of any position to which it has been swung, said latter means comprising a drive shaft in axial alignment with the axis of rotation of said hub, and an intermediate coupling shaft extending from said drive shaft to said propeller shaft and adapted to transmit rotation to the latter, said manually controlled means including an operating lever extending alongside of said coupling shaft, a universal fulcrum pivot for said operating lever adjacent the rear end of said coupling shaft, a bearing in which said coupling shaft is journaled carried by the rear end of said operating lever, and means adapted to swing said operating lever universally in any direction relatively to a central neutral position thereby to cause feathering movements of said propeller blades, and means adapted to lock said propeller shaft at any position of its swinging movement.

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